HAZARD MITIGATION PLAN

Lower Elkhorn Natural Resources District
&
Lewis and Clark Natural Resources District

2025

Volume I

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1. Executive Summary

Introduction

The Lower Elkhorn Natural Resources District (LENRD) and the Lewis and Clark Natural Resources District (LCNRD), and the counties and communities that lie within the planning area, are vulnerable to natural, technological, and manmade hazards that have the possibility of causing serious threats to the health, welfare, and security of its residents. The cost of response to and recovery from potential disasters, in terms of potential loss of life or property, can be lessened when attention is turned to mitigation their impacts and effects before they occur or reoccur.

The Lower Elkhorn Natural Resources District (LENRD) and the Lewis and Clark Natural Resources District (LCNRD) Multi-Hazard Mitigation Plan (HMP) was developed to guide the districts in a risk-based approach to become more resilient to the impacts of natural and human caused hazards through mitigation planning. The Plan identifies areas of risk and assesses the potential cost and magnitude, establishes strategies and priorities to mitigate risk from natural, technological and human caused hazards, identifies specific mitigation alternatives to pursue for each identified hazard, guides the jurisdictions in their risk management activities and minimizes conflicts among agencies, and establishes eligibility for future mitigation program funds. With increased attention to managing natural, technological, and manmade hazards, communities can reduce the threats to citizens through proper land use and emergency planning can avoid creating new problems in the future. Many solutions can be implemented at minimal cost and social impact.

While this is not an emergency response or management plan, it can be used to identify vulnerabilities and refocus emergency response planning. Enhanced emergency response planning is an important mitigation strategy; however, the focus of this plan is to support better decision-making directed toward avoidance of future risk and the implementation of activities or projects that will eliminate or reduce the risk for those that may already have exposure to a hazard threat.

The LENRD & LCNRD Hazard Mitigation Plan was created with the goal of substantially and permanently reducing the planning area's vulnerability to hazards through sound public policy. By increasing public awareness of potential harm, documenting resources for risk reduction and loss prevention and identifying activities to guide the development of less vulnerable and more sustainable communities, this plan aims to protect citizens, critical facilities, infrastructure private property, and the natural environment.

This plan is an update to the Lower Elkhorn Natural Resources District (LENRD) Multi-Hazard Mitigation Plan (HMP) approved in 2020 and incorporates the Lewis and Clark Natural Resources District (LCNRD) and Dixon and Cedar Counties. The plan update was developed in compliance with the requirements of the Disaster Mitigation Act of 2000 (DMA 2000). This five-year update was a collaborative effort among the planning team with support from Integrated Solutions Consulting.

Plan Goals and Objectives

The Goals of the LENRD and LCNRD Multi-Jurisdiction Hazard Mitigation Plan include coordinating with local governments to develop plans and processes that meet the components identified in the FEMA Region VII Crosswalk document. The overall objective is risk reduction from natural hazards in the State of Nebraska through implementing and updating the mitigation plan. The following goals were identified:

- Goal 1: Protect the Health and Safety of Residents
- Goal 2: Reduce Future Losses from Hazard Events
- Goal 3: Increase Public Awareness and Educate on the Vulnerability to Hazards
- Goal 4: Improve Emergency Management Capabilities
- Goal 5: Pursue Multi-Objective Opportunities (whenever possible)
- Goal 6: Enhance Overall Resilience and Promote Sustainability

Plan Organization

- Section I of the plan provides a general overview and introduction of the plan
- Section II describes the planning process and identifies who was involved in revisions of the plan and the process used to develop this revision.
- Section III contains a community profile of the Planning Area.
- Section IV provides a brief definition for each natural and manmade hazard. All hazards identified as affecting the planning area are analyzed and summarized in a hazard profile.
- Section V outlines the Mitigation Strategy and identifies the goals, objectives, and mitigation projects.
- Section VI details the plan maintenance process and provides a tentative timeline for updating the plan in the future.
- Section VII introduces the plan participants including local jurisdictions and special districts. Their community profiles are included in Volume II.

The **Appendix** contains contact information for the planning team, meetings, public participation, and plan adoption and endorsement forms.

Plan Purpose

The primary objective of this plan is to conduct a comprehensive assessment of natural, technological and huma-caused hazard threats to the planning area. The plan outlines strategies and actions to mitigate these hazards, with a focus on establishing achievable short-term and long-term goals for hazard mitigation planning. In addition to meeting federal, state, and local hazard mitigation planning requirements, the plan aims to enhance awareness and provide practical mitigation strategies for elected officials, agencies, and the public. By doing so, the plan seeks to minimize the potential adverse impact on citizens, the economy, and the environment resulting from potential hazards. Ultimately, the overarching goal of the plan is to significantly reduce risks to life and property in the event of a hazard event or emergency/disaster.

Hazards

The planning area, comprised of LENRD, LCNRD and Dixon and Cedar Counties, is vulnerable to a wide range of natural, technological and human-caused hazards that threaten life and property. To identify the hazards that the communities perceive as the largest threat, each member of the Steering Committee participated in the Hazard Identification Workshop during the first Steering Committee Meeting. The Steering Committee brainstormed potential hazards based on past incidents that have impacted the planning area and information incorporated from other studies. Each identified hazard was then qualitatively ranked based upon hazard probability/frequency, consequence/severity, and the area's overall vulnerability. The hazards analyzed in this plan include the following:

Table 1: LENRD Analyzed Hazards

Natural	Technological	Human-Caused
Agricultural Disease (Animal and Plant Disease) Drought Earthquake Extreme Temperatures (Heat Wave and Cold Wave) Flooding Fire (Wildfire, Urban Fire) Landslides Severe Weather (Severe Thunderstorms, Strong Winds, Hail, Tornadoes)	Dam and Levee Failure Chemical Spill (Fixed Site, Transportation) Power Loss (Extended, Rolling Blackouts)	Terrorism Public Health Emergency

Although non-natural hazards are not required by FEMA for inclusion in a hazard mitigation plan, LENRD and LCNRD wish to rank and mitigate against a comprehensive list of hazard events that could impact the area. Due to both the nature of non-natural hazards and the discretionary status regarding their inclusion, the following hazards of interest have been briefly and qualitatively assessed for the sake of public education and informing their inclusion within the hazard ranking and mitigation process.

- Dam and Levee Failure
- Chemical Spill
- Power Loss
- Public Health Emergency
- Terrorism

Per FEMA's mandate to address all natural hazards, the following natural hazards were not included because these hazards do not directly impact the planning area due to geographic location:

- Avalanche
- Coastal Flooding
- Hurricane
- Sea Level Rise
- Storm Surge
- Tsunami
- Volcanic Activity

Participating Jurisdictions

Plan participants are listed in the following table.

Table 2: Participating Jurisdictions

Participating Counties and Communities				
Burt County*				
City of Lyons	City of Oakland	Village of Craig		
Cedar County				
City of Hartington	City of Laurel	City of Randolph	Village of Belden	
Village of Coleridge	Village of Fordyce	Village of Obert	Village of St. Helena	Village of Wynot

Participating Counties and Communities				
Colfax County				
City of Clarkson	Village of Howells	Village of Leigh		
Cuming County				
City of West Point	City Of Wisner	Village of Bancroft	Village of Beemer	
Dixon County				
City of Ponca	Village of Allen	Village of Concord	Village of Dixon	Village of Waterbury
Village of Martinsburg	Village of Maskell	Village of Newcastle		
Dodge County*				
City of Hooper	City of Scribner	Village of Dodge	Village of Nickerson	Village of Winslow
Knox County*				
Village of Wausa				
Madison County				
City of Battle Creek	City of Madison	City of Tilden	Village of Meadow Grove	City of Norfolk
Pierce County				
City of Osmond	City of Pierce	City of Planview	Village of Hadar	Village of McLean
Platte County*				
City of Humphrey				
Stanton County				
City of Stanton	Village of Pilger			
Thurston County*				
Village of Emerson	Village of Pender	Village of Thurston		
Wayne County				
City of Wakefield	City of Wayne	Village of Carroll	Village of Hoskins	Village of Winside
Special Districts				
Bancroft-Rosalie Community School	Clarkson Volunteer Fire Dept.	Coleridge Volunteer Fire Department	Criag Fire & Rescue	Elkhorn Logan Valley Public Health Department
Hadar Fire Department	Laurel-Concord-Coleridge School	Leigh Fire Department	Pierce Fire Department	Lewis and Clark NRD
Lower Elkhorn NRD	Norfolk Public Schools	North Central District Health Department	Northeast Nebraska Public Health Department	Randolph Fire Department
Randolph Public Schools	Sanitary Improvement District 1 (Woodland Park)	Scribner-Snyder Community School District	Stanton Community Schools	West Point Public Schools
Winside Public Schools	Wynot Rural Fire Department			

**Indicates counties not participating in the LENRD and LCNRD HMP, just the communities within*

Summary of Changes

Several changes were made to the 2020 Hazard Mitigation Plan and its planning process. These changes include the following:

1. The inclusion of human-caused hazards, based on those addressed in the 2021 State of Nebraska Hazard Mitigation Plan.
2. Increased efforts to reach out to and involve diverse stakeholder groups.
3. An expanded risk assessment covering the entire area.
4. The addition of new mitigation strategies.

This update also aims to integrate various planning mechanisms currently in place across the participating communities, such as comprehensive plans, local emergency operation plans, zoning ordinances, and building codes. This integration will ensure that the goals and objectives identified in those planning mechanisms align with the strategies and projects included in this plan. Additionally, the update encompasses the Lower Elkhorn Natural Resources District (LENRD), the Lewis and Clark Natural Resources District (LCNRD), as well as Cedar and Dixon Counties.

Plan Implementation

Various communities across the planning area have implemented hazard mitigation projects following the 2020 Hazard Mitigation Plan. Many of these projects are related to hazard monitoring, redundant power supplies, and warning systems. A few examples include updating or improving warning and alert systems at the community level and installing back-up power generators.

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. Communities across the planning area have been able to work with a range of entities to complete projects; potential partners for future project implementation include but are not limited to: Nebraska Department of Natural Resources (NeDNR); Nebraska Emergency Management Agency (NEMA); and United States Department of Agriculture (USDA).

2. Planning Process

Introduction

The process for developing a hazard mitigation plan is crucial and should be given as much importance as the final planning document. The LENRD and LCNRD has tailored the four-step hazard mitigation planning process outlined by FEMA to meet the needs of the participating jurisdictions. The following pages will outline the establishment of the Regional Planning Team, its functions, critical project meetings, community representatives, outreach efforts to the public, key stakeholders, and neighboring jurisdictions, as well as general information regarding the risk assessment process, local/regional capabilities, plan review and adoption, and ongoing plan maintenance.

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

1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.
2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and
3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information. Requirement §201.6(c)(1): The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

Multi-Jurisdictional Approach

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

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

Both FEMA and NEMA recommend this multi-jurisdictional approach through the cooperation of counties, regional emergency management, and natural resource districts. The LENRD AND THE LCNRD utilized the multi-jurisdiction planning process recommended by FEMA (Local Mitigation Plan Review Guide[1], Local

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

Mitigation Planning Handbook[2], and Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards[3]) to develop this plan.

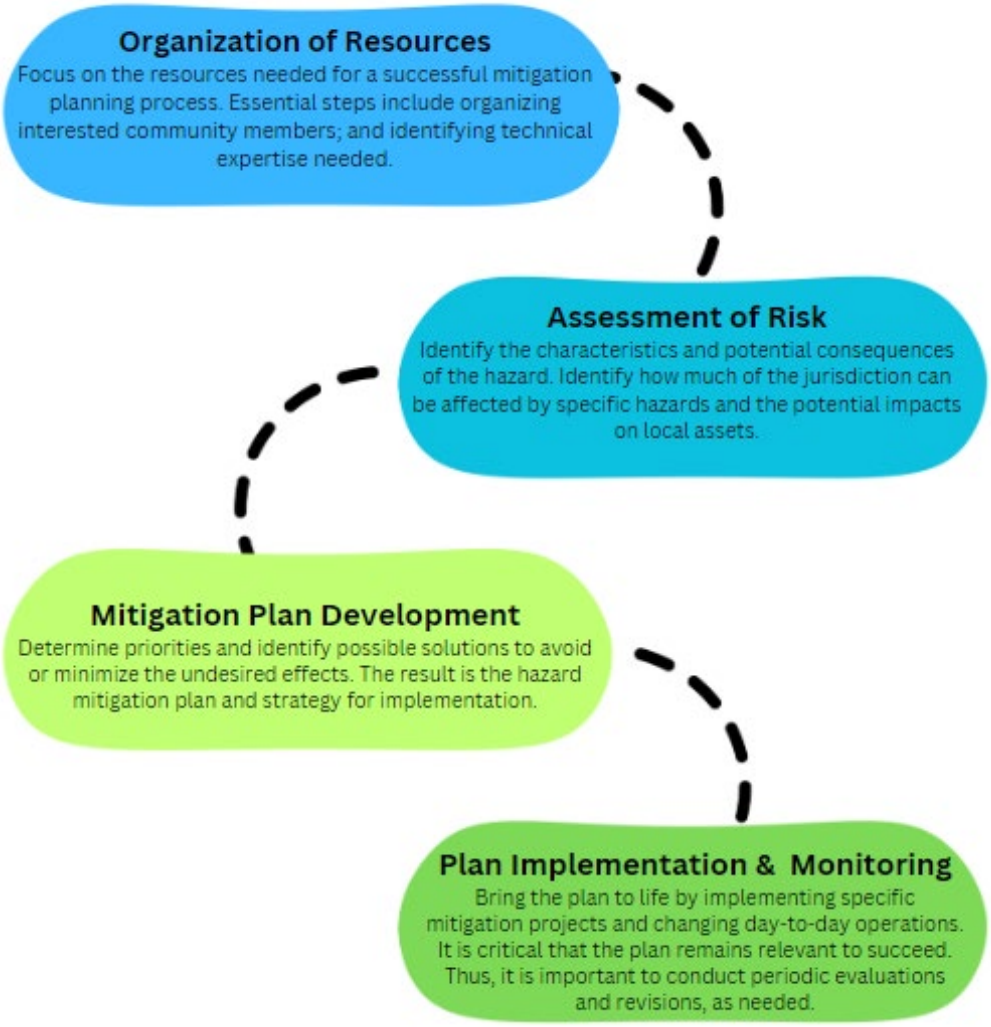
Hazard Mitigation Planning Process

The hazard mitigation planning process as outlined by FEMA has four general steps, which include: organization of resources; assessment of risks; development of mitigation strategies; and implementation and annual monitoring of the plan's progress. The mitigation planning process is rarely a linear process. It is characteristic of the process 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 overall approach to the Hazard Mitigation Plan included developing a baseline understanding of natural and man-made hazards, determining ways to reduce those risks, and prioritizing mitigation recommendations for implementation.

To complete these objectives, the LENRD and the LCNRD compiled a qualified team with various expertise, including risk management, public safety and health, engineering and public works, water infrastructure, and emergency response agencies to participate in a Steering Committee to guide the development of the LENRD and the LCNRD's comprehensive Hazard Mitigation Plan. In addition, the Steering Committee solicited public involvement throughout the planning process, including the release of a public survey through the LENRD website and social media platforms, allowing the public to comment during the drafting stage, and making the draft Plan available to allow the public to comment on its content.

[2]Federal Emergency Management Agency. (2023.) Local Mitigation Planning Handbook. Retrieved from: https://www.fema.gov/sites/default/files/documents/fema_local-mitigation-planning-handbook_052023.pdf
[3]Federal Emergency Management Agency. (2013) Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards. Retrieved from: https://www.fema.gov/sites/default/files/2020-06/fema-mitigation-ideas_02-13-2013.pdf

Figure 1: Planning Process



Organization of Resources

Plan Update Process

The LENRD secured funding for their multi-jurisdictional Hazard Mitigation Plan (HMP) in August 2023 and hired Integrated Solutions Consulting Inc. (ISC) to lead the planning process and coordinate the development of the plan. Curt Becker, Assistant General Manager with LENRD, oversaw the development of the plan and was the main contact throughout the project.

The first step in the development process for the LENRD and the LCNRD HMP update involved coordinating efforts with local, state, and federal agencies and organizations. Nebraska Department of Natural Resources (NeDNR) and Nebraska Emergency Management Agency (NEMA) became involved in the planning process. LENRD and ISC collaborated to identify elected officials and key stakeholders to lead the planning effort.

Planning Team

During the initial stages of the planning process, the Planning Team was formed to oversee the planning, assess the current plan, and communicate with participants in the planning area. A list of the Planning Team members is provided below in **Table 3.** The planning team also received technical support from NEMA and the NeDNR staff.

Table 3: Hazard Mitigation Planning Team

Name	Title	Jurisdiction/Organization
Curt Becker	Assistant Manager	Lower Elkhorn NRD
Bobbi Riser	Emergency Manager, Region 11	Antelope County, Madison County, Pierce County
Audra Connealy	Emergency Manager	Burt County
Kenneth (K.C.) Bang	Emergency Manager	Burt County
Kevin Garvin	Emergency Management Director	Cedar County
Bob Hamilton	Assistant Emergency Manager	Cedar County
Mark Arps	Emergency Manager	Colfax County
Jeff McGill	Emergency Manager	Cuming County
Deanna Hagberg	Emergency Manager	Dakota County
Shea Scollard	Emergency Management Director	Dixon County
Thomas Smith	Emergency Management Director	Dodge County
Kelsy Jelinek	Emergency Manager	Knox County
Annette Sudbeck	General Manager	Lewis & Clark NRD
Myles Lammers	Asst Manager	Lewis & Clark NRD
Tim Hofbauer	Emergency Manager	Platte County
Victoria Champaign	Emergency Manager	Ponca Tribe
Mike Frohberg	Emergency Management Director	Stanton County
Tom Perez	Emergency Management Director	Thurston County
Nic Kemnitz	Emergency Manager	Wayne County

A clear timeline for this plan update process is provided in **Figure 2**.

Figure 2: Project Timeline

Local HMP Planning Schedule, Meetings and Mitigation Workshop

On November 6, 2023, the initial Planning Team meeting was held, bringing together staff from LENRD, LCNRD, Cedar and Dixon Counties and ISC. During this meeting, the group conducted a comprehensive review and discussion of the imminent tasks to be completed in the coming months. These tasks included deliberating on whether to arrange a hazard mitigation workshop for plan participants, establishing the scheduling and venues of public meetings, delineating the goals and objectives of the plan, determining the essential data to be gathered for the Hazard Mitigation Plan (HMP), and formulating strategies for engaging the public through various outreach methods.

Public meetings were conducted throughout the planning area and are provided in **Table 4**.

Table 4 Public Meetings Location and Times

Public Meeting Session #	Location and Time
Session 1	Tuesday, April 9, 2024 5:00 PM Laurel Community Event Center 302 E 2nd St, Laurel, NE 68745
Session 2	Thursday, April 11, 2024 5:30 PM Wayne Fire Hall 511 Tomar Dr., Wayne, NE 68787

During the update in 2023/2024, jurisdictions and special districts were contacted and encouraged to participate. Every effort to include the public was made through emails, school flyers, community posters, social media posts, informational tables, personal meetings, phone calls, information sessions, surveys, community outreach through other community entities and community meetings.

Four Steering Committee meetings were held throughout the plan update. The date and location of meetings held are provided in **Table 5**.

Table 5: Steering Committee Meeting Locations and Times

Meeting	Location and Time	Agenda Items
Steering Committee Meeting # 1	Lower Elkhorn NRD 1508 Square Turn Boulevard, Norfolk, NE August 23, 2023 10:00 AM Virtual	Introductions HMP Overview 2023 Plan Process Roles and Responsibilities Public & Stakeholder Involvement Project Timeline Plan Outline Plan Goals Proposed Hazards Data Requests
Steering Committee Meeting # 2	Lower Elkhorn NRD 1508 Square Turn Boulevard, Norfolk, NE November 15, 2023 10:30 AM Virtual	• Open Remarks • Plan Participation • Public Outreach Strategy • Community Survey • Mapping • Data Requests

Meeting	Location and Time	Agenda Items
Steering Committee Meeting #3	Lower Elkhorn NRD 1508 Square Turn Boulevard, Norfolk, NE February 20, 2024 10:00 AM Virtual	Hazard Mitigation Planning Overview Participating Jurisdictions Key Stakeholders Approved Hazards List Tracking Participation Community Survey Workshops, Public Meeting Annex Review Project Timeline
Steering Committee Meeting # 4	Lower Elkhorn NRD 1508 Square Turn Boulevard, Norfolk, NE July 11, 2024 1:00 PM Virtual	Opening Remarks Plan Maintenance Strategy Public Comment Period (Draft Language) Plan Review Tool Checklist Plan Status Adoption Project Timeline Next Steps

Assessment of Risk

Hazard Identification and Mitigation Strategies

At the Mitigation Workshop Meetings, representatives (i.e. the local planning team) reviewed the hazards consistent with the 2021 Nebraska State Hazard Mitigation Plan to conduct further risk and vulnerability assessment based on these hazards' previous occurrence and the communities' exposure to the various hazards. (For a complete list of hazards reviewed, see 4. Hazard Identification and Risk Assessment.).

The intent of these meetings was to familiarize the public and jurisdiction representatives with an overview of the work to be completed over the next several months, discuss the responsibilities of being a participant, as well as being a member of the planning team. The primary functions of these meetings were to update mitigation actions from the 2020 LENRD HMP, identify the top concerns from each jurisdiction, and identify new mitigation actions. This was an opportunity to gather input on the identification of hazards, records of historical occurrences, establishment of goals and objectives, and potential mitigation projects from jurisdictional representatives (refer to Appendices A and B). In addition to the primary data collection objectives for the workshop, representatives also identified critical facilities and reviewed the preliminary community profile from each participant. Local planning teams were asked to ensure all information included was up-to-date and accurate. Information/data reviewed included but was not limited to local hazard prioritization results; identified critical facilities and their location within the community; concentrations of populations identified as 'highly vulnerable'; future development areas; and expected growth trends

There was also a brief discussion about the planning process, when the plan would be available for public review and comment, annual review of the plan, and the grant application process once the plan was approved. The date and location of the Mitigation Workshops can be found in **Table 6.** Workshop attendees are identified in **Table 7**. Additional one-on-one meetings were held for participants who could not make the April Workshop Meetings.

Table 6: Mitigation Workshops

Location	Date and Time
Hartington City Auditorium 101 N. Broadway Ave, Hartington, NE 68739	April 9, 2024 1:00 PM
Nielson Community Center 200 Anna Stalp Ave., West Point, NE 68788	April 10, 2024 10:00 AM
Wisner City Auditorium 1001 Ave. D, Wisner, NE 68791	April 10, 2024 4:00 PM
Norfolk Public Library 308 Prospect Ave., Norfolk, NE 68787	April 11, 2024 9:00 AM
Wayne Fire Hall 511 Tomar Dr., Wayne, NE 68787	April 11, 2024 3:00 PM
Virtual Webinar	May 14, 2024 10:00 AM
Virtual Webinar	May 15, 2024 6:00 PM

Table 7: Mitigation Workshop Attendees

Name	Title	Organization
Amanda Kelly	Clerk	Village of Newcastle
Amanda Kelly	Clerk	Village of Martinsburg
Brittni Benscoter	Clerk	City of Hartington
David McGregor	Commissioner	Cedar County
Janice Wobbenhorst	Village Board Chair	Village of Belden
Jody Campbell	Fire Chief	Belden Fire Department
Kathy Promes	Utility Biling Clerk	Village of Wynot
Mandy Bruning	Clerk	Village of Coleridge
Myles Lammers	Assistant Manager	Lewis & Clark NRD
Robert Hamilton	Assistant EM	Cedar County EMA
Ryan Boeckmann		Wynot Fire Department
Todd Pinkelman	Fire Chief	Wynot Fire Department
Tom Pinkelman	Chairperson	Village of Fordyce
Victor Paltz	Chairman	Village of St. Helena
Becky Lerch	Floodplain & Zoning Admin	Cuming County
Curt Becker	Assistant Director	LENRD
D.J. Weddle	Superintendent	West Point Public Schools
Dale L. Miller	Utility Superintendent	City of Scribner
Dan Jacobs	Mayor	City of Oakland
Dawn Gall	Village Clerk	Village of Howells
Elmer Armstrong	City/Floodplain Adm.	City of Scribner
James Hetzler	Chief of Police	City of Oakland
Jeff McGill	Emergency Manager	Cuming County
Jess Bland	Superintendent	Oakland-Craig Schools
Joe Peitzmeier	Superintendent	Scribner-Snyder Community Schools
Kayla Eisenmenger	City Clerk	City of Oakland
Larry Fuhr	Board Member	Village of Leigh
Leo Blaha	Chairman	Village of Dodge
Lindsey Beaudette	Superintendent	LDNE Schools
Pam Wortman	Village Clerk	Village of Bancroft
Rick Hollatz	Board Member	Village of Leigh

Name	Title	Organization
Scott Kurpgeweit	Board Chairman	Village of Leigh
Shea Scollard	Emergency Management Director	Dixon County
Terry Ueding	Utility Superintendent	City of Lyons
Tom Goulette	City Admin / Utility Super	City of Westpoint
Tom Grovijohn	Utility Superintendent	Village of Dodge
Whitney Anderson	City Clerk	City of Lyons
Zhenghong Tang	Professor & Program Director	University of Nebraska – Lincoln
Adam Woldt	Assistant Chief	Wisner Fire / City of Wisner
Charline Sparks	Clerk of Board	Woodland Park
Don Biggerstaff	1st Assistant Chief	Wisner Fire/City of Wisner
Jon Cerny	Superintendent	Bancroft-Rosalie School District
Randy Woldt	Administrator	City of Wisner
Stephanie James	City Clerk/Treasurer	City of Wisner
Tiffany McLean	Police Officer	Wisner Police Department
Tod William Voss	Village Clerk	Village of McLean
Tracy Meaike	Clerk/Treasurer	Village of Beemer
Wade Eisenhauer	Chief	Wisner Fire
Amber Labenz	Chair	Village of Pilger
Anna Allen	Assistant City Engineer	City of Norfolk
Bobbi Risor	Emergency Management Director	City of Norfolk
Bonita Lederer		Pierce County
Chad Anderson	City Administrator	City of Pierce
Chuck Hughes	Principal	NPS
Danielle Roessler	Emergency Response Coordinator	NCDHD
Doug Huttmann	Commissioner	Stanton County
Galin Heimann	Clerk	Village of Pilger
Heather Drahota	Programs Manager	Elkhorn Logan Valley Public Health Department
Joseph Braber	Assistant Fire Chief	Clarkson Fire
Krista Snodgrass	Emergency Response Coordinator	ELVPHD
Liz Lienemann	Communications	LENRD
Lyle Lutt	Operations Manager	City of Norfolk
Mark Arps	Emergency Manager	Colfax County
Matt Bloomquist	Utility Superintendent	Village of Wausa
Michael Krick	Chief	Tilden Fire
Mike Frohberg	Director	Stanton County EMA
Nancy Morfield	Clerk	City of Stanton
Nikki Mullanix	Co Emergency Response Coordinator	Elkhorn Logan Valley Public Health Department
Ronald R. Klinetobe	Utilities Superintendent	City of Stanton
Scott Hanis	Maintenance Supervisor	City of Humphrey
Steve Baumert	Chief	Clarkson Fire
Valerie Grimes	Planning & Development Director	City of Norfolk
Wanda Heermann	County Clerk	Stanton County
Beth Bonderson	Clerk/Treasurer	Village of Emerson
Brittney Timmermon	Clerk/Treasurer	City of Osmond
Caleb Eckstrom	Maintenance	City of Osmond
Dan Kauffman	Interim City Admin	City of Laurel
Daryl Schrunk	Superintendent	Randolph Public Schools
Jean Rahn	Village Clerk	Village of Allen
Jenni Topp	Bookkeeper	Winside Public School
Jim Scott	Chief	Randolph Fire
Joan Hanson	Clerk/Treasurer	Village of Concord
John Dickes	Public Works Supervisor	City of Randolph

Name	Title	Organization
Joni Tietz	Village Clerk	Village of Carroll
Kim Schultz	Assistant Director	NNPHD
Kyle Huff	Highway Superintendent	Wayne County
Mark Tietz	Board Chairman	Village of Carroll
Neil E. Wattier	Council Member	City of Osmond
Nicholas Kemnitz	Emergency Manager	Wayne County EMA
Ryan Fettig	Utility Superintendent	City of Laurel
Sarah Johnson	Program Specialist	NNPHD
Wes Blecke	City Administrator	City of Wayne
Adam Woldt	Assistant Chief	City of Wisner
Andrew Offner	Superintendent	Winside Public Schools
Beth Bonderson	Clerk/Treasurer	Village of Emerson
Bobbi Risor	Emergency Management Director	Region 11 EM
Brittni Besncoter	Clerk	City of Hartington
Chad Anderson	City Administrator	City of Norfolk
Chuck Hughes	Principal	Norfolk Public Schools
Daniel Kuhlman	Interim City Administrator	City of Hartington
Dawn Duffy	Assessor	Wayne County
Diane Doffin	Clerk	Village of Hoskins
Dick McCabe	Utility Superintendent	Village of Emerson
Erik Wilson	Director of Student Services	Norfolk Public Schools
Galin Heiman	Clerk	Village of Pilger
George Hefner	Chairman	Village of Coleridge
Heather Drahota	Programs Manager	ELVPHD
Jeff McGill	Emergency Manager	Cuming County EMA
Jim Scott	Chief	Randolph Fire Dept
Joel Hansen	Street and Planning Director	City of Stanton
Karen Kleinschmit	Village Clerk	Village of Wausa
Kayla Eisenmenger	City Clerk	City of Lyons
Kim Schultz	Assistant Director	Northeast Nebraska Public Health Department
Nancy Morfeld	Clerk	City of Oakland
Nancy Staub	Chairman	Village of Hoskins
Nicholas Kemnitz	Emergency Manager	Wayne County
Nicholas Kemnitz	Emergency Manager	Wayne County Emergency Management
Nikki Mullanix	Co Emergency Response Coordinator	ELVPHD
Pam Wortman	Village Clerk	Village of Bancroft
Ron Klinetobe		City of Pierce
Ryan Fettig	Utility Superintendent	City of Humphrey
Sarah Johnson	Program Specialist	Northeast Nebraska Public Health Department
Scott Hanis	Maintenance Supervisor	Bancroft-Rosalie School
Thomas Pinkelman	Chairperson	Village Of Fordyce
Todd Pinkelman	Fire Chief	Wynot Rural Fire Dept
Tom Goulette	City Admin / Utility Super	City of West Point
Valerie Grimes	Planning & Development Director	City of Laurel
Whitney Anderson	City Clerk	City of Laurel
Brittney Timmerman	Clerk/Treasurer	City of Osmond
Charline Sparks	Clerk of Board	SID#1 Woodland Park
Curt Becker	Assistant Director	Lower Elkhorn NRD
Jeremy Christiansen	Superintendent	Laurel-Concord-Coleridge School
Joseph Braber	Assistant Fire Chief	City of Clarkson
Myles Lammers	Assistant Manager	Lewis and Clark NRD
Neil Wattier	Council Member	City of Osmond

Name	Title	Organization
Ron Schroeder		Village of Leigh
Steve Baumert	Chief	City of Clarkson
Terry Pinkelman	Chairman	Village of Wynot

Public and Stakeholder Involvement and Outreach

Broad public participation in the planning process is essential to ensure that various perspectives on the planning area's needs are taken into consideration and addressed. The public should have opportunities to provide feedback on disaster mitigation plans during the development stages and prior to plan approval (44 CFR, Section 201.6(b)(1)). The upcoming section provides details of the public outreach strategy, which includes a mix of in-person and virtual methods. For the purposes of this plan, the term "public," as defined by the LENRD, encompasses residents, businesses, and organizations associated with the LENRD an LCNRD, particularly those citizens residing within the planning area.

At the start of the planning process, the Planning Team worked to identify stakeholder groups that could act as "communication hubs" throughout the planning process. A wide range of stakeholders were contacted and encouraged to participate. Throughout the planning area, a total of 175 stakeholders were identified and sent participation invitations. Additionally, the following groups were also invited to engage in the planning process.

Table 8: Notified Educational Stakeholder Groups

Organizations		
Allen Consolidated Schools	Laurel-Concord-Coleridge Schools	Ponca Public Schools
Bancroft-Rosalie Public Schools	Leigh Community Schools	Randolph Public Schools
Battle Creek Public Schools	Logan View Public schools	Scribner-Snyder Community Schools
Cedar County Catholic Schools	Lyons-Decatur Northeast Schools	Stanton Community Schools
Clarkson Public Schools	Madison Public Schools	Wakefield Public Schools
Elkhorn Valley Schools	Norfolk Public Schools	Wausa Public Schools
Emerson-Hubbard Public Schools	Oakland-Craig Public Schools	Wayne Community Schools
ESU #1	Osmond Community Schools	West Point Public Schools
Hartington Newcastle Public Schools	Pender Public Schools	Winside Public Schools
Howells-Dodge Consolidated School District	Pierce Public Schools	Wisner-Pilger Public Schools
Humphrey Public Schools	Plainview Public Schools	Wynot Public Schools

Table 9: Notified Responder Stakeholder Groups

Organizations		
Belden Rural Fire Department	Concord Vol Fire Department	Meadow Grove Fire And Rescue
Lyons Vol Fire & Rescue	Dixon Fire & Rescue	Norfolk Fire Department
Oakland Fire And Rescue	Martinsburg Fire Department	Osmond Fire Department
Fordyce Vol Fire Department	Newcastle Vol Fire Department	Plainview Vol Fire & Rescue
Hartington Fire Department	Ponca Vol Fire & Rescue	Creston Vol Fire Department
Laurel Vol Fire Department	Wakefield Vol Fire & Rescue	Humphrey Fire Department
Magnet Vol Fire Department	Pierce Vol Fire Department	Pilger Fire & Rescue
Clarkson Vol Fire Department	Randolph Fire Department	Stanton Vol Fire Department
Coleridge Vol Fire Department	Dodge Vol Fire Department	Emerson Vol Fire Department
Craig Fire & Rescue Assoc	Hooper Vol Fire Department	Pender Fire & Rescue Department
Hadar Vol Fire Department	Nickerson Vol Fire Department	Rosalie Rural Fire District

Organizations		
Howells Vol Fire Department	Scribner Fire Department	Thurston Fire & Rescue
Bancroft Rural Fire Department	Snyder Vol Fire Department	Carroll Vol Fire Department
Beemer Fire & Rescue	Uehling Vol Fire Department	Hoskins Vol Fire District
West Point Fire Department	Wausa Fire And Rescue	Wayne Vol Fire Department
Wisner Vol Fire & Rescue Department	Tilden Fire Department	Winside Vol Fire & Rescue
Leigh Fire Department	Battle Creek Volunteer Fire Department	Winslow Fire Dept District
Allen & Waterbury Fire Department	Madison Fire And Rescue	Wynot Rural Fire Department

Table 10: Notified Special Districts

Organizations		
East Central District Health Department	Lower Elkhorn NRD	Ponca Tribe
Elkhorn Logan Valley Public Health Department	North Central District Health Department	Three Rivers Public Health Department
Lewis and Clark NRD	Northeast Nebraska Public Health Department	Cedar County Agricultural Society

Table 11: Additional Stakeholder Groups

Organizations		
Sanitary Improvement District #1 of Cedar County - Bow Valley	Sanitary Improvement District #1 of Stanton County- Woodland Park	Midtown Health Partners
American Red Cross Norfolk Mission	Salvation Army	Columbus Area United Way

Representatives from several fire departments attended meetings and provided input for their community section. See Volume II for the members of these organizations that joined their local planning team.

Neighboring Jurisdictions

Neighboring jurisdictions were notified and invited to participate in the planning process. The following table indicates which neighboring communities were notified of the planning process. Letters were sent to county/city/village clerks, county emergency managers, and NRDs, at their respective jurisdictions and disseminated appropriately. Dakota County provided input from outside of the planning area.

Table 12: Notified Jurisdictions/Organizations

Jurisdictions		
Allen & Waterbury Fire Dept	Hartington Newcastle Public Schools	Thurston County
Allen Consolidated Schools	Hooper Vol Fire Dept	Thurston Fire & Rescue
American Red Cross	Hoskins Vol Fire Dist	Tilden Fire Dept
Antelope County	Howells Vol Fire Dept	Uehling Vol Fire Dept
Bancroft Rural Fire Dept	Howells-Dodge Consolidated School District	Village of Allen
Bancroft-Rosalie Public Schools	Humphrey Fire Dept	Village of Bancroft
Battle Creek Public Schools	Humphrey Public Schools	Village of Beemer
Battle Creek Volunteer Fire Department	Knox County	Village of Belden
Beemer Fire & Rescue	Laurel Vol Fire Dept	Village of Carroll

Jurisdictions		
Belden Rural Fire Dept	Laurel-Concord-Coleridge Schools	Village of Coleridge
Burt County	Leigh Community Schools	Village of Concord
Carroll Vol Fire Dept	Leigh Fire Dept	Village of Cornlea
Cedar County	Lewis And Clark NRD	Village of Craig
Cedar County Agricultural Society	Logan View Public Schools	Village of Creston
Cedar County Catholic Schools	Lower Elkhorn NRD	Village Of Dixon
City of Battle Creek	Lyons Vol Fire & Rescue	Village Of Dodge
City of Clarkson	Lyons-Decatur Northeast Schools	Village of Emerson
City of Hartington	Madison County	Village of Fordyce
City of Hooper	Madison Fire And Rescue	Village of Foster
City of Humphrey	Madison Public Schools	Village of Hadar
City of Laurel	Magnet Vol Fire Dept	Village of Hoskins
City of Lyons	Martinsburg Fire Dept	Village of Howells
City of Madison	Meadow Grove Fire And Rescue	Village of Leigh
City of Norfolk	Midtown Health Partners	Village of Magnet
City of Oakland	Newcastle Vol Fire Dept	Village of Martinsburg
City of Osmond	Nickerson Vol Fire Dept	Village of Maskell
City of Pierce	Norfolk Fire Department	Village of Mclean
City of Plainview	Norfolk Mission	Village of Meadow Grove
City of Ponca	Norfolk Public Schools	Village of Newcastle
City of Randolph	North Central District Health Department	Village of Nickerson
City of Scribner	Northeast Nebraska Public Health Department	Village of Obert
City of Stanton	Oakland Fire And Rescue	Village of Pender
City of Tilden	Oakland-Craig Public Schools	Village of Pilger
City of Wakefield	Osmond Community Schools	Village of Rosalie
City of Wayne	Osmond Fire Dept	Village of Sholes
City of West Point	Pender Fire & Rescue Dept	Village of Snyder
City of Wisner	Pender Public Schools	Village of St. Helena
Clarkson Public Schools	Pierce County	Village of Thurston
Clarkson Vol Fire Dept	Pierce Public Schools	Village of Uehling
Coleridge Vol Fire Dept	Pierce Vol Fire Dept	Village of Waterbury
Colfax County	Pilger Fire & Rescue	Village of Wausa
Columbus Area United Way	Plainview Public Schools	Village of Winside
Concord Vol Fire Dept	Plainview Vol Fire & Rescue	Village of Wynot
Craig Fire & Rescue Assoc	Platte County	Village Winslow
Creston Vol Fire Dept	Ponca Public Schools	Wakefield Public Schools
Cuming County	Ponca Tribe	Wakefield Vol Fire & Rescue
Dakota County	Ponca Vol Fire & Rescue	Wausa Fire And Rescue
Dixon County	Randolph Fire Dept	Wausa Public Schools
Dixon Fire & Rescue	Randolph Public Schools	Wayne Community Schools
Dodge County	Rosalie Rural Fire District	Wayne County
Dodge Vol Fire Dept	Salvation Army	Wayne Vol Fire Dept
East Central District Health Department	Sanitary Improvement District #1 Of Cedar County - Bow Valley	West Point Fire Dept
Elkhorn Logan Valley Public Health Department	Sanitary Improvement District #1 Of Stanton County- Woodland Park	West Point Public Schools
Elkhorn Valley Schools	Scribner Fire Dept	Winside Public Schools
Emerson Vol Fire Dept	Scribner-Snyder Community Schools	Winside Vol Fire & Rescue
Emerson-Hubbard Public Schools	Snyder Vol Fire Dept	Winslow Fire Dept Dist
ESU #1	Stanton Community Schools	Wisner Vol Fire & Rescue Dept

Jurisdictions		
Fordyce Vol Fire Dept	Stanton County	Wisner-Pilger Public Schools
Hadar Vol Fire Dept	Stanton Vol Fire Dept	Wynot Public Schools
Hartington Fire Dept	Three Rivers Public Health Department	Wynot Rural Fire Dept

Participant Involvement

Participants play a key role in reviewing goals and objectives, identifying hazards, providing a record of historical disaster occurrences and localized impacts, identification and prioritization of potential mitigation projects and strategies, and the development of annual review procedures.

To be a participant in the development of this plan update, jurisdictions were required to have at a minimum one representative present at the Workshop meeting or attend a follow- up meeting with a member of the Planning Team. Some jurisdictions sent multiple representatives to meetings. For jurisdictions who had only one representative, they were encouraged to bring meeting materials back to their governing bodies, to 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 request a meeting with members of the Planning Team to satisfy the meeting attendance requirement. This effort enabled jurisdictions, which could not attend a scheduled public meeting, to participate in the planning process. Outreach to eligible jurisdictions included notification prior to all public meetings, phone calls and email reminders of upcoming meetings, and invitations to complete surveys and worksheets required for the planning process. **Table 13** provides a summary of outreach activities utilized in this process.

Table 13: Outreach Activity Summary

Action	Intent
Project Website	Informed the public and local/planning team members of past, current, and future activities
Project Announcement	Project announcement posted on LENRD project website
Workshop Meeting Letters or Postcards (30-day notification)	Sent to participants and neighboring jurisdictions to discuss the agenda/dates/times/locations of the first round of public meetings
Press Release	Sent to local newspapers to announce the plan and describe the purpose of the plan
Notification Phone Calls	Called potential participants to remind them about upcoming meetings
Follow-up Emails and Phone Calls	Correspondence was provided to remind and assist participating jurisdictions with the collection and submission of required local data
Project Flyer	Flyers were posted about the LENRD HMP and how to get involved. Flyers were posted at multiple locations throughout all counties
Word-of-Mouth	Staff discussed the plan with jurisdictions throughout the planning process.
Social Media	Utilized social media to announce the plan, describe the purpose of the plan, and invite the public to workshops.

Public Survey

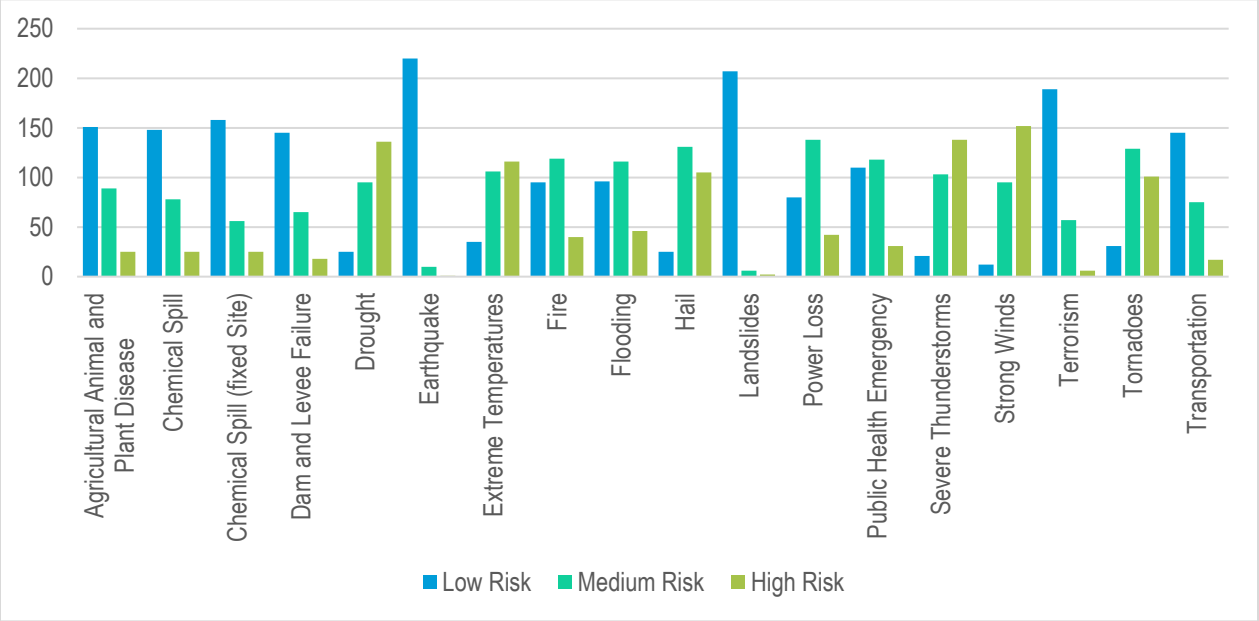
The survey was comprised of 7 questions which were primarily multiple-choice questions. The questions were clear and direct thereby minimizing the chance errors in the survey results. The respondents were given the opportunity to provide additional input via some open-ended questions that required individual evaluation; questions such as concerns about specific hazards and locations they are aware of.

There was a total of 409 surveys returned by the community. All participating jurisdictions are represented in the survey results.

Public/Stakeholder Results and Hazard Risk Rankings

A critical element in the public survey is the respondents were asked to rank their risk concerns. Drought and Severe Weather (strong winds, severe thunderstorms, hail, tornadoes) are the top concerns. Earthquakes and landslides were ranked as the least concerning to the respondents. The following chart represents the results of the survey answers collected by the mitigation planning team

Figure 3: Hazard Risk Rankings



Additionally, nearly 83 percent of respondents experienced property damage or loss from a disaster, ranging from minor to catastrophic, including damage to roofs, siding, windows, basement flooding and crop damage/loss. Open-ended responses by the public offered greater insight into the damage experienced while residing in the planning area.

The survey was not intended to be a scientific sampling of members and resident knowledge of hazards relevant to mitigation planning. It will create a baseline for which the participants can start to implement plans to mitigate deficiencies within the community. This exercise has created a foundation for a more robust plan and training opportunities for the whole community.

This information helped to validate and confirm the risk assessment findings.

Hazard Mitigation Public Review

After the draft plan was completed, a link to the plan was placed on the LENRD official website and promoted via Social Media. The draft plan remained on the website and Social Media until the FEMA-approved and formally adopted Plan was made available. Upon formal adoption of the Plan, the public engagement strategy shifted toward continual engagement of the public by soliciting and offering the public an opportunity and forum to provide input regarding known hazards and risks, and implementation of identified mitigation strategies.

Throughout the plan development process, public and stakeholder input was incorporated into the Plan. Future comments on the Hazard Mitigation Plan should be addressed to:

Curt Becker
Assistant General Manager
Lower Elkhorn NRD
1508 Square Turn Blvd.
Norfolk, NE 68701
Phone: 402-371-7313
Email: cbecker@lenrd.org

Equity Considerations for Underserved Communities and Socially Vulnerable Populations

Some disasters occur on larger scales and are more impacted by built environments and most likely to continually impact those most at risk because of existing health conditions, lack of resources, being underserved by past mitigation planning work, facing historical disinvestment in their communities, or other factors. In this case, people in widely different locations can be the most harmed by repeating disaster cycles, so mitigation strategies should also work to break cycles of loss caused by social and economic disparities. Hazard mitigation strategies can reduce existing risk by, for example, relocating a building out of an area that frequently floods. In each case, an attempt has been made to lessen the harm of a future flood before the event happens. Strategies may also seek to make future development less vulnerable to hazards at the time they are built. Examples would be requiring new structures to be elevated above predicted flood levels or by building structures to better withstand future hazards. Hazard mitigation plans are designed to involve the input of stakeholders from different perspectives to ensure plans use the best available data, are aligned with the needs of the entire community, and are in alignment with other plans, such as comprehensive plans, capital improvement plans, and climate action plans.

This Hazard Mitigation Plan continues to recognize that all members of the community are not impacted in the same way by natural disasters. Some community members are at more risk, for several possible reasons. A mitigation strategy that uses a “one size fits all” approach and does not recognize different levels of risk will not adequately or efficiently support historically underserved populations and can make inequalities worse after a disaster.

Equitable mitigation success should be measured by assessing who was most impacted in loss of life or financial harm by past and future disasters, quantifiable reductions of vulnerability to those most at risk, and increasing engagement with historically underserved populations and community organizations to better understand how plans and processes and natural hazard events are affecting different communities.

LENRD, LCNRD, and all participating jurisdictions have the responsibility to ensure equitable outcomes in the implementation of this plan and to ensure that action is taken to reduce vulnerabilities to disasters experienced disproportionately by marginalized populations.

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 are identified in Section Seven: Community Profile.

Table 14: Documents Reviewed

Documents	
Disaster Mitigation Act of 2000 DMA https://www.fema.gov/sites/default/files/2020-11/fema_disaster-mitigation-act-of-2000_10-30-2000.pdf	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
Final Rule (2021) https://www.federalregister.gov/documents/2021/09/17/2021-20090/femas-hazard-mitigation-assistance-and-mitigation-planning-regulations-correction	National Flood Insurance Program Community Status Book (2018) https://www.fema.gov/national-flood-insurance- program-community-status-book
Hazard Mitigation Assistance Program and Policy Guide (2023) https://www.fema.gov/sites/default/files/documents/fema_hma_guide_08232023_v1.pdf	National Response Framework (2019) https://www.fema.gov/sites/default/files/2020-04/NRF_FINALApproved_2011028.pdf
Local Mitigation Planning Handbook (2023) https://www.fema.gov/sites/default/files/documents/fema_local-mitigation-planning-handbook_052023.pdf	Robert T. Stafford Disaster Relief and Emergency Assistance Act (As Amended) (2019) https://www.fema.gov/sites/default/files/2020-03/stafford-act_2019.pdf
What is a Benefit: Guidance on Benefit-Cost Analysis on Hazard Mitigation Projects http://www.fema.gov/benefit-cost-analysis	The Census of Agriculture (2017) https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_State_Level/Nebraska/nev1.pdf

Table 15: Plans and Studies Reviewed

Plans and Studies	
National Climate Assessment (2014) https://nca2014.globalchange.gov/	Nebraska Drought Mitigation and Response Plan (2000) http://carc.nebraska.gov/docs/NebraskaDrought.pdf
Flood Insurance Studies https://msc.fema.gov/portal/home	State of Nebraska Hazard Mitigation Plan (2021) https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf
Fourth National Climate Assessment (2018) https://nca2018.globalchange.gov/	2021-2025 Comprehensive Economic Development Strategy Northeast Nebraska Economic Development District https://nenedd.org/wp-content/uploads/2021/08/NENEDD-2021-2026-Comprehensive-Economic-Development-Strategy-3.pdf

Table 16: Data and Technical Resources Reviewed

Data and Technical Resources	
Arbor Day Foundation – Tree City Designation https://www.arborday.org/	Nebraska Department of Natural Resource – Geographic Information Systems https://dnr.nebraska.gov/data
Environmental Protection Agency - Chemical Storage Sites https://rcrapublic.epa.gov/rcrainfoweb/action/modules/hd/handlerindex	Nebraska Department of Natural Resources http://www.dnr.ne.gov
Federal Emergency Management Agency http://www.fema.gov	Nebraska Department of Natural Resources – Dam Inventory https://dnr.nebraska.gov/sites/dnr.nebraska.gov/files/doc/data/dams/dam-inventory.html
FEMA Flood Map Service Center https://msc.fema.gov/portal/advanceSearch	Nebraska Department of Revenue – Property Assessment Division www.revenue.ne.gov/PAD
High Plains Regional Climate Center http://climod.unl.edu/	Nebraska Department of Transportation http://dot.nebraska.gov/
National Agricultural Statistics Service http://www.nass.usda.gov/	Nebraska Emergency Management Agency http://www.nema.ne.gov
National Centers for Environmental Information https://www.ncei.noaa.gov/	Nebraska Forest Service – Wildland Fire Protection Program http://nfs.unl.edu/fire
National Consortium for the Study of Terrorism and Responses to Terrorism (START) http://www.start.umd.edu/gtd/	Nebraska Forest Service (NFS) http://www.nfs.unl.edu/
National Drought Mitigation Center – Drought Impact Reporter http://droughtreporter.unl.edu/map/	Nebraska Public Power District Service http://econdev.nppd.com/
National Drought Mitigation Center – Drought Monitor http://droughtmonitor.unl.edu/	Nebraska State Historical Society https://history.nebraska.gov/
National Environmental Satellite, Data, and Information Service https://www.nesdis.noaa.gov/	Stanford University - NPDP https://npdp.stanford.edu/
National Fire Protection Association https://www.nfpa.org/	Storm Prediction Center Statistics https://www.spc.noaa.gov
National Flood Insurance Program https://dnr.nebraska.gov/floodplain/flood- insurance	United States Army Corps of Engineers – National Levee Database https://levees.sec.usace.army.mil/
National Historic Registry https://www.nps.gov/subjects/nationalregister/index.htm	United States Census Bureau http://www.census.gov
National Oceanic Atmospheric Administration (NOAA) https://www.noaa.gov/	United States Census Bureau https://www.census.gov/
National Weather Service https://www.weather.gov/	United States Department of Agriculture https://www.usda.gov
Natural Resources Conservation Service www.ne.nrcs.usda.gov	United States Department of Agriculture – Risk Assessment Agency https://www.rma.usda.gov
Nebraska Association of Resources Districts https://www.nrdnet.org	United States Department of Agriculture – Web Soil Survey https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx
Nebraska Climate Assessment Response Committee https://carc.agr.ne.gov	United States Department of Commerce http://www.commerce.gov/
Nebraska Department of Education https://nep.education.ne.gov/	United States Department of Transportation – Pipeline and Hazardous Materials Safety Administration https://www.phmsa.dot.gov/
Nebraska Department of Education https://educdirsrc.education.ne.gov/	United States Geological Survey https://www.usgs.gov/

Data and Technical Resources	
Nebraska Department of Environmental Quality http://www.deq.state.ne.us/	United States National Response Center https://www.nrc.uscg.mil/
Nebraska Department of Health and Human Services https://dhhs.ne.gov/Pages/default.aspx	United States Small Business Administration https://www.sba.gov
	UNL – College of Agricultural Sciences and Natural Resources – Schools of Natural Resources https://casnr.unl.edu

Plan Adoption

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

Copies of adoption resolutions may be requested from the State Hazard Mitigation Officer.

Once adopted, participants are responsible for implementing and updating the plan every five years. Those who participated directly in the planning process would be logical champions for updating the plan. In addition, the plan will need to be reviewed and updated annually or when a hazard event occurs that significantly affects the area or individual participants.

Requirement §201.6(c)(5):

For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.

Plan Implementation and Progress Monitoring

Hazard mitigation plans need to be living documents. To ensure this, the plan must be monitored, evaluated, and updated on a five-year or less cycle. This includes incorporating the mitigation plan into the county and local comprehensive or capital improvement plans as they stand or are developed. Section Six describes the system that jurisdictions participating in the LENRD and LCNRD HMP have established to monitor the plan; provides a description of how, when, and by whom the HMP process and mitigation actions will be evaluated; presents the criteria used to evaluate the plan; and explains how the plan will be maintained and updated.

3. Planning Area Profile

Introduction

To identify potential vulnerabilities within the jurisdiction, it is essential to gain a comprehensive understanding of the local population and infrastructure in the planning area. The following section provides a detailed description of the characteristics of the planning area, aiming to create an overall profile. While many characteristics are outlined in each jurisdiction's community profile, covering demographics, transportation routes, and structural inventory, this section will omit redundant information and instead focus on pinpointing at-risk populations and infrastructure characteristics contributing to regional vulnerabilities.

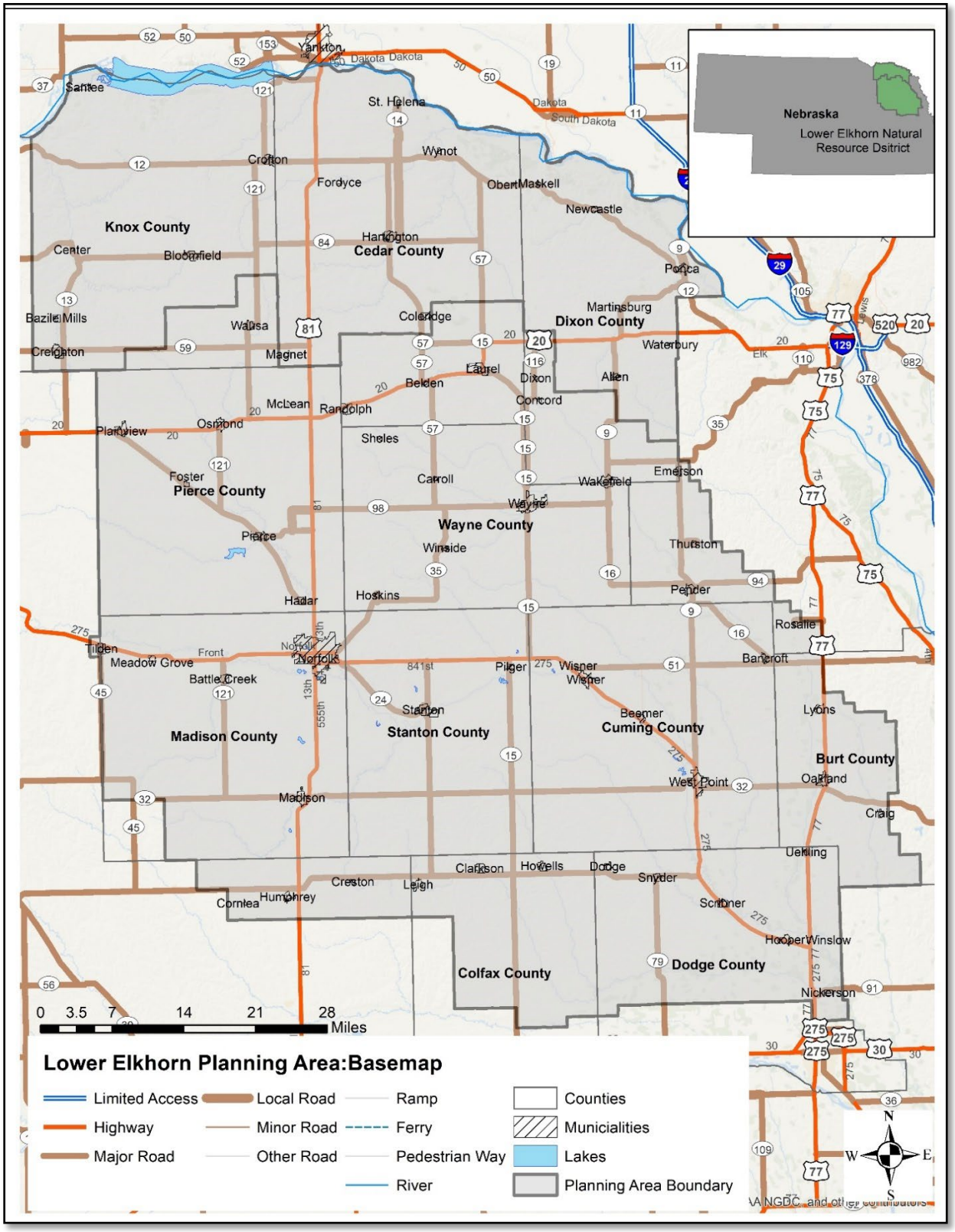
Nebraska heavily relies on its natural resources for its prosperity and future well-being. In 1972, the Nebraska Legislature consolidated 154 special purpose entities into 23 Natural Resources Districts (NRDs) with diverse responsibilities focused on preserving the state's natural resources. These districts are unique to Nebraska and are organized around major river basins, aiming to address local needs with localized solutions. Over time, the responsibilities of NRDs have expanded, particularly in the protection of groundwater. Additionally, NRDs have taken on roles in preventing erosion and floods, conserving soil, controlling pollution, managing wildlife habitat, forestry and range, as well as promoting recreation.

The Lower Elkhorn Natural Resources District (LENRD), headquartered in Norfolk, serves a total of fifteen counties in Northeast Nebraska and is dedicated to conserving the region's natural resources with the backing of elected board members and staff. Covering nearly 4,000 square miles, the LENRD encompasses all of Cuming, Madison, Pierce, Stanton, and Wayne Counties, as well as parts of eight other counties: Burt, Cedar, Colfax, Dixon, Dodge, Knox, Platte, and Thurston.

The Lewis and Clark Natural Resources District (LCNRD) covers approximately 1,300 square miles in northeastern Nebraska. Specifically, it includes parts of several counties, such as Dakota, Dixon, and Cedar. The district encompasses a variety of landscapes, including agricultural land, rivers, and natural habitats, which allows it to focus on a range of resource management initiatives tailored to the unique needs of the region.

The illustrated figure on the next page provides a visual representation of the planning area.

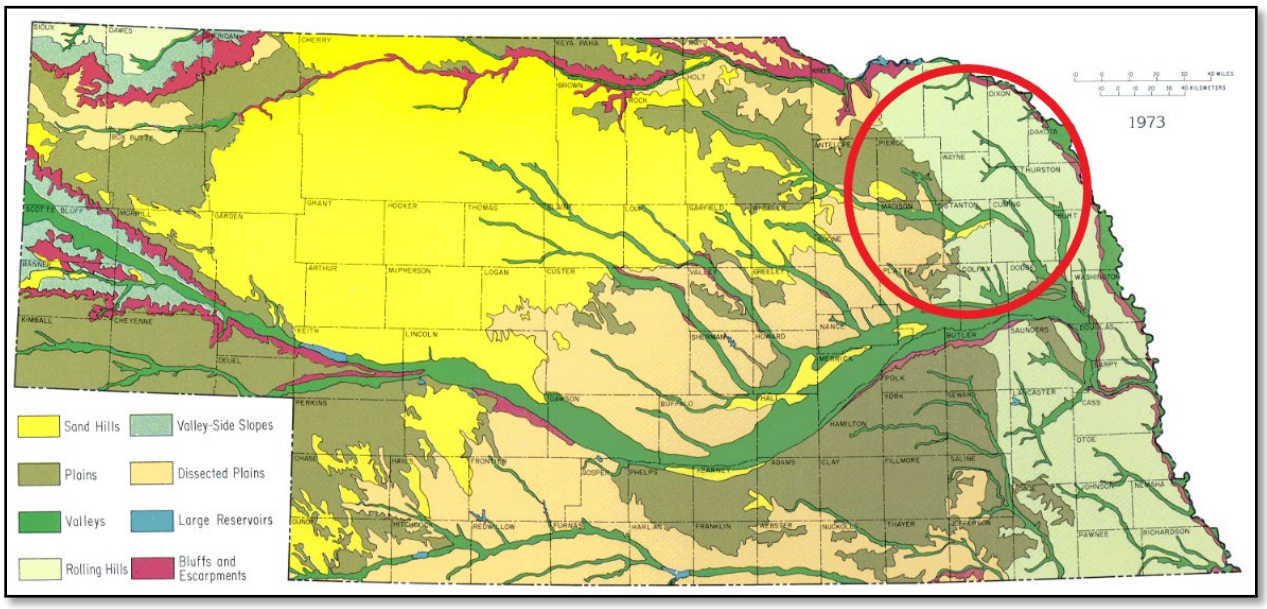
Figure 4 Planning Area Basemap



Topography

The planning area is largely made up of four topographic regions: rolling hills, valleys, dissected plains, and plains. Rolling hills feature large, flat land punctuated with hills. Valleys are formed on the sides of rivers, creeks, and streams. Dissected plains are represented by hilly land with moderate to steep slopes and sharp ridge crests. Plains are represented by flat-lying land comprised of sandstone or stream-deposited silt, clay, sand, and gravel. **Figure 5** is a topographic map of Nebraska with the planning area highlighted.

Figure 5: Topographic Regions within Nebraska[4]



Climate

Nebraska is in the Northern Great Plains region of the United States and is subject to an extreme, continental climate, with frequent changes in the weather. Nebraska is subject to warm summers and cold winters. The average annual temperature in Norfolk, Nebraska is around 50.3°F and has an average high of about 86.9°F during the month of July and an average low of about 14.0°F in January.

A signature feature of the climate is year-to-year variability for both temperature and precipitation. Precipitation varies significantly across the state with a longitudinal gradient. On average, the east receives twice as much precipitation (25 inches annually) as the Nebraska Panhandle (15 inches). The wettest times of year are late spring and early summer. Winter precipitation accounts for only 7% of the annual total.[5]

The yearly average, monthly average maximum and minimum temperatures, and precipitation are listed on **Table 17**.

[4] University of Nebraska-Lincoln. (2001). Center for Applied Rural Innovation. Topographic Regions Map of Nebraska. Retrieved from https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1062&context=caripubs

[5] North Central Climate Collaborative. (2017.) An overview of the 4th National climate Assessment, Volume II: Impacts, Risks, and Adaptation in the United States: Nebraska. Retrieved from https://weather-ready.unl.edu/nc3-Nebraska-Climate-Summary-02%20%281%29.pdf

Table 17: Lower Elkhorn Planning Area Monthly Climate Summary (2012 - 2023) Norfolk Area Station[6]

Average Temperature[7] (° F)												
2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Average
53.2	48.4	48.1	51.3	51.5	50.3	47.8	47.8	50.9	51.7	50.5	51.9	50.3
Average Maximum Temperature[8] (° F)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
34.5	35.7	51.5	61.8	72.8	84.9	86.9	84.5	80.0	68.6	50.7	37.2	62.0
Average Minimum Temperature[9] (° F)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
14.0	13.7	27.2	36.3	49.3	60.5	63.9	61.6	54.3	38.3	26.0	17.3	38.5
Average Total Precipitation[10] (inches)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
0.63	0.78	1.54	2.49	3.85	3.98	2.45	3.35	2.25	2.39	1.03	0.97	25.71

Land Use

The planning area covers approximately 3,132,000 acres. The land cover in the LENRD is largely agricultural (76%) and pasture/grasslands area (20%), with small areas of forests, open water, wetlands, and urbanized areas (all less than 2%). The most prominent crop types are corn (52%) and soybeans (44%). The agricultural land is primarily divided between dryland farming (67%) and irrigated farming (33%). In the LCNRD, land use primarily consists of agriculture, with approximately 10-15% designated as natural areas and less than 5% urbanized.

Figure 6 indicates the native vegetation of Nebraska, with the planning area highlighted.

[6] National Oceanic and Atmospheric Administration. (2022). NOWData – NOAA Online Weather Data (Monthly Mean Max Temperature for Norfolk Area, NE). Retrieved from https://www.weather.gov/wrh/Climate?wfo=oax

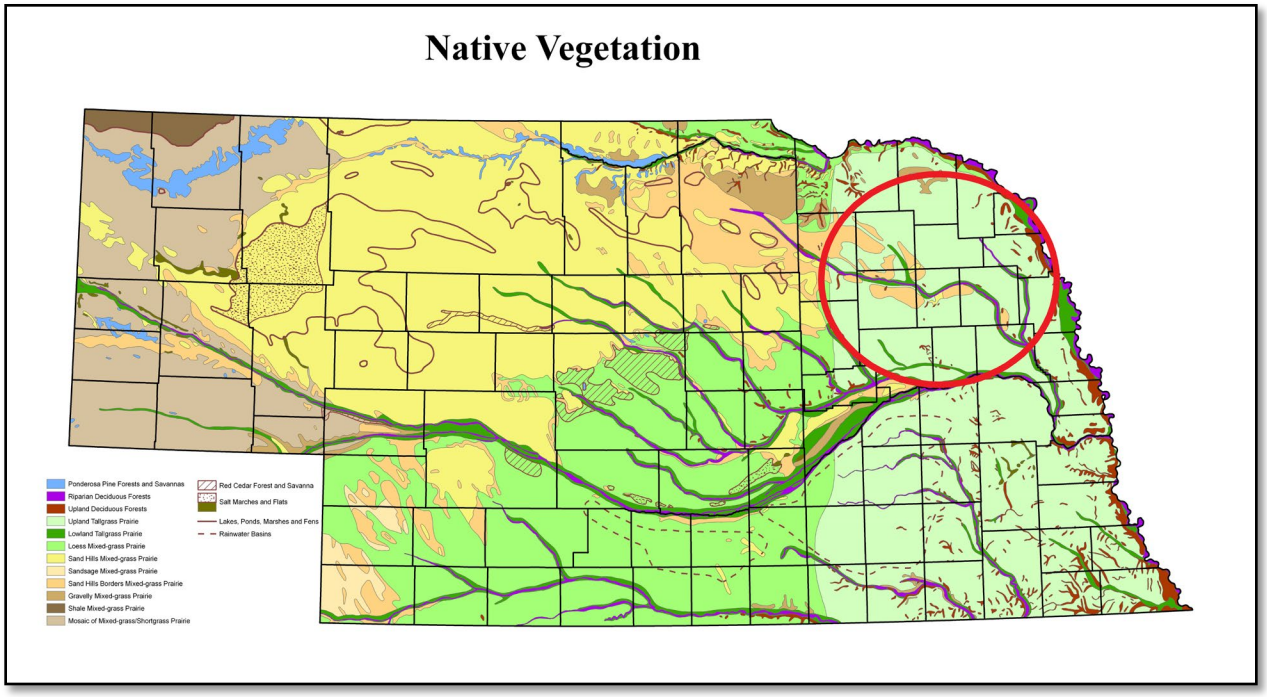
[7] National Oceanic and Atmospheric Administration. (2022). NOWData – NOAA Online Weather Data (Yearly Mean Temperature for Norfolk Area, NE). Retrieved from https://www.weather.gov/wrh/Climate?wfo=oax

[8] National Oceanic and Atmospheric Administration. (2022). NOWData – NOAA Online Weather Data (Monthly Mean Max Temperature for Norfolk Area, NE). Retrieved from https://www.weather.gov/wrh/Climate?wfo=oax

[9] National Oceanic and Atmospheric Administration. (2022). NOWData – NOAA Online Weather Data (Monthly Mean Min Temperature for Norfolk Area, NE). Retrieved from https://www.weather.gov/wrh/Climate?wfo=pqr

[10] National Oceanic and Atmospheric Administration. (2022). NOWData – NOAA Online Weather Data (Monthly Total Precipitation for Norfolk Area, NE). Retrieved from https://www.weather.gov/wrh/Climate?wfo=pqr

Figure 6: Land Use/Native Vegetation[11]



Population & Demographics

Population Density

According to the 2020 United States Census, the planning area had a combined population of 142,816. Between 2010 and 2020, the overall population increased by an average of 1.05 percent. Within 6 counties, the population, on average, increased. In 8 counties, the average population decreased. **Table 18** shows the population change in the planning area, and its respective counties, between 2010 and 2020.

Table 18: Population Estimates[12]

Participating Jurisdiction	2010	2020	Percent Change (2010 – 2022)
Burt County *(Census Tract 9632, 9634)*	4,190	4,170	-0.48
Cedar County	8,906	8,380	-5.91
Colfax County	10,201	10,681	4.71
Cuming County	9,139	9,013	-1.38
Dixon County	6,000	5,606	-6.57
Dodge County *(Census Tract 9636)*	4,865	4,648	-4.46
Knox County *(Census Tract 9763)*	2,472	2,311	-6.51
Madison County	34,876	35,585	2.03

[11] University of Nebraska-Lincoln. (1993). Land Use/Land Cover Related GIS Data (CSD) Retrieved from https://snr.unl.edu/data/geographygis/land.aspx

[12]

Participating Jurisdiction	2010	2020	Percent Change (2010 – 2022)
Pierce County	7,266	7,317	0.70
Platte County *(Census Tract 9651)*	32,237	34,296	6.39
Stanton County	6,129	5,842	-4.68
Thurston County	6,940	6,773	-2.41
Wayne County	9,595	9,697	1.06
Total	**142,816**	**144,319**	**1.05%**

Income and Socioeconomic Status

In 2022, the Lower Elkhorn planning area reported an average income of $84,367. Within this region, the average household income displayed a consistent pattern, ranging between $76,000 and $94,000 per year. This localized range reflects the economic landscape of the area, capturing the financial status of its residents among 55,612 households.

Table 19: Income and Benefits (2022 ACS 5-Year Estimates)

Jurisdiction	Number of Households (Estimate)	Average Income
Burt County[13] *(Census Tract 9632, 9634)*	1,835	$78,388
Cedar County[14]	3,354	$87,555
Colfax County[15]	3,616	$84,258
Cuming County[16]	3,711	$83,313
Dixon County[17]	2,215	$90,696
Dodge County[18] *(Census Tract 9636)*	1,794	$89,263
Knox County *(Census Tract 9763)*	956	$79,763
Madison County[19]	14,002	$84,318
Pierce County[20]	2,876	$81,865
Platte County[21]	13,292	$89,718
Stanton County[22]	2,237	$93,643

[13] United States Census Bureau. (2022.) American Community Survey. Retrieved from https://data.census.gov/table?q=Burt%20County,%20Nebraska&t=Income%20and%20Earnings
[14] United States Census Bureau. (2022.) American Community Survey. Retrieved from https://data.census.gov/table?q=Cedar%20County,%20Nebraska&t=Income%20and%20Earnings
[15] United States Census Bureau. (2022.) American Community Survey. Retrieved from https://data.census.gov/table?q=Colfax%20County,%20Nebraska&t=Income%20and%20Earnings
[16] United States Census Bureau. (2022.) American Community Survey. Retrieved from https://data.census.gov/table?q=Cuming%20County,%20Nebraska&t=Income%20and%20Earnings
[17] United States Census Bureau. (2022.) American Community Survey. Retrieved from https://data.census.gov/table?q=Dixon%20County,%20Nebraska&t=Income%20and%20Earnings
[18] United States Census Bureau. (2022.) American Community Survey. Retrieved from https://data.census.gov/table?q=Dodge%20County,%20Nebraska&t=Income%20and%20Earnings
[19] United States Census Bureau. (2022.) American Community Survey. Retrieved from https://data.census.gov/table?q=Madison%20County,%20Nebraska&t=Income%20and%20Earnings
[20] United States Census Bureau. (2022.) American Community Survey. Retrieved from https://data.census.gov/table?q=Pierce%20County,%20Nebraska&t=Income%20and%20Earnings
[21] United States Census Bureau. (2022.) American Community Survey. Retrieved from https://data.census.gov/table?q=Platte%20County,%20Nebraska&t=Income%20and%20Earnings
[22] United States Census Bureau. (2022.) American Community Survey. Retrieved from https://data.census.gov/table?q=Stanton%20County,%20Nebraska&t=Income%20and%20Earnings

Jurisdiction	Number of Households (Estimate)	Average Income
Thurston County[23]	1,993	$77,536
Wayne County[24]	3,731	$76,450
Total Households	**55,612**	
Median Household Income	**$84,366.62**	

Economy

Employment

In the planning area, a significant majority of the population, totaling over 75 percent, are employed as private wage and salary workers, illustrating the prevalent nature of this employment sector. Noteworthy 14 percent of the population is engaged in government employment, while 10 percent are self-employed. The employment landscape is characterized by its rich diversity, encompassing various sectors such as agriculture, manufacturing, healthcare, education, retail, and service industries.

Table 20: Employment Classes[25]

Participating Jurisdiction	Private Wage and Salary Workers	Government Workers	Self-Employed in own not Incoporated	Unpaid family workers
Burt County *(Census Tract 9632, 9634)*	1,572	274	190	4
Cedar County	3,047	646	577	33
Colfax County	4,271	607	349	48
Cuming County	3,573	575	475	61
Dixon County	2,162	400	235	3
Dodge County *(Census Tract 9636)*	1,812	326	262	3
Knox County *(Census Tract 9763)*	919	129	181	3
Madison County	14,274	2,486	1,325	20
Pierce County	2691	559	524	8
Platte County *(Census Tract 9651)*	1,217	186	367	17
Stanton County	2,394	373	335	9
Thurston County	1,421	1,074	194	9
Wayne County	2,394	373	335	9
Total	**41,747**	**8,008**	**5,349**	**227**

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.

[23] United States Census Bureau. (2022.) American Community Survey. Retrieved from https://data.census.gov/table?q=Thurston%20County,%20Nebraska&t=Income%20and%20Earnings
[24] United States Census Bureau. (2022.) American Community Survey. Retrieved from https://data.census.gov/table?q=Wayne%20County,%20Nebraska&t=Income%20and%20Earnings
[25] United States Census Bureau. (2022.) American Community Survey. Retrieved from https://data.census.gov/table?q=EMPLOYMENT&g=050XX00US31027

- A hazard event will, in many cases, impact at-risk populations in different ways.

The Department of Health and Human Services, (HHS) and Administration for Strategic Preparedness and Response (ASPR) defines at-risk populations as "people with access and functional needs (AFN) (temporary or permanent) that may interfere with their ability to access or receive medical care before, during, or after a disaster or public health emergency. Irrespective of specific diagnosis, status, or label, the term access and functional needs is used to describe a broad set of common and crosscutting access and functional needs."[26]

There are many school districts within the planning area. Schools house a high number of at-risk residents within the planning area during the daytime hours of weekdays, as well as during special events in the evenings and on weekends. **Table 21** identifies the various school districts located within the planning area. This list is comprehensive and does not represent only the school districts participating in this plan.

Table 21: School Inventory[27]

School District	Total Enrollment (2021-2022)
Allen Consolidated Schools	146
Bancroft-Rosalie Public Schools	313
Battle Creek Public Schools	528
Clarkson Public Schools	238
Creighton Community Schools	281
Elkhorn Valley Schools	454
Howells-Dodge Consolidated School	271
Humphrey Public Schools	292
Laurel-Concord-Coleridge Schools	431
Leigh Community Schools	270
Logan View Public Schools	579
Lyons-Decatur Northeast Schools	282
Madison Public Schools	538
Norfolk Public Schools	4,471
Oakland-Craig Public Schools	409
Osmond Community Schools	178
Pender Public Schools	417
Pierce Public Schools	694
Plainview Public Schools	344
Ponca Public Schools	451
Randolph Public Schools	276
Schuyler Community Schools	1,989
Scribner-Snyder Community Schools	193
Stanton Community Schools	354
Wakefield Community Schools	546
Wausa Public Schools	239
Wayne Community Schools	987
West Point Public Schools	717
Winside Public Schools	241
Wisner-Pilger Public Schools	438

[26] Department of Health and Human Services, (HHS), and Administration for Strategic Preparedness and Response (ASPR). (n.d.). At-Risk Individuals with Access and Functional Needs. Retrieved from: https://www.fema.gov/emergency-managers/national-preparedness/frameworks/response

[27] Nebraska Department of Education. (n.d),. Nebraska Education Profile. Retrieved from https://nep.education.ne.gov/

Seniors aged 65 and older are particularly vulnerable to temperature extremes, similar to minors. The prolonged heat waves can leave seniors without adequate resources to address the hazards, leading to potential injuries or even fatalities. Moreover, prolonged power outages, whether occurring independently or due to other factors, can have significant impacts on individuals reliant on medical devices for essential bodily functions. According to a study conducted by the Center for Injury Research and Policy, the vulnerability related to severe winter storms, accompanied by substantial snow accumulations, becomes more pronounced at the age of 55[28]. The study also revealed that on average, there are 11,500 injuries and 100 deaths annually associated with snow removal. Furthermore, 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. **Table 22** identifies the number and capacity of care facilities for counties located in the planning area.

Table 22: Inventory of Care Facilities[29]

County	Hospitals	Hospital Beds	Health Clinics	Adult Care Homes	Adult Care Beds	Assisted Living Homes	Assisted Living Beds
Burt	-	-	-	2	91	1	24
Cedar	-	-	-	4	162	4	74
Colfax	1	25	-	1	52	1	3
Cuming	1	25	-	3	126	3	122
Dixon	-	-	-	1	40	1	19
Dodge	1	75	3	4	313	6	263
Knox	1	17	1	3	162	3	55
Madison	2	281	3	6	515	7	351
Pierce	2	35	-	2	114	1	17
Platte	1	50	1	2	225	5	276
Stanton	-	-	-	1	70	1	20
Thurston	1	21	3	1	25	1	16
Wayne	1	21	-	1	60	2	74

Aside from age-related classifications for at-risk residents, there exist other specific groups within the planning area who face vulnerabilities due to challenges in communication or economic status. **Table 23** provide statistics per county regarding households with English as a second language and population reported as in poverty within the past 12 months.

Table 23 Language and Poverty

County	Percent that Speaks English as a Second Language	Percent Below Poverty Level
Burt *(Census Tract 9632, 9634)*	3.33	13.8
Cedar	1.4	5.4

[28] Nationwide Children's. (n.d.). Snow Shoveling. Retrieved from https://www.nationwidechildrens.org/research/areas-of-research/center-for-injury-research-and-policy/injury-topics/sports-recreation/snow-shoveling

[29] Nebraska Department of Health and Human Services. Rosters of Facilities and Services. Retrieved from https://dhhs.ne.gov/licensure/Pages/Rosters-of-Facilities-and-Services.aspx

County	Percent that Speaks English as a Second Language	Percent Below Poverty Level
Colfax	42.9	10.2
Cuming	8.5	7.7
Dixon	12.9	9.4
Dodge *(Census Tract 9636)*	9.9	8.1
Knox *(Census Tract 9763)*	6.9	2.0
Madison	13.1	12.2
Pierce	1.7	7.9
Platte *(Census Tract 9651)*	17.4	8.2
Stanton	5.7	7.0
Thurston	5.4	19.0
Wayne	7.4	16.6

Residents who speak English as a second language may face challenges before, during, and after hazard events. They may struggle to communicate effectively with others or understand materials used for notification and education. It's important for all community members to be able to receive, understand, and act on relevant information during hazardous situations. Those who have difficulty understanding warnings and notifications due to limited English proficiency may not be able to react promptly. Additionally, educational materials about local hazards are usually in English, posing a challenge for residents who struggle to comprehend written English. These residents are at increased vulnerability to all hazards in the area.

Residents living below the poverty line may require additional resources to prepare for, respond to, or recover from hazard events. Limited economic resources can make it difficult for them to prioritize implementing mitigation measures over immediate needs. Moreover, such residents are more likely to live in older, vulnerable structures such as mobile homes, or in areas prone to hazards like floodplains or sites with chemical storage. This group of residents is more susceptible to all hazards in the planning area.

Housing

The US Census provides information related to housing units and potential areas of vulnerability. The selected characteristics examined in **Table 24** include lacking complete plumbing facilities; lacking complete kitchen facilities; no telephone service available; housing units that are mobile homes; and housing units with no vehicles.

Table 24: Selected Housing Characteristics

County	Occupied Housing Units	Lacking Complete Plumbing Facilities	Lacking Complete Kitchen Facilities	No Telephone Service Available	Housing Unit with no Vehicles Available	Mobile Homes
Burt *(Census Tract 9632, 9634)*	1,835	12	30	8	110	30
Cedar	3,354	2	52	26	95	135
Colfax	3,616	11	8	48	52	486
Cuming	3,711	11	32	25	86	106
Dixon	2,215	11	20	39	57	95
Dodge	1,794	3	67	10	58	101

County	Occupied Housing Units	Lacking Complete Plumbing Facilities	Lacking Complete Kitchen Facilities	No Telephone Service Available	Housing Unit with no Vehicles Available	Mobile Homes
(Census Tract 9636)						
Knox *(Census Tract 9763)*	1,155	0	11	4	24	19
Madison	14,002	49	219	170	652	564
Pierce	2,876	0	15	72	97	125
Platte *(Census Tract 9651)*	1,308	0	0	6	17	23
Stanton	2,237	10	38	71	45	145
Thurston	1,993	10	14	38	172	91
Wayne	3,731	0	60	36	183	57
Total	43,827	119	566	553	1,648	1,977

Approximately one percent of housing units lack access to landline telephone service. This does not necessarily indicate that there is not a phone in the housing unit, as cellular telephones are increasingly a primary form of telephone service. However, this lack of access to landline telephone services does represent a population at increased risk of disaster impacts. Reverse 911 systems are designed to contact households via landline services and as a result, some homes in hazard prone areas may not receive notification of potential impacts in time to take protective actions. Emergency managers should continue to promote the registration of cell phone numbers with Reverse 911 systems.

Approximately five percent of housing units in the planning area are mobile homes. Colfax County has the greatest number of mobile homes (13% of total housing stock). 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.

Stanton and Colfax Counties have the highest percentage of unoccupied housing units, 11.9% and 11.8% respectively. Unoccupied homes may not be maintained as well as occupied housing, thus adding to their vulnerability.

Furthermore, approximately four percent of all housing units 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.

State and Federally Owned Properties

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

Table 25: State and Federally Owned Facilities[30]

County	Facility	Nearest Community
Cedar County	Bow Creek Recreation Area	Village of Wynot
Cedar County	Goat Island Recreation Area	Village of Wynot
Cedar County	Wiseman Wildlife Management Area	Village of Wynot

[30] Nebraska Game and Parks. 2024. "Public Access Atlas." https://outdoornebraska.maps.arcgis.com/apps/webappviewer/index.html

County	Facility	Nearest Community
Colfax County	Maple Creek Recreation Area	Village of Leigh
Colfax County	Whitetail Wildlife Management Area	Schuyler
Cuming County	Black Island Wildlife Management Area	City of Wisner
Dakota County	Basswood Ridge Wildlife Management Area	Village of Homer
Dakota County	Omadi Bend Wildlife Management Area	Homer
Dixon County	Buckskin Hills Wildlife Management Area	Newcastle
Dixon County	Ponca State Park	Ponca
Dixon County	Powder Creek Wildlife Management Area	Ponca
Dodge County	Dead Timber State Recreation Area	City of Scribner
Dodge County	Fremont Lakes State Recreation Area	Fremont
Dodge County	Powder Horn Wildlife Management Area	Village of Snyder
Knox County	Bazile Creek Wildlife Management Area	Niobara
Knox County	Niobrara State Park	Niobara
Knox County	Lewis and Clark SRA	Lindy
Madison County	Oak Valley Wildlife Management Area	City of Battle Creek
Madison County	Yellowbanks Wildlife Management Area	Village of Meadow Grove
Pierce County	Willow Creek State Recreation Area	City of Pierce
Platte County	George D. Says Wildlife Management Area	Genoa
Stanton County	Red Fox Wildlife Management Area	Village of Pilger
Stanton County	Wood Duck Wildlife Management Area	City of Stanton
Wayne County	Sioux Strip Wildlife Management Area	Village of Carroll
Wayne County	Thompson-Barnes Wildlife Management Area	City of Wayne

Historical Sites

According to the National Register of Historic Places for Nebraska by the National Park Service (NPS), there are 150 historic sites located within the planning area by county. A list is provided below in **Table 26**.

Table 26: Historical Sites

County	Site Name	Address	Date Listed	In Floodplain?
Burt County	Edward W. and Rose Folsom Bryant House	104 S. 16th St	8/5/2004	No
Burt County	Burt County Court House	13th St. between M and N Streets	1/10/1990	Yes
Burt County	Burt County State Bank	246 South 13th Street	3/4/2009	Yes
Burt County	Deutsche Evangelische Lutherische St. Johannes Kirche	Address Restricted (Lyons)	8/2/1982	Unknown
Burt County	William and Emma Guhl Farmhouse	Address Restricted (Oakland)	7/2/2008	Unknown

County	Site Name	Address	Date Listed	In Floodplain?
Burt County	Logan Creek Site	Address Restricted	1/26/1970	Unknown
Burt County	A.B. Fuller House	400 8th Street	8/2/1982	No
Burt County	E.C. Houston House	319 N. 13th Street	3/13/1986	Yes
Burt County	Oakland City Auditorium	401 N. Oakland Ave.	3/26/2019	No
Burt County	H.S.M. Spielman House	1103 I St.	7/17/1986	Yes
Burt County	John Henry Stork Log House	Southwestern corner of Section 26, Township 21 North, Range 11 East	5/29/1980	Unknown
Burt County	Tekamah Auditorium	1315 K. Street	3/5/2018	Yes
Burt County	Tekamah Carnegie Library	204 S. 13th Street	3/15/2005	Yes
Burt County	Tekamah City Bridge	US Route 75 over Tekamah Creek	6/29/1992	Yes
Cedar County	Couser Barn	Address Restricted (Laurel)	7/17/1986	Unknown
Cedar County	Cedar County Courthouse	Broadway Ave. between Centre and Franklin Sts.	1/10/1990	Unknown
Cedar County	City Hall and Auditorium	101 N. Broadway	7/21/1983	Unknown
Cedar County	Hartington Carnegie Library	106 S. Broadway Ave.	6/27/2019	Unknown
Cedar County	Hartington Downtown Historic District	Broadway Ave. from Centre St. to Railroad St.; Main St. From Madison Ave. to Alley W of Broadway Ave.	7/1/2019	Unknown
Cedar County	Hartington Hotel	202 North Broadway	11/26/2003	Unknown
Cedar County	Immaculate Conception Catholic Church and Rectory	102 and 108 E. 9th St.	7/5/2001	Unknown
Cedar County	Meridian Bridge	U.S. Route 81 over the Missouri River, just south of Yankton, South Dakota	6/17/1993	Unknown
Cedar County	St. Boniface Catholic Church Complex	Main St.	7/21/1983	Unknown
Cedar County	Saints Peter and Paul Catholic Church Complex	106 W. 889th Rd.	7/5/2000	Unknown
Cedar County	Saints Philip and James Parochial School	89039 570 Ave.	11/26/2003	Unknown
Cedar County	Schulte Archeological Site	Address Restricted	7/30/1974	Unknown
Cedar County	Wiseman Archeological Site	Address Restricted	12/2/1974	Unknown
Cedar County	Franz Zavadil Farmstead	Eastern half of the southeastern quarter of Section 35, Township 33 North, Range 1 West[5]	1/31/1985	Unknown
Colfax County	Z.C.B.J. Opera House	Fourth and Pine	9/28/1988	No
Colfax County	Baumert & Bogner	217 Center St.	7/25/2022	Yes

County	Site Name	Address	Date Listed	In Floodplain?
Colfax County	Colfax County Courthouse	Off Nebraska Highway 15	9/3/1981	No
Colfax County	John Janecek House	805 E. 8th St.	7/15/1982	Yes
Colfax County	Merchant Park	Corner of Higgins Dr. and Adams St.	10/27/2022	Yes
Colfax County	Oak Ballroom	Colfax St.	2/1/1983	Yes
Colfax County	Schuyler Carnegie Library	1003 B St.	11/29/2001	Yes
Colfax County	Schuyler City Hall	1020 A St.	9/3/1981	Yes
Colfax County	Schuyler Downtown Historic District	Railside Dr., Colfax, 12th, C, D & 10th Sts.	7/22/2016	Unknown
Colfax County	Schuyler Site	Address Restricted	8/14/1973	Unknown
Colfax County	US Post Office-Schuyler	119 E. 11th St.	5/11/1992	Yes
Colfax County	Wolfe Archeological Site	Address Restricted	7/30/1974	Unknown
Colfax County	Zion Presbyterian Church	5 miles southeast of Clarkson off Nebraska Highway 15	1/7/1988	No
Cuming County	John G. Neihardt Study	NW corner of Washington and Grove Street	7/28/1992	No
Cuming County	Rattlesnake Creek Bridge	County Road over Rattlesnake Creek, 2.8 miles NW of Bancroft	6/29/1992	Yes
Cuming County	West Point City Auditorium	237 N. Main Street	11/10/2009	No
Dixon County	Cook Blacksmith Shop	204 3rd St.	12/27/1974	Unknown
Dixon County	Dixon County Courthouse	3rd and Iowa Sts.	1/10/1990	Unknown
Dixon County	Emerson City Park	Square block between 4th, 5th, Main & Logan Sts.	3/5/2018	Unknown
Dixon County	Indian Hill Archeological District	Address Restricted	7/6/1984	Unknown
Dixon County	Ponca Historic District	Roughly bounded by East, Court, 2nd, and 3rd Sts.	5/18/1979	Unknown
Dixon County	Swedish Evangelical Lutheran Salem Church	Off Nebraska Highway 35	2/1/1983	Unknown
Dodge County	Barnard Park Historic District	Bounded by 4th, 8th, and Union Sts. and Platte Ave.	7/12/1990	Unknown
Dodge County	Samuel Bullock House	508 W. Military Ave.	9/12/1985	Yes
Dodge County	Dodge County Courthouse	435 N. Park Ave.	1/10/1990	Yes
Dodge County	Charles T. Durkee House	1125 N. Broad St.	8/10/2011	Yes
Dodge County	Fremont Historic Commercial District	Roughly bounded by 3rd, Military, Park, and D Sts.	2/17/1995	Unknown
Dodge County	Fremont Municipal Auditorium	925 Broad St.	7/11/2002	Yes
Dodge County	Fremont Municipal Power Plant and Pumping Station	8th St. and Park Ave.	7/11/2002	Yes
Dodge County	Harder Hotel	503 Main St.	11/27/1989	No

County	Site Name	Address	Date Listed	In Floodplain?
Dodge County	Hooper Historic District	Main, Elk, Fulton, and Myrtle Sts.	5/8/1980	No
Dodge County	Christopher Knoell Farmstead	Northwest of Fremont	1/13/1983	Yes
Dodge County	Love-Larson Opera House	543-545 Broad St.	9/10/1974	Yes
Dodge County	J.D. McDonald House	310 E. Military Ave.	12/10/1980	Yes
Dodge County	North Bend Carnegie Library	140 E. 8th St.	9/3/1981	Yes
Dodge County	North Broad Street Residential Historic District	Along Broad St.	3/17/2015	Yes
Dodge County	Nye House	1643 N. Nye Ave.	11/23/1977	Yes
Dodge County	Old Fremont Post Office	605 N. Broad St.	2/29/1996	Yes
Dodge County	Osterman and Tremaine Building	455 N. Broad St.	5/23/1978	Yes
Dodge County	Schneider's Opera House	104 Ash	9/28/1988	Yes
Dodge County	R.B. Schneider House	234 W. 10th St.	7/15/1982	Yes
Dodge County	Scribner Town Hall	West terminus of Howard St. at 3rd St.	8/30/2010	Yes
Dodge County	George and Nancy Turner House	78 S. C St.	1/11/1996	Yes
Dodge County	Frank Uehling Barn	Off U.S. Route 77	8/1/1985	Unknown
Knox County	Argo Hotel	211 Kansas St.	5/5/1999	No
Knox County	The Commercial Hotel	117 Main St.	4/5/1990	Unknown
Knox County	Congregational Church and Manse	Santee Sioux Reservation	3/16/1972	Unknown
Knox County	Episcopal Church	On the Missouri River in the Santee Sioux Reservation	3/16/1972	Unknown
Knox County	Gross State Aid Bridge	County road 885 Rd over Verdigris Creek, 3.5 miles north and 0.2 miles west of Verdigre	6/29/1992	Unknown
Knox County	Knox County Courthouse	Main St. between Brazile and Bridge Sts.	7/5/1990	Unknown
Knox County	Niobrara River Bridge	Over the Niobrara River 1.3 miles northwest of Niobrara	11/12/1992	Unknown
Knox County	Ponca Agency Archeological District	Address Restricted	7/12/2006	Unknown
Knox County	Ponca Fort Site	Hilltop in Section 29, Township 33 North, Range 7 West	4/3/1973	Unknown
Knox County	Ponca Tribal Self-Help Community Building Historic District	88915 521 Avenue; approximately 3 miles southeast of Niobrara	3/13/2003	Unknown
Knox County	Rad Sladkovsky	At Pishelville, northwest of Verdigre	6/29/1982	Unknown
Knox County	St. Rose of Lima Catholic Church and School Complex	1302-1316 W. 5th St	3/21/2011	No

County	Site Name	Address	Date Listed	In Floodplain?
Knox County	Winnetoon Jail	Junction of 1st St. and Sherman Ave.	2/27/1995	Unknown
Knox County	Winnetoon Public School	308 Jones St.	3/13/2020	No
Knox County	Z.C.B.J. Opera House	4th Ave. and Main	7/6/1988	Yes
Madison County	Dommer-Haase Farmstead	2400 W Eisenhower Ave.	11/5/2018	Unknown
Madison County	First United Presbyterian Church	104 E. 4th Street	12/3/2008	No
Madison County	Grand Theater	120 S 3rd Street	9/4/2013	No
Madison County	Hotel Norfolk	108 N 4th Street	12/1/1988	No
Madison County	Karl Stefan Memorial Airport Administration Building	4100 S. 13th Street	7/11/2002	No
Madison County	Mathewson-Gerecke House	1202 W. Norfolk Avenue	3/12/2012	No
Madison County	Norfolk Carnegie Library	803 W. Norfolk Avenue	12/31/1998	No
Madison county	Norfolk Masonic Temple	907 Norfolk Avenue	11/9/2021	No
Madison County	St. Leonard's Catholic Church	502 S. Nebraska Street	11/27/1989	No
Madison County	Stubbs-Ballah House	1000 Prospect Avenue	12/31/2013	No
Madison County	U.S. Post Office and Courthouse	125 S. 4th Street	10/9/1974	No
Madison County	John Wesley and Grace Shafer Warrick House	4th Street	11/28/1990	Unknown
Pierce County	Athletic Park Band Shell	Junction of Harper and Main Streets, NW corner	11/12/1992	No
Pierce County	Fremont, Elkhorn, and Missouri Valley Railroad Depot	304 S. Main Street	11/16/2005	Yes
Pierce County	Meridian Highway	4.5-mile Conty Road following 552 Avenue, 853 Road, and 551 Avenue	11/29/2001	Yes
Pierce County	Plainview Carnegie Library	102 S. Main Street	2/25/1993	No
Pierce County	Willow Creek Bridge	County Road over Willow Creek, 6.5 miles S. of Foster	6/29/1992	Yes
Platte County	Walter and Ruby Behlen House	2555 Pershing Rd.	3/11/2003	No
Platte County	Citizens State Bank	204 Pine St.	4/24/2013	No
Platte County	Columbus Commercial Historic District	Roughly bounded by 11th and 14th Sts. and 23rd and 28th Aves.	11/21/1996	Unknown
Platte County	Columbus Izaak Walton League Lodge	U.S. Route 81	11/29/2001	Unknown
Platte County	Columbus Loup River Bridge	U.S. Route 30 over the Loup River	6/29/1992	Unknown

County	Site Name	Address	Date Listed	In Floodplain?
Platte County	Dr. Carroll D. and Lorena R. North Evans House	2204 14th St.	3/14/1991	No
Platte County	Feye Archeological Site	Address Restricted	1/21/1974	Unknown
Platte County	First Welsh Calvinistic Methodist Church and Cemetery	Platte County 385 Ave. south of 370 St.	6/25/1999	Unknown
Platte County	Glur's Tavern	2301 11th St.	7/30/1975	No
Platte County	Frederick L. and L. Frederick Gottschalk Houses	2022 17th St.	6/25/1982	No
Platte County	Hill-Rupp Site	Address Restricted	9/30/1985	Unknown
Platte County	Humphrey City Hall	407 S. 4th St.	6/21/1996	No
Platte County	Hanna Larson Archeological Site	Address Restricted	2/20/1975	Unknown
Platte County	Lincoln Highway-Duncan West	North Boulevard in Duncan along rural 145th St.	7/3/2007	Unknown
Platte County	Lincoln Highway-Gardiner Station	115th St. between 340th and 355th Aves.	7/3/2007	Unknown
Platte County	Monroe Congregational Church and New Hope Cemetery	Platte County 310 St. between 400 and 415 Aves.	11/28/1990	Unknown
Platte County	Platte County Courthouse	2610 14th St.	1/10/1990	No
Platte County	C. Segelke Building	1065 17th Ave.	6/25/1982	No
Platte County	H.E. Snyder House	2522 16th St.	7/10/1986	No
Platte County	St. Michael's Catholic Church	Junction of 3rd and Cedar Sts.	11/28/1990	Unknown
Platte County	Albert and Lina Stenger House	815 Lovers Ln.	12/27/2007	No
Platte County	Wurdeman-Lawson Archeological Site	Address Restricted	7/12/1974	Unknown
Stanton County	Stant Carnegie Library	1009 Jackpine St.	11/5/2018	Unknown
Thurston County	Blackbird Hill	Off U.S. Route 75 southeast of Macy	5/2/1979	Unknown
Thurston County	First Thurston County Courthouse	400-412 Main St.	1/10/1990	No
Thurston County	Hensley Spring	Address Restricted	11/7/2022	Unknown
Thurston County	Highway 75 Spring	Address Restricted	11/7/2022	Unknown
Thurston County	Dr. Susan Picotte Memorial Hospital	505 Matthewson St.	12/16/1988	Unknown
Thurston County	Susan La Flesche Picotte House	100 S. Taft St.	11/10/2009	Yes
Thurston County	Sampson Spring	Address Restricted	11/7/2022	Unknown
Thurston County	Thurston County Courthouse	Main St. between 5th and 6th St.	1/10/1990	No
Wayne County	Wayne Commercial Historic District	S. Main, N. Main, and 2nd Street	12/8/2009	No
Wayne County	Wayne County Courthouse	510 Pearl Street	5/2/1979	No
Wayne County	Wayne Municipal Auditorium	222 N. Pearl Street	3/28/2002	No

County	Site Name	Address	Date Listed	In Floodplain?
Wayne County	Wayne United States Post Office	120 Pearl Street	12/27/2007	No
Wayne County	Dr. W.C. Wightman House	702 Lincoln Street	6/13/1978	No

Agriculture

Northeast Nebraska is known for its diverse agricultural landscape, encompassing a variety of farming operations. The region's agriculture includes the production of corn, soybeans, wheat, and livestock such as cattle and hogs. Additionally, dairy farming and poultry production are also prevalent in some parts of the area. The fertile soil and favorable climate in the planning area make it suitable for crop cultivation, and the agricultural sector plays a significant role in the region's economy. Farmers in the area often employ modern agricultural practices and technologies to enhance productivity while also preserving the region's natural resources. Moreover, agricultural education and research institutions in the area contribute to the advancement of farming methods and the sustainability of agriculture.

Utilities

Electricity

Nebraska serves as the only state with 100 percent publicly owned utilities. The planning area is served by several electric utilities that provide reliable electricity to the region. These utilities maintain an extensive network of transmission lines and distribution infrastructure to ensure a consistent power supply to residential, commercial, and industrial consumers. Some of the electric utilities serving Northeast Nebraska include Nebraska Public Power District (NPPD), Cedar-Knox Public Power District, and Lewis and Clark REC. These utilities play a vital role in providing reliable electricity to the communities and businesses across the region. Additionally, cooperatives such as Dixon County Public Power District and Burt County Public Power District also serve various parts of the planning area, contributing to the diverse landscape of electric providers in the area.

The electricity is primarily generated from a mix of sources, including coal, natural gas, wind, and hydroelectric power. With a growing emphasis on renewable energy, the region has seen an increase in the development of wind farms, contributing to the overall energy mix. Additionally, efforts to modernize the grid and enhance energy efficiency are ongoing, aiming to meet the evolving needs of the community while ensuring a sustainable and affordable energy supply.

Water

Northeast Nebraska is characterized by an abundant water supply, with numerous rivers, streams, and lakes contributing to the region's hydrology. The Missouri River forms the eastern border of the region, providing a vital water source for various purposes. Additionally, the Elkhorn River, the Niobrara River, and the Platte River are significant waterways that traverse the area, supporting agricultural irrigation, recreational activities, and wildlife habitats. Groundwater also plays a crucial role in providing water for municipal, industrial, and agricultural uses in the planning area. The presence of the vast High Plains Aquifer beneath the region underscores the importance of groundwater as a valuable resource. Management and conservation efforts are prioritized to ensure the sustainable use of water resources in Northeast Nebraska, benefiting both present and future generations.

Wastewater Treatment

Wastewater treatment in Northeast Nebraska is managed by several entities including local municipal wastewater treatment plants and regional wastewater management authorities. These facilities are responsible for treating and purifying wastewater from residential, commercial, and industrial sources before it is released back into the environment. The treatment process commonly involves physical, chemical, and biological processes to remove contaminants and impurities from the wastewater, ensuring that the discharged water meets environmental quality standards.

Moreover, these treatment facilities play a critical role in environmental protection and public health by safeguarding water quality and minimizing the impact of wastewater on the region's water bodies. Compliance with state and federal regulations governing wastewater treatment is a priority for these facilities, and ongoing investments in infrastructure and technology are made to enhance treatment capabilities and maintain environmental sustainability in the planning area.

Communications

Communications services such as landline and mobile telephone, internet, and television are provided by various companies throughout the planning area. Major telecommunications providers, including national carriers and regional companies, offer a range of services to residents and businesses in the region. Additionally, advancements in technology have led to the expansion of high-speed internet and mobile network coverage in many parts of the district, contributing to improved connectivity and communication capabilities for the community.

The Rural Broadband Task Force, established by LB 994 and signed into law by Governor Ricketts on April 17, 2018, has a primary goal of examining issues related to the availability, adoption, and affordability of broadband services in rural areas of Nebraska. Based on the most recent data available from the FCC as of June 2018, it has been reported that 89% of Nebraskans have access to fixed broadband of at least 25 Mbps down/3 Mbps up. However, this access drops to only 63% when considering rural Nebraskans. This highlights the disparity in broadband access between urban and rural areas within the state.

Transportation

The three interstate highways that are accessible from Northeast Nebraska are I-80, I-29, and I-90. US Highways 81 and 275 have been designated as four-lane expressways in Nebraska. Northeast Nebraska has commercial airline service in Omaha, Sioux City, and Sioux Falls.

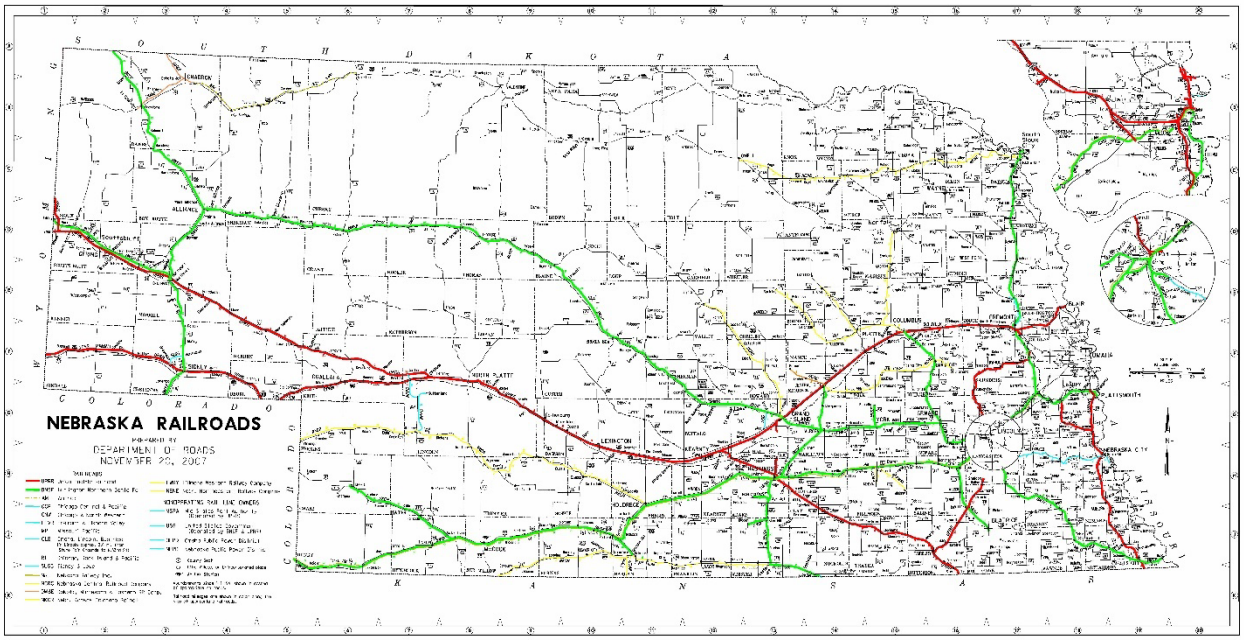
Railroads

Railroads are an essential part of commerce, but they also present hazards in the planning area. Union Pacific and Burlington Northern Santa Fe are the rail service providers for Northeast Nebraska. In addition, Nebraska Central is a short line railroad that connects with these main line rail service providers. The majority of goods are supplied by the more than 70 truck lines serving the region.

Table 27: Railroads

Railroads
Union Pacific Railroad (UPRR)
Burlington Northern Sana FE (BNSF)
Nebraska Northeastern Railway Company (NENE

Figure 7: Nebraska Railroads



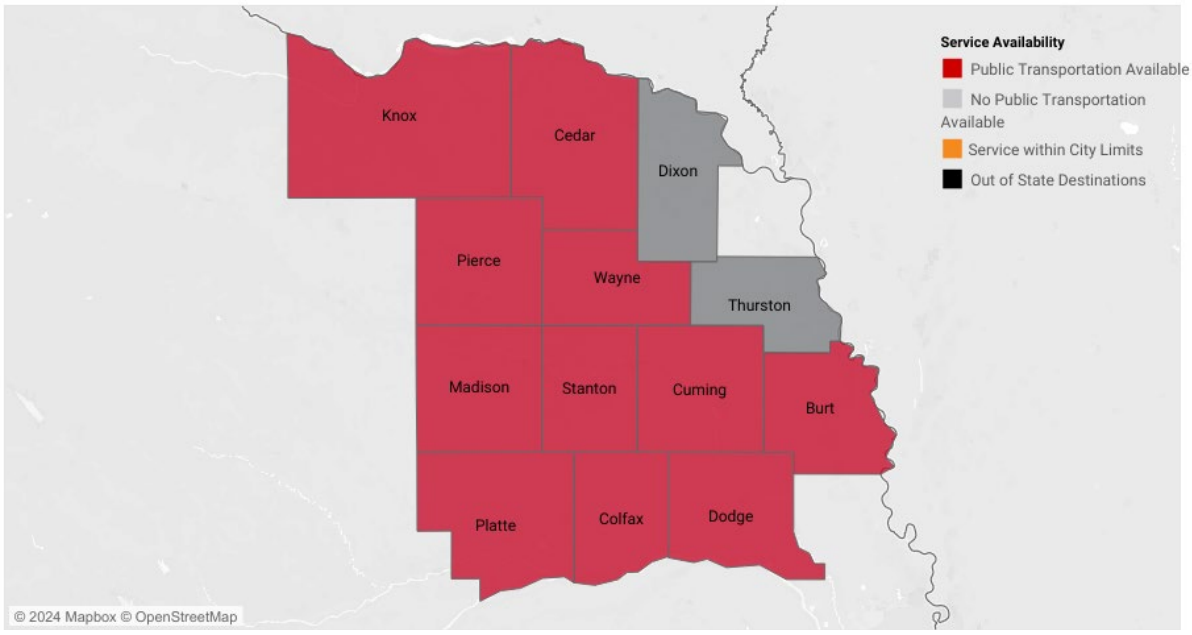
Public Transit

The planning area is served by multiple public transit agencies.

Table 28: Public Transit in Planning Area

Public Transit
Cedar County Transit
North Folk Area Transit
Oakland Public Transit
JoyRide Public Transit
Ponca Express
Butler County Transit Service
Express Arrow Omaha-Norfolk

Figure 8: Public Transit Availability



Capability Assessment

The capability assessment identifies existing authorities, policies, programs, and resources that reduce hazard impacts that could be used to implement hazard mitigation activities. The assessment also provides an evaluation of these capabilities to determine whether the activities can be improved to reduce the impact of future hazards more effectively. Each jurisdiction annex outlines its existing mitigation capabilities within the planning area.

National Flood Insurance Program

As of July 2024, 54 jurisdictions within the planning area are members of the NFIP. **Table 29** identifies each community and the date each participant joined the NFIP.

None of the NFIP communities also participate in the CRS which is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions, meeting the three (3) goals of the CRS:

- Reduce flood losses.
- Facilitate accurate insurance ratings.
- Promote flood insurance awareness.

Table 29: NFIP Participation Information

Jurisdiction	County	Cid	Current Effective Firm Date	Crs Entry Date	Crs Current Effective Date	Crs Class	Program	Participating Community
Allen, Village Of	Dixon County	310244#	7/2/87				Regular	Yes

Jurisdiction	County	Cid	Current Effective Firm Date	Crs Entry Date	Crs Current Effective Date	Crs Class	Program	Participating Community
Battle Creek, City Of	Madison County	310145#	2/4/05				Regular	Yes
Beemer, Village Of	Cuming County	310047	7/16/87				Regular	Yes
Burt County *	Burt County	310420a	6/5/20				Regular	Yes
Clarkson, City Of	Colfax County	310359b	4/5/16				Regular	Yes
Colfax County*	Colfax County	310426b	3/21/19				Regular	Yes
Concord, Village Of	Dixon County	310541					Emergency	Yes
Cuming County *	Cuming County	310427#	4/1/96				Regular	Yes
Decatur, Village Of	Burt County	310021a	6/5/20				Regular	Yes
Dodge County*	Dodge County	310068d	4/17/20				Regular	Yes
Dodge, Village Of	Dodge County	310363#	1/2/08				Regular	Yes
Emerson, Village Of	Thurston County/Dakota County/Dixon County	310366#	1/6/10				Regular	Yes
Hadar, Village Of	Pierce County	315281b	6/4/87				Regular	Yes
Hartington, City Of	Cedar County	310376#	12/17/87				Regular	Yes
Hooper, City Of	Dodge County	310379d	4/17/20				Regular	Yes
Hoskins, Village Of	Wayne County	310289#	3/18/08				Regular	Yes
Howells, Village Of	Colfax County	310380b	3/21/19				Regular	Yes
Knox County *	Knox County	310451b	10/2/15				Regular	Yes
Laurel, City Of	Cedar County	310385	11/5/76				Emergency	Yes
Leigh, Village Of	Colfax County	310386b	4/15/16				Regular	Yes
Lyons, City Of	Burt County	310022a	6/5/20				Regular	Yes
Madison County*	Madison County	310455#	2/4/05				Regular	Yes
Madison, City Of	Madison County	310240#	2/4/05				Regular	Yes
Meadow Grove, Village Of	Madison County	310146#	2/4/05				Regular	Yes

Jurisdiction	County	Cid	Current Effective Firm Date	Crs Entry Date	Crs Current Effective Date	Crs Class	Program	Participating Community
Newcastle, Village Of	Dixon County	310306	8/4/87				Regular	Yes
Nickerson, Village Of	Dodge County	310070#	1/2/08				Regular	Yes
Norfolk, City Of	Stanton County/Madison County	310147#	2/4/05				Regular	Yes
North Bend, City Of	Dodge County	310239#	1/2/08				Regular	Yes
Oakland, City Of	Burt County	310023a	6/5/20				Regular	Yes
Osmond, City Of	Pierce County	310395	7/3/86				Regular	Yes
Pierce County*	Pierce County	310466#	6/4/87				Regular	Yes
Pierce, City Of	Pierce County	310174	9/4/85				Regular	Yes
Pilger, Village Of	Stanton County	310216#	9/30/04				Regular	Yes
Plainview, City Of	Pierce County	310175	9/1/07				Regular	Yes
Platte County *	Platte County	310467#	4/19/10				Regular	Yes
Ponca, City Of	Dixon County	310067	8/1/86				Regular	Yes
Randolph, City Of	Cedar County	310397#	8/16/88				Regular	Yes
Scribner, City Of	Dodge County	310071#	3/3/11				Regular	Yes
Stanton County *	Stanton County	310478#	9/30/04				Regular	Yes
Stanton, City Of	Stanton County	310217#	9/30/04				Regular	Yes
Tekamah, City Of	Burt County	310024a	6/5/20				Regular	Yes
Tilden, City Of	Madison County	310401#	2/4/05				Regular	Yes
Wakefield, City Of	Dixon County	310404#	9/30/05				Regular	Yes
Wayne County *	Wayne County	310484#	3/18/08				Regular	Yes
Wayne, City Of	Wayne County	310231#	3/18/08				Regular	Yes
West Point, City Of	Cuming County	310048#	8/15/80				Regular	Yes
Winslow, Village Of	Dodge County	310410d	4/17/20				Regular	Yes
Wisner, City Of	Cuming County	310049	6/4/87				Regular	Yes

Jurisdiction	County	Cid	Current Effective Firm Date	Crs Entry Date	Crs Current Effective Date	Crs Class	Program	Participating Community
Carroll, Village Of	Wayne County	310257#	3/18/08					No
Craig, Village Of	Burt County	310020a	6/5/20				Regular	No
Humphrey, City Of	Platte County	310381#	4/19/10					No
Uehling, Village Of	Dodge County	310327#	1/2/08					No
Wausa, Village Of	Knox County	310405b	10/2/15					No
Winside, Village Of	Wayne County	310336#	3/18/08					No

Floodplain Management Program

Floodplain Managers

All NFIP participating jurisdictions have a designated Floodplain Manager that is charged with enforcing floodplain regulations, routinely monitoring the floodplains, and providing community assistance such as encouraging owners to maintain flood insurance. A list of Planning Area Floodplain Managers can be found in **Table 30**.

Table 30: Floodplain Managers

Jurisdiction	Name	Title	Phone Number
Burt County	Ann Chytka	Highway Superintendent & Zoning Administrator	402-374-2945
City of Lyons	Whitney Anderson	City Clerk	402-687-2485
City of Oakland	Kayla Eisenmenger	Clerk/Treasurer	402-685-5822
City of Hartington	Brittni Benscoter	City Clerk/Treasurer	402-254-6353
City of Laurel	Daniel Kuhlman	Interim City Administrator	402-256-3112
City of Randolph	Sheila Korth	City Administrator/Clerk	402-337-5900
City of Clarkson	Chuck Hamernik	Zoning Administrator	402-892-3100
Colfax County	Mark Arps	Emergency Manager	402-615-0602
Village of Howells	Dawn Gall	Village Clerk	402—986-1666
Village of Leigh	Larry Fuhr	Floodplain Administrator	402-487-3303
Village of Beemer	Traci Meaike	Village Clerk/Treasurer	402-528-3253
Cuming County	Becky Lerch	Planning and Zoning Administrator	402-372-6008
Village of Howells	Thomas Goulette	City Administrator	402-372-2466
City of Wisner	Randy Woldt	City Administrator	402-529-6616
Village of Allen	Jean Rahn	Clerk and Treasurer	402-635-2444
Village of Concord	Richard McCabe	Utilities Superintendent	402-695-2662
Village of Newcastle	Amanda Kelly	Village Clerk	402-355-2370
City of Ponca	Travis Olander	City Administrator	402-287-2080
City of Wayne	Joel Hansen	Street and Planning Director	402-375-1300
Village of Dodge	Tom Grovijohn	Utility Superintendent	402-693-2239
City of Hooper	Roxanne Meyer	City Clerk/Treasurer	402-654-3649
City of Scribner	Elmer Armstrong	City Administrator/Clerk/Treasurer	402-664-3231
Village of Winslow	Zachary Klein	Village Trustee and Treasurer	402-719-4298

Jurisdiction	Name	Title	Phone Number
City of Battle Creek	Heather McWhorter	Zoning and Floodplain Administrator	402-370-3577
City of Madison	Heather McWhorter	Zoning and Floodplain Administrator	402-370-3577
Village of Meadow Grove	Heather McWhorter	Zoning and Floodplain Administrator	402-370-3577
City of Norfolk	Valerie Grimes	Director of Planning and Development	402-844-2280
Pierce County	Heather McWhorter	Zoning and Floodplain Administrator	402-370-3577
City of Tilden	Heather McWhorter	Zoning and Floodplain Administrator	402-370-3577
Village of Hadar	Linda Spreeman	Clerk	402-379-1720
City of Osmond	Heather McWhorter	Zoning and Floodplain Administrator	402-370-3577
City of Pierce	Chad Anderson	City Administrator	402-329-4164
City of Planview	Jeremy Tarr	City Administrator	402-582-4928
City of Randolph	Sheila Korth	City Administrator/Clerk	402-337-5900
Village of Pilger	Galin Heimann	Clerk/Treasurer	402-396-3563
City of Stanton	Alisha Claussen	Deputy Clerk	402-439-2119
Stanton County	Kylee Klug	Zoning and Floodplain Administrator	402-439-2224
Village of Emerson	Richard McCabe	Utilities Superintendent	402-695-2662
Village of Pender	Christopher Reha	Board Chairperson	402-385-3232
Thurston County	Tom Perez	Emergency Management Coordinator	402-385-6070
Village of Hoskins	Nancy Staub	Deputy Clerk and Floodplain Administrator	402-565-4479
City of Wakefield	Chad Mackling	City Administrator	402-287-2080
City of Wayne	Joel Hansen	Street and Planning Director	402-375-1300
Wayne County	Kyle Huff	Highway Superintendent	402-375-1153

4. Hazard Identification and Risk Assessment

Introduction

The ultimate purpose of this hazard mitigation plan is to minimize the loss of life, personal injury economic injury, and property damage across the planning area. The basis for the planning process is the regional and local risk assessment. This section contains a description of potential hazards, regional vulnerabilities and exposures, probability of future occurrences, and potential impacts and losses. By conducting a regional and local risk assessment, participating jurisdictions can develop specific strategies to address areas of concern identified through this process.

Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards. It allows emergency management personnel to establish early response priorities by identifying potential hazards and vulnerable assets. The process focuses on the following elements:

- Hazard identification—Use all available information to determine what types of disasters may affect a jurisdiction, how often they can occur, and their potential severity.
- Vulnerability identification—Determine the impact of natural hazard events on the people, property, environment, economy, and lands of the region.
- Cost evaluation—Estimate the cost of potential damage or cost that can be avoided by mitigation.

The risk assessment for this hazard mitigation plan update evaluates the risk of natural hazards prevalent in the planning area and meets requirements of the DMA (44 CFR, Section 201.6(c)(2)).

Due to the nature of the planning area, there are several participating communities located in counties which participate in different hazard mitigation plans. Unless otherwise indicated, zonal data presented in this section only includes participating counties. However, when community specific data is available, all communities within the planning area are included.

Identified Hazards

There are countless hazards that pose a threat to human life, health, and well-being, and no attempt is made here to compile an exhaustive list. Those that are addressed in disaster planning are generally categorized as “natural” or “technological” (sometimes “manmade”). The FEMA website contains a thorough discussion and list of hazards in the section entitled “National Risk Index for Natural Hazards” (FEMA, 2022). Some hazards are a threat to all geographic areas while others (e.g., flooding) are more limited in their extent.

The planning area hazards were identified, and their frequency of occurrence was evaluated through a historical analysis using several resources, including:

- 2020 Lower Elkhorn Natural Resources District Hazard Mitigation Plan
- 2021 Cedar Dixon Hazard Mitigation Plan
- 2021 State of Nebraska Hazard Mitigation Plan
- 2022 Flood Mitigation Plan
- Hazard planning documents developed by state, federal, and private agencies
- National Centers for Environmental Information data through 2023

- National Oceanic and Atmospheric Administration/National Weather Service Space Weather Prediction Center
- United States Geological Survey data
- FEMA National Risk Index data

Although FEMA only requires and reviews natural hazards in hazard mitigation plans, the planning area decided to rank and mitigate against a comprehensive list of hazard events that could impact the region. Due to the nature of non-natural hazards and the discretionary status regarding their inclusion, the following hazards of interest have been briefly and qualitatively assessed for the sake of public education and informing their inclusion within the hazard ranking and mitigation process. Hazards that have been identified as significant in the planning area and that will be considered in this Plan are listed in **Table 31**.

Table 31: Planning Area Hazards

Natural Hazards
Agricultural Animal and Plant Disease
Drought
Earthquake
Extreme Temperatures (Cold Wave and Heat Wave)
Flooding
Fire (Wildfire, Urban Fire)
Landslides
Severe Weather (Severe Thunderstorms, Strong Winds, Hail, Tornadoes, Winter Weather)
Human Caused / Technological Hazards
Terrorism
Public Health Emergency
Dam and Levee Failure
Chemical Spill (Fixed Site)
Transportation
Power Loss (Extended, Rolling Blackouts)

Per FEMA's requirement to consider all natural hazards, the following natural hazards were not included because these hazards are not considered significant for the planning area due to its geographic location and lack of significant historical occurrences.

- Avalanche
- Hurricane
- Sea Level Rise
- Storm Surge
- Tsunami
- Volcanic Activity

Historical Disaster Declarations

The following tables list all federal disaster and emergency declarations in the Planning Area between 2003 and 2023, according to FEMA. This list shows the foundation for identifying what hazards pose the most significant risk 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 32: SBA Declarations[31]

Disaster Declaration Number	Declaration Date	Description	Primary Counties	Contiguous Counties
NE-00005	2006	Severe Winter Storm	Madison, Pierce, Wayne	
NE-00011	2007	Severe Winter Storms	Madison, Pierce, Stanton, Wayne	
NE-00014	2007	Severe Storms and Flooding.	Madison	
NE-00020	2008	Severe Storms, Tornadoes, and Flooding	Colfax	Cuming, Madison, Stanton
NE-00021	2008	Severe Storms, Tornadoes, and Flooding	Colfax, Cuming, Stanton	
NE-00033	2010	Severe Winter Storms and Snowstorm	Madison, Stanton, Colfax, Cuming, Pierce, Wayne	
NE-00035	2010	Severe Storms, Ice Jams, and Flooding	Colfax, Cuming, Madison, Pierce, Stanton	
NE-00038	2010	Severe Storms, Flooding, and Tornadoes	Colfax, Cuming, Madison, Pierce, Stanton, Wayne	
NE-00041	2011	Flooding	-	Cuming, Pierce, Wayne
NE-00042	2011	Flooding	-	Cuming, Pierce, Wayne
NE-00048	-	Drought	-	Madison
NE-00049	-	Drought	Madison, Pierce, Stanton, Wayne	Colfax, Cuming
NE-00050	-	Drought	Adams, Boyd, Burt, Butler, Clay, Colfax, Cuming, Dakota, Dodge, Hamilton, Polk, Saunders, Thurston, Webster	Stanton, Wayne
NE-00053	-	Drought	Colfax, Cuming, Madison, Pierce, Stanton, Wayne	

[31] Small Business Administration. 2005-2022. "SBA Disaster Loan Data." Accessed May 2024. https://data.sba.gov/dataset/disaster-loan-data.

Disaster Declaration Number	Declaration Date	Description	Primary Counties	Contiguous Counties
NE-00055	2013	Severe Storms, Winter Storms, Tornadoes, and Flooding	Wayne	
NE-00061	2014	Tornadoes, High Winds and Flooding	Stanton	Cuming, Madison, Pierce, Wayne
NE-00062	2014	Severe Storms, Tornadoes, Straight line Winds, and Flooding	Cuming, Stanton, Wayne	
NE-00071	2018	Severe Storms, Tornadoes, Straight-Line Winds, and Flooding	Cuming, Thurston, Wayne	
NE-00073	2019	Severe Storms, Straight-line Winds, and Flooding	Antelope, Boone, Boyd, Buffalo, Burt, Butler, Cass, Colfax, Cuming, Custer, Dawson, Dodge, Douglas, Frontier, Greeley, Hall, Holt, Howard, Knox, Lancaster, Madison, Nance, Nemaha, Pierce, Platte, Saline, Sarpy, Saunders, Stanton, Thurston, Washington	

Presidential Disaster Declarations

The presidential disaster declarations involving the planning area from 2001 to 2024 are summarized in the following table.

Table 33: Presidential Disaster Declarations[32]

Disaster Declaration Number	Declaration Date	Hazards	Declared County/Area*
1480	7/21/2003	Severe Storms	Cedar, Cuming, Dixon, Knox, Pierce, Platte, and Stanton Counties
1517	5/25/2004	Severe Storms	Burt, Cedar, Colfax, Cuming, Dixon, Dodge, Knox, Madison, Pierce, Platte, Stanton, Thurston, and Wayne Counties
3245	9/13/2005	Hurricane Katrina Evacuees	Burt, Cedar, Colfax, Cuming, Dixon, Dodge, Knox, Madison, Pierce, Platte, Stanton, Thurston, and Wayne Counties
1627	1/26/2006	Severe Storms	Knox, Madison, Pierce, and Wayne Counties

[32] Federal Emergency Management Agency. 2001-2024. “Disasters and Other Declarations.” Accessed May 2024. https://www.fema.gov/disaster/declarations.

Disaster Declaration Number	Declaration Date	Hazards	Declared County/Area*
1674	1/7/2007	Severe Storms	Cedar, Dixon, Knox, Madison, Pierce, Platte, Stanton, and Wayne Counties
1704	06/06/2007	Severe Storm	Knox County
1714	7/24/2007	Severe Storms	Madison County
1770	6/20/2008	Severe Storms	Burt, Colfax, Cuming, Platte, Stanton, and Thurston Counties
1779	07/18/2008	Severe Storm	Dodge County
1853	07/31/2009	Severe Storm	Dixon County
1878	2/25/2010	Severe Storms	Burt, Cedar, Colfax, Cuming, Dixon, Dodge, Knox, Madison, Pierce, Platte, Stanton, Thurston, and Wayne Counties
1902	4/21/2010	Flood	Colfax, Cuming, Dixon, Madison, Pierce, Platte, Stanton, and Thurston Counties
1924	7/15/2010	Severe Storm	Burt, Colfax, Cuming, Dodge, Knox, Madison, Pierce, Platte, Stanton, Thurston, and Wayne Counties
3323	6/18/2011	Flood	Burt, Cedar, Dixon, Knox, and Thurston Counties
4013	8/12/2011	Flood	Burt, Dixon, Knox, and Thurston Counties
4014	8/12/2011	Severe Storm	Dodge County
4156	11/26/2013	Severe Storms	Dixon, Thurston and Wayne Counties
4183	7/24/2014	Severe Storms	Cedar, Cuming, Dixon, Stanton, Thurston, and Wayne Counties
4185	7/28/2014	Severe Stirn	Burt and Thurston Counties
4225	6/25/2015	Severe Storms	Wayne County
4325	8/1/2017	Severe Storms	Cuming, Dodge, Platte, Thurston, and Wayne Counties
4375	6/29/2018	Snow	Knox, Madison, Pierce, and Platte Counties
4387	8/27/2018	Severe Storms	Cedar, Colfax, Cuming, Dixon, Thurston and Wayne Counties
4420	3/21/2019	Flood	Burt, Cedar, Colfax, Cuming, Dixon, Dodge, Knox, Madison, Pierce, Platte, Stanton, Thurston, and Wayne Counties
3483	3/13/2020	Biological	Burt, Cedar, Colfax, Cuming, Dixon, Dodge, Knox, Madison, Pierce, Platte, Stanton, Thurston and Wayne Counties
4521	04/04/2020	Biological	Burt, Cedar, Colfax, Cuming, Dixon, Dodge, Knox, Madison, Pierce, Platte, Stanton, Thurston and Wayne Counties
4616	9/6/2021	Severe Storm	Madison County
4641	2/23/2022	Severe Storm	Burt, Cuming, and Platte Counties
4662	7/27/2022	Severe Storm	Burt, Cedar, Cuming, Dixon, Knox, Pierce, Thurston, and Wayne Counties

Climate Change Impacts & Considerations

One of the most significant issues relating to climate change is documenting that something has changed. Anecdotal information, and stories, may be useful to help identify what needs to be examined, but they are not the same as hard data documenting that a change is underway or has occurred. The various climate

change reports utilized in this plan clearly indicate that climate change is occurring, but they neither identify nor quantify all of the consequential changes that occur along with climate change.

Long term climate trends have increased and will continue to increase the planning area's vulnerability to hazards. Since 1895, Nebraska's overall average temperature has increased by about 1°F. This trend will likely contribute to an increase in the frequency and intensity of hazardous events, which will cause significant economic, social, and environmental impacts on Nebraskans.

As seen in **Figure 9**, the United States is experiencing an increase in the number of billion-dollar natural disasters. Similarly, **Figure 10** shows an increase in the cost and frequency of disasters in Nebraska. Regardless of whether this trend is due to a change in weather patterns or due to increased development, the trend exists.

According to a recent University of Nebraska report (Understanding and Assessing Climate Change: Implications for Nebraska, 2015), Nebraskans can expect the following from the future climate:

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

These trends will have a direct impact on water and energy demands. As the number of 100°F days increase, along with warming nights, the stress placed on the energy grid will likely increase and possibly lead to more power outages. Critical facilities and vulnerable populations that are not prepared to handle periods of power outages, particularly during heat waves, will be at risk. Furthermore, the agricultural sector will experience an increase in droughts, changes in the growth cycle as winters warm, and changes in the timing and magnitude of rainfall. These added stressors on agriculture could have devastating economic effects if new agricultural and livestock management practices are not adopted.

Figure 9: United States Billion Dollar Disasters[33]

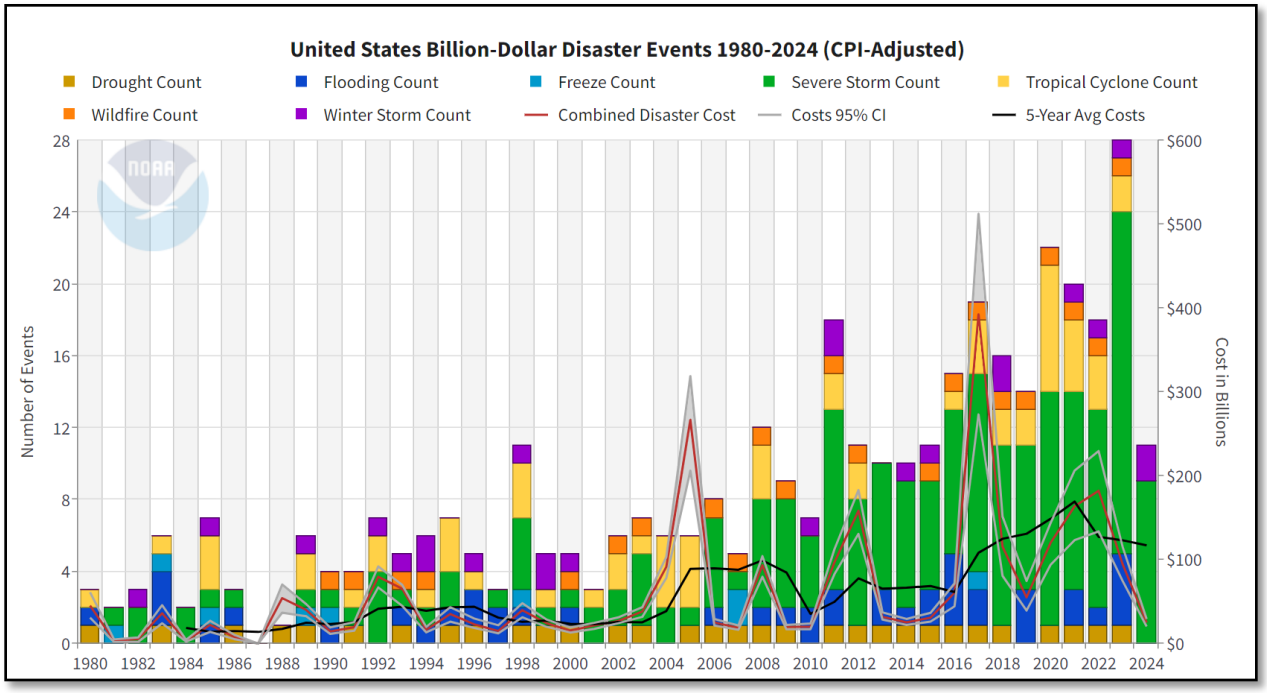
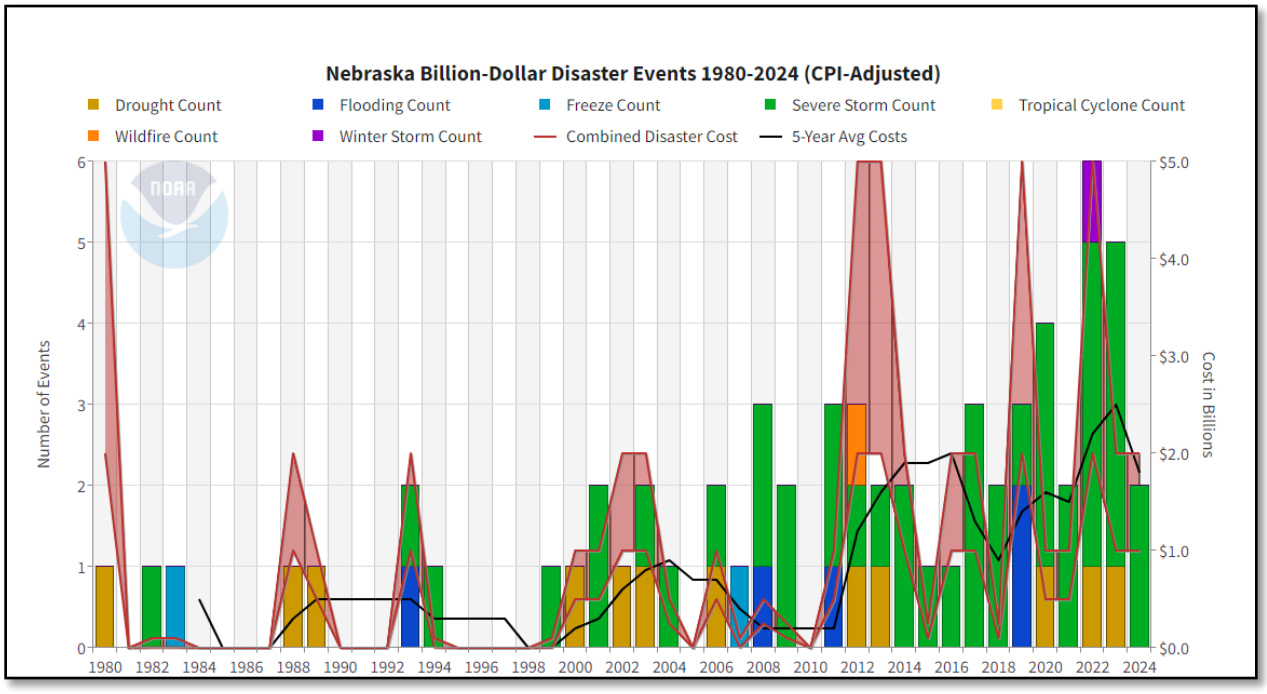


Figure 10: Nebraska Billion-Dollar Disaster Events[34]

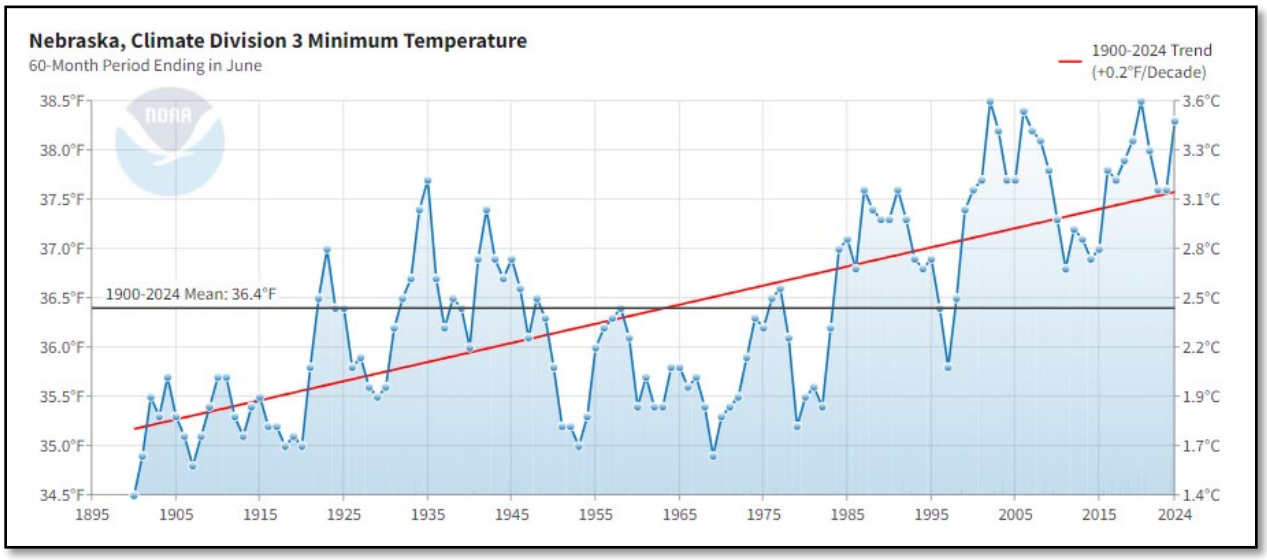


[33] NOAA National Centers for Environmental Information (NCEI). 2024. "Billion-Dollar Weather and Climate Disasters." https://www.ncei.noaa.gov/access/billions/

[34] NOAA National Centers for Environmental Information (NCEI). 2024. "Billion-Dollar Weather and Climate Disasters: Nebraska

Figure 11 shows a trend of increasing minimum temperatures in Climate Division 3, which includes the planning area. High nighttime temperatures can reduce grain yields, increase stress on animals, and lead to an increase in heat-related deaths.

Figure 11: Climate Division 8, Minimum Temperature 1895-2024[35]



Although projections can—and have been—made about future temperatures and rainfall changes, further and continued studies are needed to determine the following impacts that affect the planning area directly:

- Changing climate could cause changes in plant succession, in both disturbed areas and in natural environments.
- Culturally significant species of plants, both food and medicinal, could decrease their range and be less common.
- Insect pests may proliferate with higher mortality for trees, changing the mix of forest species. These could include pine and other tree-killing beetles, spruce budworm, Douglas fir needle midge, etc.
- Plant diseases could spread due to warmer winter temperatures. These could include blister rusts, root rot, and the spread of parasitic plants such as dwarf mistletoe.
- If there is more winter precipitation and runoff, it may increase sedimentation. This could affect fish spawning, require culvert replacement with large culverts, cause damage to roads as well as to private improvements, damage buried utility lines, and more.
- Drought and dry soils may increase erosion, which will end up in streams and culverts. Soils may also be lost through dust storms.
- Lower water levels in streams and rivers, and higher water temperatures, may increase fish mortality during spawning runs. They may also increase the mortality of non-migrating fish.

Summary" Retrieved from https://www.ncei.noaa.gov/access/billions/state-summary/NE

[35] NOAA National Centers for Environmental Information (NCEI). 2024. "Climate at a Glance Divisional Time Series" Retrieved from https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/divisional/time-series/2503/tmin/60/6/1895-2024?base_prd=true&begbaseyear=1895&endbaseyear=2024&trend=true&trend_base=10&begtrendyear=1895&endtrendyear=2024

- There may be more wildland fires. There may be additional expense to keep cheat grass and other noxious weeds from taking over newly damaged and opened lands before trees and other native species can be replanted.

The planning area will have to adapt to these changes or experience an increase in economic losses, loss of life, property damage, and crop damage. HMPs have typically been informed by past events to be more resilient to future events, and this HMP includes strategies for the planning area to address these changes and increase resilience. However, future updates to this plan should consider including adaptation as a core strategy to be better informed by future projections on the frequency, intensity, and distribution of hazards as well.

Hazard Profile

Based on research and experiences of the participating jurisdictions, the hazards profiled were determined to either have a historical record of occurrence or the potential for occurrence in the future. As the planning area is generally uniform in climate, topography, building characteristics, and development trends, overall hazards and vulnerability do not vary greatly across the planning area. The following profiles will examine the identified hazards across the region. Local concerns or deviations from the regional risk assessment will be addressed in Volume II of this plan.

The following sections were used to describe each hazard and communicate each respective level of risk:

- **Hazard Description**—Each hazard profile contains a description of the general definition and causes of the hazard. It may also include background information for understanding the context of the hazard within the planning area.
- **Location**—The location or region in the planning area where each hazard may occur is described.
- **Historical Frequency & Probability of Future Occurrence**—This section identifies past hazard events of note that have occurred in the planning area. It also includes the likelihood of each hazard occurring again if available.
- **Extent**—The strength or magnitude of each hazard is defined, usually through a form of measurement, such as a formula, scale, chart, or graph.
- **Impacts & Loss Estimates**—The potential impacts of each hazard on the region are discussed. This section also outlines the potential economic/monetary loss from a hazard event, in addition to loss of property, structures, facilities, systems, livestock, and life.
- **FEMA NRI Score**—The hazard-specific FEMA National Risk Index scores for each natural hazard is included.
- **Related Hazards**—The hazard profiles that fall under a greater hazard category can be found within this section.

Risk Assessment Methodology

The risk assessment identifies the natural, human-caused, and technological hazards that have potential impacts on all or portions of the planning area. Hazard identification, historical occurrences, and risk modeling (where applicable and available for specific hazards) information was collected from multiple sources including, but not limited to:

- Environmental Systems Research Institute (Esri)
- Federal Emergency Management Agency (FEMA)

- National Centers for Environmental Information (NCEI)
- National Weather Services (NWS)
- United States Geological Survey (USGS)
- Local repositories

This information was analyzed to assess the risk and vulnerability of people, property, the environment, and the jurisdiction's essential operations from these hazards. Furthermore, a risk ranking was performed for the hazards of concern described in this Plan. The risk ranking is an important step in developing an action plan, as it allows jurisdictions to compare the risk factors from one hazard to another. That comparison provides critical information to use in selecting hazard mitigation actions and their priorities. This process is not only intended to help focus actions on the hazards with the highest ranking, but also to ensure that jurisdictions are aware of the hazards that ranked low yet still pose significant risk.

To provide an informed and comprehensive ranking of the hazards addressed in this Plan, a number of categories of factors were considered: probability, extent, vulnerability, and impact. The sum of all the weighted factors for the extent, vulnerability, and impact categories were combined into a final consequence score. Probability multiplied by consequence resulted in a total risk score for each hazard.

$$Extent + Vulnerability + Impact = Consequence$$

$$Consequence \times Probability = TotalRiskScore$$

The following results were obtained by conducting a data-driven quantitative assessment, reviewing and ranking local knowledge from local subject matter experts, and identifying other risk factors developed by the Core Planning Team based on the collected data. These elements were then combined to guide the analysis.

At its core, consequence assesses the potential impact(s) if the hazard incident occurs. In this assessment, the consequence of an event (or the impact) will depend on the following factors:

- Vulnerabilities (i.e., social, physical, and community conditions)
- Capabilities and capacities
- Mitigation
- Characteristics of the hazard event (i.e., magnitude, scale)

The frequency/probability of the hazard is not included in assessing the consequence because without the event, there is no consequence or impact.

Probability/Likelihood of Occurrence

The probability of occurrence of a hazard is indicated by a probability factor based on the likelihood of annual occurrence. Numerical probability factors were assigned as follows.

Table 34 outlines the probability of occurrence factors used in the risk assessment calculations for this Plan. A significant hazard event is defined as any hazard occurrence that directly or indirectly damages structures or infrastructure, impedes normal business operations, and/or is likely to cause serious or fatal injuries. The

assessment of hazard frequency is generally based on past hazard events in the area and professional judgment of local subject matter experts.

Table 34: Probability of Occurrence

Probability	Description	Probability Factor
High	Significant hazard event is likely to occur annually.	3
Medium	Significant hazard event is likely to occur within 25 years.	2
Low	Significant hazard event is likely to occur within 100 years.	1
Unlikely	There is little to no probability of significant occurrence, or the recurrence interval is greater than every 100 years.	0

Extent Factors

Extent was assessed in two (2) categories – extent/intensity potential and catastrophic probability of the hazard. Numerical extent factors were assigned as follows.

Extent / Intensity Factor

Extent is defined as the range of anticipated intensities of the identified hazards. This category is most commonly expressed using various scientific scales (e.g., Saffir-Simpson, Enhanced Fujita, Modified Mercalli). Extent/Intensity Factors are hazard-specific and are detailed in each hazard profile.

Table 35: Extent/Intensity Factor

Probability	Description	Extent Factor
High	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a high-intensity incident.	3
Medium	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a medium-intensity incident.	2
Low	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a low-intensity incident.	1
Unlikely	Historical and/or probabilistic models/studies for this hazard indicate the possibility of little to no intensity.	0

Catastrophic Factor

The probability that an occurrence of this hazard could be catastrophic. Catastrophes are defined as significant incidents that cause sudden and great harm or destruction.

Each category was assigned a weighting factor to reflect its significance, consistent with this typically used for measuring the benefits of hazard mitigation actions – a weighting factor of three (3) was assigned for Extent/Intensity and its potential for Catastrophe.

Table 36: Catastrophic Factor

Probability	Description	Extent Factor
High	Catastrophic hazard event is likely to occur at least once in 10 years.	3

Probability	Description	Extent Factor
Medium	Catastrophic hazard event is likely to occur at least once between 11 and 50 years.	2
Low	Catastrophic hazard event is likely to occur at least once in 51 or more years.	1
No Impact	Virtually no probability that this hazard could be catastrophic.	0

Vulnerability Factors

Vulnerabilities were assessed in three (3) categories – population exposure, property exposure, and exposure based on changes in development. Numerical vulnerability factors were assigned as follows.

Population Exposure Factor

Population exposure values were assigned based on the percentage of the total population exposed to the hazard event.

Table 37: Population Exposure Factor

Probability	Description	Vulnerability Factor
High	30% or more of the population is exposed to the hazard.	3
Medium	15% to 29% of the population is exposed to the hazard.	2
Low	14% or less of the population is exposed to the hazard.	1
No Vulnerability	None of the population is exposed to the hazard.	0

Property Exposure Factor

Property exposure values were assigned based on the percentage of the total property value exposed to the hazard event.

Table 38: Property Exposure Factor

Probability	Description	Vulnerability Factor
High	25% or more of the total assessed property value is exposed to the hazard.	3
Medium	10% to 24% of the total assessed property value is exposed to a hazard.	2
Low	9% or less of the total assessed property value is exposed to a hazard.	1
No Vulnerability	None of the total assessed property value is exposed to a hazard.	0

Changes in Development

Changes in development in the past five (5) years have increased or decreased the community's vulnerability/exposure to the hazard.

Each category was assigned a weighting factor to reflect the significance, consistent with those typically used for measuring the benefits of hazard mitigation actions – a weighting factor of three (3) was assigned for

Population Exposure, and a weighting factor of one (1) was assigned for Property Exposed and Changes in Development.

Table 39: Changes in Development Factor

Probability	Description	Vulnerability Factor
High	Changes in development have increased the vulnerability/exposure of the community to the hazard by 10% or more.	3
Medium	Changes in development have increased the vulnerability/exposure of the community to the hazard between 5% and 9%.	2
Low	Changes in development have increased the vulnerability/exposure of the community to the hazard by 4% or less.	1
No Vulnerability	Changes in development had no effect and/or have decreased the vulnerability/exposure of the community to the hazard.	0

Impact Factors

Hazard impacts were assessed in eight (8) categories – population and life/safety, underserved/equity, property damages, economic, environmental, essential operations, future development, and climate change. Numerical impact factors were assigned as follows.

Population and Life Safety Factor

Population and life safety values were assigned based on the best available data (historical and probabilistic) for people vulnerable to the hazard event and whether the affected population is likely to experience adverse impacts from the hazard incident.

Table 40: Population and Life Safety Factor

Probability	Description	Impact Factor
High	Populations exposed to this hazard are likely to experience significant adverse impacts, such as fatalities and severe injuries.	3
Medium	Populations exposed to this hazard are likely to experience some adverse impacts, such as injuries requiring acute medical care.	2
Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1
No Impact	Populations exposed to this hazard are not likely to experience significant adverse impacts.	0

Underserved/Equity Factor

Underserved/equity values were (1) assigned based on the best available data for underserved populations vulnerable to the hazard event and whether the affected population is (2) likely to experience adverse/disproportionate impacts from the hazard incident resulting in greater disparity in equity.

Table 41: Underserved/Equity Factor

Probability	Description	Impact Factor
High	Underserved populations exposed to the hazard are likely to experience significant adverse/disproportionate impacts, such as fatalities and severe injuries.	3
Medium	Underserved populations exposed to the hazard are likely to experience some adverse/disproportionate impacts, such as injuries requiring acute medical care.	2
Low	Underserved populations exposed to the hazard are likely to experience minimal adverse/disproportionate impacts, such as ambulatory injuries.	1
No Impact	Underserved populations exposed to the hazard are not likely to experience significant adverse/disproportionate impacts.	0

Property Damage Factor

Property damage values were assigned based on the expected total property damage incurred from a hazard incident. It is important to note that values represent estimates of the loss from a major incident based on historical data or probabilistic models/studies.

Table 42: Property Damage Factor

Probability	Description	Impact Factor
High	More than $5 Million in property damages is expected from a single major hazard event, or damages are expected to occur to 15% or more of the property value within the jurisdiction.	3
Medium	More than $500,000 but less than $5 Million in property damages is expected from a single major hazard event, or damages are expected to occur to more than 5% but less than 15% of the property value within the jurisdiction.	2
Low	Less than $500,000 in property damages is expected from a single major hazard event or less than 5% of the property value within the jurisdiction.	1
No Impact	Little to no property damage is expected from a single major hazard event.	0

Economic Factor

An estimation of the impact, expressed in terms of dollars, on the local economy is based on a loss of business revenue, crops, worker wages, and local tax revenues or on the impact on the local gross domestic product (GDP).

Table 43: Economic Factor

Probability	Description	Impact Factor
High	Where the total economic impact is likely to be greater than $10 Million.	3
Medium	Total economic impact is likely to be greater than $100,000, but less than or equal to $10 Million.	2

Probability	Description	Impact Factor
Low	Total economic impact is not likely to be greater than $100,000.	1
No Impact	Virtually no significant economic impact.	0

Environmental Factor

An estimate of the environmental impact from a major hazard event requiring outside resources and support; and/or repair, clean-up, restoration, and/or preservation work.

Table 44: Environmental Factor

Probability	Description	Impact Factor
High	Environmental impact from a single major hazard event is likely to be significant, requiring extensive outside resources and support; and/or repair, clean-up, restoration, and/or preservation work	3
Medium	Environmental impact from a single major hazard event is likely to be localized, requiring some outside resources and support; and/or repair, clean-up, restoration, or preservation work	2
Low	Environmental impact from a single major hazard event is likely to be minimal, requiring little to no outside resources and support, and/or minimal repair, clean-up, restoration, or preservation work	1
No Impact	No environmental impacts from a single major hazard event are likely.	0

Essential Operations Factor

The essential operations factor is the impact on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community after a single major hazard event.

Table 45: Essential Operations Factor

Probability	Description	Impact Factor
High	Significant impact on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event	3
Medium	Some impact on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event	2
Low	Minimal impact on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event	1
No Impact	No impact on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	0

Future Development Factor

The future development factor is the potential that future development will have on increasing or decreasing the impact/consequence of the hazard.

Table 46: Future Development Factor

Probability	Description	Impact Factor
High	Future development trends will significantly increase the impact/consequence of the hazard.	3
Medium	Future development trends will increase the impact/consequence of this hazard, but not significantly.	2
Low	Future development trends will minimally increase impact/consequence of this hazard.	1
No Impact	Future development trends will not increase the impact/consequence of the hazard, and/or may even decrease the impact/consequence of this hazard.	0

Climate Change Factor

The potential that climate change will increase the risk of the hazard (i.e., type, location, and range of anticipated intensities of the hazard and impacts).

Each category was assigned a weighting factor to reflect its significance, consistent with those typically used for measuring the benefits of hazard mitigation actions – a weighting factor of three (3) was assigned for Population and Life Safety, and Underserved/Equity, and a weighting factor of two (2) was assigned for Property Damage. A weighting factor of one (1) was assigned for Economic, Environmental, Essential Operations, Future Development, and Climate Change.

Table 47: Climate Change Factor

Probability	Description	Impact Factor
High	Climate change trends will significantly increase the risk of this hazard and its impacts.	3
Medium	Climate change trends will increase the risk of this hazard and its impacts, but not significantly.	2
Low	Climate change trends will minimally increase the risk of this hazard and its impacts.	1
No Impact	Climate change trends will not increase the risk of this hazard and its impacts.	0

FEMA National Risk Index Scores

The National Risk Index (NRI) is a dataset and online tool to help illustrate the United States communities most at risk communities for 18 natural hazards. These include:

- Avalanche
- Coastal Flooding
- Cold Wave
- Drought
- Earthquake
- Heat Wave
- Hurricane
- Ice Storm
- Landslide
- Lightning
- Strong Wind
- Tornado
- Tsunami
- Volcanic Activity
- Wildfire

- Hail
- Riverine Flooding
- Winter Weather

All the hazards on this list are not applicable to the planning area; therefore, only those hazards with a defined risk to the region will be included in this Plan. The NRI's goal is to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

In the NRI, risk is defined as the potential for negative impacts as a result of a natural hazard. The Risk Index is based on three (3) components – a natural hazards component (Expected Annual Loss), a consequence enhancing component (Social Vulnerability), and a consequence reduction component (Community Resilience). Using these components, the composite and hazard type Risk Index values are calculated for each community (county and Census Tract). Risk Index values form an absolute basis for measuring Risk within the NRI and are used to generate Risk Index percentiles and ratings across communities. [36]

Expected Annual Loss

The Expected Annual Loss (EAL), the natural hazards component of the NRI, represents the average economic loss in dollars resulting from natural hazards each year. It is calculated for each hazard type and quantified loss for relevant consequence types such as, buildings, people, and agriculture. The EAL score and rating represents a community's relative level of expected losses each year when compared to other communities at the same level. Since the score is associated to a community's risk; the higher EAL score results in a higher Risk Index score.[37] **Table 48** illustrates the EAL rating and score for the planning area.

Table 48: Expected Annual Loss (FEMA National Risk Index)[38]

Jurisdiction	EAL Value	Score
Burt County (Census Tract 9632, 9634)	$1,091,849	77.01
Burt County (Census Tract 9634)	$983,662	74.03
Cedar County	$4,123,502	39.52
Colfax County	$4,579,978	43.58
Cuming County	$4,061,137	38.84
Dixon County	$2,901,227	27.92
Dodge County (Census Tract 9636)	$2,775,070	94.18
Knox County (Census Track 9763)	$970,427	73.61
Madison County	$9,196,538	65.58
Pierce County	$2,491,541	22.93
Platte County (Census Tract 9651)	$2,598,624	93.42
Stanton County	$2,516,446	23.18
Thurston County	$2,922,224	28.16
Wayne County	$3,868,878	37.26

Expected Annual Loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).

[36] Federal Emergency Management Agency. (2023). Determining Risk. Retrieved from https://hazards.fema.gov/nri/determining-risk.

[37] Federal Emergency Management Agency. (2023). Expected Annual Loss. Retrieved from https://hazards.fema.gov/nri/expected-annual-loss.

[38] Ibid.

An EAL score and rating is calculated independently for each consequence type (i.e., buildings, population, and agriculture) for each county and Census Tract. The population EAL is measured in fatalities and injuries while the building and agriculture values are measured in dollars. However, for consistency in the unit of measurement, the population EAL was monetized into population equivalence using a value of statistical life (VSL) approach where each fatality or 10 injuries is treated as $11.6 Million of economic loss.

Social Vulnerability

Social vulnerability, the consequence enhancing risk component of the NRI, measures the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. The Social Vulnerability score and rating represent the relative level of a community's social vulnerability compared to all other communities at the same level. A higher Social Vulnerability score results in a higher Risk Index score.[39] **Table 49** illustrates the Social Vulnerability rating and score for the planning area.

Table 49: Social Vulnerability Rating and Score (FEMA National Risk Index)

Jurisdiction	Rating	Score
Burt County (Census Tract 9632)	Relatively Moderate	56.4
Burt County (Census Tract 9634)	Relatively Moderate	46.1
Cedar County	Very Low	0.6
Colfax County	Relatively Low	38.5
Cuming County	Very Low	16.1
Dixon County	Relatively Low	25.0
Dodge County (Census Tract 9636)	Relatively Moderate	50.8
Knox County (Census Tract 9763)	Relatively Low	30.76
Madison County	Relatively Moderate	52.6
Pierce County	Very Low	5.0
Platte County (Census Tract 9651)	Very Low	12.3
Stanton County	Very Low	2.5
Thurston County	Relatively High	79.9
Wayne County	Very Low	5.4

Social Vulnerability is measured using the Social Vulnerability Index (SoVI) published by the University of South Carolina's Hazards and Vulnerability Research Institute (HVRI).

Community Resilience

Community resilience, the consequence reduction risk component, measures the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. The Community Resilience score and rating represent the relative level of a community's resilience compared to all other communities at the same level. Since the score is inversely proportional to a community's risk; the higher Community Resilience score results in a lower Risk Index score.[40] **Table 50** illustrates the Community Resilience rating and score for the planning area

[39] Federal Emergency Management Agency. (2023). Social Vulnerability. Retrieved from https://hazards.fema.gov/nri/social-vulnerability.

[40] Federal Emergency Management Agency. (2023). Community Resilience. Retrieved from https://hazards.fema.gov/nri/community-resilience.

Table 50: Community Resilience Rating and Score (FEMA National Risk Index)

Jurisdiction	Rating	Score
Burt County (Census Tract 9632)	Relatively Moderate	46.7
Burt County (Census Tract 9634)	Relatively Moderate	46.7
Cedar County	Relatively Moderate	55.5
Colfax County	Very Low	17.7
Cuming County	Relatively Moderate	59.0
Dixon County	Relatively Low	37.5
Dodge County (Census Tract 9636)	Relatively High	78.4
Knox County (Census Tract 9763)	Relatively Low	36.16
Madison County	Relatively Moderate	58.2
Pierce County	Relatively High	73.4
Platte County (Census Tract 9651)	Relatively Moderate	54.9
Stanton County	Relatively Moderate	58.1
Thurston County	Relatively Low	27.4
Wayne County	Very High	92.3

Community Resilience is measured using the Baseline Resilience Indicators for Communities (HVRI BRIC) published by the University of South Carolina's Hazards and Vulnerability Research Institute (HVRI).

Total Risk Scores

Table 51 represents the overall risk scores for the planning area, based on the Risk Assessment Methodology defined at the beginning of this section. Following a data driven quantitative assessment, reviewing, and ranking local knowledge from local subject matter experts, and developing other risk elements by the Core Planning Team based on data collected. These elements were aggregated to inform the analysis. The hazards are ranked from highest to lowest based on the Total Risk Score. However, if the Risk Score is the same, then it is ranked by the Probability Factor. If the Probability Factor is the same, then it is ranked by the sum of the Impact Factor. If the Impact Factor is the same, then it is ranked by the sum of the Vulnerability Factor.

Table 51: Risk Index Score for 2024 (FEMA National Risk Index)[41]

Jurisdiction	Rating	Score
Burt County (Census Tract 9632)	Relatively Moderate	77.73
Burt County (Census Tract 9634)	Relatively Moderate	72.88
Cedar County	Very Low	32.9
Colfax County	Very Low	46.96
Cuming County	Very Low	36.91
Dixon County	Very Low	27.65
Dodge County (Census Tract 9636)	Relatively High	93.73
Knox County (Census Tract 9763)	Relatively Moderate	69.33
Madison County	Relatively Low	67.17
Pierce County	Very Low	19.6
Platte County (Census Tract 9651)	Relatively High	87.9
Stanton County	Very Low	16.96
Thurston County	Very Low	40.28
Wayne County	Very Low	26.76

[41] Federal Emergency Management Agency. (2024). National Risk Index. Explore the Map. Retrieved from https://hazards.fema.gov/nri/map

Jurisdiction	Rating	Score

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).

Overall Risk Scores

The following table represents the new overall risk scores for the Planning area based on the methodology above. Following a data-driven quantitative assessment, the planning team utilized subject matter knowledge and expertise and further refined the scores. FEMA NRI Scores and the preliminary Hazard Ranking were used as appropriate and applicable to inform the analysis.

Table 52: 2024 Hazard Risk Scores

	Probability	Consequence				Total Risk
Hazard Event	**Probability Factor**	**Sum of Weighted Extent Factors**	**Sum of Weighted Vulnerability Factors**	**Sum of Weighted Impact Factors**	**Consequence Score**	**Total Risk Score** (Probability x Consequence)
Agricultural Animal and Plant Disease	2	5	9	19	33	37
Drought	3	9	15	30	54	81
Earthquake	1	0	5	4	9	7
Extreme Temperatures	3	11	15	34	60	89
Flooding	2	8	12	35	55	58
Fire	2	8	6	17	31	35
Landslides	1	4	3	8	15	10
Severe Weather (Thunderstorms, Hail, Tornado, Wind)	3	12	17	33	62	91
Terrorism	1	3	6	16	25	16
Public Health Emergency	2	8	6	13	27	31
Dam and Levee Failure	2	8	12	30	50	53
Chemical Spill (Fixed Site)	2	7	8	17	32	36
Transportation	2	6	6	15	27	31
Power Loss	3	8	12	28	48	73

Table 53: Hazard Risk Scores Legend

Classification	Probability Factor	Sum of Weighted Extent Factors	Sum of weighted Vulnerability Factors	Sum of Weighted Impact Factors	Consequence Score	Total Risk Score
Low (L)	1	0–4	0–6	0–13	0–23	0–33
Medium (M)	2	5–8	7–12	14–26	24–46	34–66
High (H)	3	9–12	13–18	27–39	47–69	67–100

This legend—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard.

The Consequence Score represents the sum of the Extent, Vulnerability, and Impact Factors.

The Total Risk Score is a product of Probability and Consequence.

Agricultural Disease Outbreaks

Hazard Description

Agriculture Disease is any biological disease or infection that can reduce the quality or quantity of either livestock or vegetative crops. This section looks at both animal disease and plant disease, as both make up a significant portion of Nebraska's and the planning area's economy. Corn will be highlighted as the primary concern, as it's the most prevalent crop.

The economy of the state of Nebraska is heavily vested in both livestock and crop sales. In Nebraska, agriculture is a major industry, providing 1 in 4 jobs. The state had 44,400 farms and ranches in 2023, averaging 991 acres per operation. The total value of agricultural products sold in 2022 was $31.6 billion, with 52% from livestock and 48% from crops. Nebraska's top 10 commodities for 2022 were cattle and calves, corn, soybeans, hogs, dairy products (milk), chicken eggs, hay, miscellaneous crops, wheat, and potatoes. In 2021, every dollar in agricultural exports generated $1.07 in economic activities. Nebraska's $9.98 billion in agricultural exports in 2022 led to $10.68 billion in additional economic activity. The top five agricultural exports in 2022 were soybeans and soybean products, corn, beef, ethanol, and pork. Nebraska ranked second in 2023 ethanol production capacity, with 24 operating plants having a total production capacity of over 2.3 billion gallons.[42] For the planning area, sold agricultural products were estimated at $7.11 billion with the cost split at $2.95 billion for crops and $4.16 billion for livestock.

Animal Disease

Animal diseases are classified as an impairment of the normal state of an animal that interrupts or modifies its vital functions. Animal diseases that people can catch are called zoonoses. Many diseases affecting humans can be traced to animals or animal products; however, because of the significant contribution to the state's people and economy from agricultural operations, the focus within this section is on those diseases that impact farm animals, and to a limited extent, wild game.[43] The following diseases are those reported in livestock within the planning area during 2023.

Table 54: Animal Disease and Descriptions

Animal Disease	Description
Anaplasmosis	A blood cell parasite of cattle with a worldwide distribution, but the disease is most common in tropical and subtropical areas. The Anaplasma organism invades the red blood cells of infected cattle, and the spleen destroys the infected cells. As a result, infected animals become anemic, weak, lethargic, go off feed, and run a fever.[44]
Bluetongue	Bluetongue is a viral disease spread by biting insects, and it affects ruminant species, especially sheep. The disease causes various symptoms in affected animals, such as ulcers, sores, painful hooves, lameness, and reproductive problems. Affected animals may also experience tongue swelling, which can lead to breathing difficulties. Bluetongue is not contagious and occurs worldwide.[45]

[42] Nebraska Department of Agriculture. Facts Sheet. (n.d.). Retrieved from https://nda.nebraska.gov/facts.pdf

[43] State of Nebraska Hazard Mitigation Plan. (2021). Animal Disease. Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf

[44] Sheppard. Texas A&M Veterinary Medical Diagnostic Laboratory. (2020). Anaplasmosis in cattle. Retrieved from https://tvmdl.tamu.edu/2020/10/19/anaplasmosis-in-cattle/

[45] Nebraska Game and Parks. Wildlife Diseases. (n.d.). Retrieved from https://outdoornebraska.gov/conservation/conservation-challenges/wildlife-diseases/

Animal Disease	Description
Bovine Viral Diarrhea	A disease of cattle caused by the Bovine Viral Diarrhea Virus (BVDV). The virus is widespread, and most herds are at risk for infection. If susceptible (non-vaccinated) animals are infected with a virulent strain of the virus, the disease will likely appear as an acute, severe sickness, with bloody diarrhea, high fever (105–107 ºF), off- feed, mouth ulcers, and often pneumonia.[46]
Epizootic Hemorrhagic Disease	Epizootic Hemorrhagic Disease (EHD) is a viral disease transmitted to deer by biting midges of the Culicoides genus. It affects both white-tailed and mule deer, with white-tailed deer being more susceptible. While cattle can also be infected, they rarely die from the virus. Notably, EHD does not infect humans. The disease typically occurs in late summer and early fall, with clinical signs including fever, hemorrhaging around the orifices, and a lack of fear of humans.[47]
Equine Herpesvirus	A common DNA virus that occurs in horse populations worldwide. The two most common species are EHV-1, which causes abortion, respiratory disease and neurologic disease; and EHV-4, which usually causes respiratory disease only but can occasionally cause abortion and rarely neurological disease. Respiratory disease caused by EHV is most common in weaned foals and yearlings, often in autumn and winter. Adult horses are more likely than younger ones to transmit the virus without showing signs of infection.[48]
Highly Pathogenic Avian Influenza	A viral infection that affects primarily domestic poultry and pet, zoo, and wild birds. In domestic poultry, AI viruses are typically of low pathogenicity (LPAI), causing subclinical infections, respiratory disease, or decreased egg production. The primary risk factor for AI infection in humans has been direct contact with live or dead infected poultry; however, a few cases have resulted from consumption of uncooked poultry products, defeathering of infected wild swans, or close contact with other human cases.[49]
Infectious Bovine Rhinotracheitis / Infectious Pustul Vulvovaginitis	A disease characterized by acute inflammation of the upper respiratory tract. BoHV-1 infection can also sporadically cause abortion in cattle. BoHV-1 infection affects animal health and productivity causing significant economic losses to cattle producers.[50]
Paratuberculosis (Johne's Disease – Bovine)	A chronic, contagious granulomatous enteritis characterized in cattle and other ruminants by progressive weight loss, debilitation, and eventually death. There is no satisfactory treatment. Control requires good sanitation and management to avoid exposure among young animals.[51]
Porcine Reproductive and Respiratory Syndrome	A widespread viral disease that affects domestic pigs, which was first recognized in the United States in 1987. Symptoms include reproductive failure, pneumonia and increased susceptibility to secondary bacterial infection.[52]

[46] College of Veterinary Medicine. Animal Health Diagnostic Center. (n.d.). Bovine Viral Diarrhea: Background, Management, and Control. Retrieved from https://www.vet.cornell.edu/animal-health-diagnostic-center/programs/nyschap/modules-documents/bovine-viral-diarrhea-background-management-and-control

[47] Nebraska Game and Parks. (n.d.). Epizootic hemorrhagic disease. Retrieved from https://outdoornebraska.gov/conservation/conservation-challenges/wildlife-diseases/epizootic-hemorrhagic-disease/

[48] American Association of Equine Practitioners. (n.d.). FAQ: Equine Herpesvirus (EHV). Retrieved from https://aaep.org/horsehealth/faq-equine-herpesvirus-ehv

[49] Swayne. D. Merck Manual. (2023). Avian Influenza. Retrieved from https://www.merckvetmanual.com/poultry/avian-influenza/avian-influenza

[50] MSD Animal Health. (n.d.). Infectious Bovine Rhinotracheitis (IBR). Retrieved from https://www.msd-animal-health.ie/species/cattle/infectious-bovine-rhinotracheitis-ibr/

[51] Collins. M. Merch Manual. (2021). Paratuberculosis in Ruminants. Retrieved from: https://www.merckvetmanual.com/digestive-system/intestinal-diseases-in-ruminants/paratuberculosis-in-ruminants

[52] World Organization for Animal Health. (n.d.). Porcine reproductive and respirator syndrome. Retrieved from

Animal Disease	Description
Seneca Valley Virus	The Seneca Valley Virus (SVV) belongs to the same family as the foot and mouth disease virus and the swine vesicular disease virus. Most cases occur between spring and fall. Infected pigs develop blisters around the nose, mouth, and hooves. Lameness is common, and general symptoms of illness, such as fever, lethargy, and anorexia may occur. The virus can spread through direct contact with infected pigs or through contact with fomites such as boots, brushes, or other equipment. SVV looks similar to foot and mouth disease and requires veterinary diagnostic tests to diagnose.[53]
West Nile Virus	The West Nile virus is a mosquito-borne virus that can cause encephalitis (inflammation of the brain) or meningitis (inflammation of the lining of the brain and spinal cord). It is commonly found in Africa, Europe, the Middle East, North America and West Asia. The virus is transmitted to humans through mosquito bites. Most people infected with West Nile virus do not experience any symptoms, but for some individuals, the virus can cause serious and potentially fatal complications. Symptoms may include fever, headache, body aches, skin rash, and swollen lymph nodes. In severe cases, it can lead to neurological diseases such as encephalitis or meningitis. There is no specific treatment for West Nile virus and prevention primarily involves avoiding mosquito bites and reducing mosquito breeding grounds.[54]

Plant Disease & Pests

Plant diseases are broadly classified according to the nature of their primary causal agent, either infectious or noninfectious. Infectious plant diseases are caused by pathogenic organisms; noninfectious plant diseases are caused by unfavorable growing conditions, including extreme temperatures, imbalance of moisture and oxygen, toxic substances in the soil or atmosphere, and an excess or deficiency of an essential mineral.[55]

A variety of diseases can impact crops and often vary from year to year. The NDA provides information on some of the most common plant diseases, which are listed in **Table 55** below.

Table 55: Plant Disease

Crop	Diseases
Corn	Anthracnose Bacterial Stalk Rot Common Rust Fusarium Stalk Rot Fusarium Root Rot Gray Leaf Spot Maize Chlorotic Mottle Virus Southern Rust Stewart's Wilt Common Smut Goss's Wilt Head Smut

https://www.woah.org/en/disease/porcine-reproductive-and-respiratory-syndrome/

[53] Nebraska Department of Agriculture. (2023). Swine Health Alert: Seneca Valley Virus (SVV). Retrieved from https://nda.nebraska.gov/animal/diseases/svv/index.html

[54] Nebraska Department of Health and Human Services. (n.d.). West Nile Virus. Retrieved from https://dhhs.ne.gov/pages/west-nile-virus.aspx

[55] Ibid.

Crop	Diseases
	Physoderma
Soybeans	Anthracnose
	Bacterial Blight
	Bean Pod Mottle
	Brown Spot
	Brown Stem Rot
	Charcoal Rot
	Frogeye Leaf Spot
	Phytophthora Root and Stem Rot
	Pod and Stem Blight
	Purple Seed Stain
	Rhizoctonia Root Rot
	Sclerotinia Stem Rot
	Sclerotinia Stem Rot
	Soybean Mosaic Virus
	Soybean Rust
	Stem Canker
	Sudden Death Syndrome
Wheat	Barley Yellow Dwarf
	Black Chaff
	Crown and Root Rot
	Fusarium Head Blight
	Leaf Rust
	Tan Spot
	Wheat Soil-borne Mosaic
	Wheat Streak Mosaic
Sorghum	Ergot
	Sooty Stripe
	Zonate Leaf Spot

As outlined in the 2021 Nebraska State Hazard Mitigation Plan, notable common crop diseases and pests are mentioned below in **Table 56**.[56]

Table 56: Crop Disease and Pests

Plant Disease	Description
Corn Diseases and Pests	
Southern Rust	Caused by a fungus, southern rust can rapidly develop under proper weather conditions in certain susceptible hybrids. Severe instances of this disease may cause considerable loss of yield, but if it does not become widespread, it may not require treatment.
Anthracnose	This is a fungal disease that impacts corn with three distinct phases: leaf blight, top dieback, and stalk rot. When the leaf blight phase begins, the lesions on the leaf can easily be confused with gray leaf spot or eye spot. As the disease progresses, the lesions expand to cover large portions of the leaf surface.
Bacterial Leaf Streak	Bacterial leaf streak has been observed on field (dent) corn, seed corn, popcorn, and sweet corn in Nebraska. Symptoms on infected plants may look like other common diseases, sometimes causing confusion and misdiagnoses. Narrow stripes between leaf

[56] State of Nebraska Hazard Mitigation Plan. (2021). Animal Disease. Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf

Plant Disease	Description
	veins may initially look like the common fungal disease, gray leaf spot. Lesions can be brown, orange, and/or yellow and are often yellow when backlit.
Fusarium	Fusarium stalk rot of corn, the most common corn stalk rot in Nebraska, is caused by several species. Two types of conidia are produced, macroconidia and microconidia, that can be splash dispersed onto leaves and washed down the leaf into the sheath and infect at the nodes. The leaves turn from a healthy green color to a dull green and the lower stalk becomes yellowed. Premature plant death may occur and lodging due to disintegration of the internal stalk pith tissue; when squeezed between the thumb and index finger at the lower nodes, the stalk often collapses.[57]
Nematodes	See "Soybean Cyst Nematode" below.
Wheat Diseases and Pests	
Wheat Streak Mosaic	The wheat streak mosaic virus (WSMV) is a member of the Potyviridae family of viruses. It occurs in most leaf cells as flexuous rods. The wheat curl mite, Aceria tosichella, vectors the virus in the field. Leaves of infected plants show a yellowed mosaic pattern of parallel discontinuous streaks. As symptoms, progress the leaves become mottled yellow. Plants infected before early tillering are stunted, discolored and rosetted.[58]
Leaf Rust	Leaf rust, also known as brown rust, is caused by the fungus Puccinia triticina. This rust disease occurs wherever wheat, barley and other cereal crops are grown. Leaf rust attacks foliage only. Identifying symptoms are dusty, reddish-orange to reddish-brown fruiting bodies that appear on the leaf surface. Leaf rust causes the most damage when severe rusting covers the upper leaves before flowering.[59]
Tan Spot	Tan spot is caused by Pyrenophora tritici-repentis. The fungus can survive and reproduce on wheat straw. Early in the growing season, spores called ascospores are released from pseudothecia (tiny black, raised fruiting structures formed on wheat straw) and spread by wind or blowing rain. On leaves, the disease first appears as small, tan to brown lens or diamond-shaped spots. Characteristic symptoms are elliptical to elongate spots that are tan colored, have a dark brown spot near the center and are surrounded by a yellow border. As the lesions increase in size they tend to coalesce, producing larger, irregular areas of dead tissue.[60]
Soybean Diseases and Pests	
Phytophthora Root Rot	Phytophthora root and stem rot (PRR) is a persistent pathogen that is considered to be one of the most yield-limiting diseases to impact soybeans in the United States. Phytophthora is a fungus with many different races, or biotypes. PRR is persistent in that it cannot be eradicated.
Soybean Cyst Nematode	The soybean cyst nematode (SCN) (Heterodera glycines) is a plant parasitic roundworm. The first indication of a problem is when soybean yields are lower than expected or are dropping when soybean are planted in the field. Lower yields will usually be associated with dryer growing seasons. High SCN levels can cause plant stunting and yellowing. Above ground symptoms can be confused with damage from compaction, nutrient deficiencies, drought stress, low-lying wet areas, herbicide injury and other plant diseases. Circular to oval areas of stunted, yellowed plants can be observed. Low levels of SCN can cause significant yield loss with no noticeable above ground symptoms. Symptoms include stunted roots with fewer nitrogen-fixing nodules. SCN infestation may

[57] Nebraska Institute of Agriculture and Natural Resources. Sparks, Adam. (n.d.). Tan Spot Retrieved from https://cropwatch.unl.edu/plantdisease/wheat/tan-spot

[58] Nebraska Institute of Agriculture and Natural Resources. Watkins, John. Wegulo, Stephen (n.d.). Wheat Streak Virus. Retrieved from https://cropwatch.unl.edu/plantdisease/wheat/wheat-streak-mosaic

[59] Crop Science: United States. (2022.). Wheat Rust Diseases. Retrieved from https://www.cropscience.bayer.us/articles/cp/wheat-rust-diseases

[60] Nebraska Institute of Agriculture and Natural Resources. Wegulo, Stephen. (n.d.). Fusarium Stalk Rot. Retrieved from https://cropwatch.unl.edu/plantdisease/corn/fusarium-stalk-rot

Plant Disease	Description
	increase susceptibility to soil-borne fungal infections, such as Rhizoctonia. The only unique symptom or "sign" is the presence of the adult females and cysts on the roots.[61] Figure 12 outlines the areas within the state affected by SCN.
Additional Diseases and Pests of Dry Beans	
Fusarium	See above definition.
Bacterial Wilt	Several pathogen color variants have been reported that produce yellow, orange, or purple pigments, both in culture and as agents staining seeds. The pathogen's host range in addition to common bean, include scarlet runner bean (Phaseolus coccineus), lima bean (P. lunatus), pea (Pisum sativa), soybean (Glycines max), Azuki bean (Vigna angularis) Willd. 0hwi & Ohashi, V. mungo(L.) Hepper, mung bean (V. radiata) L. R. Wilcz., hyacinth bean (Lablab purpureus), and cowpea (V. unguiculata).Field symptoms consist of leaf wilting during periods of warm, dry weather or periods of moisture stress. Plants often recover during evening hours when temperatures are lower, but wilt again during the heat of the day. Infected plants in the Central High Plains have additionally exhibited symptoms consisting of wavy, interveinal, necrotic lesions surrounded by bright yellow borders.[62]
Bacterial Brown Spot	Bacterial brown spot was first seen in Nebraska on the late 1960's in western Nebraska dry bean fields. Varieties of beans that were resistant to this disease were first reported in 1969, but a lack of resistance in modern varieties has led to increased incidence of and damage from bacterial brown spot in recent years. This disease, like bacterial blight, causes most damage in warmer weather, when temperatures are between 80°F and 85°F. These bacteria are able to survive in bean residue and seeds from previous years. Its spread through and between fields, aided by wet weather, hail, and violent storms.[63]
Bacterial Blight	Common bacterial blight of dry beans has been seen in Nebraska since dry beans were first introduced as a crop to the state in the 1920's. It is the most commonly observed bacterial disease of beans in the Central High Plains. It leads to reduced yield and seed quality, and is most destructive during extended periods of warm, humid weather.[64]
Halo Blight	Halo blight has been found on Nebraska farms for over three-quarters of a century. Losses due to halo blight have been reduced by using varieties of seed that are resistant to the disease. This disease is considered to be a major problem wherever bean production is marked by more moderate temperatures, 68F° to 72°F. This disease may lead to shriveled seeds and considerable loss of yield.[65]

[61] Nebraska Institute of Agriculture and Natural Resources. Mangel, Dylan. (n.d.). Soybean Cyst Nematode. Retrieved from https://cropwatch.unl.edu/plantdisease/soybean/soybean-cyst-nematode

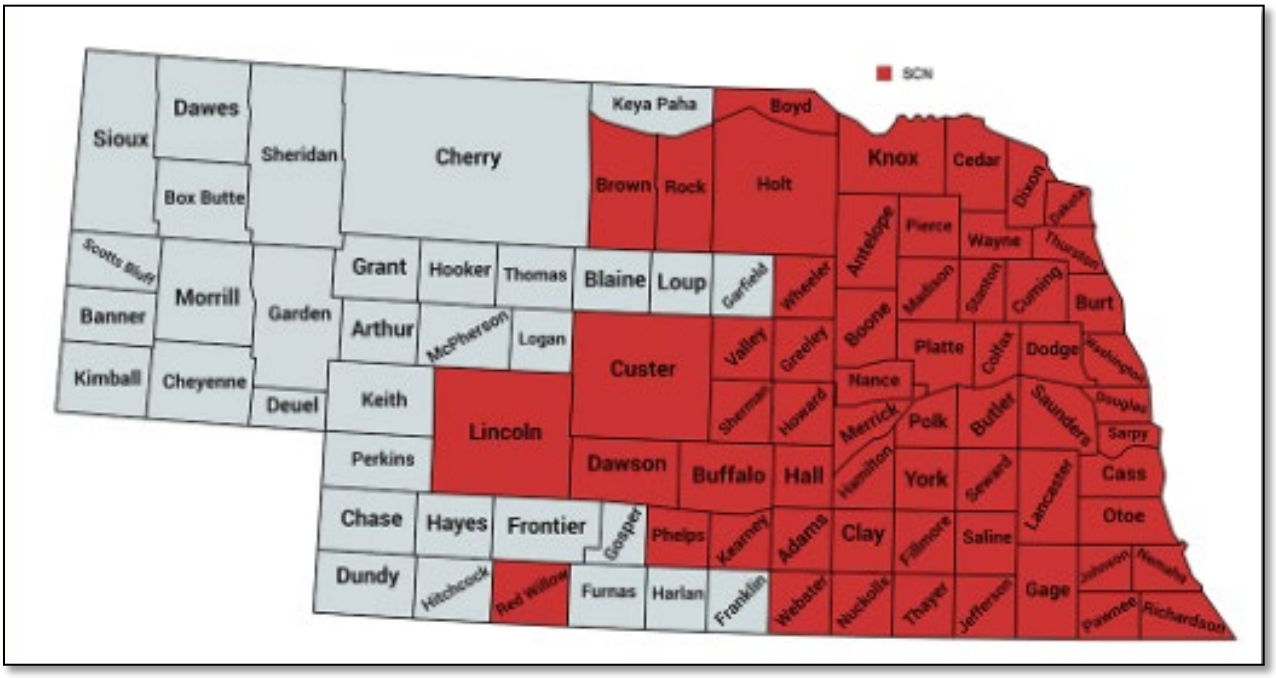
[62] Nebraska Institute of Agriculture and Natural Resources. Harveson, Robert. (n.d.). Bacterial Wilt. Retrieved from https://cropwatch.unl.edu/plantdisease/drybean/bacterial-wilt

[63] Harveson R. M., Bacterial Brown Spot of Dry Beans in Nebraska, 2009.

[64] NebGuide. Harvson R.M. (2009.)

[65] Halo Blight of Dry Beans in Nebraska. Harveson, Robert M. (2009). Retrieved from https://extensionpublications.unl.edu/assets/html/g1958/build/g1958.htm

Figure 12: Soybean Cyst Nematode (2024)[66]



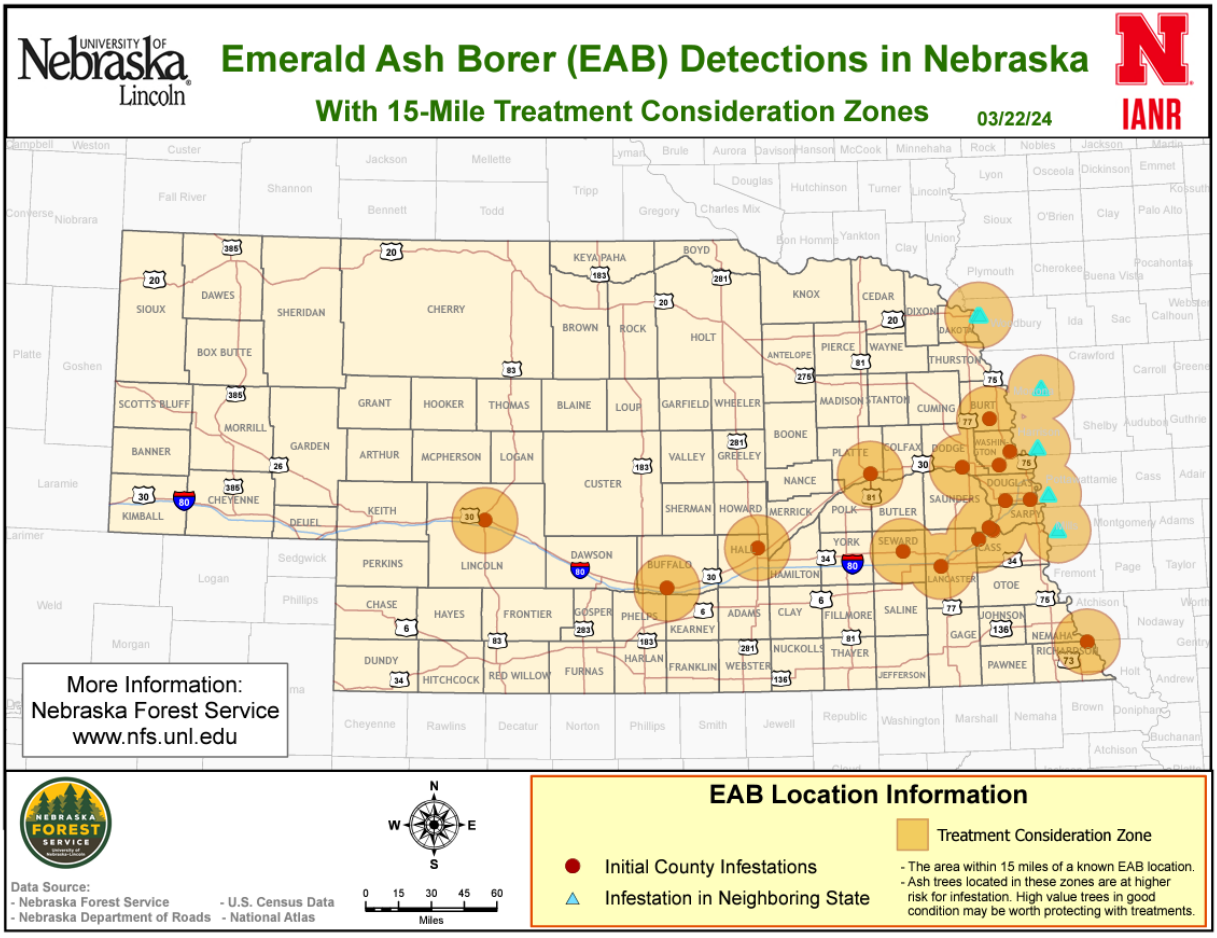
Non-Agricultural Plant Diseases and Pests are described below, focusing on the Emerald Ash Borer and the Japanese Beetle.

Emerald Ash Borer

The spread and presence of the Emerald Ash Borer (EAB) has become a rising concern for many Nebraskan communities in recent years. The beetle spreads through transport of infected ash trees, lumber, and firewood. All species of North American ash trees are vulnerable to infestation. Confirmed cases of EAB have been found in three Canadian provinces and 36 US states, primarily in the eastern, southern, and midwestern regions. **Figure 13** shows the locations of Nebraska's confirmed EAB cases as of 2024, to include Burt, Dodge, and Platte Counties. Additional confirmed cases have likely occurred throughout the year and many communities across the state are prioritizing the removal of ash trees to help curb potential infestations and tree mortality.

[66] Nebraska Institute of Agriculture and Natural Resources. Mangel. D. (2024). Soybean Cyst Nematode. Retrieved from https://cropwatch.unl.edu/plantdisease/soybean/soybean-cyst-nematode

Figure 13 Emerald Ash Borer Detections[67]



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.[68] Estimated economic impacts to Nebraska's 44 million ash trees exceeds $961 million.[69] Dead or dying trees affected by EAB are also more likely to cause damage during high winds, severe thunderstorms, or severe winter storms from weakened or hazardous limbs and can contribute a significant fuel load to grass/wildfire events.

Japanese Beetle

Japanese beetles are invasive pests first found in the United States in New Jersey in 1916. Japanese beetles are currently found in 64 Counties (NDA) A wide range of plants are attacked in the U.S. by the adult beetles.

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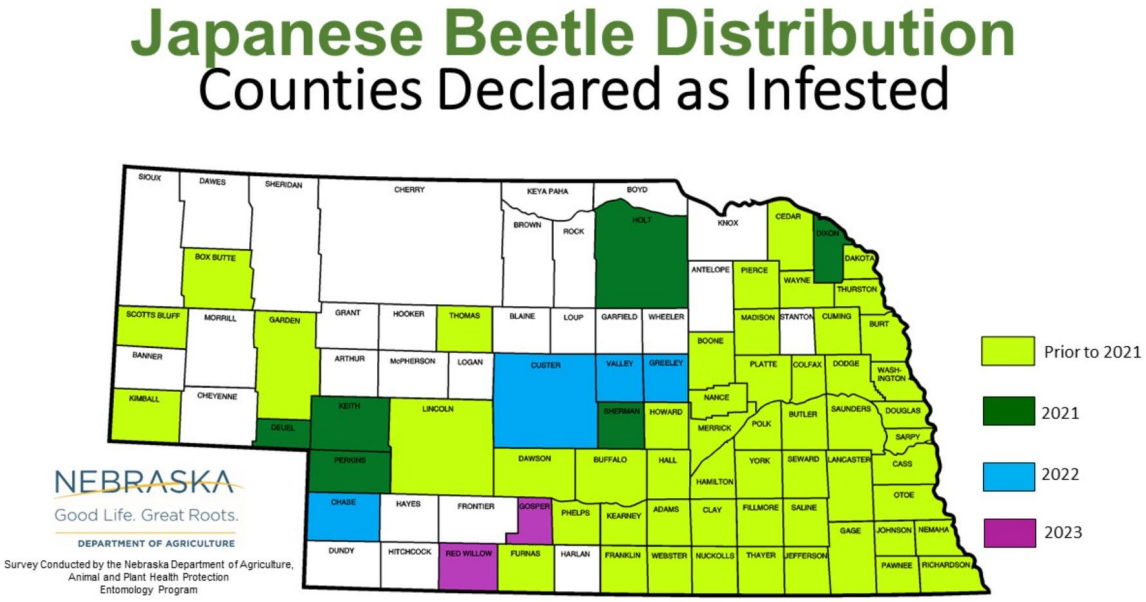
[67] Nebraska Department of Agriculture. (2024). "Emerald Ash Borer." Retrieved from https://nda.nebraska.gov/plant/entomology/eab/index.html

[68] Arbor Day Foundation. (2015). Emerald Ash Borer. Retrieved from https://www.arborday.org/trees/health/pests/emerald-ash-borer.cfm

[69] Nebraska Emerald Ash Borer Response Plan. (2015). Retrieved from https://nfs.unl.edu/NebraskaEABResponsePlan.pdf.

Hosts include small fruits, tree fruits, truck and garden crops, ornamental shrubs, vines and trees. Feeding studies show a host range in excess of 300 plants in 79 plant families. Adult beetles injure corn seriously by eating the silk which interferes with formation of kernels.[70] As of January 1, 2021, Nebraska shifted to a Category 3 state, considered to be generally infested.[71]

Figure 14: Japanese Beetle Distribution[72]



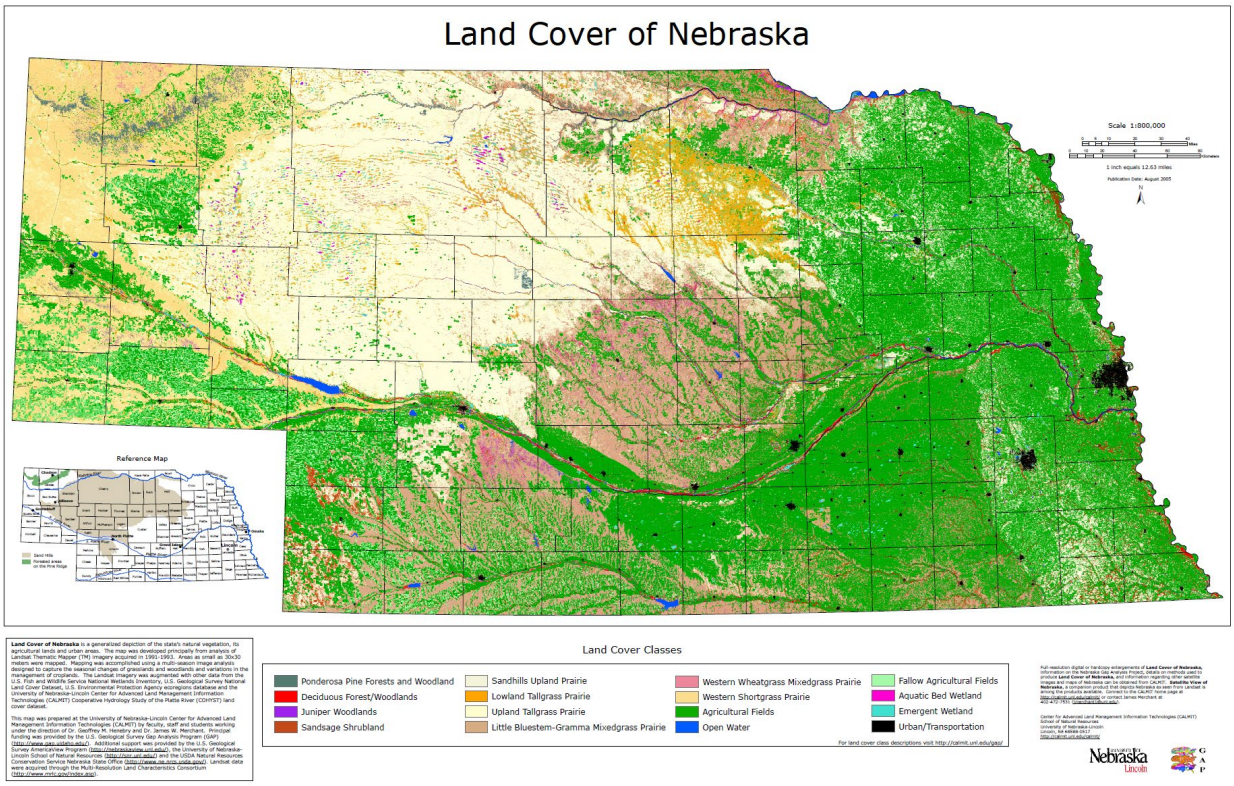
Location

The state of Nebraska has ninety-two percent of its land utilized for agricultural purposes.[73] Given the agricultural presence in the planning area, animal and plant disease have the potential to occur across the planning area. If a major outbreak were to occur, the economy in the entire planning area would be affected, including urban areas.

The main land uses where animal and plant disease will be observed include agricultural lands; range or pasture lands, and forests. It is possible that animal or plant diseases will occur in domestic animals or crops in urban areas. **Figure 15** below illustrates the extensive utilization of Nebraska's land for agricultural purposes.

[70] California Department of Food & Agriculture. (n.d.) Damage caused by Japanese Beetle. Retrieved from https://www.cdfa.ca.gov/plant/JB/pdfs/JB_Damage-web.pdf
[71] Nebraska Department of Agriculture. (n.d.). Survey and Detection Program. Retrieved from https://nda.nebraska.gov/plant/entomology/pest_survey/index.html
[72] Nebraska Department of Agriculture. (n.d.). Survey and Detection Program. Retrieved from https://nda.nebraska.gov/plant/entomology/pest_survey/index.html
[73] Nebraska Department of Agriculture. Facts Sheet. (n.d.). Retrieved from https://nda.nebraska.gov/facts.pdf

Figure 15: Land Cover Map



Extent

There is no standard for measuring the magnitude of agricultural disease. While historical events have impacted a relatively moderate number of livestock and/or crops, Nebraska cropland is vulnerable to disease and other pests, and outbreaks have the potential to incur significant economic damage.[74] The following tables outline the value of both livestock and crops, providing a potential gauge for potential losses due to disease/pests.

Table 57: Livestock Inventory (2022)[75]

County	Market Value of 2022 Livestock Sales ($1000)	Cattle and Calves	Hogs and Pigs	Sheep and Lambs	Poultry Egg Layers
Burt	134,734	26,858	59,393	-	1,024
Cedar	302,694	99,336	17,901	429,421	2,801
Colfax	279,745	83,930	125,923	200,080	562
Cuming	1,346,976	346,446	599,727	941,495	418
Dixon	200,915	37,711	58,753	97,916	1,082
Dodge	187,304	47,195	56,027	204,103	465
Knox	308,825	116,640	141,132	672,954	1,447
Madison	216,677	82,112	100,482	92,878	1,402

[74] State of Nebraska Hazard Mitigation Plan. (2021). Animal Disease. Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf

[75] USDA National Agricultural Statistics Service. (2022). 2022 Census by State Nebraska. Retrieved from https://www.nass.usda.gov/Publications/AgCensus/2022/Full_Report/Volume_1,_Chapter_2_County_Level/Nebraska/

County	Market Value of 2022 Livestock Sales ($1000)	Cattle and Calves	Hogs and Pigs	Sheep and Lambs	Poultry Egg Layers
Pierce	133,792	50,120	58,606	79,476	620
Platte	713,064	125,056	191,434	2,011,927	662
Stanton	100,860	31,763	41,164	320,129	520
Thurston	92,236	37,338	50,251	100	373
Wayne	128,945	35,095	31,493	149,189	408
Total	**4,146,767**	**1,119,600**	**1,500,793**	**5,199,668**	**11,784**

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 for the planning area. Note that at harvest time of 2022 soybeans were valued at $14.30 per bushel and corn valued at $6.90 per bushel.

Table 58: Land and Value of Farms in the planning Area (2022)[76]

County	Number of Farms	Land in Farms (acres)	Market Value of 2022 Crop Sales ($1,000)
Burt	553	249,577	165,655
Cedar	850	451,579	307,503
Colfax	456	212,605	431,408
Cuming	832	362,361	236,936
Dixon	515	275,098	140,007
Dodge	694	337,094	272,319
Knox	950	482,157	160,837
Madison	681	304,018	216,104
Pierce	529	251,807	167,609
Platte	902	430,831	329,147
Stanton	532	193,736	122,622
Thurston	238	155,821	97,986
Wayne	446	262,185	186,863
Total	8,178	3,968,869	2,834,996

Table 59: Crop Values (2022)[77]

County	Corn		Soybeans		Wheat	
	Acres Harvested	Value (2022)	Acres Harvested	Value (2022)	Acres Harvested	Value (2022)
Burt	100,913	16,696,864	89,578	4,303,573	-	-
Cedar	179,816	31,540,287	137,403	7,019,809	60	4,018
Colfax	95,407	16,116,416	74,197	3,401,075	299	18,230
Cuming	149,842	23,727,971	121,321	5,427,042	(D)	(D)
Dakota	72,378	10,808,439	69,246	3,340,465		
Dixon	97,739	14,022,607	76,340	3,300,266	459	(D)
Dodge	156,081	28,061,586	139,477	6,365,518	582	19,560
Knox	104,396	15,692,570	77,128	3,466,395	1,711	79,308
Madison	125,508	21,991,696	102,783	4,984,988	510	38,250
Pierce	96,696	17,190,370	86,493	4,430,987	1,282	70,594

[76] USDA National Agricultural Statistics Service. (2022). 2022 Census by State Nebraska. Retrieved from https://www.nass.usda.gov/Publications/AgCensus/2022/Full_Report/Volume_1,_Chapter_2_County_Level/Nebraska/

[77] USDA National Agricultural Statistics Service. (2022). 2022 Census by State Nebraska. Retrieved from https://www.nass.usda.gov/Publications/AgCensus/2022/Full_Report/Volume_1,_Chapter_2_County_Level/Nebraska/

County	Corn		Soybeans		Wheat	
Platte	186,132	33,536,288	150,847	7,437,100	991	56,928
Stanton	79,307	12,202,257	56,934	2,438,648	164	13,270
Thurston	71,248	9,781,802	56,570	2,202,385	(D)	(D)
Wayne	109,790	17,627,507	99,773	4,570,224	502	30,396
Total	1,625,253	268,996,660	1,338,090	62,688,475	6,560	330,554

Historical Frequency

Animal Disease

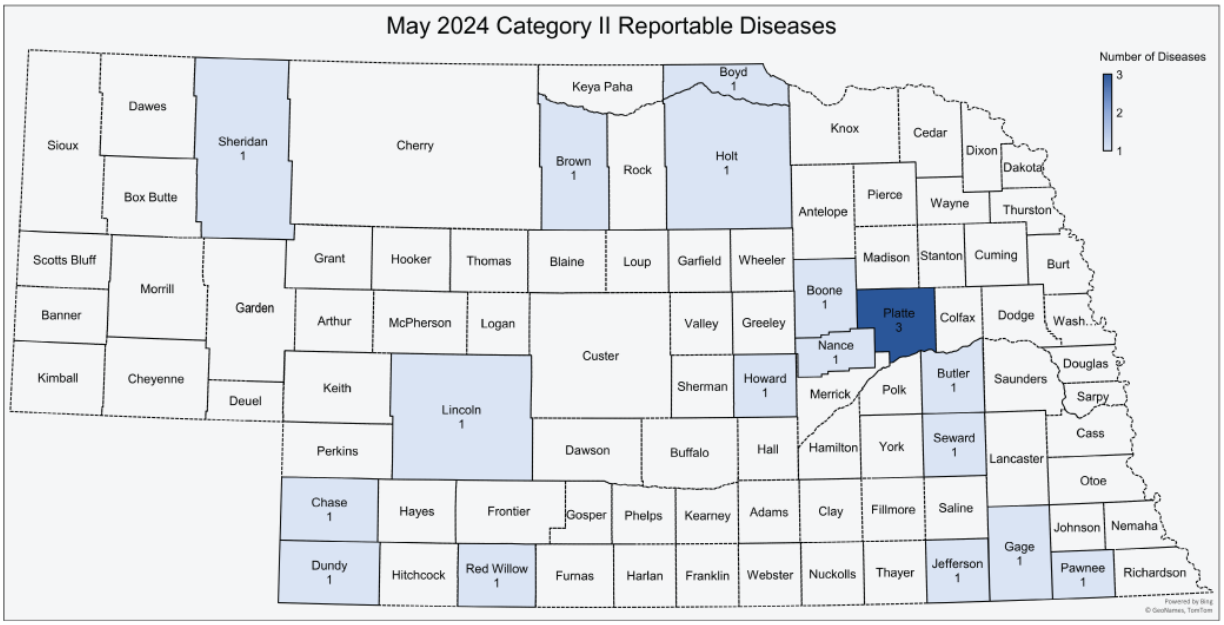
The NDA provides reports on diseases occurring in the planning area. As shown in **Table 60**, during 2023 there was a total of 45 instances of animal disease within the planning area, involving 12 different pathogens. A state-wide breakdown of diseases is illustrated on **Figure 16** and covers the month of May 2024.

Table 60: Livestock Diseases Reported in Planning Area (2023)[78]

County	Burt	Cedar	Colfax	Cuming	Dixon	Dodge	Knox	Madison	Pierce	Platte	Stanton	Thurston	Wayne	Total
Anaplasmosis	2	-	-	-	1	-	-	-	-	1	-	-	-	4
Bluetongue	-	-	-	-	-	1	-	-	-	-	-	-	-	1
Bovine Viral Diarrhea	-	-	-	-	-	-	1	-	-	-	-	-	2	3
Enzootic Bovine Leukosis	-	-	-	-	-	-	-	-	-	3	-	-	-	3
Epizootic Hemorrhagic Disease	1	-	-	-	-	1	-	-	-	-	-	-	-	2
Equine Herpesvirus	-	-	-	-	-	-	-	-	-	1	-	-	-	1
Highly Pathogenic Avian Influenza	-	-	1	-	-	-	-	-	-	-	-	-	-	1
Paratuberculosis	-	4	-	1	1	1	6	2	2	3	1	1	2	24
Porcine Delta Coronavirus	-	1	-	-	-	-	-	-	-	-	-	-	-	1
Porcine Reproductive and Respiratory Syndrome	-	-	1	-	-	-	-	-	-	-	-	-	-	1
Seneca Valley Virus	-	-	-	-	-	-	-	1	-	-	-	-	-	1
West Nile Virus	-	-	-	-	-	1	1	-	-	-	-	-	-	2
Total	**3**	**5**	**2**	**1**	**1**	**4**	**8**	**3**	**2**	**8**	**1**	**1**	**4**	**44**

[78] Nebraska Department of Agriculture. (2024). Livestock Disease Reporting. Retrieved from https://nda.nebraska.gov/animal/reporting/index.html.

Figure 16: 2024 Category II Reportable Livestock Diseases: Nebraska[79]



Boone - Paratuberculosis (Johne's Disease - Bovine)
Boyd - Infectious Bovine Rhinotracheitis/Infectious Pustular Vulvovaginitis
Brown - Paratuberculosis (Johne's Disease - Bovine)
Butler - Paratuberculosis (Johne's Disease - Bovine)
Chase - Bovine Viral Diarrhea (BVD)
Dundy - Bovine Viral Diarrhea (BVD)
Gage - Paratuberculosis (Johne's Disease - Bovine)
Holt - Paratuberculosis (Johne's Disease - Bovine)
Howard - Paratuberculosis (Johne's Disease - Bovine)
Jefferson - Enzootic Bovine Leukosis
Lincoln - Paratuberculosis (Johne's Disease - Bovine)
Nance - Enzootic Bovine Leukosis
Pawnee - Porcine Reproductive and Respiratory Syndrome (PRRS)
Platte - Anaplasmosis (Bovine), Infectious Bovine Rhinotracheitis/Infectious Pustular Vulvovaginitis, Paratuberculosis (Johne's Disease - Bovine)
Red Willow - Enzootic Bovine Leukosis
Seward - Paratuberculosis (Johne's Disease - Bovine)
Sheridan - Leptospirosis (Bovine)

Plant Disease / Pests

As the majority of Nebraska's agricultural efforts are aimed towards corn production (the state ranking 3rd in the nation in overall corn production[80],) disease/pests will primarily be focused on that crop, although others are present.

[79] Nebraska Department of Agriculture. Livestock Disease Reporting. (2024). Retrieved from https://nda.nebraska.gov/animal/reporting/index.html

[80] State of Nebraska Hazard Mitigation Plan. (2021). Plant Disease. Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf

Figure 17: Planning Area Crop Diseases

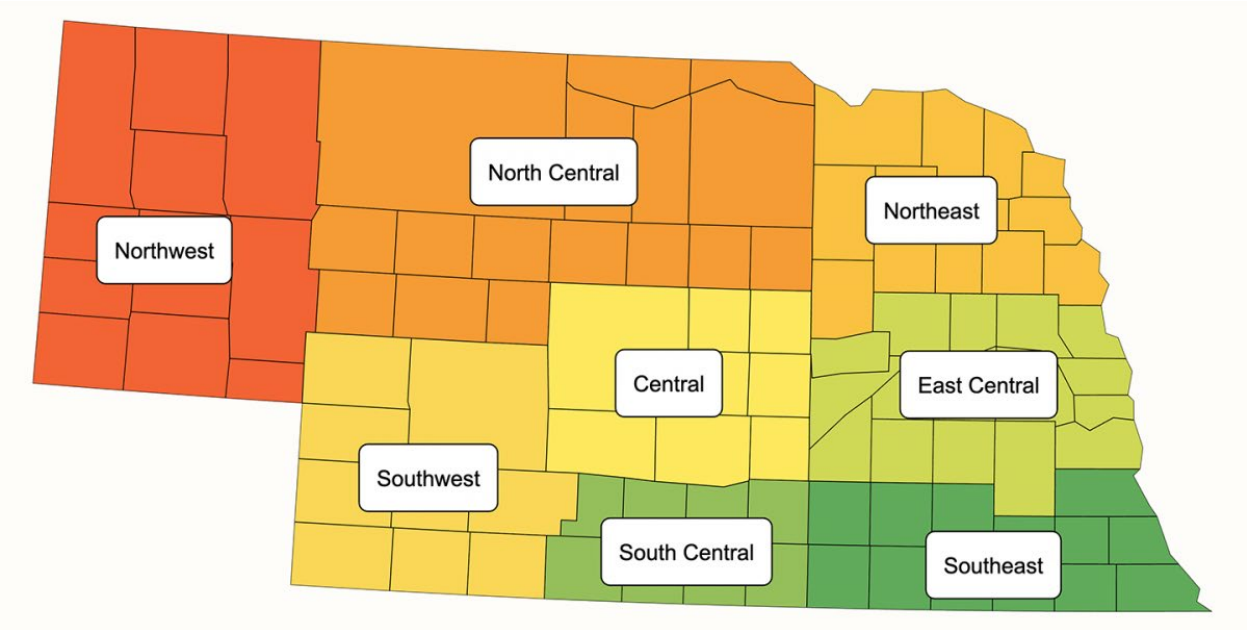


Table 61: Northeast Region Reported Diseases 2024

Northeast Region Reported Diseases
Soybean
Phytophthora Root and Stem Rot (PRSR)
Bean Leaf Beetle
Gall Midge Larvae
Dectes Stem Borer
Corn
Tar Spot
Bacterial Leaf Streak
Common Rust

Probability and Frequency

Due to continual, yearly occurrences of animal and agricultural disease, for the purposes of this plan, the annual probability of occurrence is 100 percent.

Climate Change has the potential to significantly increase the type and severity of both animal and plant diseases due to the warming climate. Increased temperatures can create more favorable conditions for the survival and reproduction of disease-carrying vectors such as mosquitoes and ticks. Furthermore, higher temperatures can alter the geographic distribution of these vectors, potentially expanding the range of certain diseases into new areas. Additionally, warm and humid conditions can create environments that are conducive to the proliferation of certain pathogens, potentially leading to an increase in the incidence of animal diseases.. [81]

[81] MDPI. Atmosphere. Chang, Q.; Zhou, H.; Khan, N.; Ma, J. (2023.) Can Climate Change Increase the Spread of Animal Diseases? Evidence from 278 Villages in China. *Atmosphere* **2023**, *14*, 1581. Retrieved from

Vulnerability and Impact

Life Safety and Health: According to the USDA, plant diseases can have significant life safety and public health impacts. Additionally, plant diseases can compromise food safety and security, impacting the availability and safety of food supplies. For example, diseases that affect crops can lead to foodborne illnesses if contaminated produce enters the food supply chain. The USDA works to monitor and manage these risks through its various food safety programs, aiming to prevent the spread of pathogens like Salmonella and E. coli that can thrive in diseased plants or contaminated agricultural environments. There is a general low impact on life safety and health due to agricultural disease and would generally be secondary such as the availability of certain foods, increased prices, and overall economic damage.[82]

Property Damage and Critical Infrastructure: Agricultural disease has the potential to damage or destroy agricultural products and property (crops, livestock.) The duration and type of disease may leave farmland unusable for a considerable amount of time. Additionally, the die-off or weakening of plants by pests or disease may increase the fuel load of an area, leading to an increase of wildfire danger.[83]

Economy: Depending on the type of disease, the economic impacts may range from minor to severe. Due to the significant portion of the planning area that is dedicated to agriculture, a disruption of production could lead to heavy losses. While highly dependent on the type and severity of the disease, local, regional, and statewide losses could be severe.[84] The loss of income for individuals employed in the agricultural sector could be significant, as 1 in 4 jobs in Nebraska are related to agriculture.[85] The increased food prices from an outbreak or infestation may be the result of agricultural losses. Transportation (and therefore shipping of product,) may be impacted by quarantine locations.

Changes in Development and Impact of Future Development: Agricultural disease is not anticipated to significantly impact current or future developments. Outbreaks or infestations may require planned crops or livestock to be quarantined or destroyed, slowing current and future agricultural development.

Underserved and At-Risk Population: If agricultural losses are severe, increased food prices may disproportionately impact underserved and at-risk populations. The loss of jobs in the agricultural sector due to quarantine, infestation, or disease outbreak likewise would heavily impact those near or close to poverty levels.

Effects of Climate Change in Severity of Impacts: As the overall climate warms, the yields of crops will likely change, as will ideal crops to plant in changing climate zones. If the temperatures exceed a crop's tolerance, a decreased yield or die-off may occur. However, some crops may benefit from a warmer climate. In general, more extreme temperature and precipitation ranges will negatively impact crop growth.[86] Additionally, a warmer and more humid climate is linked with an increase of plant disease severity.[87] Animal

https://doi.org/10.3390/atmos14101581

[82] State of Nebraska Hazard Mitigation Plan. (2021). Animal Disease. Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf

[83] Ibid.

[84] Ibid.

[85] Nebraska Department of Agriculture. Facts Sheet. (n.d.). Retrieved from https://nda.nebraska.gov/facts.pdf

[86] Environmental Protection Agency. (n.d.). City of Chicago. Climate Impacts on Agriculture and Food Supply. Retrieved from https://climatechange.chicago.gov/climate-impacts/climate-impacts-agriculture-and-food-supply

[87] MDPI. Atmosphere. Chang, Q.; Zhou, H.; Khan, N.; Ma, J. (2023.) Can Climate Change Increase the Spread of Animal Diseases? Evidence from 278 Villages in China. *Atmosphere* **2023**, *14*, 1581. Retrieved from https://doi.org/10.3390/atmos14101581

disease is likely to increase in terms of frequency and spread due to climatic warming, as warmer temperatures exacerbate disease development.[88] The same is true for plant diseases, and a warmer and more humid climate is linked to enhanced plant disease severity.[89]

Impacts & Loss Estimates

National Risk Index does not track Agricultural Diseases.

FEMA NRI Score

National Risk Index does not track Agricultural Diseases.

Total Risk Score

Table 63 represents the Agricultural Disease Total Risk Score for the Lower Elkhorn planning area, based on the Risk Assessment Methodology, as defined in this Plan.

Table 62: Agricultural Disease Total Risk Score

Agricultural Disease Total Risk Score						
Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Agricultural Disease	2	5	9	19	33	37
Consequence: Sum of all weighted factors. *Extent: Sum of the weighted Extent factors.* *Vulnerability: Sum of the weighted Vulnerability factors.*				*Impact: Sum of the weighted Impact factors.* *Total Risk Score = Probability x Consequence* ** Normalized to 100*		

Total Risk Score Legend						
Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 50
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	51 – 75
The legend—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The Consequence Score represents the sum of the Extent, Vulnerability, and Impact Factors. The Total Risk Score is a measure of Probability and Consequence.						

[88] MDPI. Atmosphere. Chang, Q.; Zhou, H.; Khan, N.; Ma, J. (2023.) Can Climate Change Increase the Spread of Animal Diseases? Evidence from 278 Villages in China. *Atmosphere* **2023**, *14*, 1581. Retrieved from https://doi.org/10.3390/atmos14101581

[89] Nature Reviews Microbiology. Singh, B.K., Delgado-Baquerizo, M., Egidi, E. *et al.* (2023). Climate change impacts on plant pathogens, food security and paths forward. *Nat Rev Microbiol* 21, 640–656 (2023). Retrieved from https://doi.org/10.1038/s41579-023-00900-7

Chemical Spills – Fixed Sites/Transportation

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

> *Chemicals are found everywhere. They purify drinking water, increase crop production and simplify household chores. But chemicals also can be hazardous to humans or the environment if used or released improperly. Hazards can occur during production, storage, transportation, use or disposal. You and your community are at risk if a chemical is used unsafely or released in harmful amounts into the environment where you live, work or play.*[90]

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. Multiple chemicals are also used extensively in agriculture, which makes up most of Nebraska's land use. These range from fertilizers to powerful pesticides.[91]

Varying quantities of hazardous materials are manufactured, used, or stored in an estimated 4.5 million facilities in the United States—from major industrial plants to local dry-cleaning establishments or gardening supply stores.[92]

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

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.[93]

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[90] Federal Emergency Management Agency. (n.d.). Hazardous Materials Incidents. Retrieved from https://www.ready.gov/hazardous-materials-incidents

[91] U.S Department of Agriculture. Economic Research Service. (n.d.). Fertilizers & Pesticides. Retrieved from https://www.ers.usda.gov/topics/farm-practices-management/fertilizers-pesticides/

[92] United States Air Force. (n.d.). Air Force Be Ready: Hazardous Materials (HAZMAT) Incidents. Retrieved from https://www.beready.af.mil/Disasters-Emergencies/Man-Made-Incident/Hazardous-Materials-Incidents/

[93] 37 Emergency Planning and Community Right-to-Know Act of 1986, Pub. L. No. 116 § 10904. (1986). Retrieved from https://www.govinfo.gov/content/pkg/USCODE-2011-title42/html/USCODE-2011-title42-chap116.htm

Fixed sites are those that involve chemical manufacturing sites and stationary storage facilities. **Table 63** demonstrates the nine classes of hazardous material.

Table 63: Hazardous Material Classes[94]

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

The transportation of hazardous materials is defined by the U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA) as a substance or material that the Secretary of the Department of Transportation has determined is capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and has designated as hazardous under section 5103 of Federal hazardous materials transportation law.[95] According to PHMSA, hazardous materials traffic in the U.S. accounts for 12% of all freight tonnage, equating out to roughly 3.3 billion tons every year, worth an estimated $1.9 trillion. All in all, this averages to about 1 million shipments per day.[96]

[94] International Association of Fire Chiefs Hazmat Fusion Center. DOT Hazard Classification System. (2024). Retrieved from https://www.iafc.org/topics-and-tools/hazmat/fusion-center/transportation-commodities/dot-hazard-classification-system.

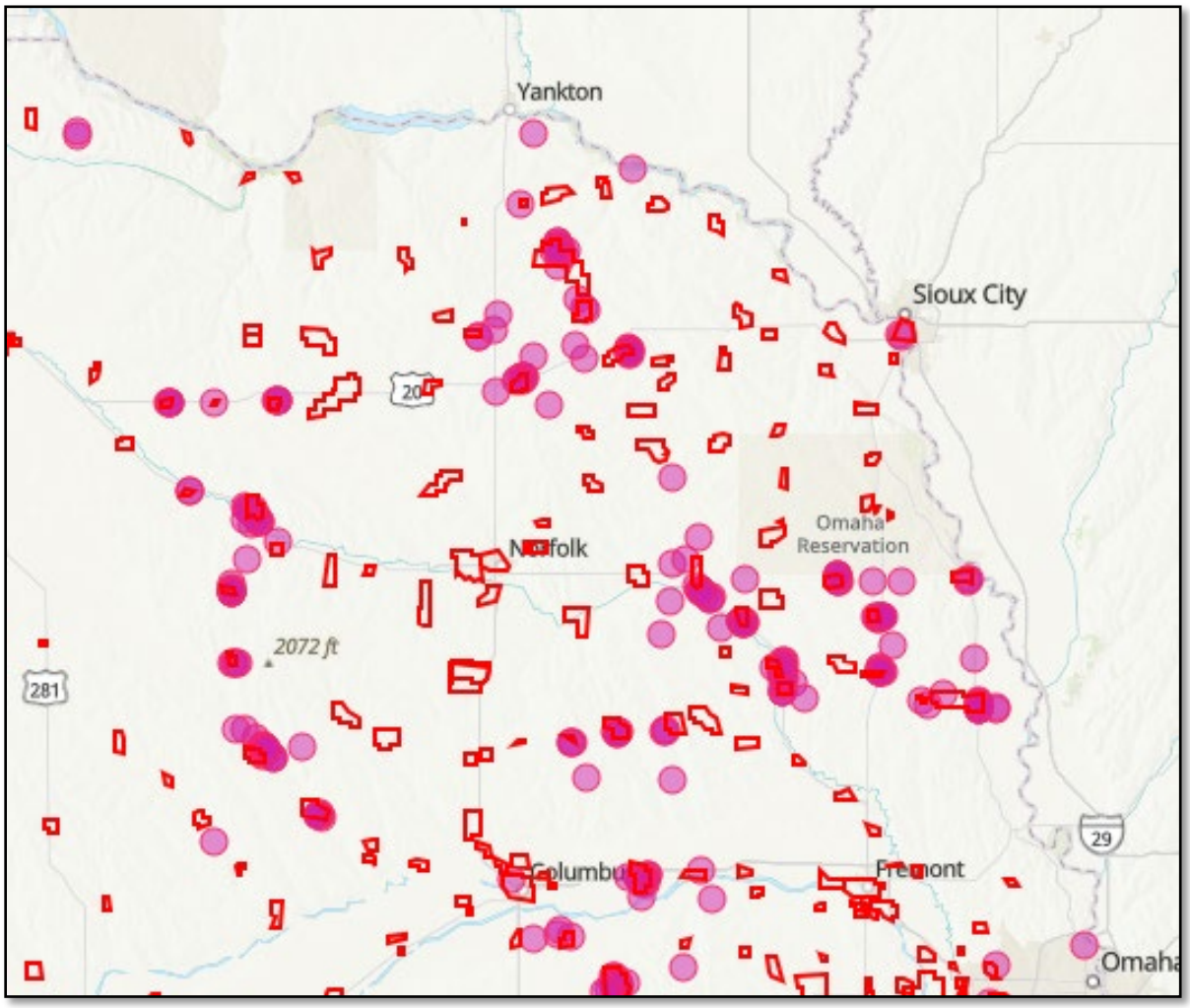
[95] U.S Department of Energy. (2016). Hazardous Material(s). Retrieved from https://www.directives.doe.gov/terms_definitions/hazardous-material

[96] U.S Department of Transportation Pipeline and Hazardous Materials Safety Administration. Office of Hazardous Material Safety. (n.d.). All Incidents. Retrieved from https://portal.phmsa.dot.gov/analytics/saw.dll?Portalpages&PortalPath=%2Fshared%2FPublic%20Website%20Pages%2F_portal%2F10%20Year%20Incident%20Summary%20Reports

Location

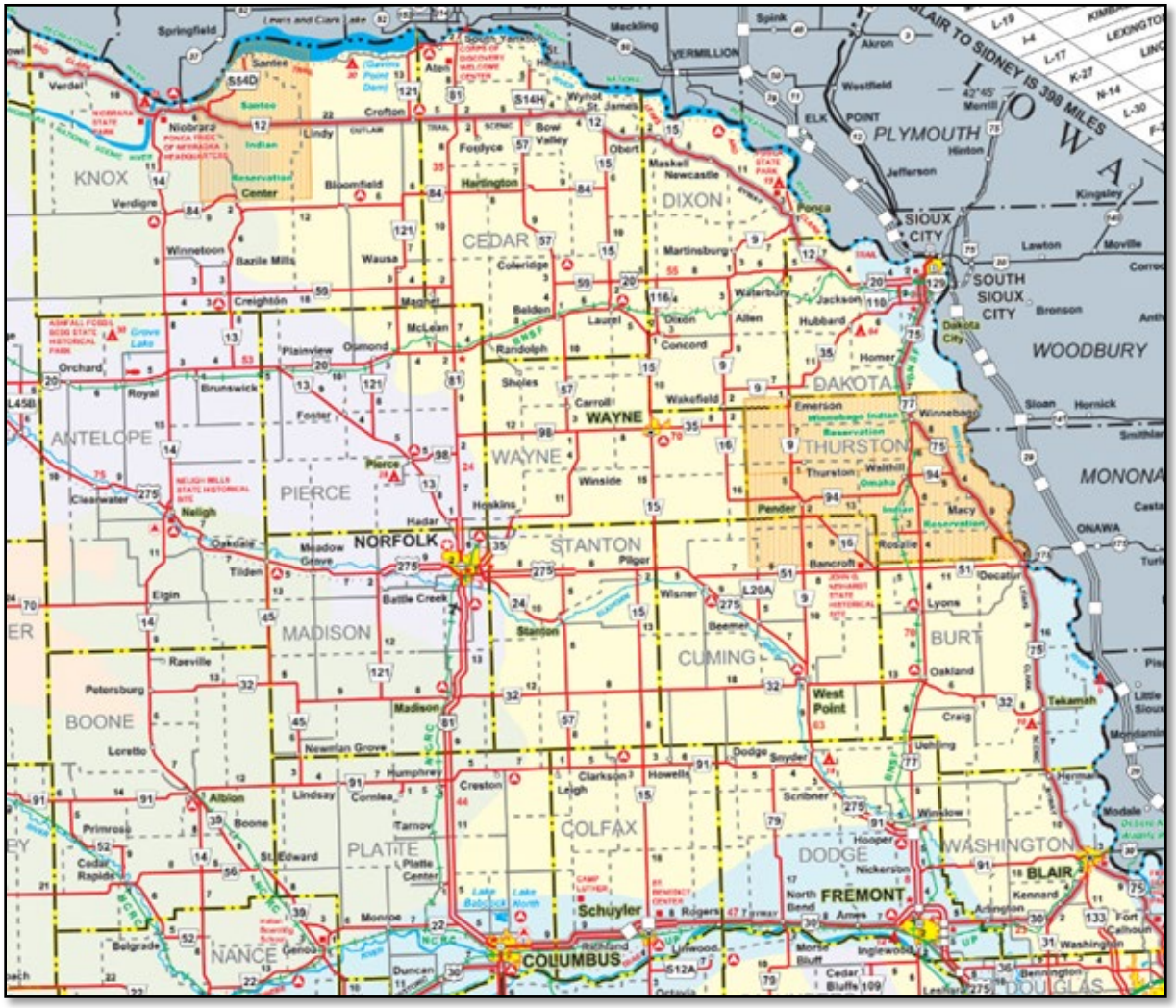
There are **356** locations across the planning area that house hazardous materials, according to the Tier II reports submitted to the Nebraska Department of Environment and Energy (NDEE) in 2023. A listing of chemical storage sites can be found in *Volume II* for each jurisdiction. **Figure 18** illustrates the general location of hazardous material storage sites within the planning area.

Figure 18: Hazardous Materials Storage Sites Map



Chemical releases can occur during transportation, primarily on major transportation routes as identified in **Figure 19**: Major transportation Routes with Half Mile Buffer A large number of spills also occur during the loading and unloading of chemicals. Participating communities reported chemical transportation via railroads and primary highways as having the potential to impact communities. Railroads providing service through the planning area have developed plans to respond to chemical release along rail routes.

Figure 19: Transportation Routes



Extent

The extent of chemical spills at fixed sites varies and depends on the type of chemical that is released with most events localized to the facility. 127 fixed chemical spills have occurred in the planning area, and the total amount spilled ranged from 0 gallons to 8,000 pounds or 6,000 gallons of pollutant. Of the fixed chemical spills, two spills led to the evacuation of 200 individuals each while others led to injuries and fatalities. Based on historic records, it is likely that any spill involving hazardous materials will not affect an area larger than a quarter mile from the spill location.

The probable extent of chemical spills during transportation is difficult to anticipate and depends on the type and quantity of chemical released. Releases that have occurred during transportation in the planning area ranged from zero to 14,000 liquid gallons. The average quantity of pollutant spilled per event was approximately 300 gallons. One chemical spill resulted in one injury.

Historical Frequency

According to the U.S. Coast Guard's National Response Center database (NRC), there have been 127 fixed chemical spills. There was **$50,000** in property damage reported for these chemical spills. The following table displays the most significant spills that have occurred throughout the planning area.

Nationally, the U.S. has had 74 fatalities and 1,496 injuries, associated with the transport of hazardous materials between 2014 through 2023.[97] While these 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.[98]

Table 64: Fixed Site Chemical Spills[99]

Year of Event	Location of Release	Quantity Spilled	Material Involved	Evacuations, Injury or Fatality	Property Damage
1990	Norfolk	1100 gallons	Anhydrous Ammonia	3 injuries	$0
1990	Norfolk	Unknown	Natural Gas	1 injury	$0
1992	Norfolk	6000 gallons	Hydrochloric Acid	None	$0
1993	Norfolk	4.7 barrels	Anhydrous Ammonia	1 injury	$0
1994	Bancroft	0	Unknown	2 evacuated	$0
1994	Madison	Unknown	Natural Gas	1 injury	$0
1998	Madison	100 pounds	Anhydrous Ammonia	100 evacuated	$0
2001	Norfolk	2340 pounds	Ammonia	None	$0
2002	Norfolk	8000 pounds	Sodium Hypochlorite	None	$0
2004	Wakefield	18 pounds	Chlorine	5 evacuated, 1 injury	$0
2010	Madison	309 pounds	Anhydrous Ammonia	200 evacuated	$0
2010	Madison	Unknown	Anhydrous Ammonia	200 evacuated	$0
2010	Norfolk	Unknown	Anhydrous Ammonia	1 fatality	$0
2012	Madison	Unknown	Propane	2 injuries	$0
2012	Madison	Unknown	Anhydrous Ammonia	10 evacuated	$0
2013	Norfolk	Unknown	Anhydrous Ammonia	1 injury	$50,000
2015	West Point	0	Flammable Gas	2 injuries	$0
2016	Wakefield	0	Chlorine	15 evacuated	$0
2017	Dakota City	100 pounds	Anhydrous Ammonia	None	$0
2017	Verdigre	200 gallons	Waste Oil	None	$0
2018	Madison	Unknown	Anhydrous Ammonia	70 evacuated	$0
2019	Columbus	1 pound	Anhydrous Ammonia	None	$0
2019	Columbus	65 gallons	Sulfuric Acid	None	$0
2019	Madison	1000 gallons	Oil: Diesel	None	$0
2020	Columbus	112 pounds	Hydrogen Sulfide	None	$0
2020	Columbus	112.1 pounds	Hydrogen Sulfide	None	$0
2021	Columbus	105.52 pounds	Hydrogen Sulfide	None	$0
2021	Columbus	98.56 pounds	Hydrogen Sulfide	None	$0
2021	Columbus	200 pounds	Hydrogen Sulfide	None	$0
2021	Columbus	5 pounds	Anhydrous Ammonia	None	$0
2021	Fremont	5 gallons	Hydraulic Oil	None	$0
2022	Wakefield	105 pounds	Anhydrous Ammonia	Everyone	$0

[97] U.S Department of Transportation Pipeline and Hazardous Materials Safety Administration. Office of Hazardous Material Safety. (n.d.). All Incidents. Retrieved from https://portal.phmsa.dot.gov/analytics/saw.dll?PortalPages

[98] Burk. R. Firehouse.com. (2017). Hazmat Studies: Lessons Learned from Anhydrous Ammonia Incident. Retrieved from https://www.firehouse.com/rescue/hazardous-materials/article/12306150/lessons-learned-from-anhydrous-ammonia-incident

[99] United States Coast Guard. (2024) National Response Center.Retrieved from: https://nrc.uscg.mil/

Year of Event	Location of Release	Quantity Spilled	Material Involved	Evacuations, Injury or Fatality	Property Damage
2023	Schuyler	Unknown	Anhydrous Ammonia	13 evacuated	
2023	Columbus	7000 gallons	Sulfuric Acid	None	$0
2023	Columbus	190.17 pounds	Hydrogen Sulfide	None	$0
2023	Wakefield	5 pounds	Anhydrous Ammonia	None	$0
2023	Wakefield	8 pounds	Anhydrous Ammonia	None	$0
2024	Fremont	201 pounds	Anhydrous Ammonia	None	$0
2024	Wakefield	24 pounds	Anhydrous Ammonia	None	$0
2024	Norfolk	200 gallons	No Chris Code – Lactos Permeate	None	$0

PHMSA reports that 99 chemical spills occurred during transportation in the planning area between 1971 and 2024. During these events, there was one injury and $199,086 in damages, but no fatalities. The following table provides a list of historical chemical spills with the largest impact to the planning area.

Table 65: Historical Chemical Spills 1971-2024[100]

Date of Event	Location of Release	Failure Description	Material Involved	Method of Transportation	Amount in Gallons	Total Damage	Injuries (Yes/No)
11/27/1977	Battle Creek	Derailment	Petroleum	Rail	14,000	$0	No
4/20/1982	Norfolk	Vehicular Crash or Accident	Anhydrous Ammonia	Highway	5,400	$0	No
1/16/2004	Wakefield	Incompatible Product Reaction	Caustic Alkali Liquids	Highway	Unknown	$0	Yes - 1
8/14/2013	Foster	Vehicular Crash or Accident	Fuel Oil	Highway	1,600	$152,150	No
3/16/2020	Dakota City	Vehicular Crash with Train	Chromic Sulfate	Highway	4,000	$0	No
5/11/2022	Fremont	Equipment Failure	Oil: Diesel	Railroad	100	$0	No

Probability and Frequency

Chemical releases at fixed site storage areas are likely in the future. Given the historic record of occurrence, the annual probability of occurrence for chemical fixed site spills is 100 percent.

The historical record indicates that chemical releases during transport have a one-hundred percent chance of occurring annually in the planning area. Highways, railways, pipelines, storage facilities, and manufacturing facilities should be considered at-risk locations for a chemical release.

[100] Pipeline and Hazardous Materials Safety Administration. 2023. “Office of Hazardous Materials Safety: Incident Reports Database Search.” Retrieved from. https://www.phmsa.dot.gov/hazmat/library/data-stats/incidents.

Vulnerability and Impact

The following table provides information related to regional vulnerabilities; for jurisdictional- specific vulnerabilities, refer to *Volume II*.

Life Safety and Health: Hazardous material releases can cause significant short and long-term sickness or injury to Lower Elkhorn residents, depending on the specific substance. In extreme cases, death may occur due to exposure to hazardous substances. These adverse health effects can range from mild effects, such as skin reddening, to serious effects such as chemical burns and death.[101] It is also possible that explosions due to hazardous materials releases both at fixed sites and during transport could damage residential or commercial property. Agricultural workers carry a higher risk of exposure to hazardous materials due to the chemicals used in fertilizers and pesticides. Individuals living near major roadways are likewise at a higher risk of hazardous materials release. Additionally, there are limited Hazmat Response Resources in the region with techs in Norfolk – Columbus.

Property Damage and Critical Infrastructure: The occurrence of explosions can result in significant damage to property and critical facilities, necessitating the evacuation of the affected area for a considerable period. In cases where radioactive material or other contaminants are present, some buildings may become uninhabitable following such incidents. Moreover, transportation-related accidents can occur due to chemical spills on roadways. Although direct impact on infrastructure may be less likely, hazardous material spills have the potential to contaminate a vast area, making certain transportation routes impassable, as exemplified by the situation in East Palestine, Ohio.[102] Additionally, the release of hazardous materials poses a risk of contaminating farmland and homes, potentially rendering current and future products unsafe for consumption or use.

Economy: A hazardous material release could impact multiple buildings in the Lower Elkhorn planning area, ranging from occurring at a chemical plant, job site, or during transport. If there is an extended clean-up time, businesses or transportation routes may be unusable. Individuals in the local area may relocate, further driving down revenue in the immediate area in the long-term. A hazardous material release on a large roadway could result in restricted or rerouted traffic, impacting revenue for multiple economic sectors until the roadway is deemed safe.

A Hazmat incident may likewise contaminate a large amount of agricultural product; be it land, crops, or livestock, rendering it unusable. As demonstrated in the East Palestine derailment, a severe incident may take months or years to be fully cleaned up.[103]

Changes in Development and Impact of Future Development: New facilities that are constructed may implement buffer areas to reduce the impact during an incident. Large-scale incidents that occur may require additional security measures to be taken to secure hazardous materials.

Underserved and At Risk Population: Individuals with pre-existing health conditions may be at a higher risk of complications in the event of a hazmat chemical release. Those living at home and requiring regular

[101] Occupational Safety and Health Administration. (n.d.). Hazardous Waste Operations and Emergency Response (HAZWOPER). Retrieved from https://www.osha.gov/emergency-preparedness/hazardous-waste-operations

[102] Environmental Monitor, (2023). Monitoring Healing: Environmental Cleanup and Community Resilience in East Palestine. Retrieved from https://www.fondriest.com/news/monitoring-healing-environmental-cleanup-and-community-resilience-in-east-palestine.htm.

[103] Ibid.

care would need support in the event of a rapid evacuation. Individuals suffering from low mobility such as the elderly, and locations including hospitals and nursing homes are at an increased risk if an evacuation is needed. If the hazardous materials incident affects businesses and/or residential areas, those in a more vulnerable economic standing would be at a disproportionate risk. This includes agricultural workers who may suffer direct job loss resulting from a job site shutdown due to contamination.

Effects of Climate Change in Severity of Impacts: There are no known effects of climate change on the severity of hazardous materials incidents.

FEMA NRI Expected Annual Loss Estimates

National Risk Index does not track Chemical Spills.

Total Risk Score

Table 66: Chemical Spill Total Risk ScoreTable 61 represents the Chemical Spill Total Risk Score for the Lower Elkhorn planning area, based on the Risk Assessment Methodology, as defined in this Plan.

Table 66: Chemical Spill Total Risk Score

Chemical Spill Total Risk Score						
Hazard Event	**Probability**	**Consequence**				**Total Risk**
	Probability Factor	**Extent**	**Vulnerability**	**Impact**	**Consequence Score**	**Total Risk Score***
Chemical Spill	2	7	8	17	32	36

Consequence: Sum of all weighted factors.
Extent: Sum of the weighted Extent factors.
Vulnerability: Sum of the weighted Vulnerability factors.
Impact: Sum of the weighted Impact factors.
Total Risk Score = Probability x Consequence
** Normalized to 100*

Total Risk Score Legend						
Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 50
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	51 – 75

The legend—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The Consequence Score represents the sum of the Extent, Vulnerability, and Impact Factors. The Total Risk Score is a measure of Probability and Consequence.

Dam and Levee Failure

Hazard Description

Dams

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.[104]

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."[105]

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

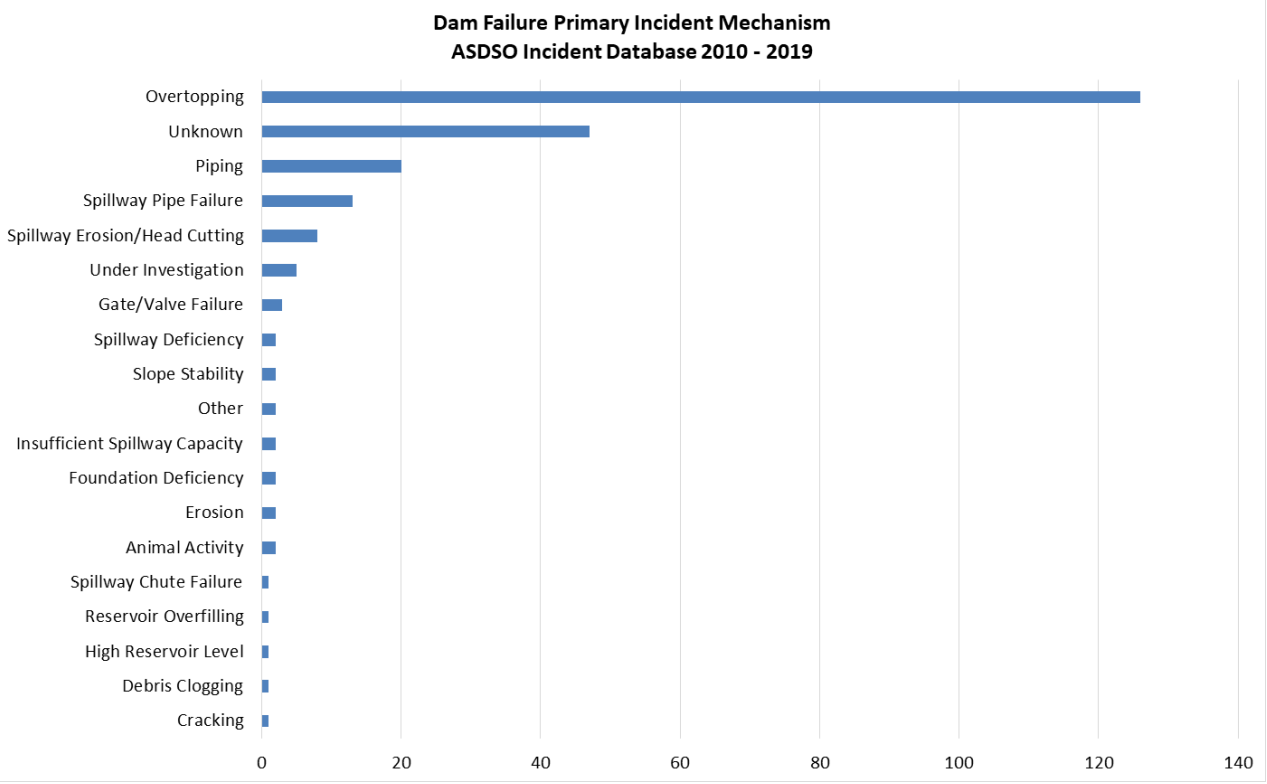
- Reservoir inflows in excess of design flows
- Flood pools higher than previously attained
- Unexpected drop in pool level
- Pool near maximum level and rising
- Excessive rainfall or snowmelt
- Large discharge through spillway
- Erosion, landslide, seepage, settlement, and cracks in the dam or area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

[104] Nebraska Department of Natural Resources. (2008). Rules for the safety of Dams and Reservoirs. Retrieved from https://dnr.nebraska.gov/sites/dnr.nebraska.gov/files/doc/about/rules/Title_458_1008.pdf

[105] Nebraska Department of Natural Resources. (2008) Department of Natural Resources Rules for Safety of Dam and Reservoirs. Nebraska Administrative Code, Title 458, Chapter 1, Part 001.09. Retrieved from https://dnr.nebraska.gov/sites/dnr.nebraska.gov/files/doc/about/rules/Title_458_1008.pdf

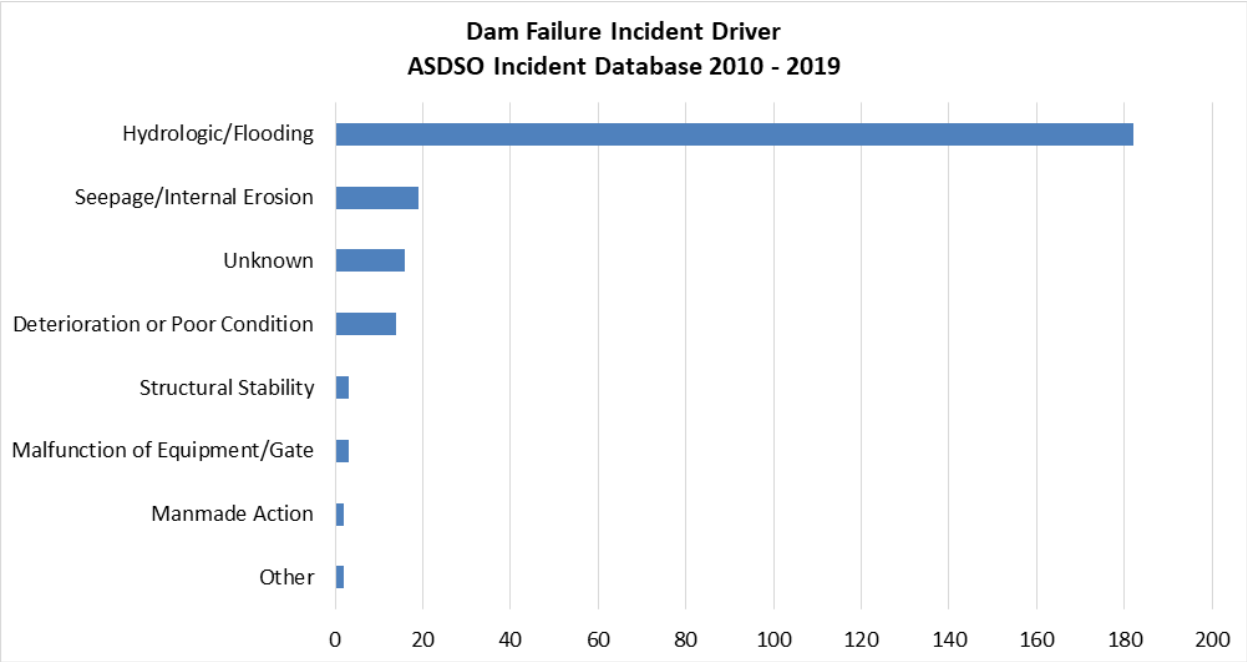
If a dam fails, issues of primary concern include loss of human life/injury, downstream property damage, lifeline disruption (of concern would be transportation routes and utility lines required to maintain or protect life), and environmental damage. Dams are an important part of the infrastructure in the U.S., providing avenues for water supply, flood control, irrigation, hydroelectric power, and recreation. According to FEMA's National Inventory of Dams (NID), the United States now has more than 92,000 total dams with an average age of 61 years. Dams in the NID are owned, operated, and regulated by a variety of entities. A breakdown of these 90,000 plus dams is as follows: 80 percent are regulated by the state dam safety offices, nearly 70 percent of the entire inventory is privately-owned, and six percent are owned or regulated by the federal government, which encompasses approximately 35 percent of the tallest dams. The cause of dam failure incidents that occurred between 2010 and 2019 can be seen in the below images.

Figure 20 Dam Failure Primary Incident Mechanism[106]



[106] Association of State Dam Safety Officials. The Causes of Dam Failure. Retrieved from: https://damsafety.org/dam-failures

Figure 21: Dam Failure Incident Driver[107]



For planning purposes and to meet the intent of FEMA requirements, the focus will be on High Hazard dams.

Levees

Levees are man-made structures, typically earthen embankments designed and constructed according to sound engineering practices. They are created to contain, control, or divert the flow of water and provide protection from temporary flooding. Levees are often built alongside rivers to prevent high water levels from flooding adjacent land. Their primary function is flood risk reduction, but they may also serve other purposes such as water conservation, irrigation, or supporting roadways or railways.

Levees can vary in size and complexity, from simple mounds of earth to large-scale systems with floodwalls, gates, and pumps. The effectiveness of a levee can be influenced by its design, construction, and maintenance, as well as by natural factors such as river flow and sedimentation.

According to FEMA, the United States has thousands of miles of levee systems. Some of these systems date back as far as 150 years and were originally built for agricultural purposes. Levee systems designed to protect urban areas have typically been built to higher standards. All levee systems are designed to provide a specific level of flood protection, but no levee system provides full protection from all flooding events. Therefore, some level of flood risk exists in levee-impacted areas.

Levee failure can occur in several ways. A breach of a levee happens when part of the levee breaks away, leaving a large opening for floodwaters to flow through. This breach can be gradual due to surface or subsurface erosion, or it can be sudden. A sudden breach often occurs when there are soil pores in the levee that allow water to flow through, causing upward pressure greater than the downward pressure from the

[107] Ibid.

weight of the soil of the levee. This under seepage can then resurface on the backside of the levee and quickly erode a hole to cause a breach. Sometimes, the levee sinks into a liquefied subsurface below.

Another way levee failure can occur is when the water overtops the crest of the levee. This happens when floodwaters exceed the lowest crest elevation of the levee. Overtopping can lead to significant erosion of the backside of the levee and result in a breach and a levee failure.[108]

Location

Communities or areas downstream of a dam, especially high hazard dams, are at greatest risk of dam failure. To view the mapped location of dams by county please refer to *Volume II.*

The Nebraska Department of Natural Resources is responsible for The Nebraska Dam Inventory includes all dams in Nebraska that are 25 feet or more in height or have a maximum storage capacity of 50 acre-feet or more. The inventory includes dams that are currently existing, have been approved for construction, or have breached.[109]

In total, there are 234 dams located within the planning area, with classifications ranging from minimal hazard to high hazard. Eight dams are rated minimal, 191 are rated low, 20 are rated significant, and 15 are rated as high hazard dams. **Figure 22** shows the location of these dams in the planning area.

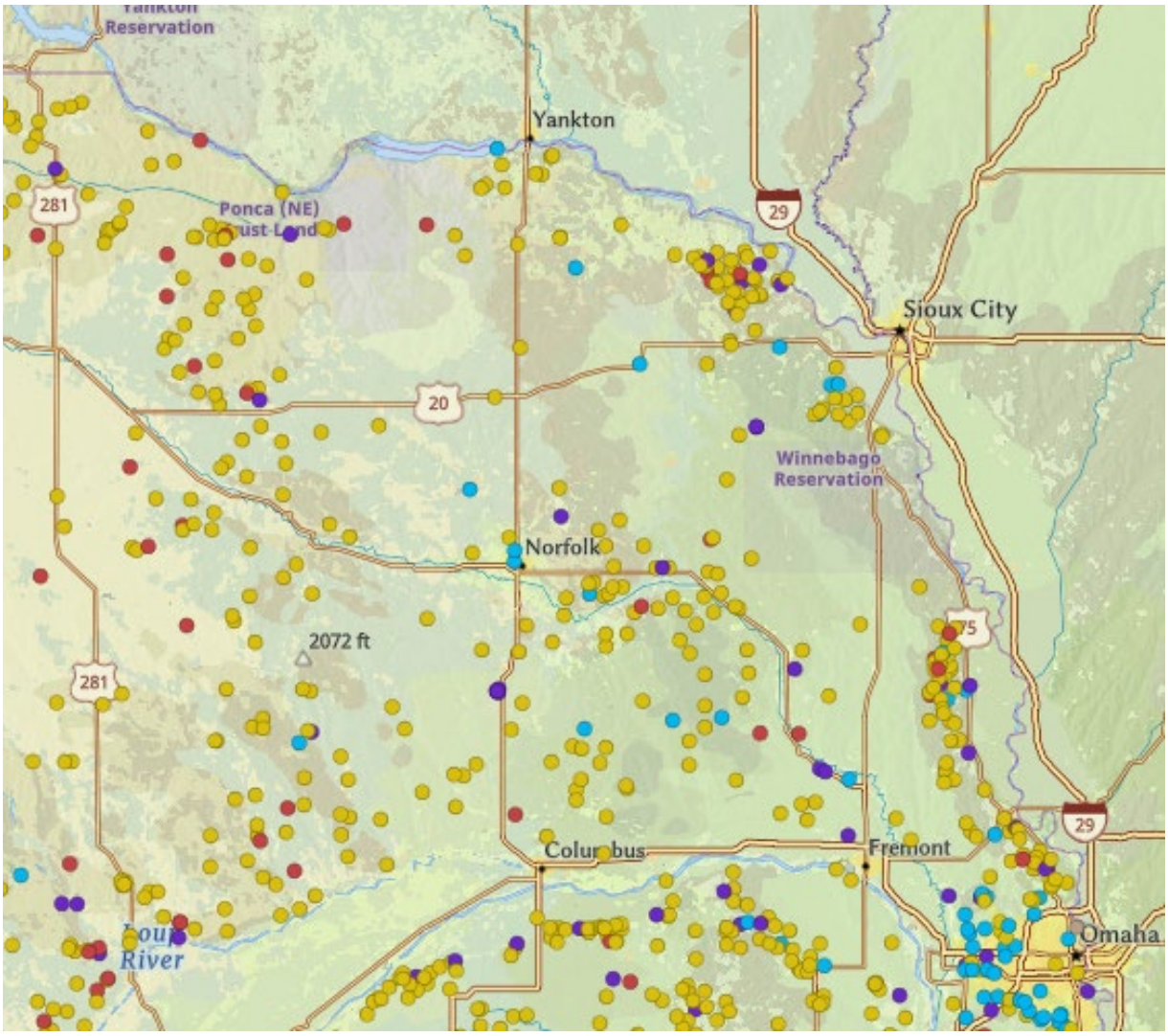
Table 67: Dams within the Planning Area

County	Number of Dams	Minimal Hazard	Low Hazard	Significant Hazard	High Hazard
Burt	37	4	28	2	3
Cedar	14	0	11	0	3
Colfax	11	0	9	0	2
Cuming	23	1	21	1	0
Dixon	44	3	33	7	1
Dodge	12	2	5	3	2
Knox	32	5	26	1	0
Madison	15	0	8	5	2
Pierce	3	0	2	0	1
Platte	16	1	15	0	0
Stanton	23	1	20	1	1
Thurston	0	0	0	0	0
Wayne	5	0	4	1	0
Total	**235**	**17**	**182**	**21**	**15**

[108] City of New Orleans Homeland Security. (n.d.). Infrastructure Failure- Levee Failure. Retrieved from https://ready.nola.gov/hazard-mitigation/hazards/infrastructure-failure-levee-failure/

[109] Nebraska Map. Department of Natural Resources. (2024). Dams. Retrieved from https://www.nebraskamap.gov/datasets/06028e0343764fcb9370dc5a4bf53dc7/explore

Figure 22: Dam Locations



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

Table 68: lists the dams classified as high hazard potential in the planning area. In total, there are 15 high-hazard dams within the planning area.

Table 68: High Hazard Dams[110]

Dam Name	Owner	County	Stream Name	Maximum Storage (acre-feet)	EAP
Tekamah-Mud Creek 5-A	Papio Missouri River Natural Resources District	Burt	Tr-Tekamah Creek	6,861	Approved
Silver Creek 11	Papio Missouri River Natural Resources District	Burt	Tr-Silver Creek	1,317	Approved
Tekamah-Mud Creek 22-A	Papio Missouri River Natural Resources District	Burt	Tr-Tekamah Creek	499	Approved
Hartington Dam	City Of Hartington	Cedar	Tr-Norwegian Creek	112	Approved
Laurel Norris Dam	City Of Laurel	Cedar	Tr-Middle Logan Creek	34	Approved
Gavins Point Dam	USACE - Omaha District	Cedar County, Nebraska/ South Dakota	Missouri River	540,000	Approved
Maple Creek Recreation Area Dam	Lower Elkhorn Natural Resources District	Colfax	W Fk Maple Creek	8,118	Approved
Pokorny Dam	Village Of Howells	Colfax	Tr-Maple Creek	129.7	Approved
Bloomfield Dam	Edward C & Eunice M Bloomfield Trustees	Dixon			No
Hooper Dam	City Of Hooper	Dodge	Tr-Elkhorn River	19	Approved
Dodge Dam	Village Of Dodge	Dodge	Tr-Pebble Creek	119	Approved
Skyview Lake Dam	City Of Norfolk	Madison	Tr-Elkhorn River	1,716	Approved
Raasch Dam	City Of Norfolk	Madison	Tr-N Fk Elkhorn River	384	Approved
Willow Creek Dam	Lower Elkhorn Natural Resources District	Pierce	Willow Creek	30,300	Approved
Maskenthine Dam	Lower Elkhorn Natural Resources District	Stanton	Maskenthine Creek	3,862	Approved

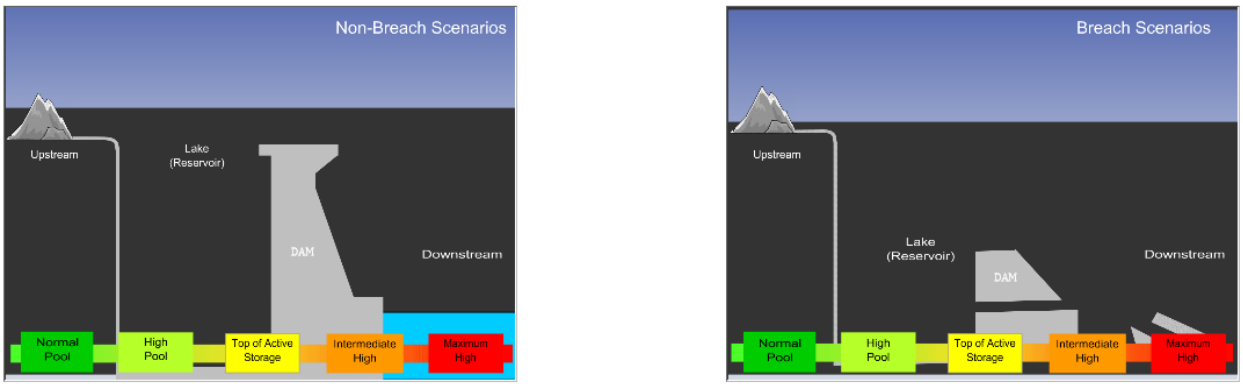
[110] Nebraska Department of Natural Resources. Dam Inventory / Interactive Map. Retrieved from: https://gis.ne.gov/portal/apps/experiencebuilder/experience/?id=e5cd8e1f09564f38ac730323c28c4f0a&page=Page

The following is a Risk Characterization Summary of the Gavins Point Dam.

Although Gavins Point Dam continues to reliably reduce floods, it alone cannot eliminate the risk of flooding (nor can the system of dams in which it operates). While unlikely, a non-breach release when the reservoir is full is critical to reduce the chance of dam overtopping, even if streams and rivers below the dam have reached or exceeded their capacity. Impacts on downstream populations and structures along the Missouri and Mississippi rivers would be overwhelming, but a breach would allow water stored behind the dam to significantly intensify downstream flooding.

When USACE last assessed the dam's ability to meet flood risk management goals, it was determined that the primary threats that could lead to a breach during an extreme flood, with the reservoir at or near its maximum storage level, are erosion of the dam's foundation from water flowing beneath the embankment, damage to the spillway during non-breach releases, and powerhouse flooding leading to an inability to provide power to open the spillway gates. Although these scenarios are very unlikely, failure of the dam or spillway would result in catastrophic flooding with swift, deep, and life-threatening floodwater in numerous communities (both with and without levees) along the Missouri and Mississippi rivers. This would substantially impact property, the economy, and critical infrastructure (such as power and water utilities, transportation systems, and commercial and industrial facilities).[111]

Figure 23: Breach vs. Non-Breach Scenario



Scenarios are designated as either non-breach or breach. In non-breach scenarios the dam is operating as designed for the given pool level, releasing from outlets and controlled or uncontrolled spillways. In breach scenarios the continuity of the structure has been compromised, resulting in uncontrolled water releases that exceed the magnitude of releases in the equivalent non-breach scenario.

The Maximum High (MH) scenario (breach and non-breach) is based on the inflow design flood per FEMA guidelines and indicates the maximum reservoir pool level and likely maximum extent of inundation.

The Normal High (NH) scenario (breach and non-breach) represents normal full reservoir pool elevations with no flooding occurring downstream prior to dam releases. The NH scenarios represent the fair weather or sunny day scenarios per FEMA guidelines. The Intermediate High (IH), Top of Active Storage (TAS) and Security (SS) scenarios are intermediate pool levels between NH and MH. They are established based on the dam's design characteristics and its operating history. The TAS represents the reservoir pool elevation

[111] National Inventory of Dams. (n.d.). Gavins Point Dam. Retrieved from https://nid.sec.usace.army.mil/#/dams/system/SD01094/risk

the structure was designed for (such as top of flood gates) and above which water must be released to ensure the integrity of the dam. The SS represents a high reservoir pool level observed or exceeded 1% of the time during the dam's operating history. The IH represents a realistic operating condition that could be experienced during a major flood where the reservoir pool elevation exceeds Top of Active Storage.[112]

Table 69: Consequence Estimate[113]

Type	Pool Elevation	Daytime People at Risk	Nighttime People at Risk	Buildings at Risk	Economic Cost
Top of Active Storage Pool Breach	1,210.70	13,788	11,264	4,789	$611,664,686
Top of Active Storage Pool Non-Breach	1,210.70	3,167	2,451	1,119	$111,998,805
Normal High Pool (10% EDP) Breach	1,208.76	8,019	6,904	2,765	$291,565,330
Normal High Pool (10% EDP) Non-Breach	1,208.76	0	0	0	$0
Maximum High Pool Breach	1,224.70	142,554	108,731	43,273	$9,546,867,675
Maximum High Pool Non-Breach	1,224.70	123,570	94,851	37,842	$7,536,019,287
Normal Low Pool (90% EDP) Breach	1,205.86	3,355	3,502	1,454	$136,856,817
Normal Low Pool (90% EDP) Non-Breach	1,205.86	0	0	0	$0

Beyond the USACE's National Levee Database, there is no known comprehensive list of levees that exists in the planning area especially for private agricultural levees. Thus, it is not possible at this time to document the full extent of non-federal levees, the areas they protect, or the potential impact of these levees.

Table 70 outlines the number and miles of Levee systems within the planning area according to the National Levee Database, along with potential losses and affected population.

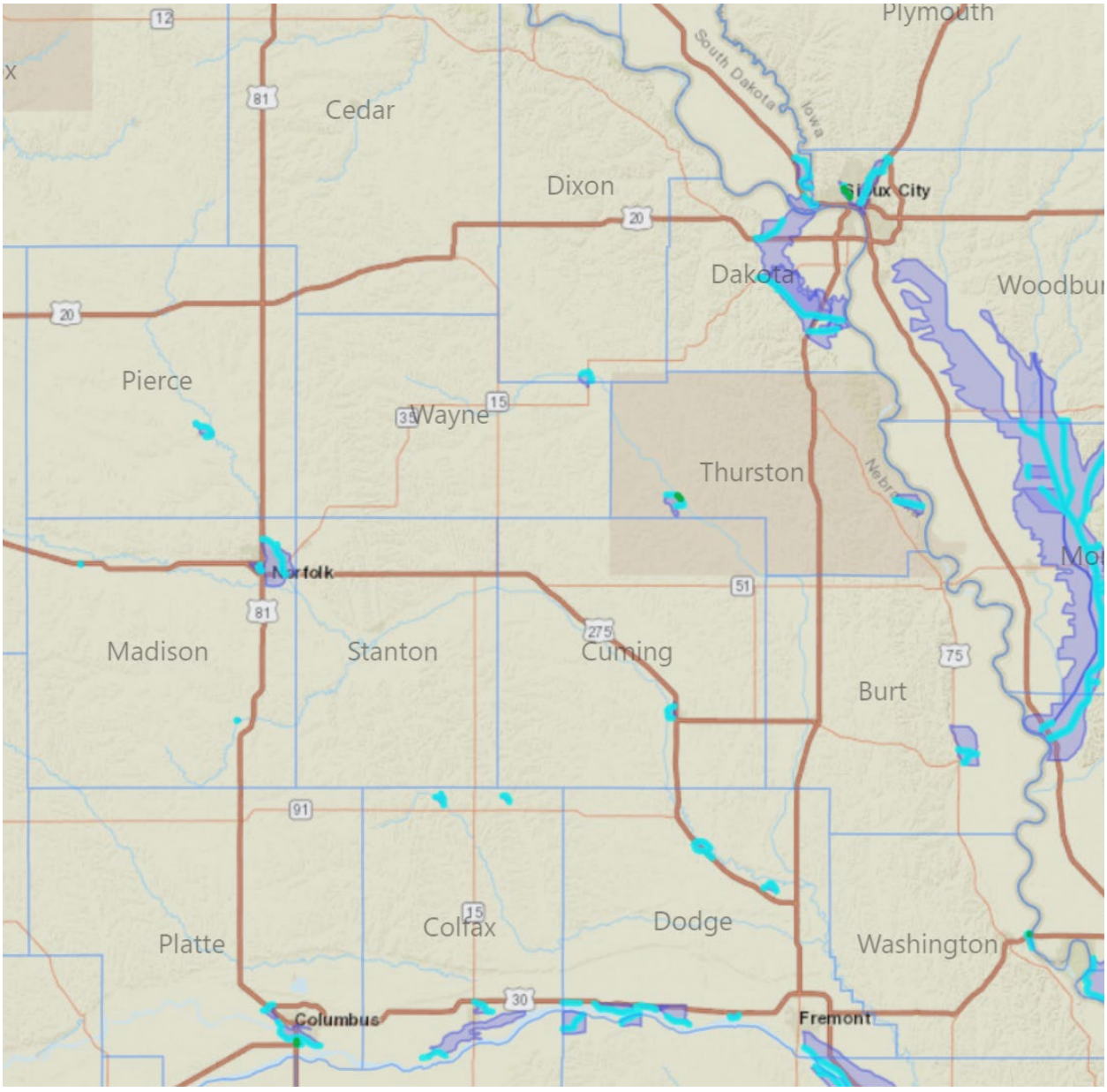
Table 70: Levee Systems[114]

County	Levee System	Miles of Levees
Burt County	3	6
Cedar County	0	0
Colfax County	7	15
Cuming County	1	2
Dixon County	2	2
Dodge County	5	23
Knox County	0	0

[112] Ibid.
[113] Ibid.
[114] National Levee Database. (n.d.). Retrieved from https://levees.sec.usace.army.mil/#/

County	Levee System	Miles of Levees
Madison County	7	9
Pierce County	2	3
Platte County	3	8
Stanton County	0	0
Thurston County	3	7
Wayne County	0	0
Total	**32**	**75**

Figure 24: Leveed Area in the Planning Area



Extent

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 71: Dam Size Classification[115]

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

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.

The 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.[116]

[115] Nebraska Department of Natural Resources. (2013.) Classification of Dams: Dam Safety Section. Retrieved from https://dnr.nebraska.gov/sites/default/files/doc/dam-safety/resources/Classificationof%20DamsMarch2023%28FINAL%29.pdf

[116] Nebraska Department of Natural Resources. (2013). Classification of Dams. Retrieved from https://dnr.nebraska.gov/sites/dnr.nebraska.gov/files/doc/dam-safety/resources/Classification-Dams.pdf

Table 72: Nebraska Dam Hazard Classifications[117, 118]

Nebraska Classification	Corresponding NID Classification	Hazard Description	Loss of Human Life (NID)	Economic Environmental Lifeline Losses (NID)
High	High	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	Probable. One or more expected	Yes (but not necessary for this classification)
Significant	Significant	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	None expected.	Yes
Low	Low	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	None expected	Low and generally limited to owner
Minimal	N/A	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		

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, the extent of a high hazard dam breach is unknown. It can be assumed that the area will be slightly larger than the 100-year floodplain. Note that there are 15 high hazard dams located within the planning area.

The United States Army Corps of Engineers (USACE), who is responsible for federal levee oversight and inspection of levees, has three ratings for levee inspections.

Table 73: USACE Levee Rating Categories[119]

Ratings	Description
Acceptable	All inspection items are rated as Acceptable

[117] Ibid.

[118] Federal Emergency Management Agency. (2004). Hazard Potential Classification System for Dams. Retrieved from https://www.ferc.gov/sites/default/files/2020-04/fema-333.pdf

[119] U.S. Army Corps of Engineers. (n.d.). USACE Levee Safety Program. Retrieved from https://www.mvd.usace.army.mil/Portals/52/docs/Levee%20Safety%20Program.pdf

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

The United States Army Corps of Engineers (USACE) Levee Safety Program key activities include levee inspections, risk assessments, and sharing levee information.[120] To better inform stakeholders and residents of the residual risk within their communities, USACE utilizes the Levee Safety Action Classification (LSAC) tool.[121] **Table 74** outlines the LSAC risk levels, actions, and risk characteristics for each level. The LSAC is not a levee rating or grade, but a classification system designed to consider the following:

- Probability of the levee being loaded (hazard).
- Existing condition of the levee.
- The current and future maintenance of the levee (performance).
- The consequences if the levee were to fail or be overwhelmed.

For example, a levee that reduces risk for a dense population will have a different classification from an equally constructed levee with a smaller population because the consequences associated with failure are greater. [122]

Table 74: USACE Levee Safety Action Classification (LSAC)[123]

Risk	Actions for Levee Systems and Leveed Areas in this Class (Adapt actions to specific levee system conditions)	Risk Characteristics of this class
Very High (1)	Based on risk drivers, take immediate action to implement interim risk reduction measures. Increase frequency of levee monitoring, communicate risk characteristics to the community within an expedited timeframe; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning systems and evacuation procedures; and recommend purchase of flood insurance. Support risk reduction actions as very high priority.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences result in very high risk.
High (2)	Based on risk drivers, implement interim risk reduction measures. Increase frequency of levee monitoring; communicate risk characteristics to the community within an expedited timeframe; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and recommend purchase of flood insurance. Support risk reduction actions as high priority.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in high risk.

[120] United States Army Corps of Engineers. (n.d.). Levee Safety Program. Retrieved from https://www.usace.army.mil/Missions/Civil-Works/Levee-Safety-Program/.
[121] United States Army Corps of Engineers. (n.d.). Levee Safety Action Classification (LSAC). Retrieved from https://www.mvn.usace.army.mil/LSAC/.
[122] Ibid.
[123] United States Army Corps of Engineers. (n.d.). Levee Safety Action Classification (LSAC). Retrieved from https://www.mvn.usace.army.mil/Portals/56/docs/PAO/LSACs/LSAC%20Table.pdf.

Risk	Actions for Levee Systems and Leveed Areas in this Class (Adapt actions to specific levee system conditions)	Risk Characteristics of this class
Moderate (3)	Based on risk drivers, implement interim risk reduction measures as appropriate. Verify risk information is current and implement routine monitoring program; assure O&M is up to date; communicate risk characteristics to the community in a timely manner; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and recommend purchase of flood insurance. Support risk reduction actions as a priority.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in moderate risk.
Low (4)	Verify risk information is current and implement routine monitoring program and interim risk reduction measures if appropriate; assure O&M is up to date; communicate risk characteristics to the community as appropriate; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and recommend purchase of flood insurance. Support risk reduction actions to further reduce risk to as low as practicable.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in low risk.
Very Low (5)	Continue to implement routine levee monitoring program, including operation and maintenance, inspections, and monitoring of risk. Communicate risk characteristics to the community as appropriate; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and recommend purchase of flood insurance.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in very low risk.
No Verdict	Not enough information is available to assign an LSAC	

**Levee risk is the risk that exists due to the presence of the levee system, and this is the risk used to inform the decision on the LSAC assignment.*

The information presented in this table does not reflect the overtopping without breach risk associated with the presence or operation of the levee system.

To determine potential losses the USACE National Levee data base was utilized. The figure below shows the total number of structures at risk from levee failure and the associated property value of those structures. **Table 75** shows the estimated leveed area which could be affected during a levee failure. There are a total of 32 levees within the planning area that could cause significant losses.

Table 75: Potential Losses in Levee Breach Area[124]

Name	Location	Length (miles)	People at Risk	Structures at Risk	Property Value at Risk	Risk Level
Mud Creek Levee - Burt Co, Ne	Location Tekamah, Burt County, Nebraska	2.64	541	191	$81.9m	Not Screened
Tekamah Diversion Ditch Levee 1	Tekamah, Burt County, Nebraska	1.66	10	13	$7.01m	Not Screened
Tekamah Diversion Ditch Levee 2	Tekamah, Burt County, Nebraska	1.77	5	2	$464k	Not Screened

[124] FEMA/US Army Corps of Engineers. (n.d.). National Levee Database. Retrieved from https://levees.sec.usace.army.mil/#/

Name	Location	Length (miles)	People at Risk	Structures at Risk	Property Value at Risk	Risk Level
Clarkson - Maple Creek Lb	Clarkson, Colfax County, Nebraska	0.61	12	18	$2m	Low
Clarkson - Maple Creek Rb	Clarkson, Colfax County, Nebraska	1.28	133	132	$65.5m	Low
Howells - Maple Creek Rb	Howells, Colfax County, Nebraska	1.14	149	69	$139m	Low
Platte River Levee 1	North Bend, Dodge County, Nebraska	3.14	0	0	$0	Not Screened
Platte River Levee 3	North Bend, Dodge County, Nebraska	4.75	46	131	$79.9m	Not Screened
Schuyler - Lost Creek & Platte River Lb	Schuyler, Colfax County, Nebraska	1.88	135	118	$12.7m	Low
Schuyler - Shell Creek Rb	Schuyler, Colfax County, Nebraska	2.16	620	257	$52.1m	Low
West Point - Elkhorn Lb	West Point, Cuming County, Nebraska	1.94	727	510	$117m	Moderate
Wakefield - Logan River Rb (Nf)	Wakefield, Dixon County, Nebraska	1.98	1,665	776	$159m	Significant
Ames	Ames, Dodge County, Nebraska	1.03	44	25	$9.8m	Not Screened
Ames Diking - Platte River Lb (Nf)	Morse Bluff, Dodge County, Nebraska	2.29	92	54	$16.5m	Low
Hooper - Elkhorn Rb	Hooper, Dodge County, Nebraska	2.05	495	268	$68.1m	Low
Scribner - Pebble Creek Lb & Elkhorn River Rb	Scribner, Dodge County, Nebraska	5.42	846	557	$105.3m	Low
Valley - Union And No Name Dikes System - Platte River LB (NF)	Leshara, Saunders County, Nebraska	11.8	3,040	1,747	$581M	Moderate
Corporation Gulch	Norfolk, Madison County, Nebraska	0.61	648	381	$282m	Not Screened
Corporation Gulch 2	Norfolk, Madison County, Nebraska	0.78	2,900	213	$469m	Not Screened
Madison - Union Creek Lb	Madison, Madison County, Nebraska	0.03	0	0	$80k	Low
Madison - Union Creek Rb	Madison, Madison County, Nebraska	0.02	9	6	$672	Low
Meadow Grove - Buffalo Creek Rb	Meadow Grove, Madison County, Nebraska	0.08	46	25	$1.47	Low
Norfolk - Elkhorn Lb	Norfolk, Madison County, Nebraska	3.08	1,391	481	$132	Low
Norfolk - Elkhorn Rb	Norfolk, Madison County, Nebraska	4.22	11,400	5,385	$1.42b	Low
Pierce - North Branch Elkhorn Lb	Pierce, Pierce County, Nebraska	0.33	2	3	$109k	Low

Name	Location	Length (miles)	People at Risk	Structures at Risk	Property Value at Risk	Risk Level
Pierce - North Branch Elkhorn Rb	Pierce, Pierce County, Nebraska	2.73	1,393	553	$151m	Significant
Columbus - Lost Creek Rb	Columbus, Platte County, Nebraska	1.34	48	20	$2.74m	Low
Columbus - Loup River Lb	Columbus, Platte County, Nebraska	5.17	3,665	1,599	$318m	Low
White Tail Lake	Columbus, Platte County, Nebraska	1.28	164	80	$37.8m	Not Screened
Macy - Blackbird Creek Lb	Macy, Thurston County, Nebraska	2.52	7	10	$1.42m	Low
Macy - Blackbird Creek Rb	Macy, Thurston County, Nebraska	2.44	0	0	$0	Low
Pender - Logan Creek Rb	Pender, Thurston County, Nebraska	2.44	1,546	568	$217m	Significant

Historical Frequency

According to the Stanford University National Performance Dam Program (NPDP), there have been four dam failures in Nebraska within the past twenty years.

While it is possible for levee failure to occur in the future, this is considered a low probability. As per the 2021 Nebraska State Hazard Mitigation Plan, there have not been any high-hazard dam failures in Nebraska. However, there have been a total of 99 dam failures since 1970.[125]

June 2010 Heavy Rain- A stagnant line of thunderstorms led to historic flooding, which caused six dam failures across Nebraska. Of these six dams, five were classified as low hazard and one as significant hazard. Several other dams across the state were overtopped but did not fail. No major property damage or loss of life occurred due to these dam failures. DR-1924 was declared involving 64 counties and $66 million in public assistance grants because of the shallow flooding of several homes, damage to a state highway, and the flooding of several county roads.

May 2015-Heavy Rain- According to the 2019 Nebraska SHMP, heavy rain producing storms caused large amounts of water runoff across the southeastern parts of the state. Several dams reached capacity and emergency spillways were activated. Two low hazard dams failed and contributed to the damage of several county roads and agricultural ground. This event resulted in federal disaster declaration DR-4225 with over $18 million in public assistance grants. Data from this event is not documented in the NOAA/NCEI Storm Events Database.

March 14, 2019- Spencer Dam (Niobrara River) Failure: Heavy rain on top of frozen ground, rivers, and streams led to historic runoff on the Niobrara River, downstream of the Norden River crossing. A series of ice jams developed upstream broke loose, which lead to a wall of water, large blocks of ice and debris moving downstream and destroyed the dam structure. The flood waters from the dam failure destroyed the south

[125] State of Nebraska Hazard Mitigation Plan (2021). Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf

bridge abutment on US Highway 281, a campground, bar, and a home immediately downstream. The flood caused one fatality.[126]

Probability and Frequency

According to the 2021 Nebraska State Hazard Mitigation Plan, the probability of a high hazard dam failing is "very low" due to the high design standards for this class of dam. There is a higher possibility of a significant or low hazard dam failing as those dams are not designed to the same standard. Currently, 23% (680) dams within the State are rated in poor condition, increasing the likelihood of failure. In general, local plans estimate dam failure as a low probability.[127]

Vulnerability and Impact

The following table provides information related to regional vulnerabilities; for jurisdictional- specific vulnerabilities, refer to *Volume II*.

For planning purposes, high-risk dams will remain the focus for this section.

Life Safety and Health: Although the probability of a dam/levee failure is typically low, they have the potential to severely impact Lower Elkhorn residents. In the unlikely event of a high-risk dam to breach, many Lower Elkhorn residents and their property would be at risk of injury, death, or damage. Evacuations would likely be needed from homes as well as businesses and critical facilities such as hospitals and nursing homes. Water supplies in the nearby regions would also likely be affected.

Floodwater is often extremely contaminated with sewage and other harmful material. Individuals caught in the flow are at risk for direct injuries from debris, but also secondary injuries such as illness and infection. [128]

Property Damage and Critical Infrastructure: A Low-Risk Dam breach would result in minimal flow in surrounding areas. However, a High-Risk Dam breach hazard has the potential to cause widespread, major structural damage to residential areas and critical infrastructure alike. This includes flows that reach above the first floors of schools, hospitals, nursing homes, and power generation facilities. Additionally, flows would likely be more than two feet above roads and railroads, impeding traffic. Environmental losses would likely require extensive cost to mitigate or not be feasible.[129]

Due to floodwaters being contaminated, extensive repair or replacement of homes or buildings may be required. This may range from replacing drywall up to complete demolition.[130]

Economy: Depending on the scale of the dam or levee breach, the economic impact would range from minor to severe. A small dam failure may only impact the immediate area, potentially not impeding traffic or

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[126] State of Nebraska Hazard Mitigation Plan (2021). Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf
[127] Ibid.
[128] Federal Emergency Management Agency. (n.d.). Flood: Damaged Buildings. Retrieved from https://community.fema.gov/ProtectiveActions/s/article/Flood-Damaged-Buildings
[129] Nebraska Department of Natural Resources. (2013). Classification of Dams. Retrieved from https://dnr.nebraska.gov/sites/dnr.nebraska.gov/files/doc/dam-safety/resources/Classification-Dams.pdf
[130] Federal Emergency Management Agency. (n.d.). Flood: Damaged Buildings. Retrieved from https://community.fema.gov/ProtectiveActions/s/article/Flood-Damaged-Buildings

economic operations. However, a high-hazard dam failure has the capacity to destroy buildings and severely disrupt a wide area. Due to the area affected, numerous individuals and businesses may be displaced for an extended period.

Due to floodwater damage, economic impact would be long-term in a high-risk dam incident. This is due to extensive repair or rebuilding needed after floodwater contamination of various structures.

Changes in Development and Impact of Future Development: Areas within the Lower Elkhorn planning area at risk of a dam or levee failure may limit opportunities in expanding or maintaining current infrastructure. Existing floodplain maps may guide future expansion efforts.

Underserved and At-Risk Population: A dam or levee failure that causes flooding may require evacuations from the affected areas. Public transportation would be a critical resource to aid the at risk populations during a dam or levee failure due to wide-scale evacuations needed from hospitals, nursing homes, and other vulnerable locations.

Effects of Climate Change in Severity of Impacts: As global average temperatures increase, evaporation increases adding moisture into the atmosphere which results in more precipitation.[131] Heavy precipitation leads to both riverine flooding and flash floods as the ground fails to absorb the high volume of precipitation that falls in a short period. Subsequently, an increase in precipitation can exacerbate dams and levees resulting in a failure.

FEMA NRI Expected Annual Loss Estimates

The FEMA NRI does not assess Dam and Levee Failure.

Total Risk Score

Table 76 represents the Dam and Levee Failure Total Risk Score for the Lower Elkhorn planning area, based on the Risk Assessment Methodology, as defined in this Plan.

Table 76 Dam and Levee Failure Total Risk Score

Dam and Levee Failure Total Risk Score						
Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Dam and Levee Failure	2	8	12	30	50	53
Consequence: Sum of all weighted factors. *Extent: Sum of the weighted Extent factors.* *Vulnerability: Sum of the weighted Vulnerability factors.*				*Impact: Sum of the weighted Impact factors.* *Total Risk Score = Probability x Consequence* ** Normalized to 100*		
Total Risk Score Legend						

[131] Environmental Protection Agency. (n.d.). Climate Change Indicators: U.S. and Global Precipitation. Retrieved from https://www.epa.gov/climate-indicators/climate-change-indicators-us-and-global-precipitation.

Dam and Levee Failure Total Risk Score						
Hazard Event	**Probability**	**Consequence**				**Total Risk**
	Probability Factor	**Extent**	**Vulnerability**	**Impact**	**Consequence Score**	**Total Risk Score***
Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 50
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	51 – 75
The legend—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The Consequence Score represents the sum of the Extent, Vulnerability, and Impact Factors. The Total Risk Score is a measure of Probability and Consequence.						

Drought

Hazard Description

Drought is generally defined as a natural hazard that results from a substantial period of below normal precipitation. Although many erroneously consider it a rare and random event, drought is a normal, recurrent feature of climate. It occurs in virtually all climatic zones, but its characteristics 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.

> **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

Drought is a slow-onset, creeping phenomenon that can affect a wide range of people and industries. While many drought impacts are non-structural, there is the potential that during extreme or prolonged drought events structural impacts can occur. Drought normally affects more people than other natural hazards, and its impacts are spread over a larger geographical area. As a result, the detection and early warning signs of drought conditions and assessment of impacts are more difficult to identify than that of quick-onset natural hazards (e.g., flood) that results in more visible impacts. To assist with drought classification and monitoring, scientists have defined five (5) types of droughts, listed on **Table 77**.[132]

Table 77: Drought Types

Type	Description
Meteorological	Occurs when dry weather patterns dominate the area.
Hydrological	Occurs when low water supply becomes evident in the water system
Agricultural	Occurs when crops become affected by drought.
Socioeconomic	Occurs when the supply and demand of various commodities is affected by drought.
Ecological	Occurs when natural ecosystems are affected by drought.

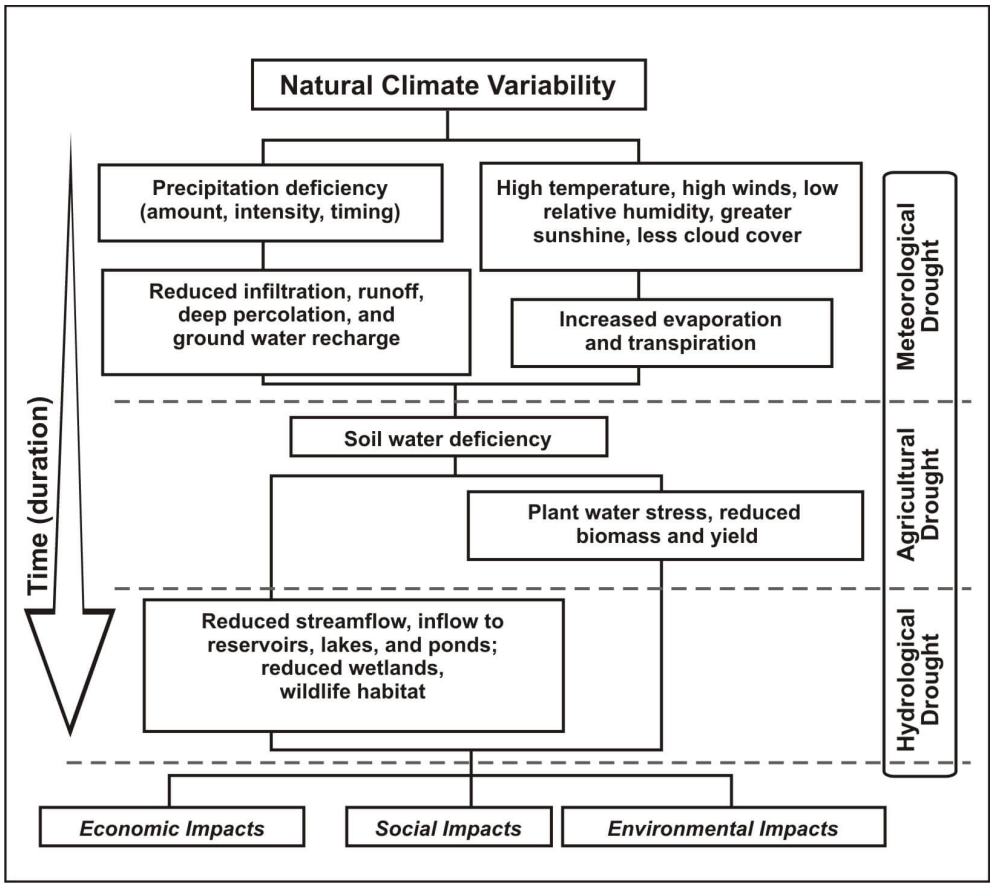
Water and drought policy, response, and mitigation fall under the responsibility of multiple agencies. The United States Department of Agriculture (USDA) is responsible for response efforts; NOAA (through NIDIS) leads monitoring efforts; the Environmental Protection Agency (EPA) regulates water quality while the USGS and the National Aeronautics and Space Administration (NASA) contribute to data. However, drought response efforts, planning, and water law vary from state to state.[133]

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

[132] Emerald Ash Borer Information Network. 2018. "Emerald Ash Borer." http://www.emeraldashborer.info/ght/drought-basics"https://www.drought.gov/what-is-drought/drought-basics.

[133] National Drought Mitigation Center. (n.d.). What is USDM. Retrieved from https://droughtmonitor.unl.edu/About/WhatistheUSDM.aspx.

Figure 25: Sequence and Impacts of Drought Types[134]



Location

The State of Nebraska Hazard Mitigation Plan indicates that the entire state, including the Lower Elkhorn planning area, is susceptible to drought conditions of varying degrees ranging from mild to extreme.[135]

Extent

The U.S. Drought Monitor (USDM) is a collaboration between the National Drought Mitigation Center (NDMC), USDA, and NOAA.[136] They also rate drought nationwide by intensity utilizing a D0 (Abnormally Dry) to D4 (Exceptional Drought) scale, shown in **Table 78.** While the Western half of the state is more likely to be impacted by drought conditions, the entirety of Nebraska and the Lower Elkhorn planning area is susceptible to drought.

[134] National Drought Mitigation Center. 2018. "Meteorological Drought." https://drought.unl.edu/Education/DroughtIn-depth/TypesofDrought.aspx

[135] State of Nebraska Hazard Mitigation Plan, 2021. Drought. (2021). Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf

[136] U.S Drought Monitor. About U.S Drought Monitor. (n.d.). Retrieved from https://droughtmonitor.unl.edu/About/WhatistheUSDM.aspx

Table 78: U.S. Drought Monitor Classifications[137]

Category	Description	Possible Impacts	PDSI Range
D0	Abnormally Dry	Used for areas showing dryness, but not yet in drought, or for areas recovering from drought. Going into drought: Short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: Some lingering water deficits. Pastures or crops not fully recovered.	-1.0 to -1.9
D1	Moderate Drought	Some damage to crops and pastures. Streams, reservoirs, or wells are low, and some water shortages are developing or imminent. Voluntary water use restrictions requested.	-2.0 to -2.9
D2	Severe Drought	Crop or pasture losses are likely. Water shortages are common. Water restrictions imposed.	-3.0 to -3.9
D3	Extreme Drought	Major crop/pasture losses. Widespread water shortages or restrictions.	-4.0 to -4.9
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses. Shortages of water in reservoirs, streams, and wells are creating water emergencies.	-5.0 or less

The Palmer Drought Severity Index (PDSI) is utilized by climatologists to standardize global long- term drought analysis. **Figure 26** shows the precipitation (in inches) the planning area would typically receive over the course of a year.

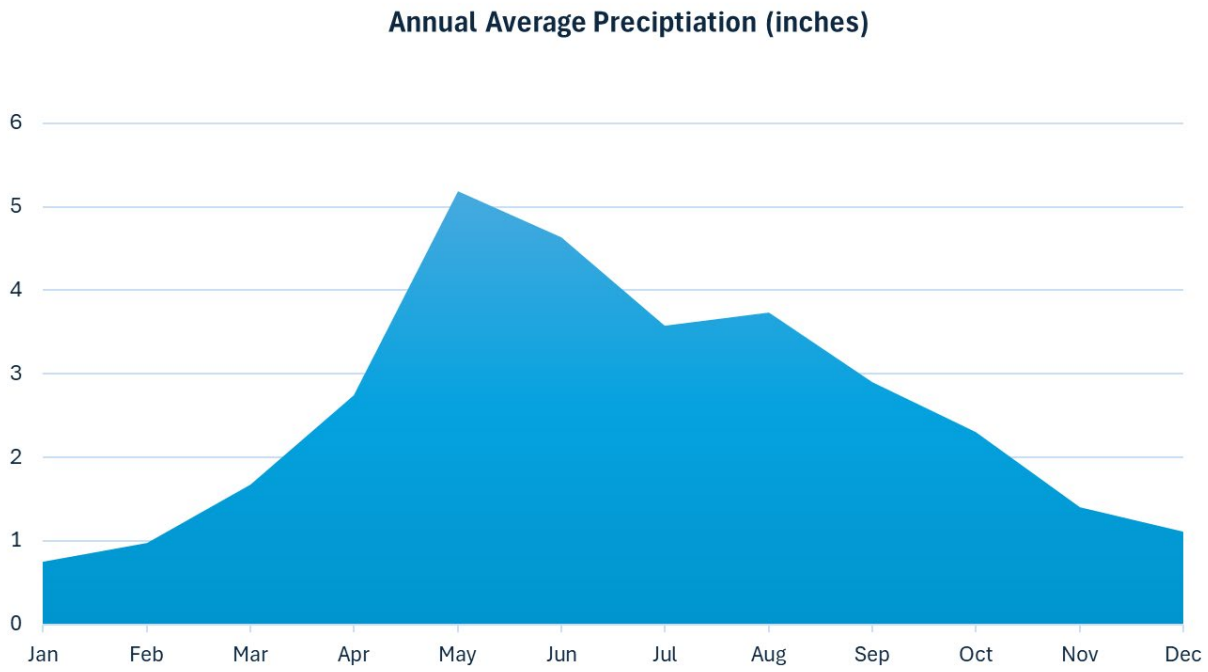
Table 79: Palmer Drought Severity Index classification[138]

Palmer Drought Severity Index	Category
- 4.00 and below	Extreme Drought
- 3.00 to - 3.99	Severe Drought
- 2.00 to - 2.99	Moderate Drought
- 1.99 to + 1.99	Mid-Range
+ 2.00 to + 2.99	Moderately Moist
+ 3.00 to + 3.99	Very Moist
+ 4.00 and above	Extremely Moist

[137] U.S Drought Monitor. About U.S Drought Monitor. (n.d.). Retrieved from https://droughtmonitor.unl.edu/About/WhatistheUSDM.aspx

[138] National Weather Service, National Centers for Environmental Information. (2007). Time Bias Corrected Divisional Temperature-Precipitation-Drought Index. Retrieved from https://www.ncei.noaa.gov/pub/data/cirs/drd/divisional.README

Figure 26: Average Annual Precipitation



Historical Frequency

The state of Nebraska experiences regular droughts to varying extents. Over the prior decades, significant drought conditions have affected the state and the Lower Elkhorn planning area according to the U.S Drought Monitor and the National Centers for Environmental Information (NCEI). Drought levels range from Abnormally Dry to Extreme Drought on the U.S Drought Monitor method of classification. The U.S Seasonal Outlook highlights these persistent drought conditions (Figure 21: Climate Prediction Center, 2024).

The past ten years of drought conditions for the Lower Elkhorn planning area is presented in **Table 80** according to the NCEI database as a part of the National Oceanic and Atmospheric Administration. NCEI has reported 78 drought events between 2013 and 2023 in the Lower Elkhorn planning area. Notably, in 2023, the USDA designated eight separate Secretarial natural disasters in Nebraska due to drought, many of them part of the Lower Elkhorn planning area.[139] According to the U.S. Drought Monitor, counties listed in the eight Secretarial disaster designations suffered from a drought intensity value during the growing season of 1) D2 Drought-Severe for eight or more consecutive weeks or 2) D3 Drought-Extreme or D4 Drought-Exceptional.

Table 80: Drought Events (2013-2023)[140]

Location	County / Zone	State	Date	Death	Injury	Property Damage	Crop Damage
Cedar (Zone)	Cedar (Zone)	NE	1/1/2013	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	1/1/2013	0	0	0.00K	0.00K

[139] U.S Department of Agriculture. USDA Designates 12 Nebraska Counties as Disasters Due to Drought. (2022). Retrieved from https://www.fsa.usda.gov/state-offices/Nebraska/news-releases/2022/5_03_22_usda-designates-12-nebraska-counties-as-disasters-due-to-drought

[140] National Centers for Environmental Information. (n.d.). Storm Events Database. Retrieved from https://www.ncdc.noaa.gov/stormevents/

Location	County / Zone	State	Date	Death	Injury	Property Damage	Crop Damage
Stanton (Zone)	Stanton (Zone)	NE	1/1/2013	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	1/1/2013	0	0	0.00K	0.00K
Madison (Zone)	Madison (Zone)	NE	1/1/2013	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	1/1/2013	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	1/1/2013	0	0	0.00K	0.00K
Colfax (Zone)	Colfax (Zone)	NE	1/1/2013	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	2/1/2013	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	2/1/2013	0	0	0.00K	0.00K
Stanton (Zone)	Stanton (Zone)	NE	2/1/2013	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	2/1/2013	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	2/1/2013	0	0	0.00K	0.00K
Madison (Zone)	Madison (Zone)	NE	2/1/2013	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	2/1/2013	0	0	0.00K	0.00K
Colfax (Zone)	Colfax (Zone)	NE	2/1/2013	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	3/1/2013	0	0	0.00K	0.00K
Madison (Zone)	Madison (Zone)	NE	3/1/2013	0	0	0.00K	0.00K
Colfax (Zone)	Colfax (Zone)	NE	3/1/2013	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	3/1/2013	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	3/1/2013	0	0	0.00K	0.00K
Stanton (Zone)	Stanton (Zone)	NE	3/1/2013	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	3/1/2013	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	3/1/2013	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	4/1/2013	0	0	0.00K	0.00K
Colfax (Zone)	Colfax (Zone)	NE	4/1/2013	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	4/1/2013	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	4/1/2013	0	0	0.00K	0.00K
Stanton (Zone)	Stanton (Zone)	NE	4/1/2013	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	4/1/2013	0	0	0.00K	0.00K
Madison (Zone)	Madison (Zone)	NE	4/1/2013	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	4/1/2013	0	0	0.00K	0.00K
Madison (Zone)	Madison (Zone)	NE	5/1/2013	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	5/1/2013	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	5/1/2013	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	5/1/2013	0	0	0.00K	0.00K
Stanton (Zone)	Stanton (Zone)	NE	5/1/2013	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	5/1/2013	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	5/1/2013	0	0	0.00K	0.00K
Colfax (Zone)	Colfax (Zone)	NE	5/1/2013	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	7/1/2013	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	7/1/2013	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	7/1/2013	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	8/1/2013	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	8/1/2013	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	8/1/2013	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	10/6/2020	0	0	0.00K	275.00K
Dixon (Zone)	Dixon (Zone)	NE	11/1/2020	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	12/1/2020	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	1/1/2021	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	2/1/2021	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	3/1/2021	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	6/8/2021	0	0	0.00K	100.00K

Location	County / Zone	State	Date	Death	Injury	Property Damage	Crop Damage
Dixon (Zone)	Dixon (Zone)	NE	7/1/2021	0	0	0.00K	308.00K
Dixon (Zone)	Dixon (Zone)	NE	8/1/2021	0	0	0.00K	285.00K
Dixon (Zone)	Dixon (Zone)	NE	9/1/2021	0	0	0.00K	55.00K
Dixon (Zone)	Dixon (Zone)	NE	3/15/2022	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	4/1/2022	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	5/1/2022	0	0	0.00K	197.00K
Dixon (Zone)	Dixon (Zone)	NE	6/1/2022	0	0	0.00K	647.00K
Dixon (Zone)	Dixon (Zone)	NE	7/1/2022	0	0	0.00K	4.710M
Dixon (Zone)	Dixon (Zone)	NE	8/1/2022	0	0	0.00K	6.480M
Dixon (Zone)	Dixon (Zone)	NE	9/1/2022	0	0	0.00K	1.390M
Dixon (Zone)	Dixon (Zone)	NE	10/1/2022	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	11/1/2022	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	12/1/2022	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	1/1/2023	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	1/1/2013	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	2/1/2023	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	2/1/2013	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	3/1/2023	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	3/1/2013	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	4/1/2023	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	4/1/2013	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	5/1/2023	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	5/1/2013	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	6/1/2023	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	7/1/2023	0	0	0.00K	0.00K
Totals				0	0	0.00K	14.447M

The Drought Impact Reporter is a database of drought impacts throughout the United States with data going back to 2000. The Drought Impact Reporter has recorded a total of 240 drought-related impacts throughout the region. This is not a comprehensive list of droughts which may have impacted the planning area. These impacts are summarized in the following **Table 81** and **Figure 27**.

Table 81: Drought Impacts in Planning Area[141]

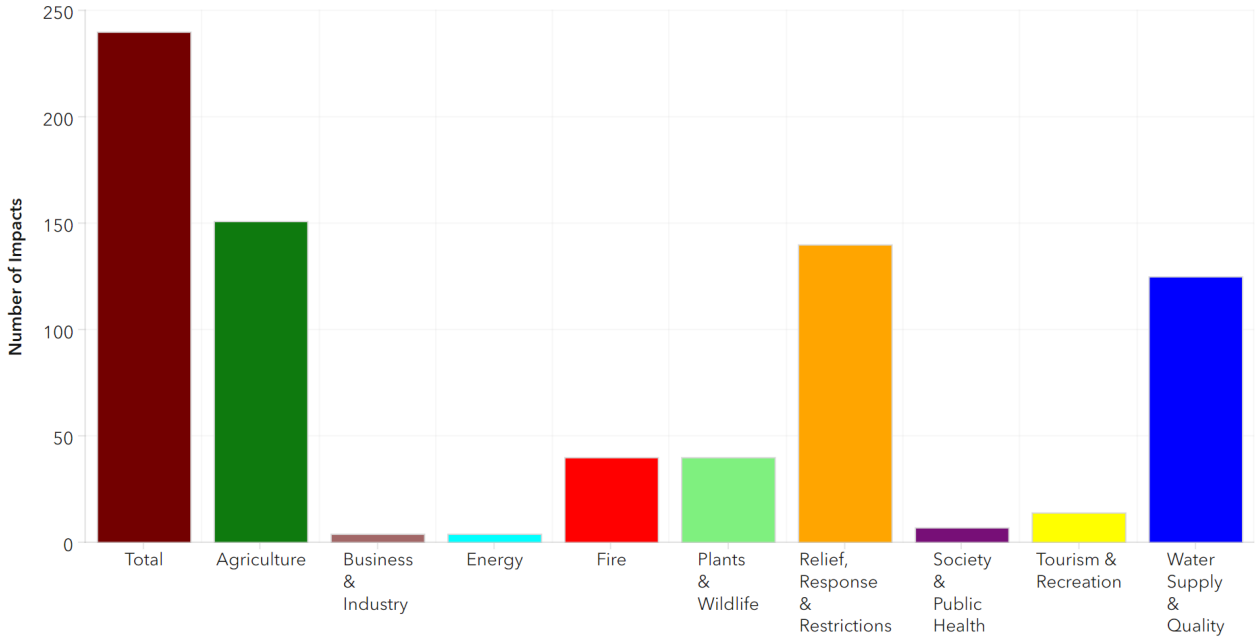
Category	Date	Affected Counties	Title
Agriculture, Plants & Wildlife	2023	Cedar County	Variable corn, soybean yields in northeast Nebraska

[141] National Drought Mitigation Center. (n.d.). U.S. Drought Impact Reporter. Retrieved from http://droughtreporter.unl.edu/map/

Category	Date	Affected Counties	Title
Agriculture, Relief, Response & Restrictions, Water Supply & Quality	2023	Burt County, Cedar County, Colfax County, Cuming County, Dixon County, Dodge County, Knox County, Madson County, Pierce County, Platte County, Stanton County, Thurston County, Wayne County	Groundwater levels closely monitored throughout LENRD (northeast Nebraska)
Fire Relief, Response & Restrictions	2022	Madison, Knox, Cedar, Pierce, Wayne, Stanton, Cuming, Platte, Colfax, and Dodge Counties	Burn ban in eastern Nebraska
Agriculture, Relief, Response & Restrictions, Water Supply & Quality	2022	Burt County, Cedar County, Colfax County, Cuming County, Dixon County, Dodge County, Knox County, Madson County, Pierce County, Platte County, Stanton County, Thurston County, Wayne County	LENRD enacted annual limit for wells in D3/D4 areas
Relief, Response & Restrictions, Water Supply & Quality	2020	Stanton County	Water restriction in Stanton, Nebraska
Fire, Relief, Response and Restrictions	2017	Statewide	Emergency proclamation to prepare for wildfires
Fire, Relief, Response and Restrictions, Water Supply & Quality	2017	Pierce County	Water, fire restrictions in Pierce.
Water Supply and Quality; Relief, Response, and Restrictions	2013, 2014	Colfax County, Dodge County, Madison County, Platte County	Moratorium on new irrigation in Lower Platte North Natural Resources District in eastern Nebraska
Water Supply and Quality; Relief, Response, and Restrictions; Agriculture	2013	Burt County, Cedar County, Colfax County, Cuming County, Dixon County, Dodge County, Knox County, Madson County, Pierce County, Platte County, Stanton County, Thurston County, Wayne County	Water use restrictions for irrigators in the Lower Elkhorn Natural Resources District in northeastern Nebraska
Relief, Response, and Restrictions; Agriculture	2013	Burt County, Cedar County, Colfax County, Cuming County, Dixon County, Dodge County, Knox County, Madison County, Pierce County, Platte County, Stanton County, Thurston County, Wayne County	Drought-related USDA disaster declarations in 2013
Water Supply and Quality; Relief, Response, and Restrictions; Agriculture	2012	Burt County, Cedar County, Colfax County, Cuming County, Dixon County, Dodge County, Knox County, Madison County, Platte County, Stanton County,	Low flow in several Nebraska rivers brought surface irrigation closures
Fire; Relief, Response, and Restrictions	2012	Cedar County, Colfax County, Cuming County, Dixon County, Dodge County, Knox County, Madison County, Pierce County, Platte County, Stanton County, Thurston County, Wayne County	Nebraskans urged to leave the fireworks to the professionals

Category	Date	Affected Counties	Title
Water Supply and Quality; Relief, Response, and Restrictions	2012	Burt County, Cedar County, Colfax County, Cuming County, Dixon County, Dodge County, Knox County, Madison County, Pierce County, Platte County, Stanton County, Thurston County, Wayne County	More than $100,000 paid to assist those with dry domestic wells in northeastern Nebraska
Relief, Response, and Restrictions; Agriculture	2009	Stanton County	Stanton County farmers seek grazing on Conservation Reserve Program land
Relief, Response, and Restrictions	2006	Burt County, Cedar County, Colfax County, Cuming County, Dixon County, Dodge County, Madison County, Pierce County, Platte County, Stanton County, Thurston County, Wayne County	Relief, Response & Restrictions impact from Media submitted on 9/28/2006
Relief, Response, and Restrictions	2004	Burt County, Cedar County, Colfax County, Cuming County, Dixon County, Dodge County, Knox County, Madison County, Pierce County, Platte County, Stanton County, Thurston County, Wayne County	Relief, Response & Restrictions impact from Media submitted on 9/30/2005
Agriculture	2003	Cedar County, Dixon County, Knox County, Pierce County	Agriculture impact from Media submitted on 10/24/2007
Relief, Response, and Restrictions	2003	Burt County, Cedar County, Colfax County, Cuming County, Dixon County, Dodge County, Knox County, Madison County, Pierce County, Platte County, Stanton County, Wayne County	Relief, Response & Restrictions impact from Media submitted on 3/1/2006
Relief, Response, and Restrictions	2000	Cedar County, Cuming County, Dixon County, Madison County, Pierce County, Stanton County, Thurston County, Wayne County	Relief, Response & Restrictions impact from Government submitted on 12/15/2005
Relief, Response, and Restrictions	2000	Cedar County, Cuming County, Dixon County, Madison County, Pierce County, Stanton County, Thurston County, Wayne County	Relief, Response & Restrictions impact from Government submitted on 2/22/2006

Figure 27: Impacts by Category (2000-2023)[142]



Probability and Frequency

As indicated in the State of Nebraska Hazard Mitigation Plan, the entire state, including the Lower Elkhorn planning area, is susceptible to drought conditions of varying degrees. **Figure 28** further elaborates on the monthly precipitation values within the state of Nebraska (Norfolk Area,) indicating which months are at higher risk for lower precipitation. [143] **Figure 29** indicates the most current season outlook via the Climate Prediction Center, with the planning area marked. Presently, no drought conditions persist across the Lower Elkhorn Planning Area.

In addition, **Figure 30** utilizes the U.S Drought Monitor to portray past drought conditions for the past 24 years. These events have ranged from minor (D0) to Exceptional Drought conditions (D4). **Table 82** further breaks down the monthly amounts of precipitation within the state of Nebraska from 1991-2023.

[142] National Drought Mitigation Center, University of Nebraska. Drought Impact Reporter Dashboard. Retrieved from: https://unldroughtcenter.maps.arcgis.com/apps/dashboards/46afe627bb60422f85944d70069c09cf

[143] State of Nebraska Hazard Mitigation Plan, 2021. (2021). Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf

Figure 28: NOAA NOW Data: 1991-2023 Precipitation Averages[144]

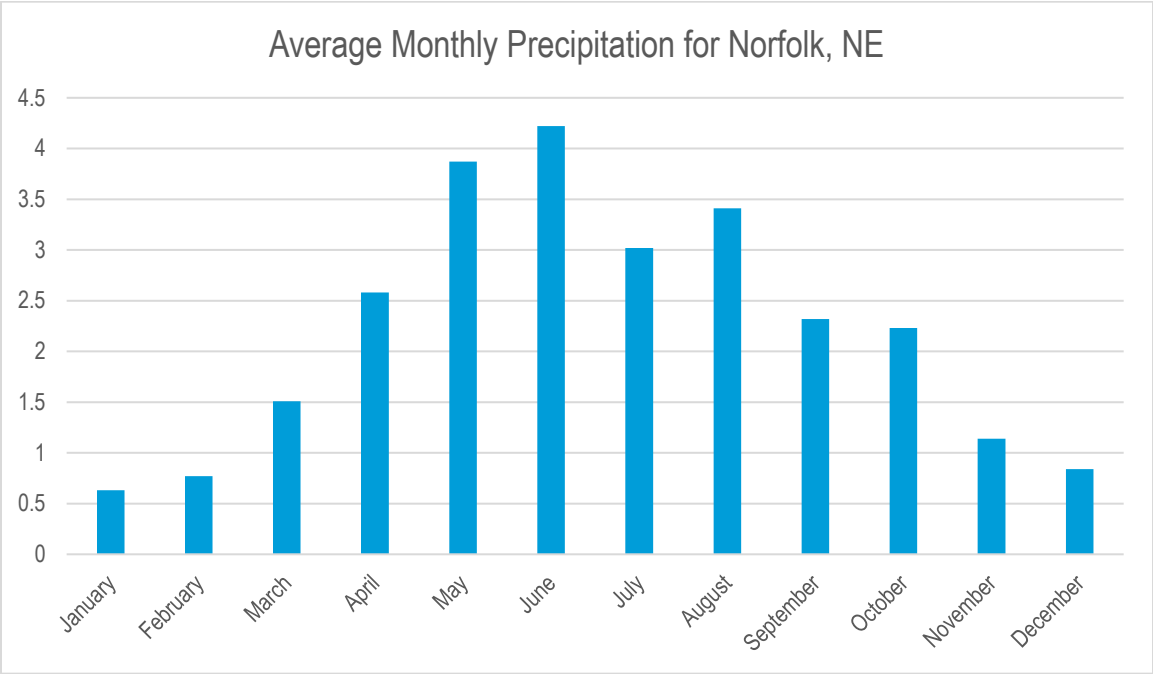


Table 82: 1991-2023 Monthly Precipitation[145]

Month	Total Precipitation Normal (inches)
January	0.63
February	0.77
March	1.51
April	2.58
May	3.87
June	4.22
July	3.02
August	3.41
September	2.32
October	2.23
November	1.14
December	0.84
Annual	**26.54**

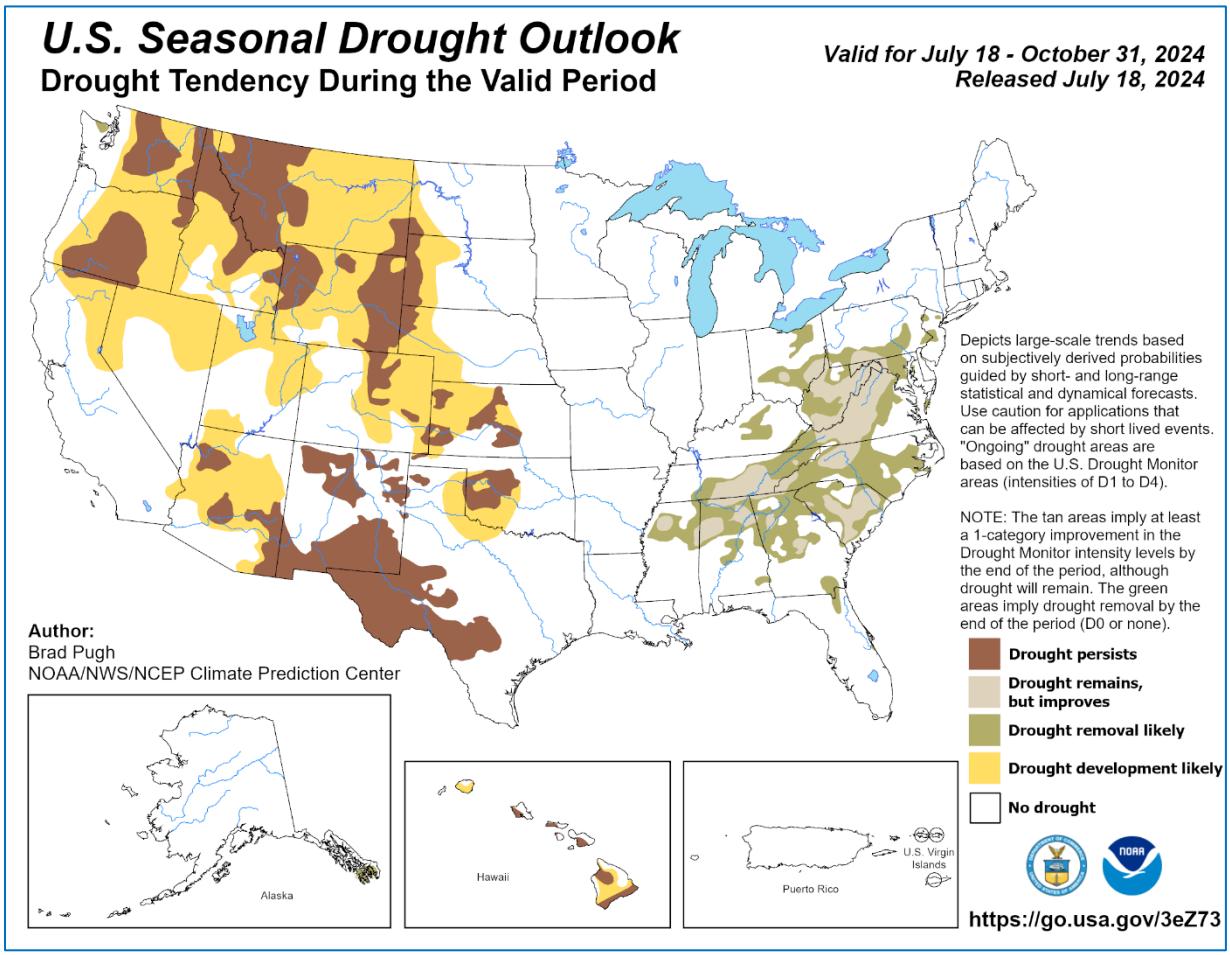
The U.S. Seasonal Drought Outlook (**Figure 29**) provides a short-term drought forecast that can be utilized by local officials and residents to examine the likelihood of drought developing or continuing depending on the current situation. The following figure provides the drought outlook for July 18, 2024, through October 31, 2024. According to the U.S. Seasonal Drought Outlook, drought is likely to persist in the southern United

[144] National Weather Service. National Oceanic and Atmospheric Administration. NOWData, Precipitation. (n.d.). Retrieved from https://www.weather.gov/wrh/Climate?wfo=oax

[145] National Weather Service. National Oceanic and Atmospheric Administration. NOWData, Precipitation. (n.d.). Retrieved from https://www.weather.gov/wrh/Climate?wfo=oax

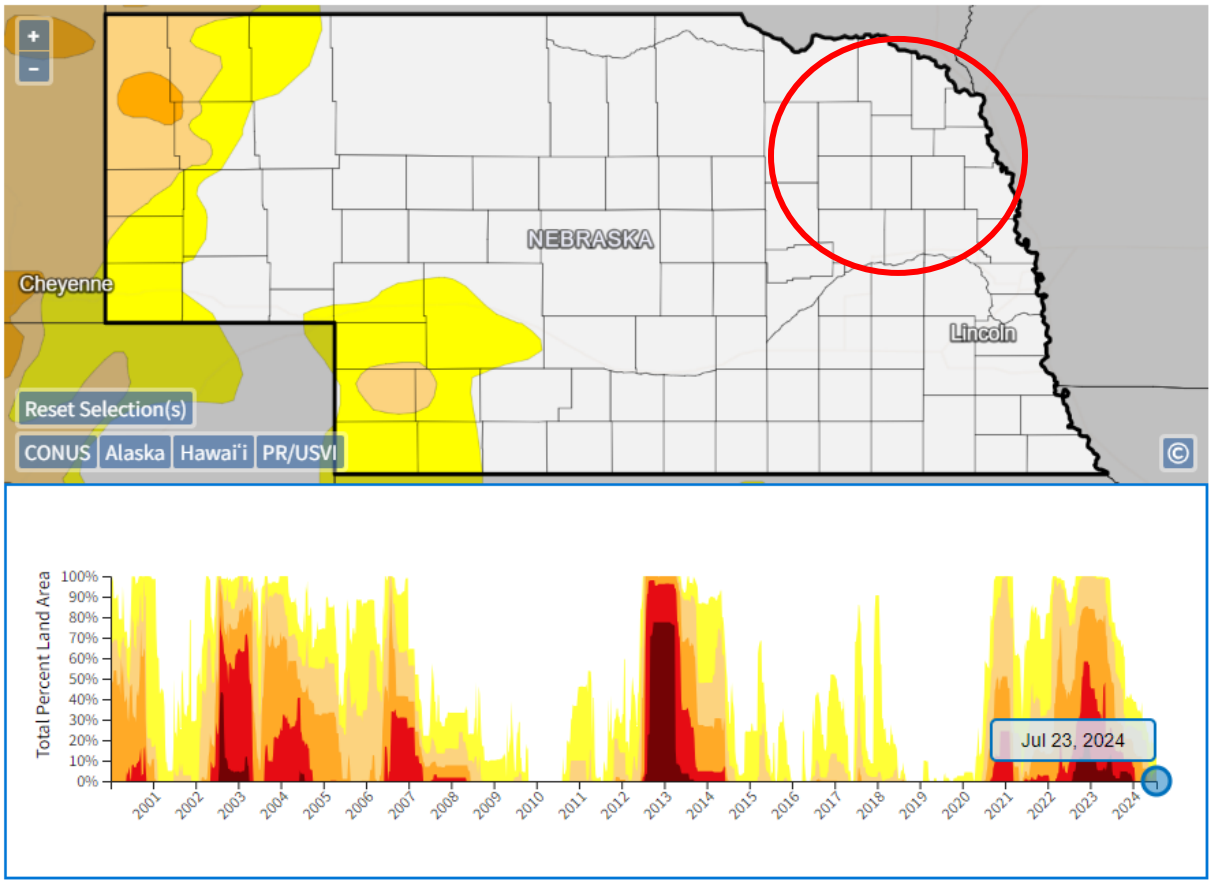
States while the planning area is expected to experience seasonal norms relative to precipitation and temperatures.

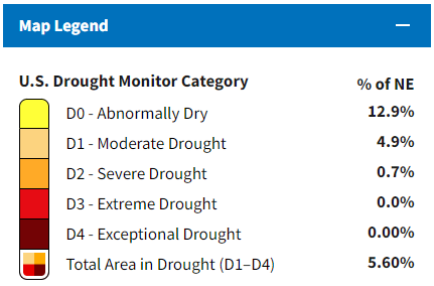
Figure 29: Climate Prediction Center, 2024[146]



[146] U.S Seasonal Drought Outlook, Climate Prediction Center, (n.d.). Retrieved from https://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php

Figure 30: U.S. Drought Monitor, State of Nebraska (2000-Present)[147]





The drought annualized frequency value represents the number of recorded drought hazard occurrences, in event days, per year over the period of record (22 years). **Table 83** outlines the annualized frequency for droughts based on FEMA National Risk Index (NRI) data.

Table 83: Drought Annualized Frequency for Lower Elkhorn Planning Area[148]

Location	Events on Record (2000-2021)	Annualized Frequency
Burt County *(Census Tracts 9632, 9634)*	602	13.65 events per year

[147] U.S Drought Monitor, Time Series, State of Nebraska. (n.d.). Retrieved from https://www.drought.gov/historical-information?dataset=0&selectedDateUSDM=20240723&selectedDateSpi=20240601&selectedDatePaleo=20170101&state=Nebraska

[148] National Risk Index. (n.d.). Annualized Losses. Annualized Frequency. Retrieved from https://hazards.fema.gov/nri/map#

Location	Events on Record (2000-2021)	Annualized Frequency
Cedar County	343	15.1 events per year
Colfax County	301	13.4 events per year
Cuming County	329	14.7 events per year
Dixon County	329	14.5 events per year
Dodge County *(Census Tracts 9636)*	294	13.4 events per year
Knox County *(Census Tracts 9763)*	308	14 events per year
Madison County	322	14.6 events per year
Pierce County	308	13.9 events per year
Platte County *(Census Tracts 9651)*	322	14.6 events per year
Stanton County	343	15.2 events per year
Thurston	315	13.6 events per year
Wayne County	315	14.3 events per year

Vulnerability and Impact

For jurisdictional- specific vulnerabilities, refer to *Volume II*.

Life Safety and Health: The impact of drought can directly affect the population within the planning area. These impacts may include causing an insufficient water supply, the loss of jobs within the agricultural sector, and an increase in food prices which may impact residents who are in poverty. An indirect threat to the general public is that of heat exhaustion and heat stroke, both of which are more likely during hot and dry conditions, especially for outdoor workers. Possible loss of human life from a drought event is often largely due to secondary effects such as heat, fire, and other health-related problems such as increased pollutant concentrations in surface water. If precipitation deficiencies continue, then people dependent on other sources of water will begin to feel the effects of the shortage. In addition, poor air quality and a lack of water may reduce residents' engagement in recreational activities, reducing overall mental and physical well-being.

Property Damage and Critical Infrastructure: The conditions that produce droughts may actively damage certain areas or structures such as cracking the foundations of residential and commercial structures. Additionally, waterlines below the ground may become damaged, along with roadways during prolonged, extreme events. Power outages/brownouts may occur during drought conditions due to increased usage and the increased stress on the grid. Property such as crops, and livestock may be directly impacted by having die-off events due to lack of water or increased heat. Wells may run dry due to decreased groundwater levels and may require modification.[149]

Economy: As a large percentage of Nebraska is utilized for agricultural or rangeland purposes, drought has the capacity to cause direct damage through die-off, as well as increased water usage during the event.[150] Crop yields would either be decreased due to a drought, or massively plumet during an extreme drought event. Damage to wildlife and fish habitats are all additional impacts of drought events. Droughts are also associated with increases in insect infestations, plant disease, and wind erosion. Tourism may be impacted during

[149] State of Nebraska Hazard Mitigation Plan, 2021. Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf
[150] Ibid.

an extended drought event, due to the closure of water-intensive businesses (carwashes, pools, etc.) The loss of tourism funds and general decrease in land prices are additional economic impacts of a drought event.

Changes in Development and Impact of Future Development: Due to the increase of wildfires and wildfire intensity, vulnerable areas may need to be considered for long-term drought conditions. Physical damage to roadways, bridges, water systems, and building foundations may likewise impact existing or future development projects within the Lower Elkhorn Planning Area. Additionally, new well pumps may need to be drilled deeper to accommodate lower groundwater levels.[151]

Underserved and At-Risk Population: Drought conditions can directly impact both energy and food prices. This would disproportionately affect underserved and at-risk populations. Additional vulnerable occupational groups: residents who work in the agriculture sector of the economy, may be impacted severely. While a true food shortage resulting from drought or famine is unlikely in the near future, significant food price spikes caused by agricultural disruptions could place food beyond the financial reach of many residents, especially lower income households.

Effects of Climate Change in Severity of Impacts: Due to climate change, drought conditions are expected to worsen worldwide. The frequency and intensity of droughts are likely to increase, and they will last for longer periods, both globally and within the Lower Elkhorn planning area. According to the University Corporation for Atmospheric Research (UCAR), climate change is leading to more extreme weather events, including severe drought. UCAR explains that higher temperatures result in increased evaporation, turning water into vapor in the air and causing drought in some parts of the world. Areas that are already prone to drought are projected to become even drier over the next century.

FEMA NRI Expected Annual Loss Estimates

A drought NRI Expected Annual Loss (EAL) score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to drought when compared to the rest of the United States. The EAL score is positively associated with a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 84** outlines the drought EAL for the Lower Elkhorn planning area.

Table 84: Drought Expected Annual Loss[152]

Location	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Burt County (Census Tracts 9632, 9634)	n/a	n/a	$200,511	$200,511	97.93	Relatively Moderate
Cedar County	n/a	n/a	$443,319	$443,319	84.57	Relatively Moderate
Colfax County	n/a	n/a	$283,000	$283,000	79.7	Relatively Low

[151] State of Nebraska Hazard Mitigation Plan, 2021. Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf

[152] FEMA National Risk Index. Community Report. (n.d.). Retrieved from https://hazards.fema.gov/nri/map

Location	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Cuming County	n/a	n/a	$420,436	$420,436	84.79	Relatively Moderate
Dixon County	n/a	n/a	$233,557	$233,557	79.29	Relatively Low
Dodge County	n/a	n/a	$164,535	$164,535	98.57	Relatively High
(Census Tracts 9636)	n/a	n/a	$34,246	$34,246	95.8	Relatively Moderate
Knox County	n/a	n/a	$369,676	$369,676	85.24	Relatively Moderate
(Census Tracts 9763)	n/a	n/a	$288,168	$288,168	81.16	Relatively Low
Madison County	n/a	n/a	$280,943	$280,943	98.81	Relatively High
Pierce County	n/a	n/a	$212,148	$212,148	73.4	Relatively Low
Platte County	n/a	n/a	$219,268	$219,268	83.01	Relatively Moderate
(Census Tracts 9651)	n/a	n/a	$286,508	$286,508	75.63	Relatively Low

Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).

Total Risk Score

Table 85 represents the Drought Total Risk Score for the Lower Elkhorn planning area, based on the Risk Assessment Methodology, as defined in this Plan.

Table 85: Drought Total Risk Score

Drought Total Risk Score						
Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Drought	3	9	15	30	54	81

Consequence: Sum of all weighted factors.
Extent: Sum of the weighted Extent factors.
Vulnerability: Sum of the weighted Vulnerability factors.
Impact: Sum of the weighted Impact factors.
Total Risk Score = Probability x Consequence
** Normalized to 100*

Total Risk Score Legend						
Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 50
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	51 – 75

Drought Total Risk Score						
Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
The legend—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The Consequence Score represents the sum of the Extent, Vulnerability, and Impact Factors. The Total Risk Score is a measure of Probability and Consequence.						

Earthquake

Hazard Description

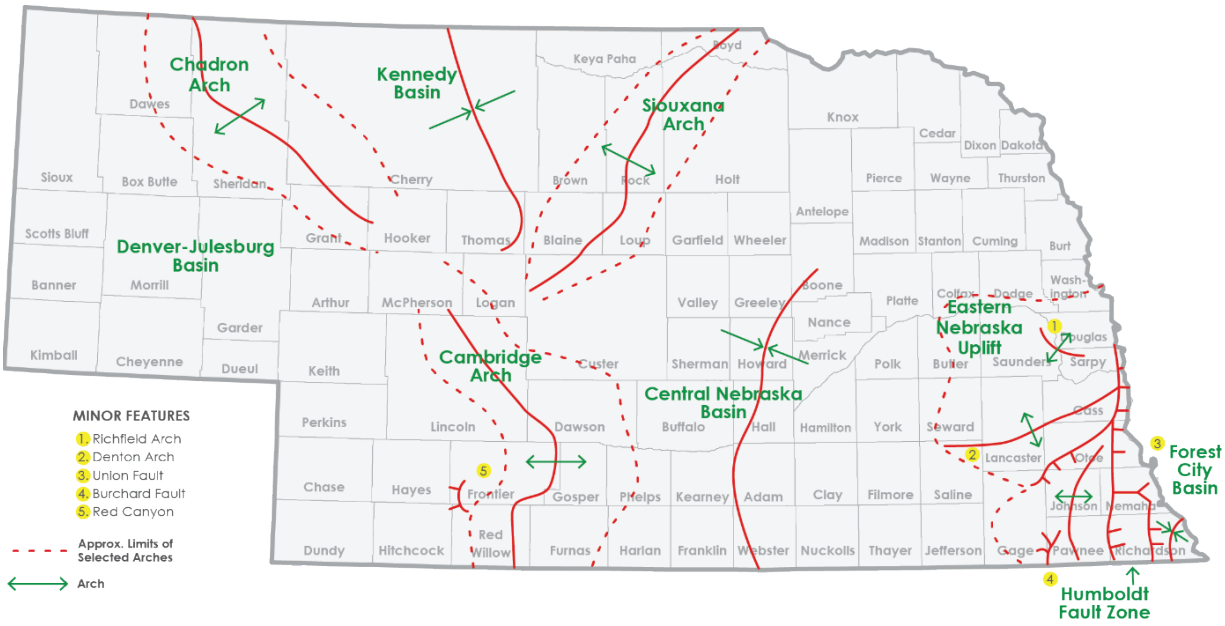
An earthquake is the result of a sudden release of energy in the Earth's tectonic plates that creates seismic waves. The seismic activity of an area refers to the frequency, type, and size of earthquakes experienced over a period of time. Earthquakes cause both vertical and horizontal ground shaking which varies both in amplitude (the amount of displacement of the seismic waves) and frequency (the number of seismic waves per unit time), usually lasting less than 30 seconds.[153] Buildings with foundations resting on unconsolidated landfill and other unstable soil, and trailers or homes not tied to their foundations are at risk because they can be shaken off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths, injuries, and extensive property damage.

Although rather uncommon, earthquakes do occur in Nebraska and have occurred in the Lower Elkhorn NRD. These earthquakes are usually small, generally not felt, and cause little to no damage.

Location

The most likely locations in the planning area to experience an earthquake are near a fault line (**Figure 31**). The Eastern Nebraska Uplift could potentially affect the planning area.

Figure 31: Fault Lines in Nebraska[154]

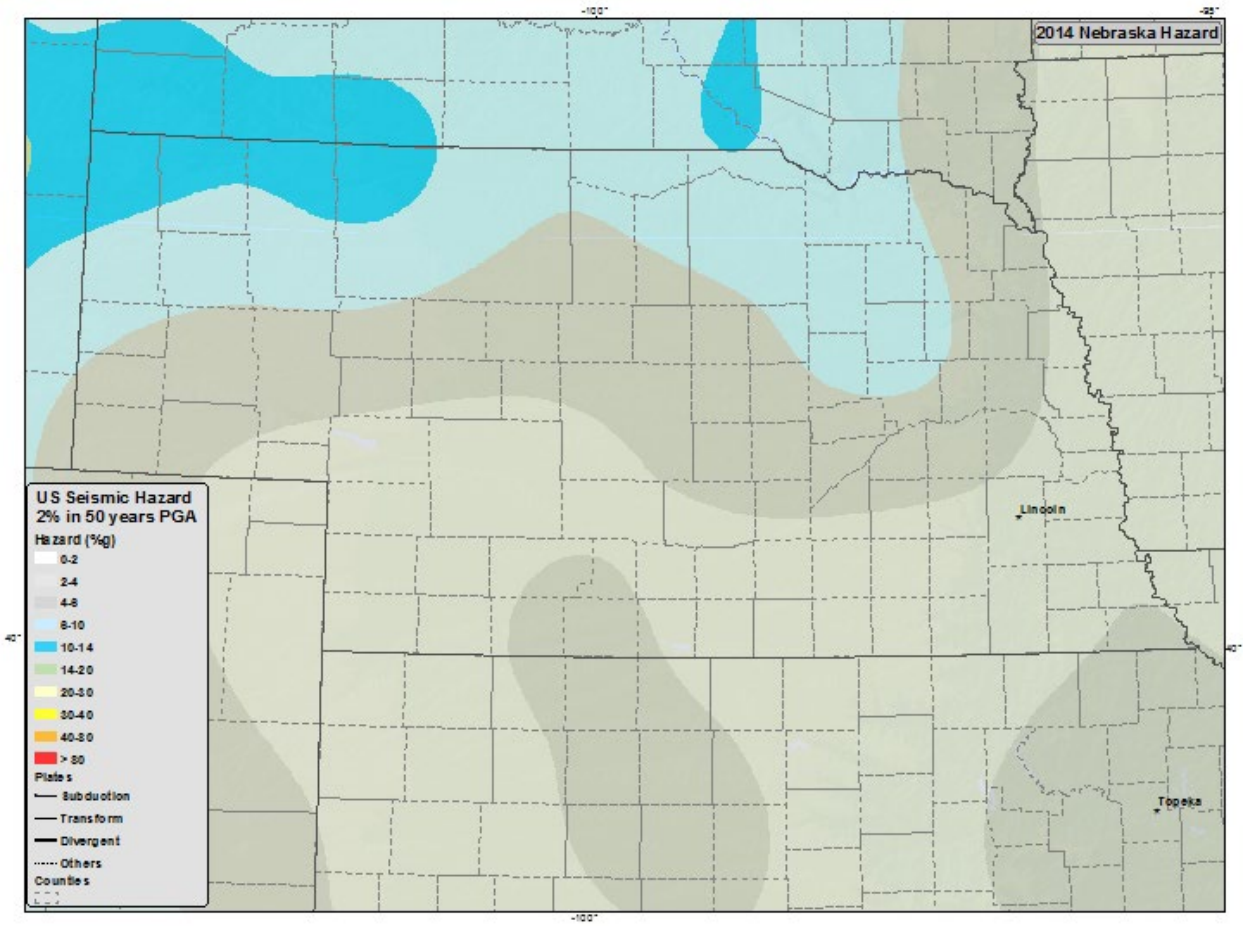


The following figure created by the United States Geological Survey illustrates a 2% seismic hazard event within the state of Nebraska.

[153] U.S Geological Survey. (n.d.). What are the Effects of Earthquakes. Retrieved from https://www.usgs.gov/programs/earthquake-hazards/what-are-effects-earthquakes.

[154]

Figure 32: 2% Seismic Hazard: State of Nebraska[155]



Extent

Earthquakes are measured by magnitude and intensity. There are several standard measures of earthquakes, including the Richter Scale and the Modified Mercalli Intensity (MMI) scale. The Richter Scale measures the magnitude or amount of energy an earthquake releases. Magnitude is measured by seismographs. The MMI scale is an observed measurement of the earthquake's intensity felt at the earth's surface and it varies depending on the observer's location at the earthquake's epicenter. The MMI Scale is comprised of 12 increasing levels, designated by Roman numerals, that range from imperceptible shaking to catastrophic destruction. Furthermore, the MMI can be used to map earthquake impacts.[156]

Table 86 summarizes the Richter Scale and Modified Mercalli Scale, correlating the two with the effects of ground shaking.

[155] United States Geological Survey, (2019). Earthquake Hazards Program. .Information by Region – Nebraska. Retrieved from https://www.usgs.gov/programs/earthquake-hazards/science/information-region-nebraska

[156] Pacific Northwest Seismic Network. (n.d.). Magnitude/Intensity. Retrieved from https://pnsn.org/outreach/about-earthquakes/magnitude-intensity.

Table 86: Modified Mercalli Scale vs. Richter Scale[157]

Mercalli Intensity	Effects	Richter Scale *(approximate)*
I. Instrumental	Not felt.	1 – 2
II. Just Perceptible	Felt by only a few people, especially on upper floors of tall buildings.	3
III. Slight	Felt by people lying down, seated on a hard surface, or in the upper stories of tall buildings.	3.5
IV. Perceptible	Felt indoors by many, by few outside; dishes and windows rattle.	4
V. Rather Strong	Generally felt by everyone; sleeping people may be awakened.	4.5
VI. Strong	Trees sway, chandeliers swing, bells ring, some damage from falling object.	5
VII. Very Strong	General alarm; walls and plaster crack.	5.5
VIII. Destructive	Felt in moving vehicles; chimneys collapse; poorly constructed buildings seriously damaged.	6
IX. Ruinous	Some houses collapse; pipes break.	6.5
X. Disastrous	Obvious ground cracks; railroad tracks bent; some landslides on steep hillsides.	7
XI. Very Disastrous	Few buildings survive; bridges damaged or destroyed; all services interrupted (electrical, water, sewage, railroad; severe landslides.	7.5
XII. Catastrophic	Total destruction; objects thrown into the air; river courses and topography altered.	8

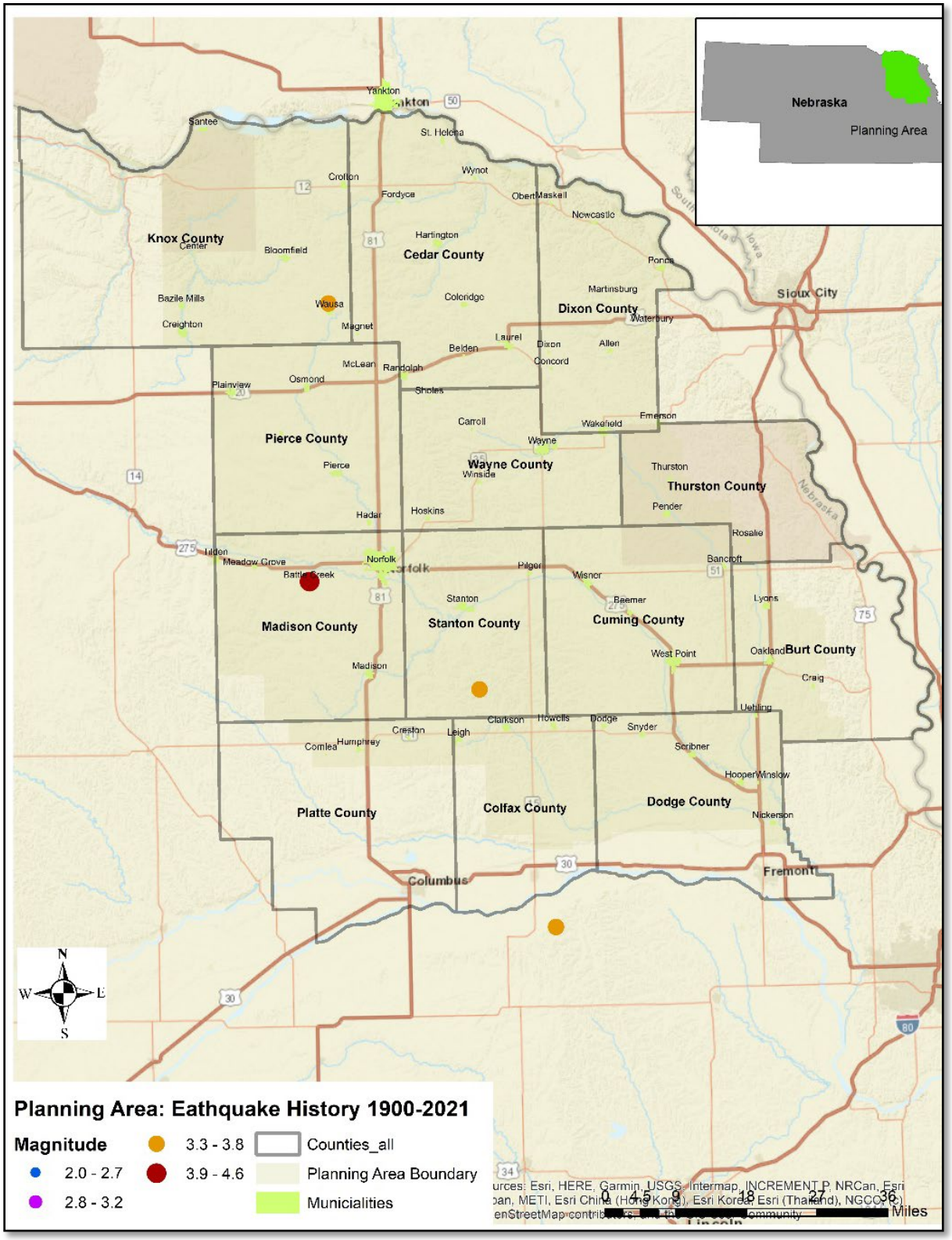
Historical Frequency

According to the United States Geological Survey (USGS), there have been 3 earthquakes exceeding a 3.0 in the planning area since 1900 as indicated in **Figure 33**. As of 2023, there have been no recorded major earthquakes in the State.[158] Based on the low intensity of earthquakes in Nebraska, it is unlikely for an earthquake to exceed a 5.0 on the Richter scale as most quakes are mild and cause little to no damage.

[157] United Nations Office for the Coordination of Humanitarian Affairs. (n.d.). Using Modified Mercalli Intensity (MMI) scale to estimate population exposed to Earthquake shaking. Retrieved from HPC Tools.

[158] History Nebraska. (n.d.). Publications: Earthquakes. Retrieved from https://history.nebraska.gov/publications_section/earthquakes/

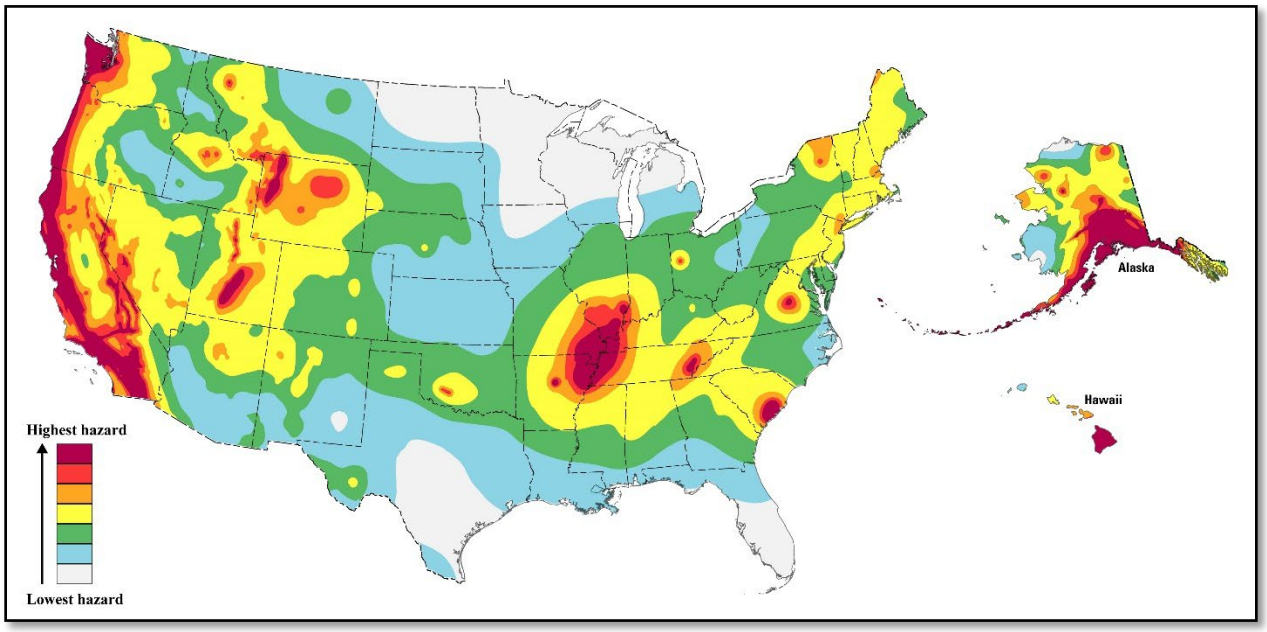
Figure 33: Earthquakes in Planning Area[159]



Probability and Frequency

The USGS indicates the probability of a 5.0 or greater earthquake occurring in the planning area within 50 years is less than one percent (**Figure 34**). As illustrated within both of the following maps, the risk of an earthquake within the planning area, and the entire state of Nebraska, is extremely low.

Figure 34: Earthquake Probability (2023)[160]



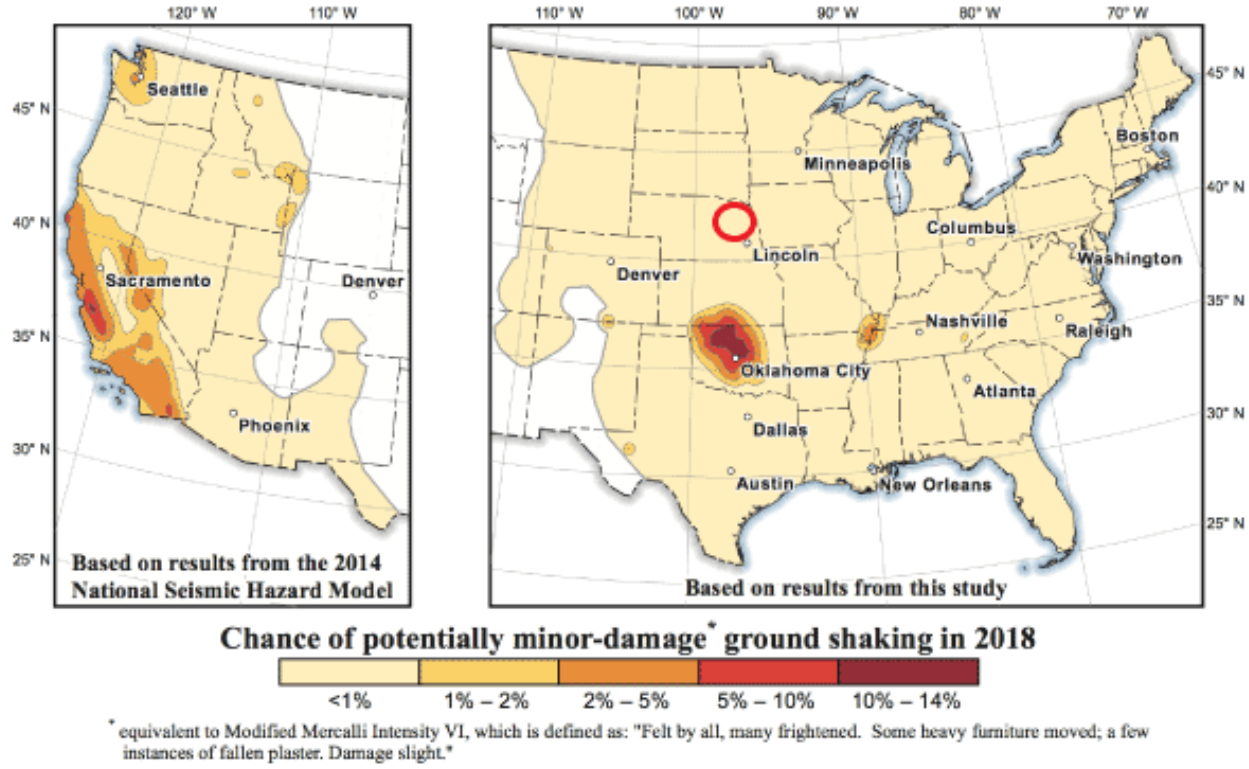
**Map shows the two-percent probability of exceedance in 50 years of peak ground acceleration. The models are based on seismicity and fault-slip rates, and take into account the frequency of earthquakes of various magnitudes. Locally, the hazard may be greater than shown, because site geology may amplify ground motions.*

Figure 35 shows the probability of damage from earthquakes, according to the USGS. The planning area has a less than one percent chance of damage from earthquakes.

[159] USGS Earthquakes by Region. All Earthquakes 1900-Present. (n.d.). Retrieved from https://www.usgs.gov/programs/earthquake-hazards/science/information-region-nebraska

[160] USGS 2023 Probabilistic Seismic Hazard Analysis Model. (n.d.). Retrieved from https://www.usgs.gov/media/images/hazard-map-2023-50-state-update-national-seismic-hazard-model-project

Figure 35: 2018 Probability of Damage from Earthquakes[161]



The earthquake annualized frequency value represents the number of recorded earthquake hazard occurrences, in event days, per year over the period of record.**Table 87** outlines the annualized frequency for earthquakes based on FEMA National Risk Index (NRI) data utilizing the 2021 dataset.

Table 87: Earthquake Annualized Frequency (FEMA National Risk Index)

Location	Events on Record	Annualized Frequency
Burt County *(Census Tract 9632, 9634)*	n/a	0.0115% chance per year
Cedar County	n/a	0.016% chance per year
Colfax County	n/a	0.018% chance per year
Cuming County	n/a	0.016% chance per year
Dixon County	n/a	0.012% chance per year
Dodge County *(Census Tract 9636)*	n/a	0.015% chance per year
Knox County *(Census Tract 9763)*	n/a	0.020% chance per year
Madison County	n/a	0.023% chance per year
Pierce County	n/a	0.022% chance per year
Platte County *(Census Tract 9651)*	n/a	0.025% chance per year
Stanton County	n/a	0.019% chance per year

[161] USGS Short-term Seismicity Model 2018. (n.d.). Retrieved from https://www.usgs.gov/media/images/short-term-seismicity-model-2018

Location	Events on Record	Annualized Frequency
Thurston County	n/a	0.011% chance per year
Wayne County	n/a	0.017% chance per year

Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.

Vulnerability and Impact

The following table provides information related to regional vulnerabilities; for jurisdictional- specific vulnerabilities, refer to Volume II.

Life Safety and Health: Earthquakes have the potential to cause significant damage and pose a significant threat to an individual's life. According to FEMA, earthquakes can impact life safety and public health in different ways. Some of the most common impacts are as follows:

- Injuries and Loss of Life: The violent shaking and structural damage caused by earthquakes can result in injuries and, in severe cases, loss of life. Falling debris, structural collapses, and ground ruptures can pose immediate risks to individuals in affected areas.
- Structural Damage: Earthquakes can cause extensive damage to buildings, homes, and infrastructure, making them unsafe for occupancy. This can lead to injuries, homelessness, and the need for temporary shelter.
- Displacement: Earthquake-affected individuals may be forced to evacuate their homes due to damage or the threat of aftershocks. This displacement can lead to overcrowding in emergency shelters and increased stress for affected individuals and families.
- Mental Health Impact: Earthquakes can have long-lasting psychological effects, including trauma, anxiety, and post-traumatic stress disorder (PTSD), which may require mental health support and counseling.
- Strain on Healthcare Systems: Earthquakes can overwhelm healthcare systems with an influx of injured individuals in need of medical attention. Hospitals and medical facilities may face challenges in providing care and resources.
- Infrastructure Disruption: Critical infrastructure, including roads, bridges, utilities, and communication networks, can be damaged, affecting emergency response capabilities and access to essential services.
- Water Supply Contamination: Ground shaking can damage water supply systems, leading to contamination of drinking water sources. This poses health risks and requires water treatment and distribution efforts.
- Fire Hazards: Earthquakes can cause gas leaks and damage to electrical systems, increasing the risk of fires. Fire outbreaks can lead to additional injuries, property damage, and air quality issues.
- Aftershocks: Aftershocks following the initial earthquake can further damage weakened structures, hinder response efforts, and prolong the risks to life safety and public health.

Property Damage and Critical Infrastructure: Earthquakes can buckle roads, collapse buildings, and severely damage multiple types of property including critical infrastructure. Additionally, while a building may appear undamaged, the foundation may be cracked and therefore require significant repair before resuming operations.

Generally, wood frame buildings and structures on solid ground fare best during an earthquake. Wood frame buildings are flexible enough to withstand ground shaking and swaying. Evaluations of recent earthquakes found that damage was primarily caused to:

- Unreinforced masonry structures.
- Older buildings with some degree of deterioration.
- Buildings without foundation ties.
- Multi-story structures with open or "soft" first floors.

Most building codes have standards related to the first three concerns. This means that the most threatened buildings are older ones (built before current codes), masonry ones, and taller ones with open first floors.

In addition to the building type, damage is related to the underlying soils. Buildings on solid ground fare better, while those on loose or sandy soils will suffer more from shaking. These can be found in floodplains. If there is enough water present, the shaking can liquefy the underlying soils, which removes the support under the foundation.

If damaged, response facilities such as hospitals, fire departments, and police departments, could suffer from reduced response time or capacity. Additionally, water and sewage treatment facilities may be unable to ensure a sanitary and clean water supply to the population due to damaged or destroyed facilities, water mains, and sewer lines.[162]

Economy: According to FEMA, earthquake events can have profound and multifaceted economic impacts, affecting communities, businesses, and governments at all levels. Initially, earthquakes inflict direct damage to infrastructure, including buildings, roads, and bridges, leading to substantial repair and reconstruction costs. These costs not only strain public budgets but also divert resources from other vital community needs. Businesses experience significant disruptions, with some forced to cease operations temporarily or permanently, resulting in lost income, employment, and productivity. The ripple effects extend to the wider economy, as supply chains are disrupted, and consumer spending patterns shift in the aftermath of the disaster. As there have been no major earthquakes in Nebraska, damage and interruption is unlikely to be severe or long-term.

Changes in Development and Impact of Future Development: As the planning area hasn't experienced a major earthquake, the impact to current and future developments is anticipated to be minimal. Even with the reduced risk, new homes and developments should be built to adhere to the most current buildings codes which take earthquakes into account.

Underserved and At Risk Population: As with many other disasters, at-risk and underserved populations are at a heightened risk during an earthquake. Economically disadvantaged individuals may suffer during the period after an earthquake when utilities won't function and usual sources of income are put on hold or eliminated due to building damage. Individuals with mobility challenges may be at a higher risk of injury due to falling debris or falling during a minor quake.

Effects of Climate Change in Severity of Impacts: According to NOAA, the relationship between climate change and the severity of earthquake events is not direct, as earthquakes are primarily caused by

[162] USGS. How does an earthquake affect groundwater levels and water quality in wells? (n.d.). Retrieved from https://www.usgs.gov/faqs/how-does-earthquake-affect-groundwater-levels-and-water-quality-wells

geophysical processes related to the movement of tectonic plates beneath the Earth's surface. According to NOAA, earthquakes result from the buildup and release of energy along faults or by volcanic activity, processes that are generally considered to be independent of atmospheric conditions influenced by climate change.

FEMA NRI Expected Annual Loss Estimates

An earthquake NRI Expected Annual Loss Estimate (EAL) score, and rating represent a community's relative level of expected building and population loss each year due to earthquakes when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 88** outlines the earthquake EAL for the Lower Elkhorn Planning Area.

Table 88: Earthquake Expected Annual Loss

Location	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Burt County *(Census Tract 9632, 9634)*	$199	$2,498	n/a	$2,697	12.69	Relatively Moderate
Cedar County	$403	$5,423	n/a	$5,826	12.4	Very Low
Colfax County	$771	$7,511	n/a	$8,282	15.8	Very Low
Cuming County	$475	$6,230	n/a	$6,705	13.7	Very Low
Dixon County	$211	$2,519	n/a	$2,730	7.0	Very Low
Dodge County *(Census Tract 9636)*	$299	$4,287	n/a	$4,585	64.5	Relatively Moderate
Knox County *(Census Tract: 9763)*	$227	$2,567	n/a	$2,794	21.0	Very Low
Madison County	$3,107	$29,450	n/a	$32,557	29.7	Very Low
Pierce County	$404	$6,198	n/a	$6,602	13.5	Very Low
Platte County *(Census Tract 9651)*	$194	$4,678	n/a	$4,872	31.0	Very Low
Stanton County	$177	$2,853	n/a	$3,030	7.4	Very Low
Thurston County	$268	$2,070	n/a	$2,339	6.0	Very Low
Wayne County	$686	$6,145	n/a	$6,831	14.0	Very Low

Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).

Total Risk Score

Table 88 represents the earthquake Total Risk Score for the Lower Elkhorn planning area, based on the Risk Assessment Methodology, as defined in this Plan.

Table 89: Earthquake Total Risk Score

Earthquake Total Risk Score						
Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Earthquake	1	0	5	4	9	7

Consequence: Sum of all weighted factors.
Extent: Sum of the weighted Extent factors.
Vulnerability: Sum of the weighted Vulnerability factors.
Impact: Sum of the weighted Impact factors.
Total Risk Score = Probability x Consequence
** Normalized to 100*

Total Risk Score Legend						
Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 50
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	51 – 75

The legend—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The Consequence Score represents the sum of the Extent, Vulnerability, and Impact Factors. The Total Risk Score is a measure of Probability and Consequence.

Extreme Temperatures (Heat Wave & Cold Wave)

Heat Wave Hazard Description

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

Along with humans, animals also can be affected by high temperatures and humidity. For instance, cattle and other farm animals respond to heat by reducing feed intake, increasing their respiration rate, and increasing their body temperature.[163] These responses assist the animal in cooling itself, but this is usually not sufficient. When animals overheat, they will begin to shut down body processes not vital to survival, such as milk production, reproduction, or muscle building.

Other secondary concerns connected to extreme heat hazards include water shortages brought on by drought-like conditions and high demand. Government authorities report that civil disturbances and riots are more likely to occur during heat waves.[164] In cities, pollution becomes a problem because the heat traps pollutants in densely populated urban areas. Adding pollution to the stresses associated with the heat magnifies the health threat to the urban population.

For the planning area, the months with the highest temperatures are June, July, and August. The National Weather Service (NWS) is responsible for issuing excessive heat outlooks, excessive heat watches, and excessive heat warnings.

A period of abnormally and uncomfortably hot, and unusually humid weather, typically lasting two (2) or more days with temperatures outside the historical averages for a given area is referred to as a heat wave.[165] Heat waves develop when a high-pressure system aloft (10,000 feet – 25,000 feet) strengthens and remains over a region for several days or weeks. Under a high-pressure system, the air sinks towards the surface and acts as a dome capping the atmosphere by trapping the heat instead of allowing it to lift. Additionally, without the lift mechanism there is little to no convection which results in little cloud cover and precipitation.[166]

Location

This hazard may occur throughout the entirety of the Lower Elkhorn planning area.

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[163] The Cattle Site. (2010). Behavioral Responses to Heat Stress. Retrieved from https://www.thecattlesite.com/articles/2404/behavioural-responses-to-heat-stress/

[164] JSTOR: Yeeles, Adam. "Weathering Unrest: The Ecology of Urban Social Disturbances in Africa and Asia. (2015). Journal of Peace Research 52, no. 2: 158–70. Retrieved from http://www.jstor.org/stable/24557452

[165] Federal Emergency Management Agency. (2023). Heat Wave. Retrieved from https://hazards.fema.gov/nri/heat-wave.

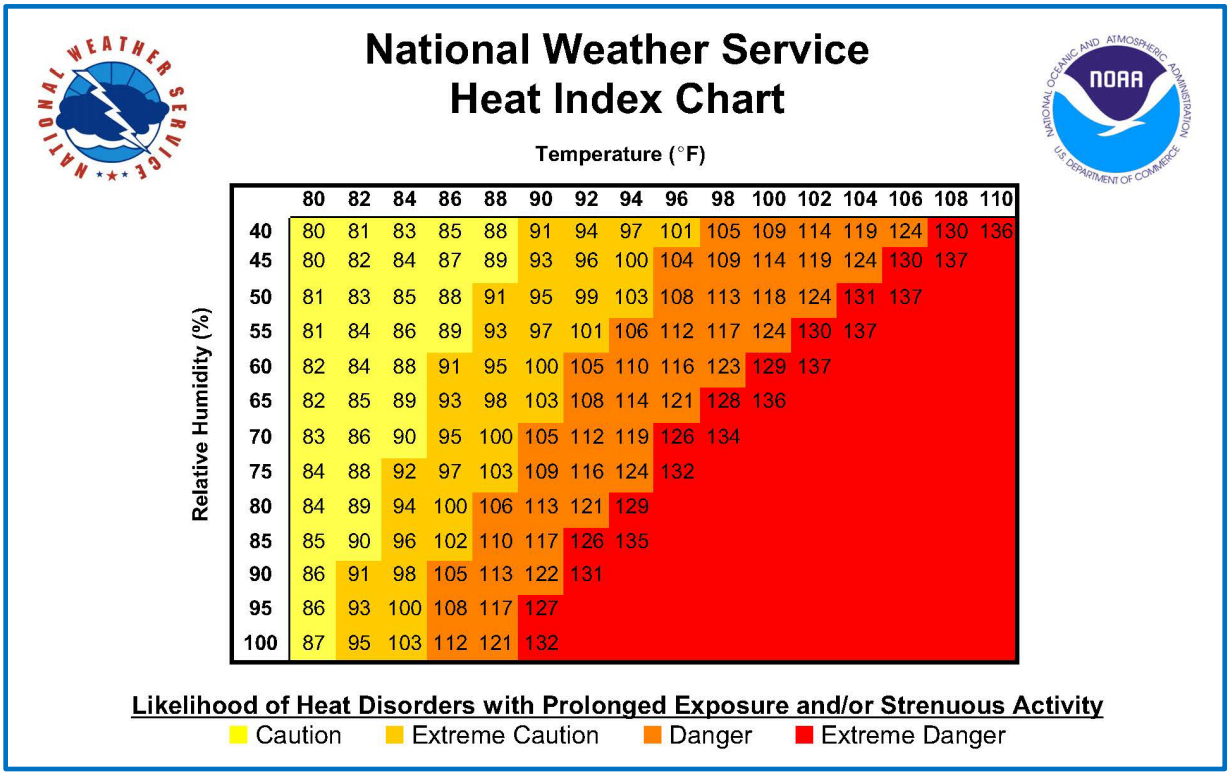
[166] National Oceanic and Atmospheric Administration. (2022). Heat Index. Retrieve from https://www.noaa.gov/jetstream/global/heat-index#.

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 (NOAA), as the Relative Humidity increases, the temperature needed to cause a dangerous situation decreases. For example, for 100 percent Relative Humidity, dangerous levels of heat begin at 86°F whereas a Relative Humidity of 50 percent, require 94°F.

Figure 36 illustrates NWS's Heat Index Chart; the combination of Relative Humidity and Temperature. The NWS primarily uses Heat Index values to determine excessive heat events and issue the appropriate advisories.[167]

Figure 36: National Weather Service Heat Index Chart



The figure above is designed for shady and light wind conditions. Exposure to full sunshine or strong winds can increase hazardous conditions and raise heat index values by up to 15°F. For the purposes of this plan, extreme heat is defined as temperatures of 100°F or greater.

Table 90: Heat Risk Categories

Category		Risk of Heat-Related Impacts
0	Green	Little to no risk from expected heat.
1	Yellow	Minor: This level of heat affects primarily those individuals extremely sensitive to heat, especially when outdoors without effective cooling and/or adequate hydration.

[167] National Weather Service. (n.d.). Heat Forecast Tools. Retrieved from https://www.weather.gov/safety/heat-index.

Category		Risk of Heat-Related Impacts
2	Orange	Moderate: This level of heat affects most individuals sensitive to heat, especially those without effective cooling and/or adequate hydration. Impacts possible in some health systems and in heat-sensitive industries.
3	Red	Major: This level of heat affects anyone without effective cooling and/or adequate hydration. Impacts likely in some health systems, heat-sensitive industries, and infrastructure.
4	Magenta	Extreme: This level of rare and/or long-duration extreme heat with little to no overnight relief affects anyone without effective cooling and/or adequate hydration. Impacts likely in most health systems, heat-sensitive industries, and infrastructure.

The Heat Risk takes into consideration the following – how unusual the heat is for the time of the year, the duration of the heat including both daytime and nighttime temperatures, and those temperatures that pose an elevated risk of heat-related impacts based on data from the CDC.

Table 91: National Weather Service Excessive Heat Advisories[168]

Type	Definition
Excessive Heat Outlook	Issued when the potential exists for an excessive heat event in the next 3-7 days. An Outlook provides information to those who need considerable lead time to prepare for the event.
Heat Advisory	Issued within 12 hours of the onset of extremely dangerous heat conditions. Generally, an advisory is issued when the heat index values are expected to reach 100°F or higher for at least two (2) days, and nighttime air temperatures will not drop below 75°F. *HeatRisk Value: 2.4 – 2.65 (orange/red levels)*
Excessive Heat Watch	Issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours. Generally, a watch is issued when the risk of a heat wave has increased, but its occurrence and timing is still uncertain
Excessive Heat Warning	Issued within 12 hours of the onset of extremely dangerous heat conditions. Generally, a warning is issued when the heat index values are expected to reach 105°F or higher for at least two (2) days and nighttime air temperatures will not drop below 75°F. *HeatRisk Value: 2.66 – 4 (red/magenta levels)*

Historical Frequency

The past ten years of excessive heat events for the Lower Elkhorn planning area are presented in **Table 92** according to the NCEI database as a part of the National Oceanic and Atmospheric Administration. NCEI has reported 27 excessive heat events in the planning area within the past 10 years. While no damages were reported, the August heat wave in 2023 broke multiple records across the Midwest including Nebraska. Falls City, for example, recorded a heat index of 128 degrees on August 19th; their highest in 42 years of records.[169]

Table 92: Excessive Heat Events (2013 - 2023)[170]

Location	County / Zone	State	Date	Death	Injury	Property Damage	Crop Damage
Dixon (Zone)	Dixon (Zone)	NE	6/10/2016	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	7/20/2016	0	0	0.00K	0.00K

[168] National Weather Service. (n.d.). Heat Watch vs. Warning. Retrieved from https://www.weather.gov/safety/heat-ww.

[169] Weather Underground. Erdman, Jonathan. (2023). Heat Dome Brought Record-Breaking Temperatures. Retrieved from https://www.wunderground.com/article/safety/heat/news/2023-08-18-heat-dome-records-midwest-plains-south-forecast

[170] National Centers for Environmental Information. (n.d.). Storm Events Database. Retrieved from https://www.ncdc.noaa.gov/stormevents/

Location	County / Zone	State	Date	Death	Injury	Property Damage	Crop Damage
Dixon (Zone)	Dixon (Zone)	NE	7/20/2016	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	6/29/2019	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	7/26/2023	0	0	0.00K	0.00K
Platte (Zone)	Platte (Zone)	NE	7/28/2023	0	0	0.00K	0.00K
Dodge (Zone)	Dodge (Zone)	NE	7/28/2023	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	7/28/2023	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	7/28/2023	0	0	0.00K	0.00K
Colfax (Zone)	Colfax (Zone)	NE	7/28/2023	0	0	0.00K	0.00K
Burt (Zone)	Burt (Zone)	NE	7/28/2023	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	8/19/2023	0	0	0.00K	0.00K
Dodge (Zone)	Dodge (Zone)	NE	8/19/2023	0	0	0.00K	0.00K
Platte (Zone)	Platte (Zone)	NE	8/19/2023	0	0	0.00K	0.00K
Burt (Zone)	Burt (Zone)	NE	8/19/2023	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	8/21/2023	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	8/21/2023	0	0	0.00K	0.00K
Knox (Zone)	Knox (Zone)	NE	8/21/2023	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	8/21/2023	0	0	0.00K	0.00K
Madison (Zone)	Madison (Zone)	NE	8/21/2023	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	8/21/2023	0	0	0.00K	0.00K
Burt (Zone)	Burt (Zone)	NE	8/21/2023	0	0	0.00K	0.00K
Stanton (Zone)	Stanton (Zone)	NE	8/21/2023	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	8/21/2023	0	0	0.00K	0.00K
Platte (Zone)	Platte (Zone)	NE	8/21/2023	0	0	0.00K	0.00K
Colfax (Zone)	Colfax (Zone)	NE	8/21/2023	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	8/21/2023	0	0	0.00K	0.00K
Totals				0	0	0.00K	0.00K

Probability and Frequency

Extreme heat is a regular part of the climate for the planning area; there is a 100 percent probability that temperatures greater than 100°F will occur annually. The Union for Concerned Scientists released a report and interactive tool in 2019, the report titled *Killer Heat in the United States: Climate Choices and the Future of Dangerously Hot Days*[171] 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 93: Extreme Heat Predictions for Days over 100F[172]

Jurisdiction	Historical Average 1971 - 2000 (Days per Year)	Midcentury Prediction 2036 – 2065 (Days per Year)	Late Century 2070 – 2099 (Days per Year)
Burt County	6	45	61
Cedar County	5	27	52
Colfax County	5	31	57
Cuming County	5	31	56
Dixon County	5	28	53
Dodge County	6	34	59

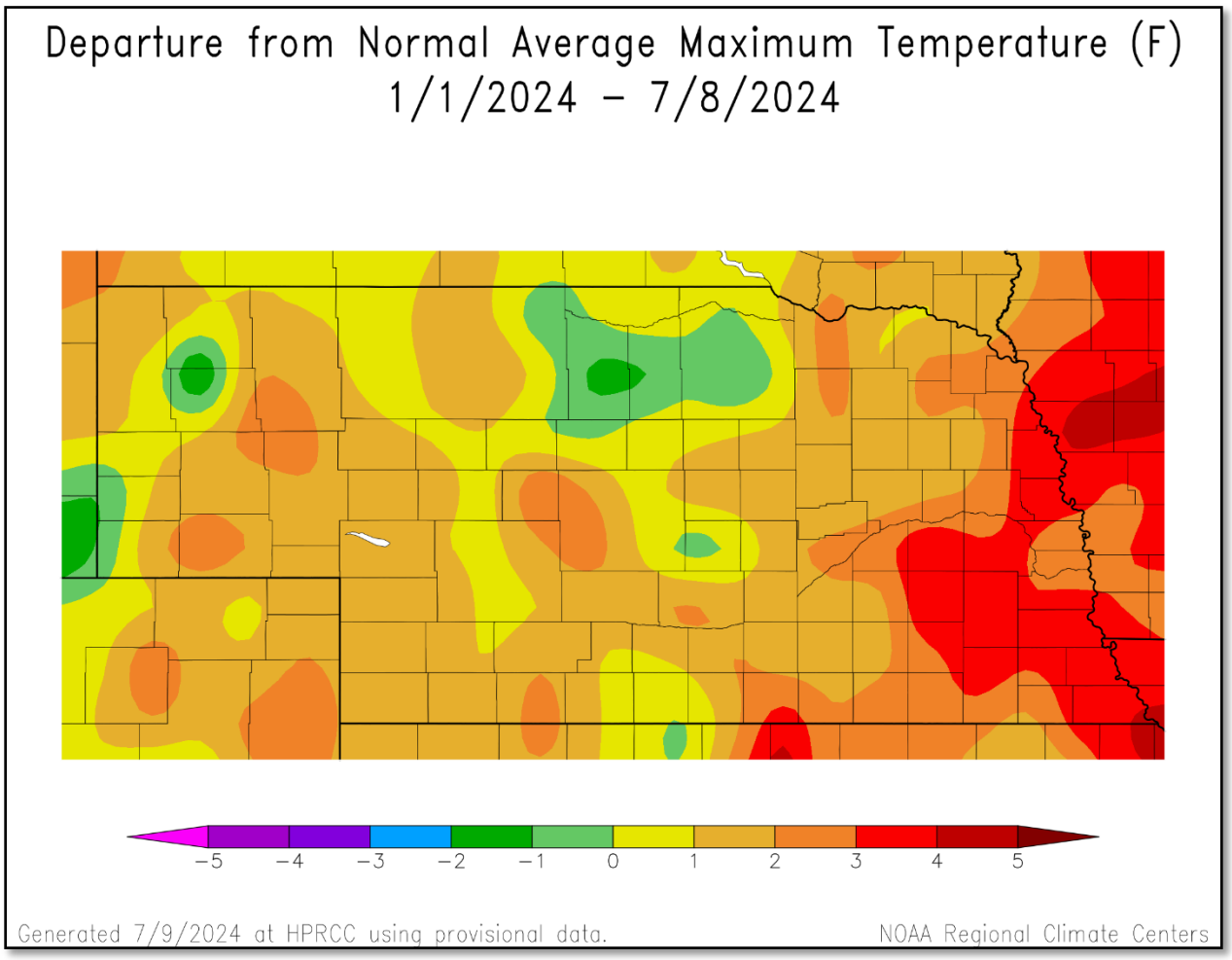
[171] Union of Concerned Scientists. (2019). Killer Heat in the United States: Climate Choices and the Future of Dangerously Hot Days.. Retrieved from https://www.ucsusa.org/sites/default/files/attach/2019/07/killer-heat-analysis-full-report.pdf

[172] Union of Concerned Scientists. 2019. "Extreme Heat and Climate Change: Interactive Tool". Retrieved from https://www.ucsusa.org/global-warming/global-warming-impacts/extreme-heat-interactive-tool?location=lancaster-county--ne

Jurisdiction	Historical Average 1971 - 2000 (Days per Year)	Midcentury Prediction 2036 – 2065 (Days per Year)	Late Century 2070 – 2099 (Days per Year)
Knox County	5	29	54
Madison County	4	27	53
Pierce County	5	29	54
Platte County	5	31	57
Stanton County	5	29	54
Thurston County	6	33	58
Wayne County	4	27	52

According to the High Plains Regional Climate Center (HPRCC), the planning area has a regular departure (increase) from the normal average maximum temperature (**Figure 37**)

Figure 37: Departure from Normal Average maximum Temperature[173]



[173] High Plains Regional Climate Center. (n.d.). ACIS Climate Maps. Departure from Normal Average Maximum Temperature. Retrieved from https://hprcc.unl.edu/maps.php?map=ACISClimateMaps

Although excessive/extreme heat are not synonymous concepts, they are related. Two (2) or more consecutive days with temperatures outside the historical averages (i.e., excessive/extreme heat) for a given area result in a heat wave. As a result, the FEMA NRI measures excessive/extreme heat events as heat waves. The heat wave annualized frequency value represents the average number of recorded heat wave hazard occurrences in event days, per year over the period of record (16 years)

The heat wave annualized frequency value represents the number of recorded heat wave hazard occurrences, in event days, per year over the period of record. **Table 94** outlines the annualized frequency for heat wave based on FEMA National Risk Index (NRI) data from 2005-2021 (16 years). On average, there is approximately one heat wave event per year within the planning area.

Table 94: Heat Wave Annualized Frequency[174]

Location	Events on Record	Annualized Frequency (2005-2021)
Burt County *(Census Tract 9632, 9634)*	50	1.5 events per year
Cedar County	13	0.8 events per year
Colfax County	13	0.8 events per year
Cuming County	14	0.9 events per year
Dixon County	18	1.1 events per year
Dodge County *(Census Tract 9636)*	28	1.7 events per year
Knox County *(Census Tract: 9763)*	13	0.8 events per year
Madison County	12	0.7 events per year
Pierce County	12	0.7 events per year
Platte County *(Census Tract 9651)*	12	0.7 events per year
Stanton County	12	0.7 events per year
Thurston County	16	1 event per year
Wayne County	12	0.7 events per year

Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.

Vulnerability and Impact

The following table provides information related to regional vulnerabilities; for jurisdictional- specific vulnerabilities, refer to *Volume II.*

Life Safety and Health: Heat is the leading cause of weather-related deaths in the United States and poses many risks to life safety and health, including death.[175] Increased hospital admissions for heat-related illnesses, and cardiovascular and respiratory disorders increase during excessive/extreme heat events.[176] During heat events, when the body's temperature control is overloaded, people suffer heat-related illnesses.

[174] National Risk Index. (n.d.). Annualized Losses. Annualized Frequency. Retrieved from https://hazards.fema.gov/nri/map#

[175] National Oceanic and Atmospheric Administration. (2022). Extreme Heat: A Media Resource Guide. Retrieved from https://www.noaa.gov/media-advisory/extreme-heat-media-resource-guide.

[176] Centers for Disease Control and Prevention and the American Public Health Association. (n.d.). Extreme Heat Can Impact Our Health in Many Ways. Retrieved from https://www.cdc.gov/climateandhealth/pubs/extreme-heat-final_508.pdf.

Three (3) types of heat-related illnesses include heat cramps, heat exhaustion, and heat stroke.[177] If heat exhaustion is left untreated it can lead to a heat stroke, the most severe form of all heat illnesses.[178]

Although everyone is vulnerable during excessive/extreme heat events, the groups most at risk include, but are not limited to, children, older adults, people experiencing homelessness, individuals with pre-existing conditions, outdoor workers, emergency responders, low income communities, pregnant women, and athletes.[179] Additionally, heat can increase respiratory problems (e.g., asthma, allergies) because increased temperatures can contribute to the build-up of harmful air pollutants.[180] Additionally, excessive/extreme heat impacts can exacerbate and compound other hazards, such as, pandemics, infectious diseases, wildfire, drought, and air quality.

Property Damage and Critical Infrastructure: Excessive heat can be dangerous to both property and critical infrastructure. If severe enough, a heat wave can buckle railway tracks and pavement, strain power distribution networks, and exceed aircraft operational limits. Power networks may suffer brownouts or blackouts from overloaded grids, threatening critical infrastructure unless backup power is available. In terms of agriculture, increased water may be needed for cooling and consumption. Additionally, conventional power plants may require more water for operations.[181]

Economy: A heat wave has the potential to severely impact the economy of the planning area. As the majority of Nebraska is utilized for agricultural purposes, a heat wave causing crop damage would disproportionately affect the local and regional economies, as tourism and other forms of income are not as prevalent. A heat wave can increase crop water consumption, and damage may occur to existing crops. This in turn may lead to a shortage of crops and increases costs to farmers and consumers.[182]

Changes in Development and Impact of Future Development: As global temperatures are expected to rise, current and future developments should take into account increased electricity and water usage. In terms of agriculture, the shift to more heat-tolerant crops could help reduce losses during future growing seasons. Additionally, planning for sufficient shelter and water for livestock should be taken into account.

Underserved and At Risk Population: Children, older adults, people experiencing homelessness, individuals with pre-existing conditions, outdoor workers, emergency responders, low-income communities, pregnant women, and athletes are the most at risk to excessive/extreme heat.[183]

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[177] Centers for Disease Control and Prevention. (n.d.). Frequently Asked Questions (FAQ) About Extreme Heat. Retrieved from https://www.cdc.gov/disasters/extremeheat/faq.html.

[178] Johns Hopkins Medicine. (n.d.). Heat-Related Illnesses (Heat Cramps, Heat Exhaustion, Heat Stroke). Retrieved from https://www.hopkinsmedicine.org/health/conditions-and-diseases/heatrelated-illnesses-heat-cramps-heat-exhaustion-heat-stroke.

[179] National Integrated Heat Health Information System. (n.d.). Who is Most at Risk to Extreme Heat? Retrieved from https://www.heat.gov/pages/who-is-at-risk-to-extreme-heat.

[180] Centers for Disease Control and Prevention and the American Public Health Association. (n.d.). Extreme Heat Can Impact Our Health in Many Ways. Retrieved from https://www.cdc.gov/climateandhealth/pubs/extreme-heat-final_508.pdf.

[181] National Weather Service: National Oceanic and Atmospheric Administration. (n.d.). During a Heat Wave. Retrieved from https://www.weather.gov/safety/heat-during

[182] Ibid.

[183] National Integrated Heat Health Information System. (n.d.). Who is Most at Risk to Extreme Heat? Retrieved from https://www.heat.gov/pages/who-is-at-risk-to-extreme-heat.

Effects of Climate Change in Severity of Impacts: As temperatures continue to increase worldwide, scientists expect that excessive/extreme heat events will become more common, more severe, and last longer. Subsequently, this will lead to an increase of heat-related illnesses and deaths.[184]

FEMA NRI Expected Annual Loss Estimates

A Heat Wave NRI Expected Annual Loss (EAL) score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to Heat Waves when compared to the rest of the United States. The EAL score is positively associated with a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 95** outlines the Heat Wave EAL for the Lower Elkhorn planning area.

Table 95: Heat Wave Expected Annual Loss

Location	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Burt County *(Census Tract 9632, 9634)*	$8,040	$5,865	$5	$13,911	47.1	Relatively Low
Cedar County	$14,986	$19,497	$9	$34,492	39.6	Relatively Low
Colfax County	$15,946	$16,155	$8	$32,109	38.6	Relatively Low
Cuming County	$13,835	$17,433	$26	$31,294	38.1	Relatively Low
Dixon County	$38,951	$2,136	$8	$41,096	42.3	Relatively Low
Dodge County *(Census Tract 9636)*	$41,015	$3,272	$6	$44,293	83.7	Relatively High
Knox County *(Census Tract: 9763)*	$4,112	$2,272	$1	$6,384	45.7	Relatively Low
Madison County	$14,865	$13,722	$5	$28,592	37.0	Relatively Low
Pierce County	$14,746	$15,274	$5	$30,026	37.5	Relatively Low
Platte County *(Census Tract 9651)*	$1,648	$3,246	$4	$4,898	41.6	Relatively Low
Stanton County	$13,950	$11,884	$4	$25,838	35.5	Relatively Low
Thurston County	$51,576	$4,147	$5	$55,729	47.3	Relatively Low
Wayne County	$14,797	$14,571	$4	$29,373	37.3	Relatively Low

Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).

[184] U.S. Environmental Protection Agency and the Centers for Disease Control and Prevention. (2016). Climate Change and Extreme Heat: What You Can Do to Prepared. Retrieved from https://www.epa.gov/sites/default/files/2016-10/documents/extreme-heat-guidebook.pdf.

The direct and indirect effects of extreme heat are difficult to quantify. Potential losses such as power outages could affect businesses, homes, and critical facilities. High demand and intense use of air conditioning can overload the electrical systems and cause damages to infrastructure.

Total Risk Score

Table 100 found at the end of the Cold Wave Section represents the Extreme Temperature (Heat Wave, Cold Wave), Total Risk Score for the Lower Elkhorn planning area, based on the Risk Assessment Methodology, as defined in this Plan.

Cold Wave Hazard Description

Cold waves are a rapid temperature drop within 24 hours and/or when extreme low temperatures are expected for an extended period of time. The temperatures classified as a cold wave are dependent on the location and defined by the local NWS Forecast Office.[185]

Cold waves generally are capable of occurring at any geological location and are formed by large cool air masses that accumulate over certain regions, caused by movements of air streams. Cold waves affect much larger areas than blizzards, ice storms, and other winter hazards. The "wave" in cold wave is apparent in the upper-air flow (the jet stream), which is usually amplified into a strong ridge-trough pattern during a major cold outbreak.[186]

The Wind Chill Index is a measure of how cold it really feels when there is wind and low temperatures. It considers the human body's heat loss due to its surroundings during cold and windy weather.[187]

A primary risk during a cold wave is Hypothermia (abnormally low body temperature.) This dangerous health condition is caused by prolonged exposure to low temperatures, and an individual's body loses heat faster than it can be produced. Those who are elderly and work outdoors are at a higher risk of becoming hypothermic during a cold wave.[188]

Location

This hazard may occur throughout the entirety of the Lower Elkhorn planning area.

Extent

In addition to standard winter weather alerts, a wind chill warning may additionally be broadcast across weather-related media for the severity of a cold wave, which may or may not accompany winter weather. The wind chill index helps determine when dangerous conditions develop that could lead to frostbite and hypothermia.[189] **Figure 38** illustrates the NWS Wind Chill Chart.

[185] Federal Emergency Management Agency. (2023). Cold Wave. Retrieved from https://hazards.fema.gov/nri/winter-weather.
[186] SKYbrary. (n.d.). Cold Wave. Retrieved from https://skybrary.aero/articles/cold-wave
[187] National Weather Service. (n.d.). Wind Chill Chart. Retrieved from https://www.weather.gov/safety/cold-wind-chill-chart.
[188] Centers for Disease Control. (n.d.). Prevent Hypothermia & Frostbite. Retrieved from https://www.cdc.gov/disasters/winter/staysafe/hypothermia.html
[189] National Weather Service. (n.d.). Wind Chill Chart. Retrieved from https://www.weather.gov/safety/cold-wind-chill-chart

Figure 38: National Weather Service Wind Chill Chart[190]

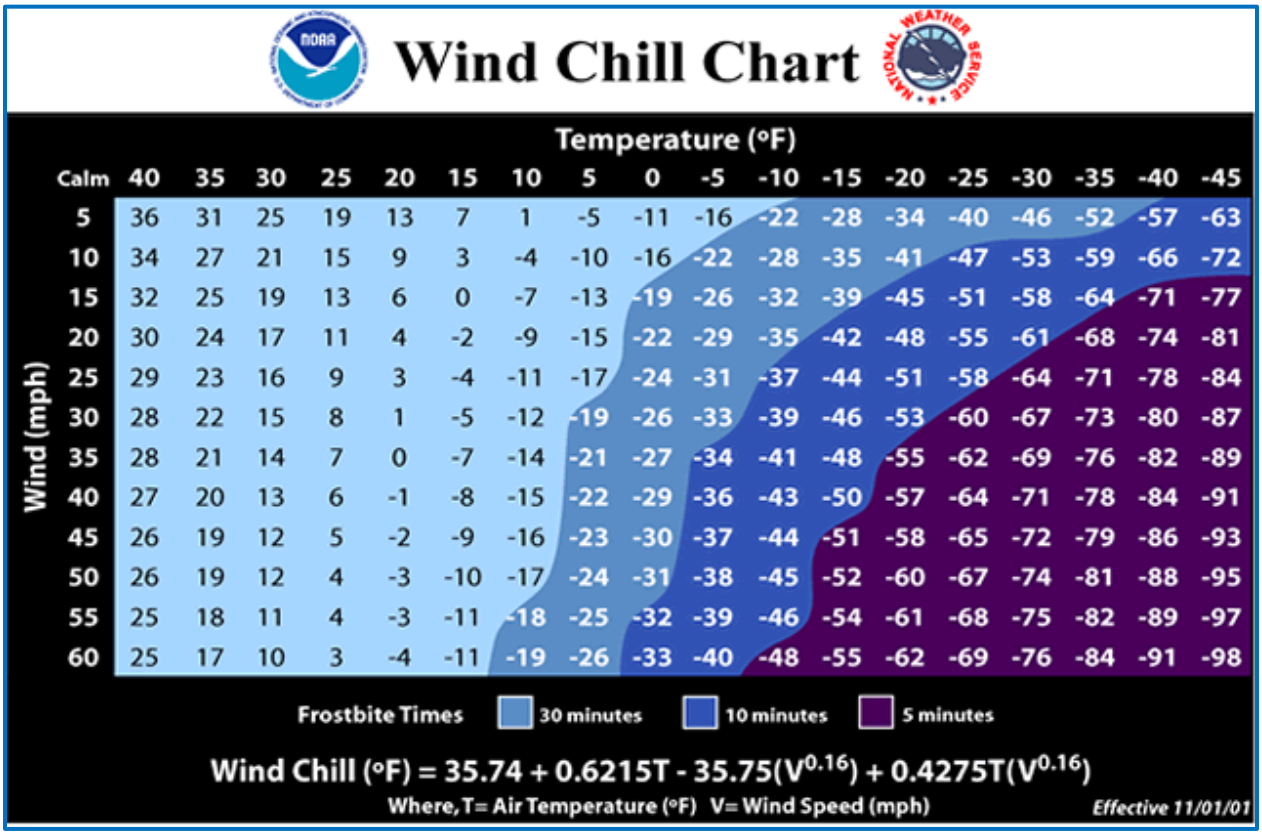

Table 96: National Weather Service Wind Chill Advisories[191]

Type	Definition
Wind Chill Warning	NWS issues a wind chill warning when dangerously cold wind chill values are expected or occurring. If you are in an area with a wind chill warning, avoid going outside during the coldest parts of the day. If you do go outside, dress in layers, cover exposed skin, and make sure at least one other person knows your whereabouts. Update them when you arrive safely at your destination.
Wind Chill Watch	WS issues a wind chill watch when dangerously cold wind chill values are *possible*. As with a warning, adjust your plans to avoid being outside during the coldest parts of the day. Make sure your car has at least a half a tank of gas and update your winter survival kit.
Wind Chill Advisory	NWS issues a wind chill advisory when seasonably cold wind chill values but not extremely cold values are expected or occurring. Be sure you and your loved ones dress appropriately and cover exposed skin when venturing outdoors.

Historical Frequency

The past ten years of excessive cold events for the Lower Elkhorn planning area are presented in **Table 97** according to the NCEI database as a part of the National Oceanic and Atmospheric Administration. NCEI

[190] National Weather Service. (n.d.). Wind Chill Chart. Retrieved from https://www.weather.gov/safety/cold-wind-chill-chart

[191] National Weather Service. (n.d.). Wind Chill Warning vs Watch. Retrieved from https://www.weather.gov/safety/cold-wind-chill-warning

has reported 164 excessive cold events in the planning area within the past 10 years. Notably, in February 2021, temperatures below 0F persisted for multiple days across Nebraska, breaking multiple records, as this was the longest recorded streak since 1989.[192]

Table 97: Excessive Cold Events for the Planning Area (2013 - 2023)[193]

Location	County / Zone	State	Date	Death	Injury	Property Damage	Crop Damage
Cedar (Zone)	Cedar (Zone)	NE	1/31/2013	0	0	0.00K	0.00K
Knox (Zone)	Knox (Zone)	NE	1/31/2013	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	1/31/2013	0	0	0.00K	0.00K
Madison (Zone)	Madison (Zone)	NE	1/31/2013	0	0	0.00K	0.00K
Stanton (Zone)	Stanton (Zone)	NE	1/31/2013	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	1/31/2013	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	1/31/2013	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	1/31/2013	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	12/1/2013	0	0	0.00K	0.00K
Knox (Zone)	Knox (Zone)	NE	12/1/2013	0	0	0.00K	0.00K
Madison (Zone)	Madison (Zone)	NE	12/1/2013	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	12/1/2013	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	12/1/2013	0	0	0.00K	0.00K
Burt (Zone)	Burt (Zone)	NE	12/1/2013	0	0	0.00K	0.00K
Dodge (Zone)	Dodge (Zone)	NE	12/1/2013	0	0	0.00K	0.00K
Colfax (Zone)	Colfax (Zone)	NE	12/1/2013	0	0	0.00K	0.00K
Platte (Zone)	Platte (Zone)	NE	12/1/2013	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	12/1/2013	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	12/1/2013	0	0	0.00K	0.00K
Stanton (Zone)	Stanton (Zone)	NE	12/1/2013	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	12/23/2013	0	0	0.00K	0.00K
Knox (Zone)	Knox (Zone)	NE	12/23/2013	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	12/23/2013	0	0	0.00K	0.00K
Burt (Zone)	Burt (Zone)	NE	12/23/2013	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	12/23/2013	0	0	0.00K	0.00K
Stanton (Zone)	Stanton (Zone)	NE	12/23/2013	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	12/23/2013	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	12/23/2013	0	0	0.00K	0.00K
Madison (Zone)	Madison (Zone)	NE	12/23/2013	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	12/29/2013	0	0	0.00K	0.00K
Knox (Zone)	Knox (Zone)	NE	12/29/2013	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	12/29/2013	0	0	0.00K	0.00K
Madison (Zone)	Madison (Zone)	NE	12/29/2013	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	12/29/2013	0	0	0.00K	0.00K
Stanton (Zone)	Stanton (Zone)	NE	12/29/2013	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	12/29/2013	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	12/29/2013	0	0	0.00K	0.00K
Knox (Zone)	Knox (Zone)	NE	1/5/2014	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	1/5/2014	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	1/5/2014	0	0	0.00K	0.00K
Stanton (Zone)	Stanton (Zone)	NE	1/5/2014	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	1/5/2014	0	0	0.00K	0.00K

[192] National Weather Service. (n.d.). Top Weather Events of 2021. Retrieved from https://www.weather.gov/oax/2021TopEvents

[193] National Centers for Environmental Information. (n.d.). Storm Events Database. Retrieved from https://www.ncdc.noaa.gov/stormevents/

Location	County / Zone	State	Date	Death	Injury	Property Damage	Crop Damage
Thurston (Zone)	Thurston (Zone)	NE	1/5/2014	0	0	0.00K	0.00K
Madison (Zone)	Madison (Zone)	NE	1/5/2014	0	0	0.00K	0.00K
Platte (Zone)	Platte (Zone)	NE	1/5/2014	0	0	0.00K	0.00K
Burt (Zone)	Burt (Zone)	NE	1/5/2014	0	0	0.00K	0.00K
Dodge (Zone)	Dodge (Zone)	NE	1/5/2014	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	1/5/2014	0	0	0.00K	0.00K
Colfax (Zone)	Colfax (Zone)	NE	1/5/2014	0	0	0.00K	0.00K
Knox (Zone)	Knox (Zone)	NE	1/22/2014	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	1/22/2014	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	1/22/2014	0	0	0.00K	0.00K
Stanton (Zone)	Stanton (Zone)	NE	1/22/2014	0	0	0.00K	0.00K
Madison (Zone)	Madison (Zone)	NE	1/22/2014	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	1/22/2014	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	1/22/2014	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	1/22/2014	0	0	0.00K	0.00K
Platte (Zone)	Platte (Zone)	NE	1/22/2014	0	0	0.00K	0.00K
Burt (Zone)	Burt (Zone)	NE	1/22/2014	0	0	0.00K	0.00K
Colfax (Zone)	Colfax (Zone)	NE	1/22/2014	0	0	0.00K	0.00K
Dodge (Zone)	Dodge (Zone)	NE	1/22/2014	0	0	0.00K	0.00K
Knox (Zone)	Knox (Zone)	NE	1/27/2014	0	0	0.00K	0.00K
Burt (Zone)	Burt (Zone)	NE	1/27/2014	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	1/27/2014	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	1/27/2014	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	1/27/2014	0	0	0.00K	0.00K
Burt (Zone)	Burt (Zone)	NE	2/4/2014	0	0	0.00K	0.00K
Knox (Zone)	Knox (Zone)	NE	2/5/2014	0	0	0.00K	0.00K
Stanton (Zone)	Stanton (Zone)	NE	2/5/2014	0	0	0.00K	0.00K
Dodge (Zone)	Dodge (Zone)	NE	2/5/2014	0	0	0.00K	0.00K
Colfax (Zone)	Colfax (Zone)	NE	2/5/2014	0	0	0.00K	0.00K
Platte (Zone)	Platte (Zone)	NE	2/5/2014	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	2/5/2014	0	0	0.00K	0.00K
Madison (Zone)	Madison (Zone)	NE	2/5/2014	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	2/5/2014	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	2/5/2014	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	2/5/2014	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	2/5/2014	0	0	0.00K	0.00K
Knox (Zone)	Knox (Zone)	NE	3/1/2014	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	3/1/2014	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	3/1/2014	0	0	0.00K	0.00K
Madison (Zone)	Madison (Zone)	NE	3/1/2014	0	0	0.00K	0.00K
Platte (Zone)	Platte (Zone)	NE	3/2/2014	0	0	0.00K	0.00K
Colfax (Zone)	Colfax (Zone)	NE	3/2/2014	0	0	0.00K	0.00K
Stanton (Zone)	Stanton (Zone)	NE	3/2/2014	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	3/2/2014	0	0	0.00K	0.00K
Burt (Zone)	Burt (Zone)	NE	3/2/2014	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	3/2/2014	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	3/2/2014	0	0	0.00K	0.00K
Dodge (Zone)	Dodge (Zone)	NE	3/2/2014	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	12/29/2014	0	0	0.00K	0.00K
Knox (Zone)	Knox (Zone)	NE	12/29/2014	0	0	0.00K	0.00K
Stanton (Zone)	Stanton (Zone)	NE	12/30/2014	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Death	Injury	Property Damage	Crop Damage
Thurston (Zone)	Thurston (Zone)	NE	12/30/2014	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	12/30/2014	0	0	0.00K	0.00K
Burt (Zone)	Burt (Zone)	NE	12/30/2014	0	0	0.00K	0.00K
Colfax (Zone)	Colfax (Zone)	NE	12/30/2014	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	12/30/2014	0	0	0.00K	0.00K
Dodge (Zone)	Dodge (Zone)	NE	12/30/2014	0	0	0.00K	0.00K
Madison (Zone)	Madison (Zone)	NE	12/30/2014	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	12/30/2014	0	0	0.00K	0.00K
Platte (Zone)	Platte (Zone)	NE	12/30/2014	0	0	0.00K	0.00K
Knox (Zone)	Knox (Zone)	NE	1/7/2015	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	1/7/2015	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	1/7/2015	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	1/7/2015	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	1/7/2015	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	1/7/2015	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	1/7/2015	0	0	0.00K	0.00K
Stanton (Zone)	Stanton (Zone)	NE	1/7/2015	0	0	0.00K	0.00K
Madison (Zone)	Madison (Zone)	NE	1/7/2015	0	0	0.00K	0.00K
Platte (Zone)	Platte (Zone)	NE	1/7/2015	0	0	0.00K	0.00K
Colfax (Zone)	Colfax (Zone)	NE	1/7/2015	0	0	0.00K	0.00K
Dodge (Zone)	Dodge (Zone)	NE	1/7/2015	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	12/17/2016	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	12/31/2017	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	1/1/2018	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	1/15/2018	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	12/31/2018	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	1/1/2019	0	0	0.00K	0.00K
Colfax (Zone)	Colfax (Zone)	NE	1/29/2019	0	0	0.00K	0.00K
Dodge (Zone)	Dodge (Zone)	NE	1/29/2019	0	0	0.00K	0.00K
Platte (Zone)	Platte (Zone)	NE	1/29/2019	0	0	0.00K	0.00K
Burt (Zone)	Burt (Zone)	NE	1/29/2019	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	1/29/2019	0	0	0.00K	0.00K
Madison (Zone)	Madison (Zone)	NE	1/29/2019	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	1/29/2019	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	1/29/2019	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	1/29/2019	0	0	0.00K	0.00K
Stanton (Zone)	Stanton (Zone)	NE	1/29/2019	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	1/29/2019	0	0	0.00K	0.00K
Knox (Zone)	Knox (Zone)	NE	1/29/2019	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	1/19/2020	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	2/12/2020	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	2/14/2021	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	2/14/2021	0	0	0.00K	0.00K
Knox (Zone)	Knox (Zone)	NE	2/14/2021	0	0	0.00K	0.00K
Burt (Zone)	Burt (Zone)	NE	2/14/2021	0	0	0.00K	0.00K
Madison (Zone)	Madison (Zone)	NE	2/14/2021	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	2/14/2021	0	0	0.00K	0.00K
Stanton (Zone)	Stanton (Zone)	NE	2/14/2021	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	2/14/2021	0	0	0.00K	0.00K
Colfax (Zone)	Colfax (Zone)	NE	2/14/2021	0	0	0.00K	0.00K
Platte (Zone)	Platte (Zone)	NE	2/14/2021	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Death	Injury	Property Damage	Crop Damage
Thurston (Zone)	Thurston (Zone)	NE	2/14/2021	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	2/14/2021	0	0	0.00K	0.00K
Dodge (Zone)	Dodge (Zone)	NE	2/14/2021	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	1/6/2022	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	2/22/2022	0	0	0.00K	0.00K
Knox (Zone)	Knox (Zone)	NE	12/21/2022	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	12/21/2022	0	0	0.00K	0.00K
Cedar (Zone)	Cedar (Zone)	NE	12/21/2022	0	0	0.00K	0.00K
Wayne (Zone)	Wayne (Zone)	NE	12/21/2022	0	0	0.00K	0.00K
Pierce (Zone)	Pierce (Zone)	NE	12/21/2022	0	0	0.00K	0.00K
Stanton (Zone)	Stanton (Zone)	NE	12/21/2022	0	0	0.00K	0.00K
Platte (Zone)	Platte (Zone)	NE	12/21/2022	0	0	0.00K	0.00K
Burt (Zone)	Burt (Zone)	NE	12/22/2022	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	12/22/2022	0	0	0.00K	0.00K
Thurston (Zone)	Thurston (Zone)	NE	12/22/2022	0	0	0.00K	0.00K
Colfax (Zone)	Colfax (Zone)	NE	12/22/2022	0	0	0.00K	0.00K
Cuming (Zone)	Cuming (Zone)	NE	12/22/2022	0	0	0.00K	0.00K
Dodge (Zone)	Dodge (Zone)	NE	12/22/2022	0	0	0.00K	0.00K
Dakota (Zone)	Dakota (Zone)	NE	01/19/2024	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (zone)	NE	01/19/2024	0	0	0.00K	0.00K
Totals				0	0	0.00K	0.00K

Probability and Frequency

Cold waves are anticipated to become less frequent and intense in the future due to the climate warming. [194] The cold wave annualized frequency value represents the number of recorded cold wave hazard occurrences, in event days, per year over the period of record. **Table 98** outlines the annualized frequency for cold wave based on FEMA National Risk Index (NRI) data from 2005-2021 (16 years). As illustrated, there is an average of one cold wave per year within the planning area.

Table 98: Cold Wave Annualized Frequency (FEMA National Risk Index)[195]

Location	Events on Record	Annualized Frequency (2005 – 2021)
Burt County *(Census Tract 9632, 9634)*	32	1 event per year
Cedar County	19	1.2 events per year
Colfax County	13	0.8 events per year
Cuming County	16	1 event per year
Dixon County	15	0.9 events per year
Dodge County *(Census Tract 9636)*	14	0.9 events per year
Knox County *(Census Tract 9763)*	19	1.2 events per year
Madison County	17	1.1 events per year
Pierce County	18	1.1 events per year

[194] Communications Earth & Environment. Zhang, Y., Li, Q., Ge, Y. *et al.* (2022). Growing prevalence of heat over cold extremes with overall milder extremes and multiple successive events. *Commun Earth Environ* **3**, 73. https://doi.org/10.1038/s43247-022-00404-x. Retrieved from https://www.nature.com/articles/s43247-022-00404-x#citeas

[195] [195] National Risk Index. (n.d.). Annualized Losses. Annualized Frequency. Retrieved from https://hazards.fema.gov/nri/map#

Location	Events on Record	Annualized Frequency (2005 – 2021)
Platte County *(Census Tract 9651)*	12	0.7 events per year
Stanton County	17	1.1 events per year
Thurston County	16	1 event per year
Wayne County	18	1.1 events per year

Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.

Vulnerability and Impact

The following table provides information related to regional vulnerabilities; for jurisdictional- specific vulnerabilities, refer to *Volume II.*

Life Safety and Health: A cold wave can pose significant danger to an individual's safety and health. Hypothermia and frostbite are both dangerous conditions that can happen when a person is exposed to extremely cold temperatures. Hypothermia is when the body begins to lose heat faster than it is produced which leads to lower body temperatures. Those at a higher risk for hypothermia include, but are not limited to, older adults with inadequate food, clothing, or heating, babies sleeping in cold bedrooms, and people who remain outdoors for extended period of time (e.g., outdoor workers, houseless individuals, hikers). Frostbite is a type of injury caused by freezing and it can permanently damage the body.[196]

Property Damage and Critical Infrastructure: Winter weather during a cold wave can severely impact critical infrastructure and property by damaging and destroying buildings and equipment. Cold wave damages include frozen electrical equipment, cracked water pipes, dangerous/damaged roads, damaged bridges, and damaged aircraft systems.[197] During winter weather events during a cold wave electrical infrastructure may fail due to damage and or destroyed power lines and poles.

Economy: A cold wave can be a significant threat to agricultural production in the region, but also provide some benefits. Initially, if crops are damaged or destroyed, the economic impact would be both localized and regional. Crop shortages may occur, and jobs may be threatened due to the loss of income. Recovery may vary depending on the type of crop and the number of animals impacted (cold weather requiring additional shelter and feed for the animals.)

While there are significant negatives to a cold wave, a deep frost depth may benefit farmers. A freezing/thawing cycle can help reduce soil compaction and prevent fall-applied nitrogen from volatizing during the winter, reducing overall loss.[198]

Changes in Development and Impact of Future Development: Within the planning area, future developments (both residential and agricultural,) should anticipate mitigating cold wave events. This may include projects such as insulating equipment, walls, and attics, water pipes, and weather-stripping windows

[196] Centers for Disease Control and Prevention. (2019). Prevent Hypothermia & Frostbite. Retrieved from https://www.cdc.gov/disasters/winter/staysafe/hypothermia.html.

[197] Cybersecurity & Infrastructure Security Agency. (n.d.). Retrieved from https://www.cisa.gov/topics/critical-infrastructure-security-and-resilience/extreme-weather-and-climate-change/extreme-cold.

[198] Climate Fieldview. Massey, J. Et. Al. (2018.) Extreme Cold: The Impact of Cold Weather on Farming. Retrieved from https://climate.com/blog/impact-of-cold-weather-on-farming/

and doors.[199] For agricultural production, crop harvesting and viability may need to be closely monitored. During a cold wave, livestock will require additional shelter and feed.

Underserved and At Risk Population: Cold weather presents a significant threat to those who do not have adequate shelter or reliable ways of staying warm. The at risk and underserved populations are especially vulnerable to severe cold weather events. In the last few decades, almost all of the deaths from hypothermia due to winter storms (as listed in the NCEI database) were houseless individuals.[200] Additionally, older individuals are also more sensitive to cold and may lead to additional health complications.[201]

Effects of Climate Change in Severity of Impacts: As global average temperatures continue to increase; scientists expect less frequent extreme cold events, the prevailing climate shifting to heat extreme events.[202] However, increasing temperatures evaporate more water adding moisture into the atmosphere which results in more precipitation in the form of heavy snowfall.[203]

FEMA NRI Expected Annual Loss Estimates

Cold wave NRI Expected Annual Loss (EAL) score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to cold waves when compared to the rest of the United States. The EAL score is positively associated with a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 99** outlines the cold wave EAL for the Lower Elkhorn planning area.

Table 99: Cold Wave Expected Annual Loss[204]

Location	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Burt County *(Census Tract 9632, 9634)*	$12,910	$15	$521	$13,446	82.1	Relatively Moderate
Cedar County	$57,688	$75	$4,484	$62,247	52.9	Relatively Low
Colfax County	$49,922	$46	$2,644	$52,612	50.6	Relatively Low
Cuming County	$52,367	$71	$10,106	$62,545	53.0	Relatively Low
Dixon County	$30,536	$33	$2,273	$32,842	44.8	Relatively Low

[199] Federal Emergency Management Agency. (n.d.). Winter Storm. Mitigation (Property). Retrieved from https://community.fema.gov/ProtectiveActions/s/article/Winter-Storm-Mitigation-Property.
[200] National Oceanic and Atmospheric Administration, Nation centers for Environmental Information. (n.d.). Storm Events Database. Retrieved from https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=-999%2CALL.
[201] Centers for Disease Control and Prevention. (n.d.). Older Adults and Extreme Cold. Retrieved from https://www.cdc.gov/aging/emergency-preparedness/older-adults-extreme-cold/index.html
[202] Communications Earth & Environment. Zhang, Y., Li, Q., Ge, Y. *et al.* (2022). Growing prevalence of heat over cold extremes with overall milder extremes and multiple successive events. *Commun Earth Environ* **3**, 73. https://doi.org/10.1038/s43247-022-00404-x. Retrieved from https://www.nature.com/articles/s43247-022-00404-x#citeas
[203] Environmental Defense Fund. (n.d.). 4 Reasons Climate Change is Here, Even Though It's Cold. Retrieved from https://www.edf.org/card/4-reasons-climate-change-still-happening-despite-cold-weather?card=1.
[204] FEMA National Risk Index. Community Report. (n.d.). Retrieved from https://hazards.fema.gov/nri/map

Location	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Dodge County *(Census Tract 9636)*	$37,179	$30	$948	$38,157	93.2	Relatively High
Knox County *(Census Tract 9763)*	$15,945	$21	$453	$16,419	84.7	Relatively Moderate
Madison County	$219,604	$186	$2,618	$222,408	73.2	Relatively Moderate
Pierce County	$47,795	$54	$2,565	$50,414	50.0	Relatively Low
Platte County *(Census Tract 9651)*	$15,879	$28	$1,380	$17,287	85.4	Relatively Moderate
Stanton County	$36,015	$34	$1,977	$38,026	46.6	Relatively Low
Thurston County	$39,312	$25	$1,851	$41,188	47.5	Relatively Low
Wayne County	$63,384	$62	$2,248	$65,694	53.9	Relatively Low

Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).

Total Risk Score

Table 100 represents the Extreme Temperature (Heat Wave, Cold Wave), Total Risk Score for the Lower Elkhorn planning area, based on the Risk Assessment Methodology, as defined in this Plan.

Table 100: Extreme Temperatures Total Risk Score

Extreme Temperature Total Risk Score						
Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Extreme Temperatures (Heat Wave, Cold Wave)	3	11	15	34	60	89

Consequence: Sum of all weighted factors.
Extent: Sum of the weighted Extent factors.
Vulnerability: Sum of the weighted Vulnerability factors.
Impact: Sum of the weighted Impact factors.
Total Risk Score = Probability x Consequence
** Normalized to 100*

Total Risk Score Legend						
Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 50
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	51 – 75

The legend—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The Consequence Score represents the sum of the Extent, Vulnerability, and Impact Factors. The Total Risk Score is a measure of Probability and Consequence.

Flooding

Hazard Description

The state of Nebraska has a wide range of topography, geology, and weather variations from east to west. This lends to a wide variety of different types of flooding, which occurs regularly.[205] Flooding can occur on a local level, sometimes affecting only a few streets, but can also extend throughout an entire district, affecting whole drainage basins and impacting property in multiple states. Heavy accumulations of ice or snow can also cause flooding during the melting stage. These events are complicated by the freeze/thaw cycles characterized by moisture thawing during the day and freezing at night. There are four main types of flooding in the planning area: riverine flooding, flash flooding, sheet flooding, and ice jam flooding.

Riverine Flooding

Riverine flooding, slower in nature, 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 during rapid runoff are called floodplains. A floodplain or flood risk area is defined as the lowland and relatively flat area adjoining a river or stream. The terms "base flood" and "100-year flood" refer to the area in the floodplain that is subject to a one percent or greater chance of flooding in any given year. Floodplains are part of a larger entity called a basin or watershed, which is defined as all the land drained by a river and its tributaries.[206]

Flash Flooding

Flash floods, faster in nature than the other types of floods, result from convective precipitation usually due to intense thunderstorms or sudden releases from 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.[207] 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

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. This unconfined water will therefore begin to move down a slope to the lowest elevations – areas that are often not in a floodplain. This type of flooding, often referred to as sheet flooding[208], is becoming increasingly prevalent as development exceeds the capacity of drainage infrastructure, therefore limiting its capacity to convey 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.

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[205] State of Nebraska Hazard Mitigation Plan 2021. (2021). Flood/Flash Flood., Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf

[206] Code of Federal Regulations. Part 9—Floodplain Management And Protection Of Wetlands. 45 FR 59526 (1980). Retrieved from https://www.ecfr.gov/current/title-44/chapter-I/subchapter-A/part-9

[207] National Weather Service. Flash Flooding Definition. (n.d.). Retrieved from https://www.weather.gov/phi/FlashFloodingDefinition

[208] Sheetfloods, sheetwash, sheetflow, or ... ?, Susan Hogg. Earth-Science Reviews, Volume 18, Issue 1, 1982, Pages 59-76, ISSN 0012-8252. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/0012825282900034

Ice Jam Flooding

Ice jams typically occur when ice breaks up in moving waterways during thawing conditions, 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.[209] Along the Platte River in central Nebraska, ice jams have also occurred during freeze up at the beginning of winter, most recently in January, 2021.

Dam/Levee Failure Flooding

Flooding due to the failure of a dam or levee is covered within their separate hazard profiles.

Location

Nebraska has numerous watersheds and rivers including over 5,000 wetlands, 2,000 natural lakes, and over a 1,000 reservoirs and sandpit lakes.[210] This lends to a significant area across the state that may be affected by various flood events.

Table 101 shows current statuses of Flood Insurance Rate Map (FIRM) panels. Most jurisdictions throughout the planning area also have FIRMs at the municipal level. Note that this list is extensive and includes all communities and counties found within the planning area, not solely those participating in this HMP Update.

Figure 39 shows the special flood hazard area for the planning area.. For jurisdictional-specific maps as well as an inventory of structures in the floodplain, please refer to *Volume II.*

There are several ongoing Flood Risk Studies which cover the entire planning area. The North Fork Elkhorn watershed, the Lewis and Clark Lake watershed, and Logan Creek watershed projects are currently in the ongoing-data development stage. Updates to the Flood Risk Studies can be viewed online.

[209] State of Nebraska Hazard Mitigation Plan 2021. (2021). Flood/Flash Flood., Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf
[210] Ibid.

Figure 39: Special Flood Hazard Area (SFHA) National Flood Layer

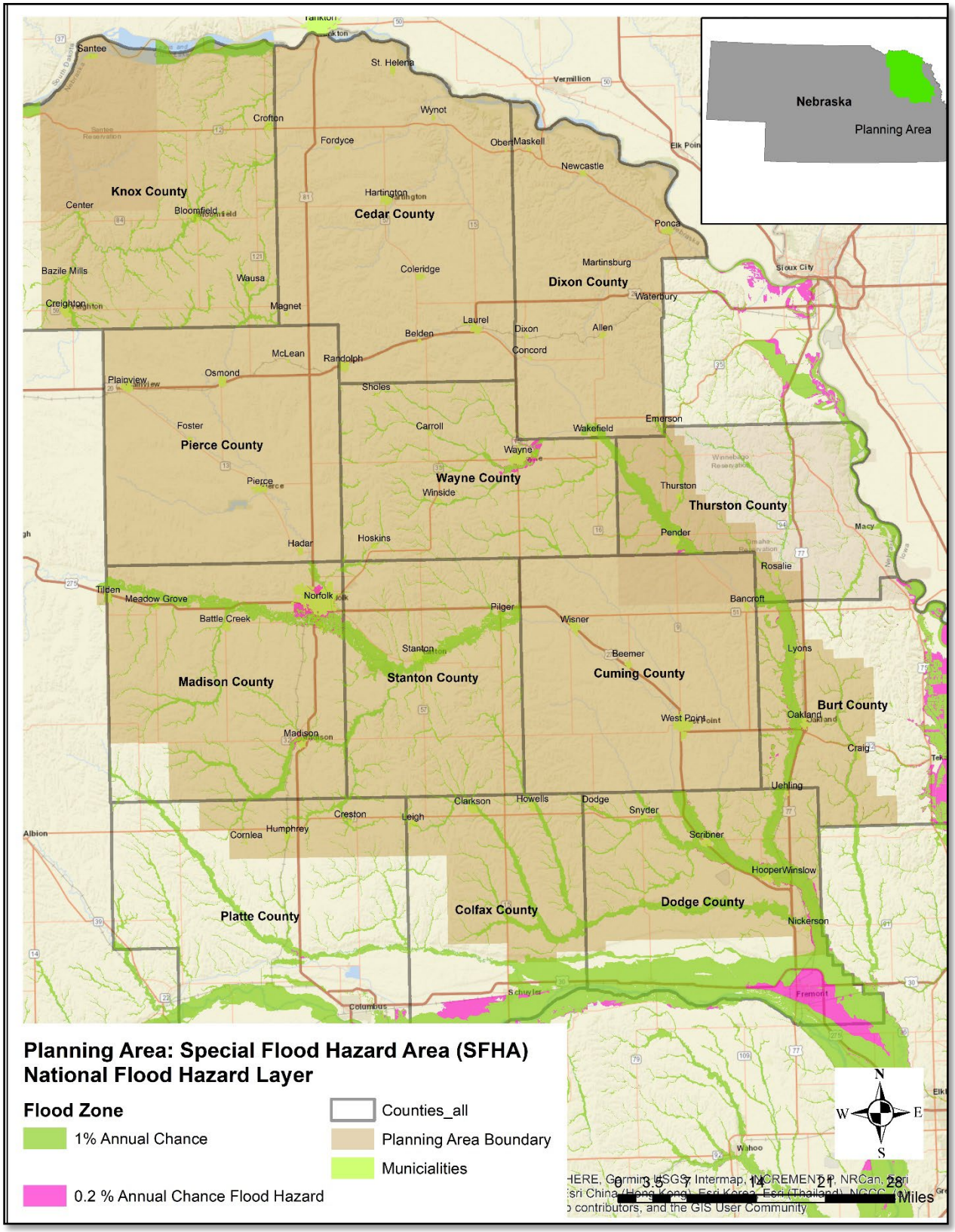

Table 101: FEMA FIRM Panel Status

Jurisdiction	Panel Number	Effective Date
Burt County	**310420IND0A**	**9/1/2005**
Craig	310020A	07/01/1987
Lyons	N/A	N/A
Oakland	N/A	N/A
Cedar County	**N/A**	**N/A**
Belden	N/A	N/A
Laurel	310385	11/05/1976
Randolph	3103970005A	08/16/1988
Colfax County	**31037CIND0B**	**3/21/2019**
Clarkson	31037C0050D, 31037C0055D	04/05/2016
Howells	31037C0060E, 31037C0080E	3/21/2019
Leigh	31037C0030D	04/05/2016
Cuming County	**310427IND0**	**4/1/1996**
Bancroft	N/A	N/A
Beemer	310047B	07/16/1987
West Point	310045IND0	08/15/1980
Wisner	310049B	06/04/1987
Dixon County	**N/A**	**N/A**
Concord	N/A	N/A
Emerson	31173C0040E	01/06/2010
Dodge County	**31053CIND0C**	**3/3/2011**
Dodge	31053C0060E, 31053C0080E	½/2008
Hooper	31053C0260F	05/04/2009
Nickerson	31177C0115D, 31053C0290E	½/2008, 1/6/2012
Scribner	31053C0120G	03/03/2011
Snyder	31053C0085E	½/2008
Uehling	31053C0135E	½/2008
Winslow	31053C0260F	05/04/2009
Knox County	**31007CIND0B**	**10/2/2015**
Wausa	31107C0600D	10/02/2015
Madison County	**31119CIND0A**	**2/4/2005**
Battle Creek	31119C0065D, 31119C0155D	02/04/2005
Madison	31119C0279D	02/04/2005
Meadow Grove	31119C0020D	02/04/2005
Norfolk	31119C0095D, 31119C0090D	2/4/2005
Tilden	31119C0015D	02/04/2005
Pierce County	**310466IND0**	**6/4/1987**
Foster	N/A	N/A
Hadar	N/A	N/A
McLean	31107C0825C	8/18/2005
Osmond	310395A	07/03/1986
Pierce	310174B	09/04/1985
Plainview	310175A	09/01/2007
Platte County	**31141CIND0A**	**4/19/2010**
Cornlea	31141C0065E	4/19/2010
Creston	31141C0125E	4/19/2010
Humphrey	31141C0075E	04/19/2010
Stanton County	**31167IND0A**	**9/30/2004**
Pilger	31167C0068C	9/30/2004
Stanton	31167C0103C, 31167C0104C	9/30/2004
Thurston County	**31173CIND0A**	**1/6/2010**

Jurisdiction	Panel Number	Effective Date
Pender	31173C0165E	01/06/2010
Rosalie	31173C0325E	01/06/2010
Thurston	31173C0165E	01/06/2010
Wayne County	**31179IND0A**	**2/20/2008**
Carroll	31179C0045C, 31179C0040C	3/18/2008
Hoskins	31179C0150C	03/18/2008
Sholes	31179C0010C	03/18/2008
Wakefield	31040400004B	9/30/2005
Wayne	31179C0185C	3/18/2008
Winside	31179C0170C	03/18/2008

Extent

The NWS has three categories to define the severity of a flood once a river reaches flood stage as indicated in **Table 102**.

Table 102: Flooding Stages[211]

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

Figure 40 shows the normal average monthly precipitation between 1991-2020 for the planning area, which is helpful in determining whether any given month is above, below, or near normal in precipitation. As indicated in **Table 103**, the most common months for flooding within the planning area are May, June, and August.

[211] National Severe Storms Laboratory. (n.d). NOAA. Severe Weather 101. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/floods/faq/

Figure 40: NOAA NOW Data: 1991-2023Precipitation Averages[212]

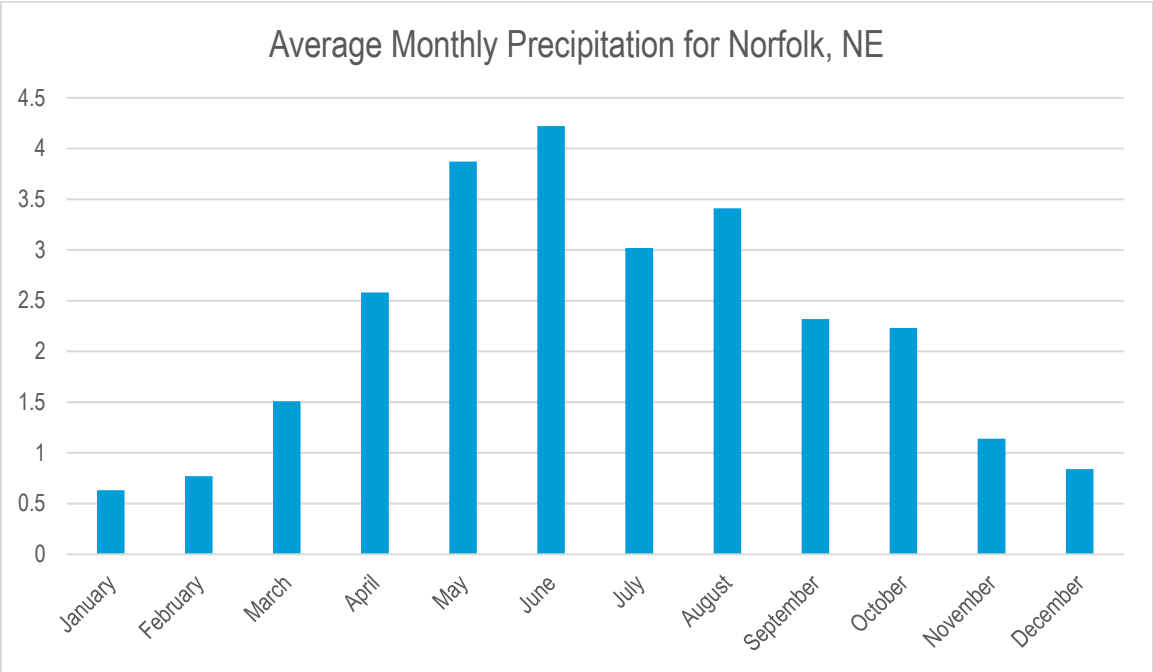

Table 103: 1991-2023 Monthly Precipitation[213]

Month	Total Precipitation Normal (inches)
January	0.63
February	0.77
March	1.51
April	2.58
May	3.87
June	4.22
July	3.02
August	3.41
September	2.32
October	2.23
November	1.14
December	0.84
Annual	**26.54**

National Flood Insurance Program (NFIP)

The NFIP was established in 1968 to reduce flood losses and disaster relief costs by guiding future development away from flood hazard areas where feasible; by requiring flood resistant design and construction practices; and by transferring the costs of flood losses to the residents of floodplains through flood insurance premiums.[214]

[212] National Weather Service. National Oceanic and Atmospheric Administration. NOWData, Precipitation. (n.d.). Retrieved from https://www.weather.gov/wrh/Climate?wfo=oax

[213] National Weather Service. National Oceanic and Atmospheric Administration. NOWData, Precipitation. (n.d.). Retrieved from https://www.weather.gov/wrh/Climate?wfo=oax

[214] Federal Emergency Management Agency. (n.d.). Flood Insurance. Retrieved from https://www.fema.gov/flood-insurance

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

The following tables summarize NFIP participation and active policies within the planning area.

Table 104: NFIP Participants[215] [216]

Jurisdiction	Eligible – Regular Program	Date Current Map	Sanction	Suspension
Burt County	**9/1/2005**	**9/1/2005**	**-**	**-**
Craig	-	7/1/1987	7/1/1987	-
Lyons	9/4/1986	NSFHA	-	-
Oakland	5/7/1979	NSFHA	-	-
Cedar County	**-**	**-**	**-**	**-**
Belden	-	-	-	-
Laurel	8/16/2002	11/5/1976	-	-
Randolph	8/16/1988	8/16/1988	-	-
Colfax County	**2/1/1987**	**3/21/2019**	**-**	**-**
Clarkson	12/18/1986	12/18/1986	-	-
Howells	6/2/1981	4/5/2016	-	-
Leigh	7/1/1987	04/05/2016	-	-
Cuming County	**4/1/1996**	**04/01/96(L)**	**-**	**-**
Bancroft	-	-	-	-
Beemer	7/16/1987	07/16/1987	-	-
West Point	8/15/1980	8/15/1980	-	-
Wisner	6/4/1987	06/04/1987	-	-
Dixon County	**-**	**-**	**-**	**-**
Concord	11/09/2011	-	-	-
Emerson	9/1/1986	1/6/2010	-	-
Dodge County	**8/17/1981**	**3/3/2011**	**-**	**-**
Dodge	1/21/1981	½/2008	-	-
Hooper	8/4/1987	3/3/2011	-	-
Nickerson	1/20/2004	01/02/2008		
Scribner	11/1/1979	3/3/2011	-	-
Snyder	11/1/1979	½/2008	-	-
Uehling	-	½/2008	½/2009	-
Winslow	12/4/1979	3/3/2011	-	-
Knox County	**11/14/2005**	**10/2/2015**	**-**	**-**
Wausa	-	10/2/2015	8/8/1976	-
Madison County	**1/1/1987**	**2/4/2005**	**-**	**-**
Battle Creek	9/30/1987	02/04/2005	-	-
Madison	8/3/1981	2/4/2005	-	-
Meadow Grove	9/4/1987	02/04/2005	-	-
Norfolk	3/16/1981	2/4/2005	-	-
Tilden	9/4/1987	2/4/2005	-	-
Pierce County	**6/4/1987**	**6/4/1987**	**-**	**-**
Foster	-	-	-	-
Hadar	-	-	-	-
McLean	-	-	-	-
Osmond	7/3/1986	07/03/1986	-	-

[215] https://www.fema.gov/cis/NE.html

[216] Nebraska Department of Natural Resources, National Flood Insurance Program, 2018

Jurisdiction	Eligible – Regular Program	Date Current Map	Sanction	Suspension
Pierce	9/4/1985	09/04/1985	-	-
Plainview	9/1/2007	09/01/2007	-	-
Platte County	**9/1/1990**	**4/19/2010**	**-**	**-**
Cornlea	-	-	-	-
Creston	-	4/19/2010	4/19/2011	-
Humphrey	-	4/19/2010	7/11/1976	-
Stanton County	**12/19/1997**	**9/30/2004**	**-**	**-**
Pilger	9/30/2004	9/30/2004	-	-
Stanton	9/18/1987	9/30/2004	-	-
Thurston County	**9/22/2011**	**1/6/2010**	**-**	**-**
Pender	4/3/1978	1/6/2010(M)	-	-
Rosalie	-	1/6/2010	2/4/1978	-
Thurston	-	1/6/2010	1/6/2011	-
Wayne County	**3/18/2008**	**6/1/1988**	**-**	**-**
Carroll	-	3/18/2008	1/31/1976	-
Hoskins	3/1/1987	3/18/2008	-	-
Sholes	-	3/18/2009	3/18/2009	-
Wakefield	9/1/1986	9/30/2005	-	-
Wayne	12/2/1980	3/18/2008	-	-
Winside	-	3/18/2008	7/18/1976	-

**NSFHA = No Special Flood Hazard Area – All Zone C; (M) = No Elevation Determined – All Zone A, C and X; (L) = Original FIRM by Letter*

Table 105: NFIP Policies in Force and Total Payments[217] [218]

Jurisdiction	Policies In-Force	Total Coverage (in Thousands)	Total Premium	Total Losses*	Total Payments
Colfax County	**21**	**$2,407**	**$23,277**	**13**	**$255,973**
Clarkson	-	-	-	-	-
Howells	6	$681	$3,612	32	$463,570
Leigh	-	-	-	-	-
Cuming County	**23**	**$2,398**	**$34,958**	**19**	**$247,671**
Bancroft	-	-	-	-	-
Beemer	4	$365	$2,885	7	$37,172
West Point	16	$4,721	$36,701	11	$191,015
Wisner	2	$700	$798	0	$0
Madison County	**12**	**$2,798**	**$7,246**	**14**	**$56,583**
Battle Creek	7	$1,820	$3,567	4	$19,032
Madison	43	$3,544	$39,467	27	$99,165
Meadow Grove	9	$535	$7,731	3	$3,157
Norfolk	55	$18,776	$118,582	13	$3,139,122
Tilden	4	$457	$2,568	0	$0
Pierce County	**16**	**$2,197**	**$17,294**	**7**	**$43,566**
Foster	-	-	-	-	-
Hadar	-	-	-	-	-
McLean	-	-	-	-	-

[217] OpenFEMA Dataset: NFIP Community Status Book - v1. (n.d.) Retrieved from https://www.fema.gov/openfema-data-page/nfip-community-status-book-v1

[218] Federal Emergency Management Agency: National Flood Insurance Program. July 2019. "Financial Losses by State." Retrieved from https://nfipservices.floodsmart.gov/reports-flood-insurance-data

Jurisdiction	Policies In-Force	Total Coverage (in Thousands)	Total Premium	Total Losses*	Total Payments
Osmond	13	$1,470	$6,832	4	$136,102
Pierce	8	$2,307	$5,481	1	$8,076
Plainview	1	$175	$358	0	$0
Stanton County	**14**	**$4,000**	**$11,485**	**2**	**$153,405**
Pilger	10	$1,475	$10,910	3	$2,627
Stanton	2	$210	$3,001	0	$0
Wayne County	**0**	**$0**	**$0**	**2**	**$3,948**
Carroll	-	-	-	-	-
Hoskins	0	$0	$0	3	$1,495
Sholes	-	-	-	-	-
Wakefield	-	-	-	-	-
Wayne	1	$350	$415	0	$0
Winside	-	-	-	-	-
Burt County	**22**	**$4,332**	**$21,821**	**42**	**$851,023**
Craig	-	-	-	-	-
Lyons	1	$350	$446	0	$0
Oakland	-	-	-	-	-
Cedar County	-	-	-	-	-
Belden	-	-	-	-	-
Laurel	2	$61	$811	0	$0
Randolph	29	$2,670	$42,741	3	$3,422
Dixon County	-	-	-	-	-
Concord	-	-	-	-	-
Emerson	2	$159	$2,249	0	$0
Dodge County	**113**	**$15,952**	**$114,417**	**132**	**$1,723,539**
Dodge	1	$140	$340	11	$41,886
Hooper	4	$313	$2,698	4	$6,870
Nickerson	-	-	-	-	-
Scribner	2	$385	$736	16	$83,234
Snyder	-	-	-	-	-
Uehling	-	-	-	-	-
Winslow	22	$1,550	$19,632	35	$754,535
Knox County	**61**	**$11,938**	**$38,901**	**13**	**$643,982**
Wausa	-	-	-	-	-
Platte County	**62**	**$13,432**	**$44,521**	**14**	**$318,260**
Cornlea	-	-	-	-	-
Creston	-	-	-	-	-
Humphrey	-	-	-	-	-
Thurston County	-	-	-	-	-
Pender	4	$805	$1,996	13	$552,055
Rosalie	-	-	-	-	-
Thurston					

This plan highly recommends and strongly encourages each plan participant to remain in good standing and continue involvement with the NFIP. Compliance with the NFIP should remain a top priority for each participant, regardless of whether or not a flooding hazard area map has been delineated for the

jurisdiction. Jurisdictions are encouraged to initiate activities above the minimum participation requirements, which are described in the Community Rating System (CRS) Coordinator's Manual (FIA-15/2017).[219]

NFIP Repetitive Loss Structures

NeDNR was contacted to determine if any existing buildings, infrastructure, or critical facilities are classified as NFIP Repetitive Loss Structures for the planning area. According to the state floodplain coordinator, there are five Repetitive Loss Structures and two Severe Repetitive Loss Structures in the planning area on FEMA's official listing. The following table indicates the number, type, and location of these properties in the planning area.

Table 106: NFIP Repetitive Loss Structures

Jurisdiction	Repetitive Loss	Building Type	Severe Repetitive Loss	Building Type
Dodge County	4	Single Family	1	Other Non-Residence
Village of Winslow	1	Single Family	1	Single Family

Historical Frequency

Due to the wide range of topography, geology, and weather across the state of Nebraska, flooding events occur with regularity. The most notable flooding event in recent history occurred in March 2019.

March 2019 Flood Event

The March 15, 2019, flood event significantly impacted the entire planning area and most of the eastern side of the State of Nebraska. Between March 13th and March 23rd, 2019, heavy rainfall of up to three inches over frozen soil and rapid snow melt led to record river levels across the planning area, northeastern Nebraska, and several other states.[220] This weather pattern was due to various storm systems and a "bomb cyclone" which caused rapid snow melting and heavy rain to occur. Flooded rivers and creeks created strong currents carrying large sheets of ice and sediment which damaged roadways making many transportation routes impassible. Damage to bridges was extensive, and flooded highways left many municipalities isolated with no way in or out of the community. In total, there were $439 million in damages to infrastructure, $85 million in damages to private homes and businesses, and a total of 4 individuals lost their lives.[221] Many communities were inundated with flood waters forcing mandatory evacuations. Communities in the planning area which were fully or partially evacuated include: Beemer, Randolph, Pender, Norfolk, Wisner, and Winslow.

Thirty stream gages in Nebraska reached all-time record levels, five of which were located in the planning area.[222] The agricultural sector was also heavily impacted by the flooding. The event occurred in the middle of calving season and hundreds of claves were killed, and in many locations, livestock became stranded. Once floodwaters receded, many pastures and fields were covered in several inches of sand and silt. Total

[219] Federal Emergency Management Agency. May 2017. "National Flood Insurance Program Community Rating System: Coordinator's Manual FIA-15/2017." Accessed August 2017. https://www.fema.gov/sites/default/files/documents/fema_community-rating-system_coordinators-manual_2017.pdf

[220] Hastings, NE Weather Forecast Office Mid-March 2019: Historical, Catastrophic Flooding Impacts Parts of Central/South Central Nebraska. (n.d.). Retrieved from https://www.weather.gov/gid/march2019flood

[221] State of Nebraska Hazard Mitigation Plan 2021. (2021). Flood/Flash Flood., Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf

[222] Nebraska Flooding: March 2019 - ArcGIS StoryMaps. (n.d.). Retrieved from https://storymaps.arcgis.com/stories/9ce70c78f5a44813a326d20035cab95a

crop and livestock damages exceeded $840 million across the affected area.[223] In total 104 cities, 81 counties, and five tribal nations in Nebraska received state or federal disaster declarations due to the flood events.[224,225] A Community specific impacts reported by affected communities are included in *Volume II* as appropriate.

Data for this event came from NeDNR and the State of Nebraska Hazard Mitigation Plan. NeDNR has collected and reviewed extensive data records from the flood event and has developed an event-wide story map to understand the cause, duration, impacts, and recovery efforts from this event.[226]

The past ten years of flood events for the Lower Elkhorn planning area are presented in **Table 107** according to the NCEI database as a part of the National Oceanic and Atmospheric Administration. NCEI has reported 130 flood events in the planning area. Notably, the bomb cyclone and overall weather system in March 2019 affected a wide area of Nebraska and the planning area, incurring significant damages during that time.

Table 107: Flood Events (2013 - 2023)[227]

Location	County / Zone	State	Date	Death	Injury	Property Damage	Crop Damage
Beemer	Cuming Co.	NE	6/14/2013	0	0	0.00K	0.00K
Plainview Muni Arpt	Pierce Co.	NE	8/21/2013	0	0	0.00K	0.00K
Maskell	Dixon Co.	NE	6/15/2014	0	0	0.00K	0.00K
Herman	Thurston Co.	NE	6/15/2014	0	0	1.00K	0.00K
Wisner	Cuming Co.	NE	6/16/2014	0	0	50.00K	0.00K
Maskell	Dixon Co.	NE	6/16/2014	0	0	0.00K	0.00K
Hartington	Cedar Co.	NE	6/17/2014	0	0	200.00K	50.00K
Wayne	Wayne Co.	NE	6/30/2014	0	0	50.00K	0.00K
Wynot	Cedar Co.	NE	7/5/2014	0	0	0.00K	0.00K
Beemer	Cuming Co.	NE	9/15/2016	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	9/15/2016	0	0	0.00K	0.00K
Leigh	Colfax Co.	NE	9/16/2016	0	0	0.00K	0.00K
Pilger	Stanton Co.	NE	9/16/2016	0	0	0.00K	0.00K
Beemer	Cuming Co.	NE	9/16/2016	0	0	0.00K	0.00K
Richland	Colfax Co.	NE	8/16/2017	0	0	50.00K	30.00K
Richland	Colfax Co.	NE	8/16/2017	0	0	50.00K	50.00K
Allen	Dixon Co.	NE	8/25/2017	0	0	0.00K	0.00K
Wayne	Wayne Co.	NE	8/25/2017	0	0	10.00K	100.00K
Plainview	Pierce Co.	NE	10/7/2017	0	0	5.00K	0.00K
Beemer	Cuming Co.	NE	6/6/2018	0	0	0.00K	5.00K
Beemer	Cuming Co.	NE	6/24/2018	0	0	0.00K	0.00K
Wakefield	Wayne Co.	NE	6/25/2018	0	0	0.00K	0.00K
Pender Muni Arpt	Thurston Co.	NE	6/25/2018	0	0	0.00K	0.00K
Concord	Dixon Co.	NE	6/25/2018	0	0	0.00K	0.00K
Rogers	Colfax Co.	NE	6/26/2018	0	0	0.00K	0.00K

[223] State of Nebraska Hazard Mitigation Plan 2021. (2021). Flood/Flash Flood., Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf

[224] Nebraska Severe Winter Storm, Straight-line Winds, and Flooding. Federal Emergency Management Agency. Retrieved from: https://www.fema.gov/disaster/4420

[225] Public Assistance Unit. FEMA DR-4420 Severe Storms And Straight-Line Winds, And Flooding. (n.d.). Retrieved from https://nema.nebraska.gov/fema-dr-4420.php

[226] Nebraska Flooding: March 2019 - ArcGIS StoryMaps. (n.d.). Retrieved from https://storymaps.arcgis.com/stories/9ce70c78f5a44813a326d20035cab95a

[227] National Centers for Environmental Information. (n.d.). Storm Events Database. Retrieved from https://www.ncdc.noaa.gov/stormevents/

Location	County / Zone	State	Date	Death	Injury	Property Damage	Crop Damage
Hartington Muni Arpt	Cedar Co.	NE	7/18/2018	0	0	0.00K	0.00K
Walthill	Thurston Co.	NE	3/13/2019	0	0	0.00K	0.00K
Osmond	Pierce Co.	NE	3/13/2019	0	0	0.00K	0.00K
Osmond	Pierce Co.	NE	3/13/2019	0	0	0.00K	0.00K
Wakefield	Dixon Co.	NE	3/13/2019	0	0	3.500M	0.00K
Stanton	Stanton Co.	NE	3/13/2019	0	0	0.00K	0.00K
Thurston	Thurston Co.	NE	3/13/2019	0	0	60.00K	0.00K
Belden	Cedar Co.	NE	3/13/2019	0	0	0.00K	0.00K
Concord	Dixon Co.	NE	3/13/2019	0	0	0.00K	0.00K
Concord	Dixon Co.	NE	3/13/2019	0	0	0.00K	0.00K
Schuyler	Colfax Co.	NE	3/13/2019	0	0	0.00K	0.00K
Norfolk	Madison Co.	NE	3/13/2019	0	0	0.00K	0.00K
Wakefield	Wayne Co.	NE	3/13/2019	0	0	0.00K	0.00K
Wisner	Cuming Co.	NE	3/13/2019	0	0	0.00K	0.00K
Howells	Colfax Co.	NE	3/13/2019	0	0	0.00K	0.00K
Schuyler	Colfax Co.	NE	3/13/2019	0	0	0.00K	0.00K
Plainview	Pierce Co.	NE	3/13/2019	0	0	0.00K	0.00K
Battle Creek	Madison Co.	NE	3/13/2019	0	0	0.00K	0.00K
Tilden	Madison Co.	NE	3/13/2019	1	0	194.00K	0.00K
Pierce	Pierce Co.	NE	3/13/2019	0	0	475.00K	0.00K
Rogers	Colfax Co.	NE	3/13/2019	0	0	170.00K	0.00K
Laurel	Cedar Co.	NE	3/13/2019	0	0	0.00K	0.00K
Wayne	Wayne Co.	NE	3/13/2019	0	0	1.300M	0.00K
Beemer	Cuming Co.	NE	3/13/2019	0	0	300.00K	0.00K
Aloys	Cuming Co.	NE	3/14/2019	0	0	0.00K	0.00K
Schuyler	Colfax Co.	NE	3/14/2019	0	0	0.00K	0.00K
Rogers	Colfax Co.	NE	3/15/2019	0	0	0.00K	0.00K
Newcastle	Dixon Co.	NE	5/29/2019	0	0	0.00K	0.00K
Wakefield	Dixon Co.	NE	6/1/2019	0	0	0.00K	230.00K
Newcastle	Dixon Co.	NE	6/1/2019	0	0	0.00K	0.00K
Newcastle	Dixon Co.	NE	9/14/2019	0	0	10.00K	0.00K
Pender Muni Arpt	Thurston Co.	NE	9/19/2019	0	0	0.00K	0.00K
Pilger	Stanton Co.	NE	9/19/2019	0	0	0.00K	0.00K
Wisner	Cuming Co.	NE	9/19/2019	0	0	0.00K	0.00K
Newcastle	Dixon Co.	NE	10/1/2019	0	0	5.00K	0.00K
Monterey	Cuming Co.	NE	6/25/2021	0	0	0.00K	0.00K
Plainview Muni Arpt	Pierce Co.	NE	8/31/2021	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	9/30/2021	0	0	0.00K	0.00K

Probability and Frequency

The NCEI reports 194 combined flooding and flash flooding events from January 2013 to November 2023. Based on the historic record and reported incidents by participating communities, there is a 100 percent probability that flooding will occur annually in the planning area.

The flood annualized frequency value represents the number of recorded flood hazard occurrences, in event days, per year over the period of record between 1996 and 2019 (24 years). **Table 108** outlines the annualized frequency for floods based on FEMA National Risk Index (NRI) data.

Table 108: Flood Annualized Frequency for Lower Elkhorn Planning Area[228]

Location	Events on Record *(1996 – 2019)*	Annualized Frequency
Burt County *(Census Tract 9632, 9634)*	16	0.7 events per year,
Cedar County	18	0.8 events per year
Colfax County	21	0.9 events per year
Cuming County	33	1.4 events per year
Dixon County	26	1.1 events per year
Dodge County *(Census Tract 9636)*	47	2 events per year
Knox County *(Census Tract 9763)*	30	1.3 events per year
Madison County	22	0.9 events per year
Pierce County	16	0.7 events per year
Platte County *(Census Tract 9651)*	37	1.5 events per year
Stanton County	20	0.8 events per year
Thurston County	20	0.8 events per year
Wayne County	11	0.5 events per year

Vulnerability and Impact

For jurisdictional- specific vulnerabilities, refer to *Volume II.*

Life Safety and Health: Flooding presents both indirect and direct threats to an individual's health and wellbeing. Fast-moving water may sweep away those who are caught in the path of the flow or attempt to cross it, potentially leading to injury or death. This also applies to first responders attempting to rescue those caught in floodwaters.[229]

Due to the unhygienic nature of floodwater, water sources may become contaminated during and after a flood. Water sources may require boiling before consumption, leading to an increased need for bottled water and the potential increase in illness.[230]

Property Damage and Critical Infrastructure: Flooding presents a high risk to numerous property types and infrastructure and has the potential to cause high amounts of damage to structures and infrastructure such as roadways, bridges, wastewater facilities, and Emergency Services. There are a significant number of responder facilities in at-risk areas. This means during a flood event, response times may be greatly impacted, and medical services may become overwhelmed.

During a flood, houses, infrastructure, and vehicles may be swept away, damaging or destroying them. Damage is highly dependent on the amount and velocity of the water, amount of debris, depth of the water, and longevity of the flood. [231]

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[228] National Risk Index. (n.d.). Annualized Losses. Annualized Frequency. Retrieved from https://hazards.fema.gov/nri/map#

[229] State of Nebraska Hazard Mitigation Plan 2021. (2021). Flood/Flash Flood., Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf

[230] Centers for Disease Control. (n.d.). Dangers of Flooding and Tips for How You Can Protect Yourself. Retrieved from https://www.cdc.gov/nceh/toolkits/floods/default.html

[231] State of Nebraska Hazard Mitigation Plan 2021. (2021). Flood/Flash Flood., Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf

Economy: Economic impacts due to a flood event greatly depend on the location, size, and duration of the flood. Impacts to the economy could be extremely localized or widespread. Regardless of the location, however, there is a risk for damage or destruction of personal property, buildings, infrastructure, and agricultural products. As was shown during the 2019 Flood, agricultural impacts may be severe due to loss of cattle and crops. Destroyed workplaces and homes may likewise impact local economies due to job or home loss.

Changes in Development and Impact of Future Development: Current and future developments should take into account 100-year and 500-year floodplain maps. It may be necessary to evaluate the locations of various business developments, critical infrastructure, and agricultural activities to mitigate future flood events based on historic floodplain maps. Roads and bridges within floodplain areas may require additional maintenance or reinforcement to prevent destruction during a flood. Planned agricultural developments in floodplain areas may be at a higher risk for losses during an event.

Underserved and At Risk Population: A 2008 national study examining social vulnerability as it relates to flood events found that low- income and minority populations are disproportionately vulnerable to flood events. These groups may lack needed resources to mitigate potential flood events as well as resources that are necessary for evacuation and response. In addition, low-income residents are more likely to live in areas vulnerable to the threat of flooding but lack the resources necessary to purchase flood insurance. The study found that flash floods are more often responsible for injuries and fatalities than prolonged flood events.[232]

Other groups that may be more vulnerable to floods, specifically flash floods, include the elderly, those outdoors during rain events, and those in low-lying areas. Elderly residents may suffer from a decrease or complete lack of mobility and as a result, be caught in flood-prone areas. [233]Residents in campgrounds or public parks may be more vulnerable to flooding events. Many of these areas exist in natural floodplains and can experience rapid rise in water levels resulting in injury or death.

On a state level, the Nebraska's State National Flood Insurance Coordinator's office has 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

Effects of Climate Change in Severity of Impacts: As the worldwide environment warms, this leads to an overall increase in precipitation. This in turn will increase the frequency, size, and duration of flood events in the planning area.[234] Future flood events are likely to be more severe and common than in the past due to the effects of climate change.

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[232] Social vulnerability and the natural and built environment: a model of flood casualties in Texas. Zahran S. Et. Al. (2008.) Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1467-7717.2008.01054.x

[233] State of Nebraska Hazard Mitigation Plan 2021. (2021). Flood/Flash Flood., Retrieved from ttps://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf

[234] Environmental Protection Agency. (n.d.). Climate Change Indicators: U.S. and Global Precipitation. Retrieved from

FEMA NRI Expected Annual Loss Estimates

A flood NRI Expected Annual Loss (EAL) score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to flood when compared to the rest of the United States. The EAL score is positively associated with a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 109** outlines the flood EAL for the Lower Elkhorn planning area.

Table 109: Flood Expected Annual Loss[235]

Location	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Burt County *(Census Tract 9632, 9634)*	$3,757	$2,645	$6	$6,409	41.7	Relatively Low
Cedar County	$75,856	$26,316	$782	$102,954	26.3	Very Low
Colfax County	$601,720	$191,550	$46,979	$840,249	66.9	Relatively Low
Cuming County	$70,642	$117,506	$31,638	$219,786	38.3	Relatively Low
Dixon County	$11,862	$113,493	$4,512	$129,867	29.8	Very Low
Dodge County *(Census Tract 9636)*	$74,897	$14,361	$229,850	$319,108	95.2	Relatively High
Knox County *(Census Tract 9763)*	$83,255	$10,126	$18	$93,398	85.7	Relatively Moderate
Madison County	$500,492	$173,721	$274,313	$948,526	69.6	Relatively Low
Pierce County	$13,117	$14,429	$8,638	$36,184	14.7	Very Low
Platte County *(Census Tract 9651)*	$45,583	$9,909	$24,754	$80,246	84	Relatively Moderate
Stanton County	$56,740	$198,779	$356,572	$612,091	59.8	Relatively Low
Thurston County	$22,471	$14,343	$219,520	$256,333	41.3	Relatively Low
Wayne County	$5,084	$47,232	$7,559	$59,876	19.7	Very Low

Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).

Total Risk Score

Table 110 represents the flood Total Risk Score for the Lower Elkhorn planning area, based on the Risk Assessment Methodology, as defined in this Plan.

https://www.epa.gov/climate-indicators/climate-change-indicators-us-and-global-precipitation

[235] FEMA National Risk Index. Community Report. (n.d.). Retrieved from https://hazards.fema.gov/nri/map

Table 110: Flood Total Risk Score

Flood Total Risk Score						
Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Flood	2	8	12	35	55	58

Consequence: Sum of all weighted factors.
Extent: Sum of the weighted Extent factors.
Vulnerability: Sum of the weighted Vulnerability factors.
Impact: Sum of the weighted Impact factors.
Total Risk Score = Probability x Consequence
** Normalized to 100*

Total Risk Score Legend						
Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 50
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	51 – 75

The legend—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The Consequence Score represents the sum of the Extent, Vulnerability, and Impact Factors. The Total Risk Score is a measure of Probability and Consequence.

Fire / Wildfire

Hazard Description

Wildfires, also known as brushfires, forest fires, or wildland fires, are any uncontrolled fire that occurs in the countryside or wildland. Wildland areas may include, but are not limited to grasslands, forests, woodlands, agricultural fields, pastures, and other vegetated areas. Wildfires differ from other fires by their extensive size, the speed at which they can spread from the original source, their ability to change direction unexpectedly, and to jump gaps (such as roads, rivers, and fire breaks). While some wildfires burn in remote forested regions, others can cause extensive destruction of homes and other property located in the wildland-urban interface (WUI), the zone of transition between developed areas and undeveloped wilderness. For the purpose of this plan, Wildfires (including grassland fires,) will remain the focus due to the high level of agriculture within the planning area and lack of large cities, where urban fire risks would take precedence.

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

Free-burning fires can occur whenever combustible fuel (e.g., grasses, shrubs, trees, dead leaves) in the presence of oxygen at an extremely high temperature becomes gas (flames are the visual indicator of heated gas). Smoldering fires can occur with lower temperature heat sources and, over time, can reach ignition temperature when rapid fire growth occurs. Wildfires can be ignited by natural occurrences (e.g., lightning strike) or by human causes (e.g., unattended campfire, debris burning, or arson). In 2022, 87% of wildfires in the United States were ignited by humans; meaning that they could have been prevented.[236] However, weather conditions and topography determine the behavior of wildfire. Wind, high temperatures, and low humidity create a perfect environment for a wildfire to grow; furthermore, flames burn faster when they are moving uphill versus downhill.

Wildfires are characterized in terms of their physical properties including topography, weather, and fuels.

Wildfire behavior is often complex and variably dependent on factors such as fuel type, moisture content in the fuel, humidity, wind speed, topography, geographic location, ambient temperature, the effect of weather on the fire, and the cause of ignition. Fuel is the only physical property humans can control and is the target of most mitigation efforts. The NWS monitors the risk factors including high temperature, high wind speed, fuel moisture (greenness of vegetation), low humidity, and cloud cover in the state on a daily basis, and other agencies likewise provide current risk maps for the planning area. (**Figure 41** and **Figure 42**)

[236] United States Forest Service. (n.d.). About Wildfires. Retrieved from https://smokeybear.com/en/about-wildland-fire.

Figure 41: Rangeland Fire Danger[237]

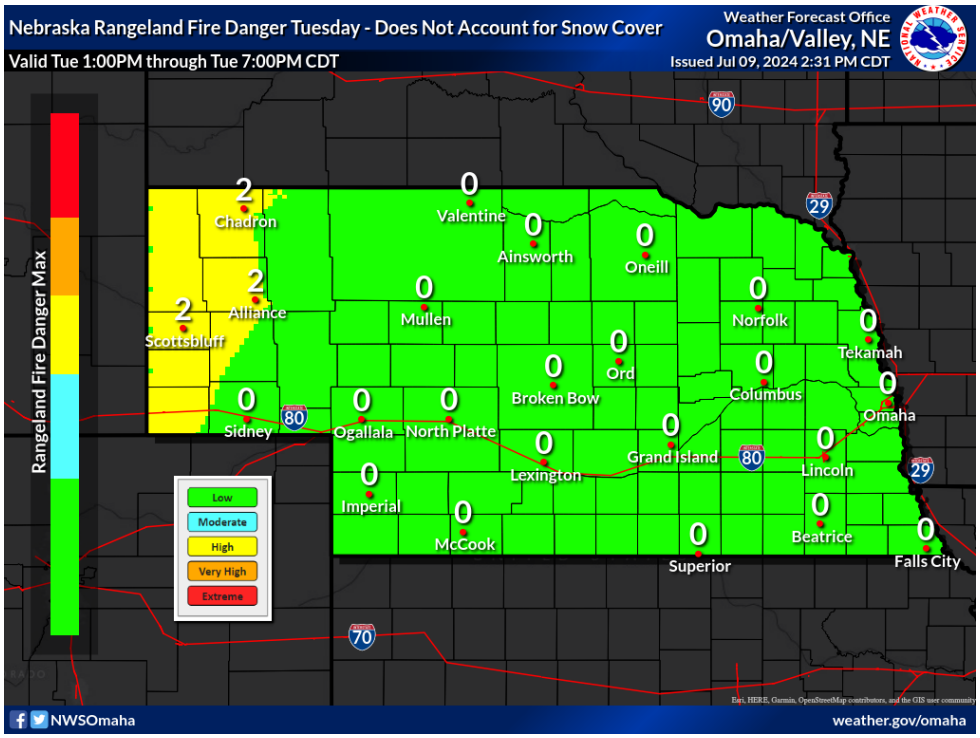
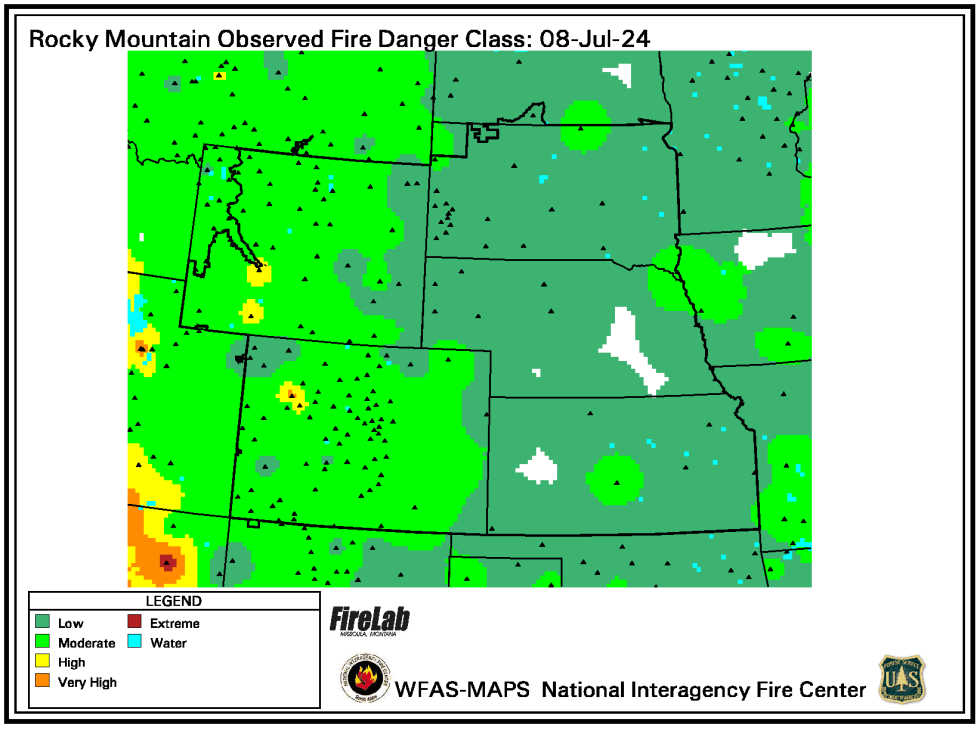


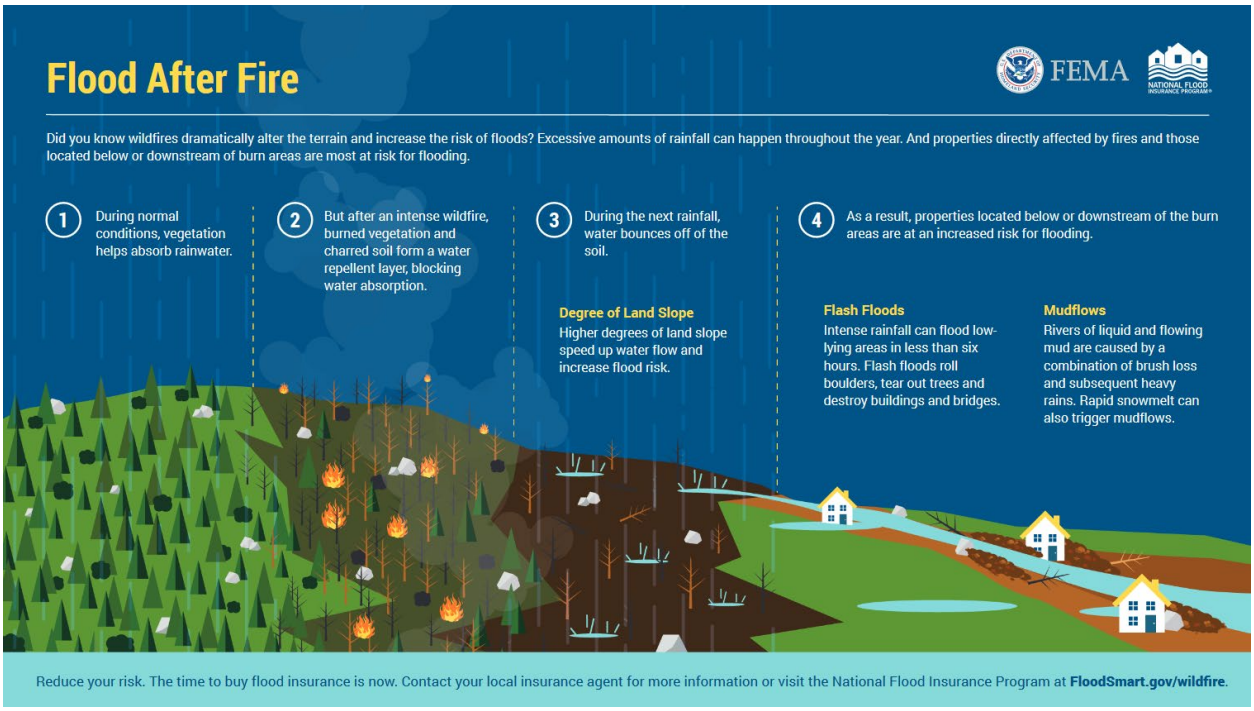
Figure 42: Rocky Mountain Fire Danger[238]



[237] Nebraska Forest Service. (n.d.). Nebraska Fire Danger. Retrieved from https://nfs.unl.edu/nebraska-fire-danger
[238] National Weather Service. (n.d.). Fire Weather Info Omaha, NE. Retrieved from https://www.weather.gov/oax/fire

Wildfire also contributes to an increased risk from other hazard events, compounding existing damages and straining resources. FEMA has provided additional information in recent years detailing the relationship between wildfire and flooding. 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, as illustrated in **Figure 43**.

Figure 43: FEMA Flood and Fire[239]



Location

While the entire planning area is vulnerable to wildfires, as the number of reported wildfires by the county indicates, the greatest threat of wildfire that could impact people and homes is in Madison County.

Table 111: Reported Wildfires by County[240]

County	Reported Wildfires	Acres Burned
Burt*	17	4,742.01
Cedar*	74	389.27
Colfax	51	254.29
Cuming	89	613.86
Dixon*	26	819.7
Dodge*	110	407.03
Knox*	8	14.6
Madison	468	3,155.21
Pierce	169	946.8
Platte*	106	2,092.1

[239] Floodsmart. (2021). FEMA. Flood After Fire. Retrieved from https://agents.floodsmart.gov/sites/default/files/FEMA-FAF-Infographic-ENG-web_508_01152021.pdf

[240] Nebraska Forest Service, 2000-2018

Stanton	136	2,226.55
Thurston*	57	1,904.23
Wayne	197	882.05
Total	1,508	18,447.7

**Partial Counties included for completeness, they are not being compared to counties fully in the NRD*

Extent

When weather conditions are conducive to wildfire ignition, the NWS local Forecast Office issues a series of advisories. **Table 112** outlines the fire advisories issued by NWS as conditions warrant.

Table 112: National Weather Service Fire Advisories[241]

Type	Definition
Fire Weather Watch	Issued to alert land managers and the public that upcoming weather conditions (e.g., combination of strong winds and low humidity, dry and unstable air mass, and/or lightning) could result in extensive wildland fire occurrence or extreme fire behavior. It is issued when critical fire weather conditions are possible but not imminent or occurring.
Red Flag Warning	Issued by NWS, in conjunction with land management agencies, to alert land managers to an ongoing or imminent critical fire weather pattern (e.g., combination of strong winds and low humidity, dry and unstable air mass, and/or lightning). It is issued when fire conditions are ongoing or expected to occur shortly.
Extreme Fire Behavior	Issued when a wildfire is likely to run out of control. It is often hard to predict because fires tend to behave erratically and sometimes dangerously. To issue this alert, one (1) or more of the following criteria must be met – moving fast (i.e., high rate of spread), prolific crowning and/or spotting, presence of fire whirls, and/or strong convection column.

Table 113 breaks down the total number of wildfires by cause in Nebraska which burned 180,733 acres in total during 2023.

Table 113: Total Number Wildfires in Nebraska (2023)[242]

Agency	Fires – Human	Acres – Human	Fires – Lightning	Acres – Lightning	Fires – Total	Acres - Total
DOF	505	177,236	55	1,799	560	179,035
FS	5	1,475	3	1	8	1,476
FWS	1	222	0	0	1	222
Totals	**511**	**178,933**	**58**	**1,800**	**569**	**180,733**

Even if a wildfire is not occurring within the Lower Elkhorn planning area, wildfire smoke can affect the visibility and air quality of the region. Wildfire smoke is a mix of gases and fine particles from burning vegetation, building materials, and other materials. The Air Quality Index (AQI) is used by the United States Environmental Protection Agency (EPA) to report air quality. The AQI is divided into six (6) categories (**Table 114**), each of which corresponds to a different level of health concern.

[241] National Weather Service. (n.d.). Understanding Wildfire Warnings, Watches and Behavior. Retrieved from https://www.weather.gov/safety/wildfire-ww.

[242] National Interagency Coordination Center Wildland Fire Summary and Statistics Annual Report 2023. (2023). Wildland Fires and Acres Burned by State and Agency. Retrieved from https://www.nifc.gov/sites/default/files/NICC/2-Predictive%20Services/Intelligence/Annual%20Reports/2023/annual_report_2023_0.pdf

Table 114: Air Quality Index for Ozone and Particle Pollution[243]

Daily AQI Color	Levels of Concern	Values of Index	Description of Air Quality
Green	Good	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Yellow	Moderate	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Orange	Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Red	Unhealthy	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Purple	Very Unhealthy	201 to 300	Health alert. The risk of health effects is increased for everyone.
Maroon	Hazardous	301 or higher	Health warning of emergency conditions. Everyone is more likely to be affected.
EPA establishes an AQI for five (5) major air pollutants regulated by the Clean Air Act. Each of these pollutants has a national air quality standard set by EPA to protect public health - ground-level ozone, particle pollution (also known as particulate matter, including PM2.5 and PM10), carbon monoxide, sulfur dioxide, and nitrogen dioxide.			

Historical Frequency

NCEI has reported no wildfire events between 1950 and 2022 in the Lower Elkhorn planning area. However, the Nebraska Forest Service recorded 1,617.

Wildfires are most likely to be started by debris burning (32%). Miscellaneous causes (28%) and equipment (14%) are the second and third leading causes of fires in the planning area. Most wildfires that occur in the planning area will likely be kept to under 100 acres.

[243] AirNow. (n.d.). AQI Basics for Ozone and Particle Pollution. Retrieved from https://www.airnow.gov/aqi/aqi-basics/

Table 115: Wildfires by Cause for the Planning Area 2000-2023[244]

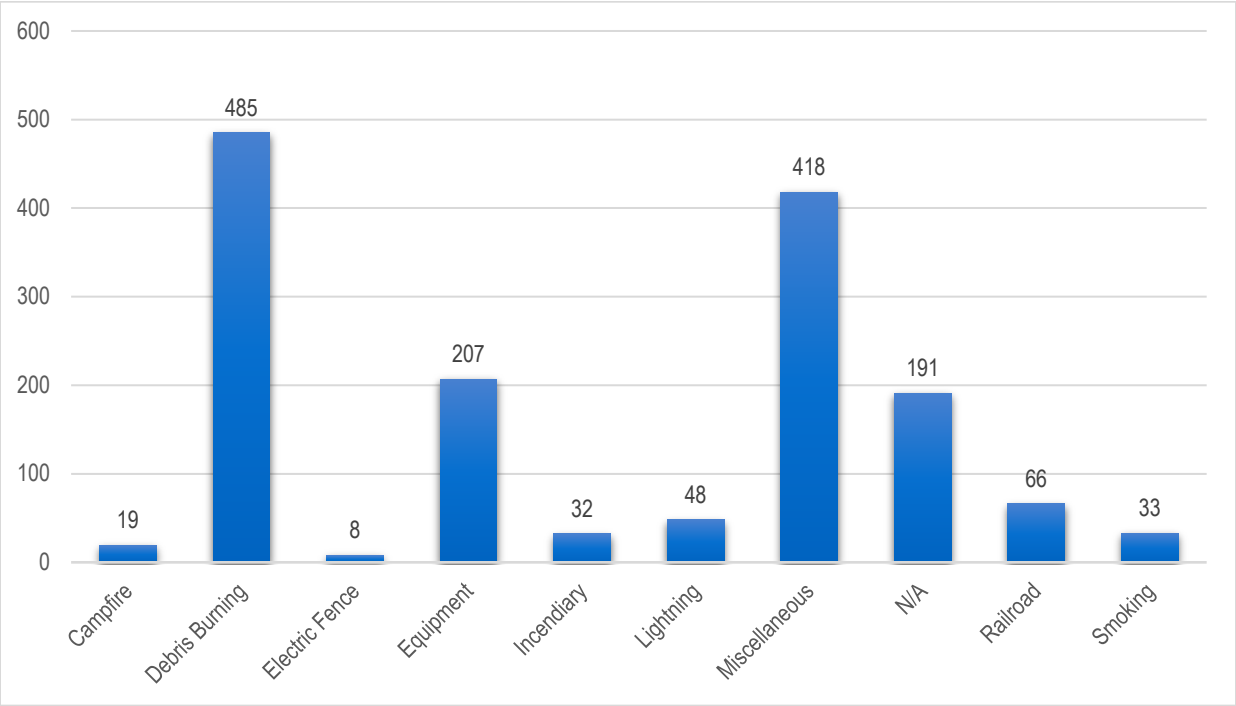
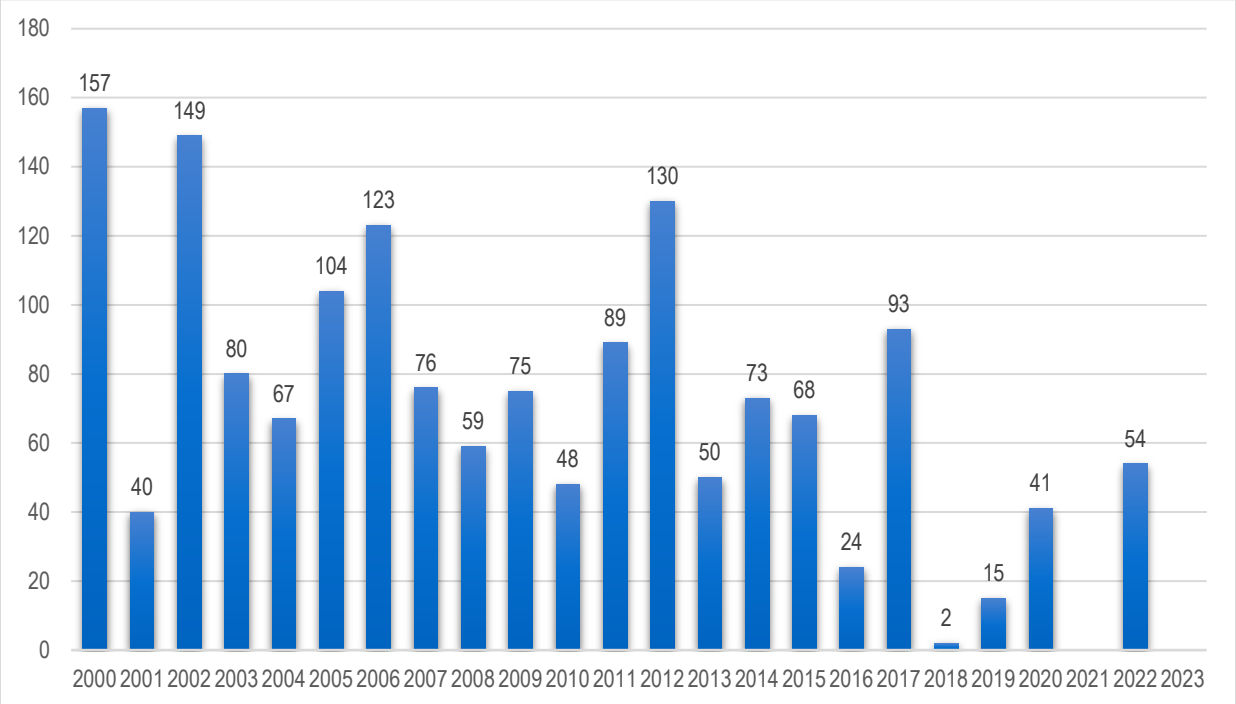


Table 116: Number of Wildfires by Year for the Planning Area 2000-2023[245]

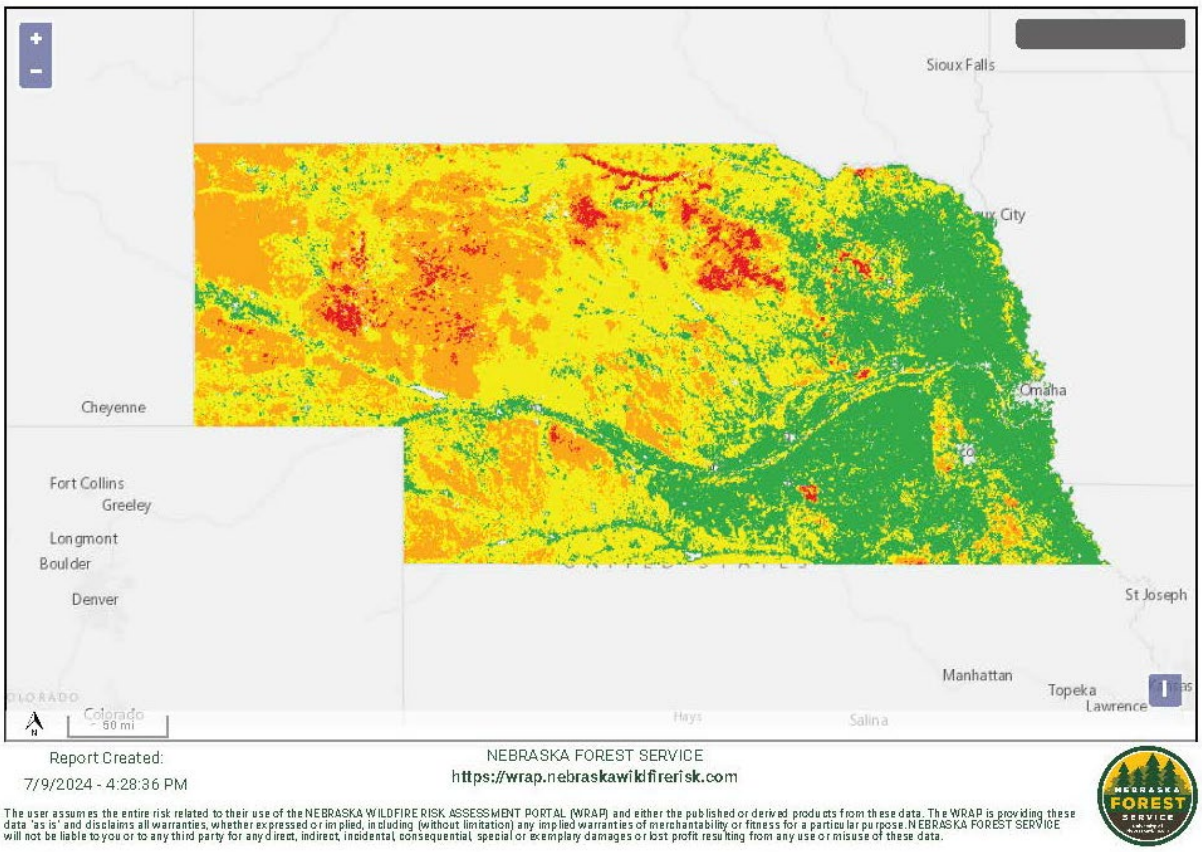


[244] Nebraska Forest Service, 2000-2023
[245] Nebraska Forest Service, 2000-2023

Probability and Frequency

Probability of grass/wildfire occurrence is based on the historic record provided by the Nebraska Forest Service and reported potential by participating jurisdictions. Based on the historic record, there is a 100 percent annual probability of wildfires occurring in the planning area each year, further elaborated on by **Figure 44** .

Figure 44: Wildfire Risk Map[246]



The wildfire annualized frequency value represents the number of recorded wildfire hazard occurrences, in event days, per year over the period of record between 2021 and 2021 (1 year).**Table 117** outlines the annualized frequency for wildfires based on FEMA National Risk Index (NRI) data.

Table 117: Wildfire Annualized Frequency for Lower Elkhorn Planning Area[247]

Location	Events on Record (2021 Dataset)	Annualized Frequency
Burt County *(Census Tract 9632, 9634)*	n/a	0.039% chance per year
Cedar County	n/a	0.045% chance per year
Colfax County	n/a	0.006% chance per year

[246] Nebraska Forest Service (n.d.). Nebraska Wildfire Risk Explorer: Basic Viewer. Retrieved from https://wrap.nebraskawildfirerisk.com/Map/Public/

[247] National Risk Index. (n.d.). Annualized Losses. Annualized Frequency. Retrieved from https://hazards.fema.gov/nri/map#

Location	Events on Record (2021 Dataset)	Annualized Frequency
Cuming County	n/a	0.035% chance per year
Dixon County	n/a	0.050% chance per year
Dodge County *(Census Tract 9636)*	n/a	0.023% chance per year
Knox County *(Census Tract 9763)*	n/a	0.040% chance per year
Madison County	n/a	0.026% chance per year
Pierce County	n/a	0.043% chance per year
Platte County *(Census Tract 9651)*	n/a	0.003% chance per year
Stanton County	n/a	0.037% chance per year
Thurston County	n/a	0.081% chance per year
Wayne County	n/a	0.031% chance per year

Vulnerability and Impact

For jurisdictional- specific vulnerabilities, refer to *Volume II.*

Life Safety and Health: Wildfires can pose direct dangers to an individual's health and safety due to the extreme heat produced and the speed at which they spread. However, secondary hazards such as extremely poor and toxic air quality can further affect individuals even if they are located far from the original blaze.[248] Wildfire smoke can be extremely harmful to the lungs, especially for those with pre-existing conditions, the very young, and elderly.[249] Additionally, smoke can impair visibility, potentially causing vehicular accidents on affected roadways. Contamination of water supplies due to debris is also a potential hazard. An additional, secondary hazard of wildfires is the increased chance of landslides and erosion due to the lack of vegetation on slopes.

Property Damage and Critical Infrastructure: Wildfires pose a significant risk to both property and critical infrastructure. Wildfires can disrupt critical infrastructure sectors such as transportation, communications, power and gas services, and water supply. They also lead to a deterioration of the air quality, and loss of property, crops, resources, animals and people. Wildfires additionally can threaten emergency services as various response organizations (e.g. police, fire,) are tasked with fighting the fire. Smoke can impact crops by reducing available sunlight, negatively impacting soil compositions, or directly damage crops.[250]

Economy: Wildfire poses direct dangers to the primary economic sector within the planning area; agriculture. A fire, depending on its size, could directly impact both immediate jobs in agriculture and, as well as products such as cattle or crops. The direct threat to the economic sector from a wildfire is the potential destruction of crops or livestock. In addition, secondary hazards from wildfire may cause significant economic impact even after the fire is controlled. As previously mentioned, wildfire smoke can impact crops directly by altering the soil composition, thereby disrupting future yields. Depending on the scope and scale, the impacts may be

[248] Environmental Protection Agency. (n.d.). Why Wildfire Smoke is a Health Concern. Retrieved from https://www.epa.gov/wildfire-smoke-course/why-wildfire-smoke-health-concern

[249] American Lung Association. (2016.). How Wildfires Affect Our Health. Retrieved from https://www.lung.org/blog/how-wildfires-affect-health

[250] Cybersecurity & Infrastructure Security Agency. (n.d.). Wildfires. Retrieved from https://www.cisa.gov/topics/critical-infrastructure-security-and-resilience/extreme-weather-and-climate-change/wildfires

localized, or spread to an entire region (or state.) This may include the loss of jobs, price increases, and disrupting crop seeding/harvesting schedules.

Changes in Development and Impact of Future Development: Current and future developments should take into account wildfire risk zones and consider mitigation methods.

Underserved and At Risk Population: Wildfires pose similar threats to underserved and at-risk populations as other disasters. Older adults have also been shown to be disproportionately vulnerable to wildfires. Physical difficulties and cognitive decline can hamper older adults' ability to keep their properties clear of flammable materials, such as dry shrubs and grasses, and can slow their ability to evacuate in an emergency.[251] Economic disruptions from a wildfire would additionally impact individuals with an unsteady financial situation, exacerbating the crisis due to potential job loss especially if they are displaced due to the wildfire.

As is the case with severe weather hazards, the Elderly are less mobile and may not have the means or knowledge to receive alerts for the hazard, especially at night. Those reliant on public transportation would likewise not be able to evacuate efficiently from a wildfire; the elderly falling into this category. Additionally, non-English speaking individuals are at a disadvantage in regards to receiving emergency alerts. In areas with non-English speaking populations, additional steps to alert these populations should be taken into account.[252]

Effects of Climate Change in Severity of Impacts: Changes in climate are creating warmer and drier conditions which are leading to longer and more active wildfire seasons. Studies have shown that the number of large wildfires has more than doubled in the western United States. Furthermore, projections show that a one (1) degree Fahrenheit increase in the average annual temperature could increase the average burned area per year by as much as 600% (in some types of forests) in the western United States.[253]

FEMA NRI Expected Annual Loss Estimates

A wildfire NRI Expected Annual Loss (EAL) score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to wildfire when compared to the rest of the United States. The EAL score is positively associated with a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 118** outlines the wildfire EAL for the Lower Elkhorn planning area.

[251] Prevention Web: Research Briefs. (2023.) Sadegh M., Abatzoglou J. Wildfire risk is soaring for low-income, elderly and other vulnerable populations in California, Washington and Oregon. Retrieved from https://www.preventionweb.net/news/wildfire-risk-soaring-low-income-elderly-and-other-vulnerable-populations-california

[252] Ahlborn L, Franc JM. Tornado hazard communication disparities among Spanish-speaking individuals in an English-speaking community. (2012) Prehosp Disaster Med. Feb;27(1):98-102. doi: 10.1017/S1049023X12000015. Epub 2012 Mar 23. PMID: 22445029. Retrieved from https://pubmed.ncbi.nlm.nih.gov/22445029/

[253] NOAA. (2023). Wildfire Climate Connection. Retrieved from https://www.noaa.gov/noaa-wildfire/wildfire-climate-connection.

Table 118: Wildfire Expected Annual Loss[254]

Location	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Burt County *(Census Tract 9632, 9634)*	$83	$ 16,363	$41	$ 16,486	83.15	Relatively Low
Cedar County	$232	$53,088	$361	$53,681	55.5	Very Low
Colfax County	$54	$9,102	$41	$9,198	26.6	Very Low
Cuming County	$324	$71,269	$461	$72,054	60.1	Very Low
Dixon County	$209	$28,935	$229	$29,373	45.7	Very Low
Dodge County *(Census Tract 9636)*	$66	$12,019	$21	$12,106	85.3	Relatively Moderate
Knox County *(Census Tract 9763)*	$80	$15,128	$10	$15,218	86.3	Relatively Moderate
Madison County	$737	$96,868	$138	$97,744	63.9	Relatively Low
Pierce County	$290	$54,985	$387	$55,663	56.2	Very Low
Platte County *(Census Tract 9651)*	$14	$3,346	$6	$3,366	78.7	Relatively Low
Stanton County	$378	$39,661	$115	$40,154	51.0	Very Low
Thurston County	$673	$33,358	$171	$34,202	48.4	Very Low
Wayne County	$207	$24,138	$18	$24,363	42.8	Very Low

Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).

Total Risk Score

Table 119 represents the wildfire Total Risk Score for the Lower Elkhorn planning area, based on the Risk Assessment Methodology, as defined in this Plan.

Table 119: Wildfire Total Risk Score

Wildfire Failure Total Risk Score						
Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Wildfire	2	8	6	17	31	35

[254] FEMA National Risk Index. Community Report. (n.d.). Retrieved from https://hazards.fema.gov/nri/map

Wildfire Failure Total Risk Score						
Hazard Event	**Probability**	**Consequence**				**Total Risk**
	Probability Factor	**Extent**	**Vulnerability**	**Impact**	**Consequence Score**	**Total Risk Score***

Consequence: Sum of all weighted factors.
Extent: Sum of the weighted Extent factors.
Vulnerability: Sum of the weighted Vulnerability factors.
Impact: Sum of the weighted Impact factors.
Total Risk Score = Probability x Consequence
** Normalized to 100*

Total Risk Score Legend						
Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 50
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	51 – 75

The legend—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The Consequence Score represents the sum of the Extent, Vulnerability, and Impact Factors. The Total Risk Score is a measure of Probability and Consequence.

Landslides

Hazard Description

The United States Geological Survey instructs that landslides occur in all 50 states and territories, and are a risk in any area composed of very weak or fractured materials resting on a steep slope.[255] The majority of Nebraska's landslides fall under five categories: rockfalls, earth slumps, rock spreads, rock slumps, and complex slides, with earth slumps being the most common. The following table elaborates on the specific types of landslides common in Nebraska.

Table 120: Landslide Types and Definition[256]

Type of Landslide	Definition
Rock Falls	Free falling rocks from a steep cliff or slope, along an undercut stream bank or an eroding valley wall. They occur mainly in the Greenhorn Limestone of Cretaceous age and in the Permian and Pennsylvanian aged rocks in eastern Nebraska and in the Arikaree, and Ogallala groups of Tertiary age in western Nebraska.
Earth Slumps	Non-bedrock deposits (loess, glacial materials, etc.) that move downward on a rotational failure plane. Earth slumps are the most widespread and common type of landslide found in Nebraska. They develop mainly in loess and glacial deposits.
Rock Spread	Blocks or slabs of bedrock that move laterally usually without a well-defined controlling basal shear surface or zone of plastic flow. Examples in Nebraska were observed along the south-central border and involved Cretaceous Greenhorn Limestone with lateral extension (movement) on the underlying Graneros Shale of Cretaceous age.
Rock Slumps	A mass of bedrock that moves downward on a rotational failure plane. A majority of these rock slumps, occurred in the Pierre Shale of Cretaceous age.
Complex Slides	A combination of one or more of the principal types of landslides. Many landslides are complex, although one type of movement dominates over the other types in certain areas of a slide or at a particular time. Older and larger slides such as those observed along major river bluffs involving younger deposits overlying older bedrock were classified as complex.

As per the State of Nebraska Hazard Mitigation Plan, documented landslides have not caused any reportable, serious damage, and the events have been highly localized and did not exceed the capacity of local authorities to address.[257]

Location

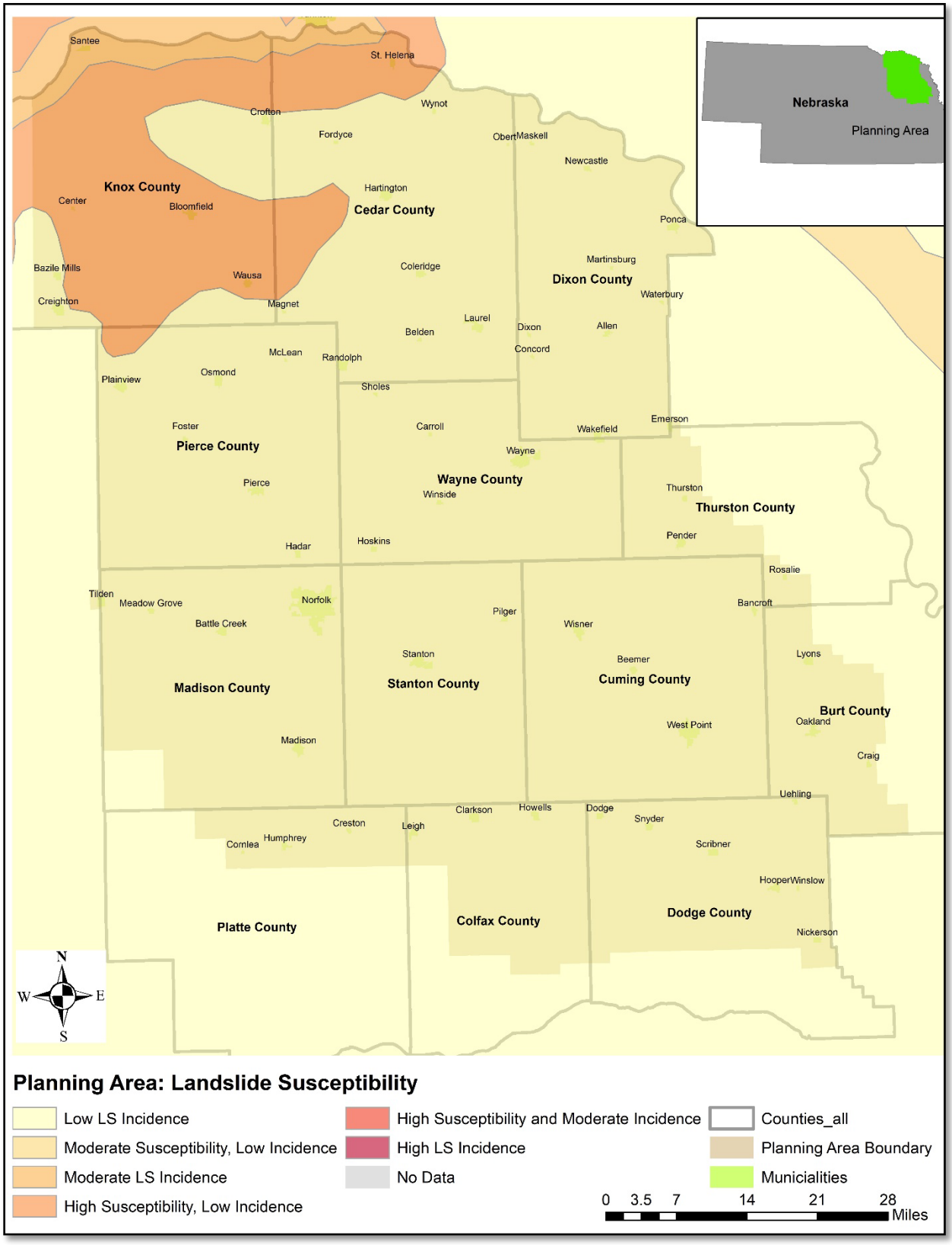
Figure 45 displays the landslide hazard area map of Nebraska. Within the planning area, the overall risk of landslides remains low.

[255] USGS. Landslide Hazards Program. (n.d.). Landslide Basics. Retrieved from https://www.usgs.gov/programs/landslide-hazards/landslide-basics

[256] Nebraska Institute of Agriculture and Natural Resources. (n.d.) Types of Landslides. Retrieved from https://snr.unl.edu/data/geologysoils/landslides/landslidetypes.aspx

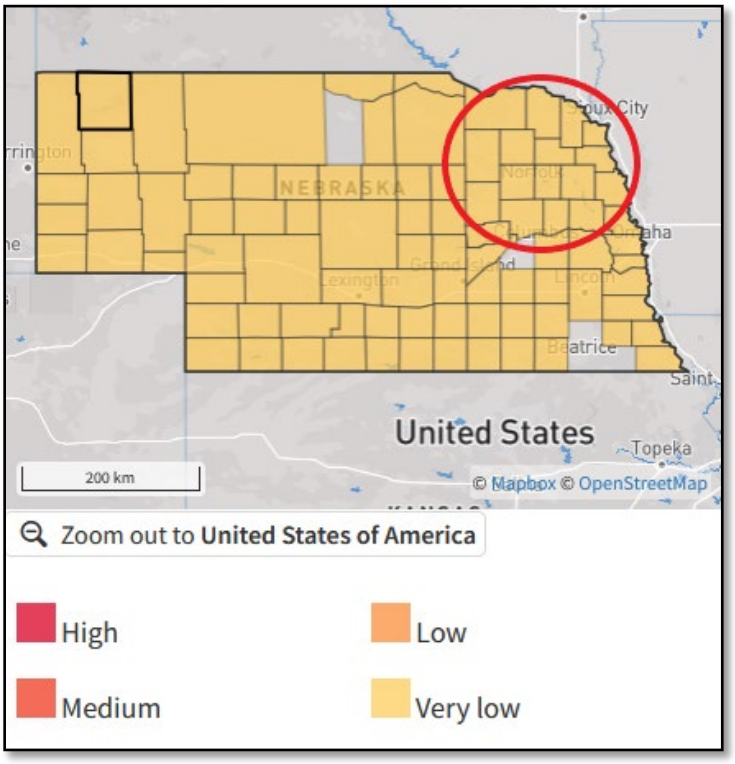
[257] State of Nebraska Hazard Mitigation Plan. (2021). Hazards Eliminated from Further Consideration in the 2021 SHMP. Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf

Figure 45: Landslide hazard Area[258]



The following figure further indicates the planning area. As outlined, the overall risk for a landslide hazard remains very low.

Figure 46: Landslide hazard Level[259]



Extent

Slope movement is classified utilizing the Varnes classification of slope movements, as illustrated in **Figure 47**. It has been adopted by the Landslide Committee, Highway Research Board, Washington. It classifies Landslides into falls, topples, slides, lateral spreads, and flows.[260]

[258] Nebraska Geologic Survey Landslide Study, 1990

[259] ThinkHazard: Nebraska. (n.d.). Landslide Hazard Level. Retrieved from https://www.thinkhazard.org/en/report/3241-united-states-of-america-nebraska/LS

[260] Classification of Mass Movement. Annex 1. Retrieved from https://lib.icimod.org/record/23541/files/c_attachment_240_1920.pdf

Figure 47: Varnes Landslide Classification Method[261] [262]

TYPE OF MOVEMENT		TYPE OF MATERIAL		
		BEDROCK	ENGINEERING SOILS	
			Predominantly coarse	Predominantly fine
FALLS		Rock fall	Debris fall	Earth fall
TOPPLES		Rock topple	Debris topple	Earth topple
SLIDES	ROTATIONAL	Rock slide	Debris slide	Earth slide
	TRANSLATIONAL			
LATERAL SPREADS		Rock spread	Debris spread	Earth spread
FLOWS		Rock flow (deep creep)	Debris flow (soil creep)	Earth flow
COMPLEX		Combination of two or more principal types of movement		

Historical Frequency

The National Centers for Environmental Information (NCEI) does not track landslide events. However, Nebraska has had over 300 landslides have occurred since 1982, as reported by the Nebraska Geological Survey. Nebraska is not known to the general public as a "landslide prone" state, but these prior events have incurred a total of more than $4.5 million in general damages since 1982.[263] **Table 121** illustrates the number of landslides that have occurred in the planning area since data collection in 1986.

Table 121: Lower Elkhorn Landslides[264]

Location	Number of Landslides since 1986
Burt County	12
Cedar County	7
Colfax County	8
Cuming County	1
Dixon County	9
Dodge County	2
Knox County	81
Madison County	1
Pierce County	0
Platte County	0
Stanton County	0
Thurston County	6

[261] Slope movement types and processes. Varnes, D.J. (1978). Schuster, R.L., and Krizek, R.J., eds., Landslides—Analysis and control: National Research Council, Washington, D.C., Transportation Research Board, Special Report 176, p. 11–33.Figure X: Varnes Classification Method. Retrieved from https://pubs.usgs.gov/fs/2004/3072/pdf/fs2004-3072.pdf

[262] Varnes Landslide Classification. (2013). Jan Novotny. Charles University. Retrieved from http://www.geology.cz/projekt681900/vyukove-materialy/2_Varnes_landslide_classification.pdf

[263] Eversoll. Duane. Nebraska Geological Survey. (2005.) Final Report on USGS/AASG Landslide Loss (Estimation Pilot Project). Retrieved from https://pubs.usgs.gov/of/2006/1032/pdf/Nebraska.pdf

[264] Nebraska Institute of Agriculture and Natural Resources. (n.d.) Collection of Nebraska Landslides. Retrieved from https://snr.unl.edu/data/geologysoils/landslides/landslidedatabase.aspx

Location	Number of Landslides since 1986
Wayne County	1
Total	**128**

Probability and Frequency

While the overall risk of a landslide is low across the planning area, multiple landslides have occurred. **Table 122** outlines the annualized frequency as per the National Risk Index for landslides within their respective counties. The landslides annualized frequency value represents the number of recorded landslide hazard occurrences, in event days, per year over the period of record between 2010 and 2021 (12 years).

Table 122: Landslide Annualized Frequency for Lower Elkhorn Planning Area

Location	Events on Record (2010 – 2021)	Annualized Frequency
Burt County *(Census Tract 9632, 9634)*	0	0 events per year
Cedar County	0	0 events per year
Colfax County	0	0 events per year
Cuming County	0	0 events per year
Dixon County	0	0 events per year
Dodge County *(Census Tract 9636)*	0	0 events per year
Knox County *(Census Tract 9763)*	0	0 events per year
Madison County	0	0 events per year
Pierce County		0 events per year
Platte County *(Census Tract 9651)*	0	0 events per year
Stanton County	0	0 events per year
Thurston County	0	0 events per year
Wayne County	0	0 events per year

Vulnerability and Impact

The following table provides information related to regional vulnerabilities; for jurisdictional- specific vulnerabilities, refer to Volume II.

Life Safety and Health: While most landslides are minor events, they have the potential to pose significant health hazards if large enough. Health hazards associated with landslides include rapidly moving debris that can lead to bodily trauma, disrupted roadways, and building collapses. Additional dangers include trauma or suffocation from entrapment by the debris, and diseases following a landslide from broken water and sewer pipes.[265,266]

Property Damage and Critical Infrastructure: Landslides can damage or destroy both structures and roadways in their path. Water, electricity, and communications infrastructure are at risk if placed on or near a landslide-prone slope.[267]

[265] Centers for Disease Control. (n.d.). Landslides and Mudslides. Retrieved from https://www.cdc.gov/disasters/landslides.html
[266] World Health Organization. (n.d.). Landslides: Impact. Retrieved from https://www.who.int/health-topics/landslides#tab=tab_2
[267] Ibid.

Economy: While landslides can destroy property and roadways, impacts are likely to be temporary, as the affected area is not likely to be large. However, with larger events, the destruction of homes, infrastructure such as water, sewer, and power distribution lines would lead to a longer recovery period. Agriculture in the affected area has the potential to being damaged or destroyed, impacting the local economy.

Changes in Development and Impact of Future Development: For future and current developments, efforts should be made to reinforce landslide-prone slopes that pose a danger to property or infrastructure. Future developments should examine historic landslide areas and consider relocating to areas not at risk.

Underserved and At Risk Population: If homes or infrastructure are damaged or destroyed by a landslide, the at-risk and underserved population will feel greater impact due to the disproportionate financial impact. Disruptions may include water supplies, job availability, shelter availability, and overall well-being.

Effects of Climate Change in Severity of Impacts: Due to increasing air temperature, higher intensity and frequent rain events, and decreasing summer precipitation, climate change is anticipated to alter landslides in terms of increasing severity and frequency.[268]

FEMA NRI Expected Annual Loss Estimates

A landslide NRI Expected Annual Loss (EAL) score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to landslides when compared to the rest of the United States. The EAL score is positively associated with a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 123** outlines the landslide EAL for the Lower Elkhorn planning area.

Table 123: Landslide Expected Annual Loss[269]

Location	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Burt County *(Census Tract 9632, 9634)*	$4,899	$1,187	n/a	$6,085	80.85	Relatively Moderate
Cedar County	$17,400	$4,500	n/a	$21,900	19.7	Relatively Low
Colfax County	$9,319	$3,216	n/a	$12,535	13.9	Relatively Low
Cuming County	$17,400	$4,500	n/a	$21,900	37.1	Relatively Low
Dixon County	$17,400	$4,500	n/a	$21,900	66.7	Relatively Low
Dodge County *(Census Tract 9636)*	$14,170	$3,474	n/a	$17,644	98.3	Relatively High
Knox County *(Census Tract 9763)*	$466	$172	n/a	$638	59.0	Relatively Low
Madison County	$17,400	$4,500	n/a	$21,900	63.4	Relatively Low

[268] Climate Impact Group. (n.d.). Section 5: Sediment. How Will Climate Change Affect Landslides, Erosion, and Sediment Transport? Retrieved from https://cig.uw.edu/wp-content/uploads/sites/2/2014/11/ps-sok_sec05_sediment_2015.pdf
[269] FEMA National Risk Index. Community Report. (n.d.). Retrieved from https://hazards.fema.gov/nri/map

Location	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Pierce County	$3,646	$1,868	n/a	$5,514	13.5	Very Low
Platte County *(Census Tract 9651)*	$2,409	$402	n/a	$2,812	82.7	Relatively Moderate
Stanton County	$17,400	$4,500	n/a	$21,900	20.0	Relatively Low
Thurston County	$17,400	$4,500	n/a	$21,900	28.1	Relatively Low
Wayne County	$17,400	$4,500	n/a	$21,900	70.0	Relatively Low

Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).

Total Risk Score

Table 124 represents the Landslide Total Risk Score for the Lower Elkhorn planning area, based on the Risk Assessment Methodology, as defined in this Plan.

Table 124: Landslide Total Risk Score

Landslide Total Risk Score						
Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Landslide	1	4	3	8	15	10

Consequence: Sum of all weighted factors.
Extent: Sum of the weighted Extent factors.
Vulnerability: Sum of the weighted Vulnerability factors.
Impact: Sum of the weighted Impact factors.
Total Risk Score = Probability x Consequence
** Normalized to 100*

Total Risk Score Legend						
Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 50
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	51 – 75

The legend—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The Consequence Score represents the sum of the Extent, Vulnerability, and Impact Factors. The Total Risk Score is a measure of Probability and Consequence.

Power Outage

Hazard Description

An electric power outage is the loss of the electricity supply to a geographic area. The area of an outage can range from a single facility or neighborhood to a multi-state region. The length of the outage is determined by a combination of factors to include the scale of the outage, weather, and redundant equipment and capacity.

A power outage can be described as a blackout if power is lost completely or as a brownout if the voltage level is below the normal minimum level specified for the system. The reasons for a power outage can, for instance, be a defect in a power station, damage to a power line or other part of the distribution system, a short circuit, or the overloading of electricity mains. Load shedding is a common term for a controlled way of rotating available generation capacity between various districts or customers, thus avoiding areawide blackouts.

A rolling blackout is similar to a blackout; power loss across an area. However, a rolling blackout is intentionally performed. The purpose of an intentional blackout that rotates around the area is to prevent the electrical grid from overloading and leading to a larger, uncontrolled outage.[270]

Power outages are particularly serious for hospitals and other critical facilities and operations. Communities are extremely reliant upon life-critical medical devices, communications, and electronic information all of which require reliable (uninterrupted) electric power.

An extended power outage would threaten these areas of critical infrastructure reliant on electricity. While some buildings and services have backup power, many vital pieces of infrastructure do not (e.g. gas stations.)

The entire energy system is complex and consists of three (3) major components: generation, transmission, and distribution. The control and communication between these parts are extremely important as the failure of one (1) component can disrupt the entire system. The energy system is reliant upon the following factors: continual maintenance, equipment replacement and redundancy, and additional high-load capacity. These factors have to be carefully balanced against operating cost and profit. These initiatives are expensive but the costs cannot be readily pushed down to the consumer due to public pressure and opinion.

Nebraska is an "all public power state." This means that there are no investor-owned utilities providing electrical services. Consumers receive power from public districts, electric cooperatives, municipal electric systems, joint action agencies, or a combination of the above.[271] The Nebraska Rural Electric Association (NREA) is a non-profit trade association for 34 rural electrical systems that provide power to consumers in most of the rural areas and small towns of Nebraska.[272]

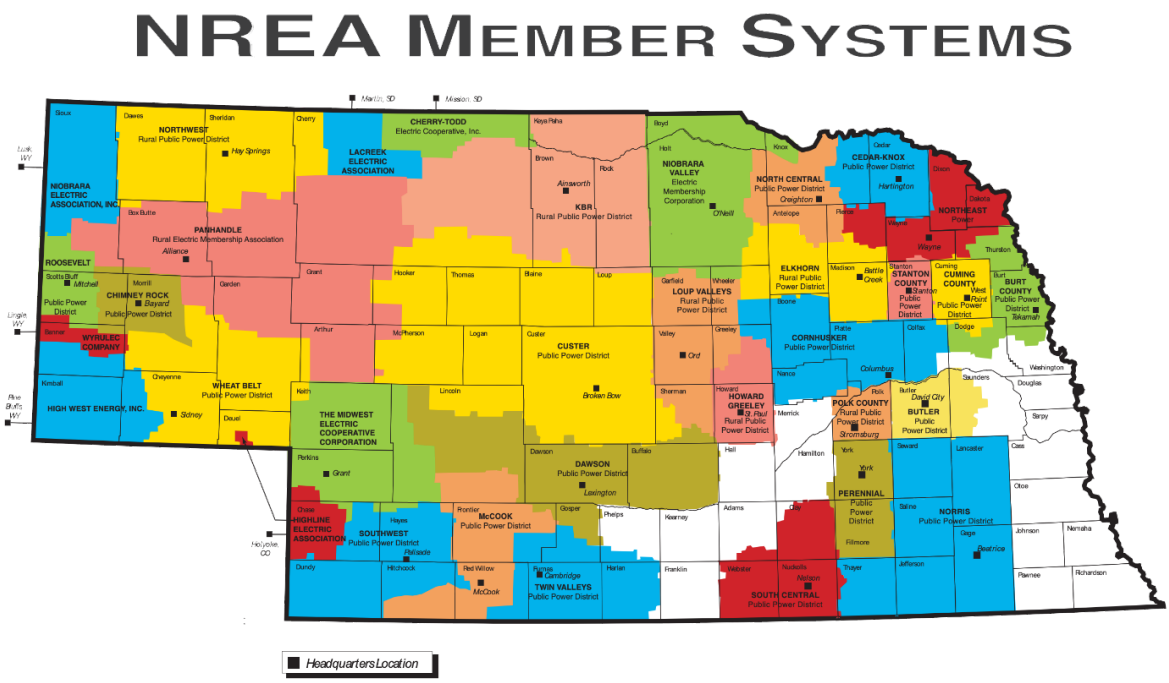
[270] Major Energy. (n.d.). Rolling Blackouts: What are they and how long do they last? Retrieved from https://majorenergy.com/learn-about-rolling-blackouts/
[271] Nebraska Rural Electric Association. (n.d.). NREA Member Systems. Retrieved from https://www.nrea.org/nrea-member-systems
[272] Nebraska Rural Electric Association. (n.d.). About NREA. Retrieved from https://www.nrea.org/about

Location

Power outages, temporary or long-term, could occur anywhere within the Lower Elkhorn planning area. Their impact could range from extremely localized (a few city blocks,) up to a regional power outage that spans multiple counties.

Figure 48 outlines the NREA Member Systems and their various headquarters and power districts.

Figure 48: NREA Member Systems[273]



Extent

A power outage may disrupt communications, water, and transportation; close retail businesses, grocery stores, gas stations, ATMs, banks, and other services; cause food spoilage and water contamination; and prevent use of medical devices.[274]

A temporary outage may only be a minor convenience, leading to a temporary disruption of services. Many pieces of critical infrastructure (e.g. fire stations, hospitals,) have backup generators to supply power during such an event. A longer-term, extended power outage poses a significant threat, both economically and in terms of health and safety. Considering past events, the majority of power outages are resolved promptly.

As per the Nebraska State Hazard Mitigation Plan, no local plans identified jurisdictional vulnerabilities or potential losses related to power failure.[275]

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[273] Nebraska Rural Electric Association. (n.d.). NREA Member Systems. Retrieved from https://www.nrea.org/nrea-member-systems

[274] Ready. (2023). Power Outages. Retrieved from https://www.ready.gov/power-outages.

[275] Nebraska State Hazard Mitigation Plan (2021). Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf

Historical Frequency

Power outages are a fairly regular, yearly occurrence within Nebraska. The most notable, recent widespread power interruption occurred during June of 2022. Due to severe weather, there was a loss of power to more than 50,000 people across Kansas, Missouri, and Nebraska.[276] Small-scale power outages likely occurred but were remedied promptly.

Table 125 outlines electrical disturbances that included Nebraska from 2018-2023 that included the loss of power to customers.

Table 125: Electric Disturbance Events in Nebraska (2018-2023)[277]

Date Began	Date Restored	Location	Event Type	Demand Loss (Megawatts)	Customers Affected
01/12/2019	Unknown	Missouri: Nebraska:	Severe Weather	Unknown	116600
01/18/2019	01/19/2019	Nebraska:	Transmission Interruption	8	Unknown
04/02/2020	04/02/2020	Nebraska: York County;	Transmission Interruption	5	Unknown
08/20/2020	08/20/2020	Nebraska: Custer County;	Transmission Interruption	60	Unknown
02/14/2021	02/18/2021	North Dakota: South Dakota: Nebraska: Kansas: Oklahoma: Texas:	Severe Weather	3000	Unknown
02/15/2021	Unknown	Nebraska: Lancaster County;	Fuel Supply Deficiency	613	Unknown
02/16/2021	02/16/2021	Nebraska: Douglas County, Burt County, Washington County, Dodge County, Colfax County, Saunders County, Sarpy County, Cass County, Otoe County, Johnson County, Nemaha County, Pawnee County, Richardson County;	Severe Weather	126	81100
02/16/2021	02/16/2021	Nebraska: Custer County;	Transmission Interruption	31	Unknown
07/10/2021	07/10/2021	Nebraska: Missouri:	Severe Weather/Transmission Interruption	Unknown	211500
07/10/2021	07/10/2021	Nebraska:	Severe Weather	Unknown	188000
07/10/2021	07/10/2021	Missouri: Nebraska:	Severe Weather/Transmission Interruption	Unknown	212500
12/15/2021	12/15/2021	Nebraska: Burt County;	System Operations	5	Unknown
06/08/2022	06/08/2022	Kansas: Missouri: Nebraska:	Severe Weather	Unknown	62000
08/15/2022	08/16/2022	Wyoming: Nebraska:	Transmission Interruption	0	5000

[276] Department of Energy. (n.d.). Electric Disturbance Events. (OE-417) Annual Summaries (2022). Retrieved from https://www.oe.netl.doe.gov/OE417_annual_summary.aspx

[277] United States Department of Energy. (n.d.). Electric Disturbance Events (OE-417) Annual Summaries. Retrieved from https://www.oe.netl.doe.gov/OE417_annual_summary.aspx.

Probability and Frequency

The probability of power outages increases during inclement weather (e.g., severe thunderstorms and winter weather). However, Public Safety Power Shutoffs (PSPS) may occur during extreme weather conditions that can result in a wildfire to prevent the electric system from becoming a potential source of ignition. The wildfire season usually extends from early summer through mid-autumn. However, in recent years, the threat of wildfires now extends year-round.[278] A PSPS is a last resort measure to temporarily turn off power. Factors considered before issuing a PSPS are high winds, dry vegetation, temperature, low humidity levels, red flag warnings, real-time observations from the field, and collaboration with local, state, and regional agencies.

Vulnerability and Impact

The following table provides information related to regional vulnerabilities; for jurisdictional- specific vulnerabilities, refer to *Volume II*.

Life Safety and Health: Power outages can impact life safety and health in a number of ways. Winter weather and extreme heat events can significantly impact the electrical grid and result in a power outage. If a power outage occurs during winter weather, this means that households will not have access to heat which can result in hypothermia. Meanwhile, if a power outage is a result of extreme heat, the population will be unable to appropriately cool homes which can result in heat-related illness. Inability to regulate your body temperature can result in death.

Furthermore, people who are electrically dependent have are extremely vulnerable and individuals who have medication that requires refrigeration are at risk of having to dispose of it. Water purification systems may not be fully functional in the event of a power outage causing drinkable water to become unsafe. Additionally, individuals are likely to use items such as generators and camping stoves. This leads to regular accidental deaths. In general, excess mortality may increase during a prolonged power outage (as was demonstrated in an incident in New York).[279]

Property Damage and Critical Infrastructure: The energy sector is one of the 16 critical infrastructure sectors, and it protects a multifaceted web of electricity, oil, and natural gas resources to maintain a steady energy supply and ensure the overall health and wellness of the United States. A power outage means there has been a disruption to the critical infrastructure and potential effects could be experienced in other critical infrastructure sectors. For example, law enforcement, fire, and emergency medical services will be impacted indirectly by a loss of systems (e.g., data and communications, street and traffic lighting, alarm) and directly by increased calls for service. Emergency response may be adversely affected due to a lack of electric power to fuel pumps at fleet operations centers and service stations.

Economy: In the event of a power outage, economic services usually are paused. Ordinarily, the outage would be temporary, and economic losses would be limited. However, if a widescale blackout occurs, significant economic damage could occur. This includes losses due to tourism, overall business shutdowns, and more. Due to the large agricultural economy in the planning area, other impact areas include the lack of

[278] Nebraska Department of Environment and Energy. (n.d.). Wildfires and Impacts in Nebraska. Retrieved from http://dee.ne.gov/NDEQProg.nsf/OnWeb/AirSA-3

[279] Anderson, G. B. and Bell, M. L. (2013). Lights out: Impact of the August 2003 Power Outage on Mortality in New York, NY. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3276729/.

harvesting or processing agricultural products, accepting or sending deliveries of products, and related economic activities dependent on electrical infrastructure. The income of individuals at affected locations may be severely impacted, leading to minor, or significant economic hardship.

Changes in Development and Impact of Future Development: Future developments would not be impacted by power outages. However, adding mitigation measures to the Lower Elkhorn planning area's resources, and infrastructure may be appropriate to become more resilient in the event of a power outage.

Underserved and At Risk Population: The elderly, electrically dependent individuals, those dependent on medication that requires refrigeration, and those vulnerable to excessive heat and extreme cold are more at risk during a power outage. Additionally, neighborhoods where the underserved community lives tend to have older, less reliable electric infrastructure making them more vulnerable to power outages.[280] Those more vulnerable to economic disruption are at a higher risk of impact due to economic fallout due to a temporary or extended power outage.

Effects of Climate Change in Severity of Impacts: As global average temperatures continue to rise, extreme winter weather events with more winter precipitation (e.g., ice and snow), extreme heat events, and wildfires can be expected. All of which can increase the risk of power outages.

FEMA NRI Expected Annual Loss Estimates

The FEMA NRI estimated annual loss data does not include power outages.

Total Risk Score

Table 126 represents the Power Loss Total Risk Score for the Lower Elkhorn planning area, based on the Risk Assessment Methodology, as defined in this Plan.

Table 126: Power Loss Total Risk Score

Power Loss Total Risk Score						
Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Power Loss	3	8	12	28	48	73
Consequence: Sum of all weighted factors. *Extent: Sum of the weighted Extent factors.* *Vulnerability: Sum of the weighted Vulnerability factors.*				*Impact: Sum of the weighted Impact factors.* *Total Risk Score = Probability x Consequence* ** Normalized to 100*		
Total Risk Score Legend						
Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 50

[280] Foster, J. (2022). Too Many Blackouts: How Underserved Communities are Making Utilities Listen. Retrieved from https://vitalsigns.edf.org/story/too-many-blackouts-how-underserved-communities-are-making-utilities-listen.

Power Loss Total Risk Score						
Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	51 – 75
The legend—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The Consequence Score represents the sum of the Extent, Vulnerability, and Impact Factors. The Total Risk Score is a measure of Probability and Consequence.						

Public Health Emergency

Hazard Description

A public health emergency is a widespread and/or severe epidemic, incident of contamination or other situation that presents a danger to, or otherwise negatively impacts, the general health and well-being of the public. Public health emergencies can result from several causes such as food borne illness, waterborne pathogens, loss of sewer/water service and epidemics of communicable diseases. In recent years, the risk of a public health emergency resulting from an intentional release of a chemical, biological, or radiological agent has become more apparent. Pandemic influenza represents one of the greatest threats within this hazard category, and historically has had devastating impacts globally. For the purpose of this plan, pandemic-level health emergencies will remain the focus, as they are the most likely pathogen to cause the next pandemic.[281]

While not an influenza strain, COVID-19 demonstrated the immense effects a pandemic can have on society as a whole. A public health emergency may or may not deal with a contagious disease. Diseases that can spread from person-to-person contact include influenza, yellow fever, smallpox, measles, polio, and others. Additional pathogens that are not contagious but have the potential to cause outbreaks, include the West Nile Virus, Salmonella contamination, and intentional contamination of food or water supplies.

The following table outlines the differences between localized disease outbreaks and widespread infection, otherwise known as a pandemic.

Table 127: Disease Spread Definitions[282]

Spread Severity	Definition
Endemic	A disease that belongs to a particular people or country.
Outbreak	A greater-than-anticipated increase in the number of endemic cases. It can also be a single case in a new area. If it's not quickly controlled, an outbreak can become an epidemic.
Epidemic	A disease that affects a large number of people within a community, population, or region.
Pandemic	An epidemic that's spread over multiple countries or continents.

The most effective strategy to combating pandemic influenza is vaccination. However, since a pandemic is caused by a novel strain, it is likely vaccines will not be available for the first wave and sometimes not until the middle of the second wave. Alternate strategies for mitigation include the use of antiviral medication, antibiotics for bacterial pneumonia often associated with influenza, social distancing, and public health hygienic practices.

Location

There is no geographic location for this hazard, beyond that outbreaks typically begin in areas with high populations. In contrast to seasonal influenza when it occurs during the late fall and early winter months,

[281] World Health Organization. (n.d.). Preparing for Pandemics. Retrieved from https://www.who.int/westernpacific/activities/preparing-for-pandemics

[282] Intermountain Health. (2023.) What's the difference between a pandemic, an epidemic, endemic, and an outbreak? Retrieved from https://intermountainhealthcare.org/blogs/whats-the-difference-between-a-pandemic-an-epidemic-endemic-and-an-outbreak

pandemic influenza can occur during any month or season. The entirety of the Lower Elkhorn planning area should be considered at risk.

Extent

Although the likelihood of another pandemic is a certainty, their frequency is difficult to predict. In the 20th century, there were three influenza pandemics. In the 21st century, there has been one to date. Pandemic influenza is characterized based on its ability to spread, not its virulence. Pandemics in the past have ranged from severe to mild.

Table 128 illustrates the influenza pandemic phases from the World Health Organization.

Table 128: World Health Organization Pandemic Phases[283]

Pandemic Phases	Definition
Phase 1	No viruses circulating among animals have been reported to cause infections in humans.
Phase 2	An animal influenza virus circulating among domesticated or wild animals is known to have caused infection in humans, and is therefore considered a potential pandemic threat.
Phase 3	An animal or human-animal influenza reassortant virus has caused sporadic cases or small clusters of disease in people, but has not resulted in human-to-human transmission sufficient to sustain community-level outbreaks. Limited human-to-human transmission may occur under some circumstances, for example, when there is close contact between an infected person and an unprotected caregiver. However, limited transmission under such restricted circumstances does not indicate that the virus has gained the level of transmissibility among humans necessary to cause a pandemic.
Phase 4	Characterized by verified human-to-human transmission of an animal or human-animal influenza reassortant virus able to cause "community-level outbreaks". The ability to cause sustained disease outbreaks in a community marks a significant upwards shift in the risk of a pandemic. Any country that suspects or has verified such an event should urgently consult with WHO so that the situation can be jointly assessed and a decision made by the affected country if implementation of a rapid pandemic containment operation is warranted. Phase 4 indicates a significant increase in risk of a pandemic but does not necessarily mean that a pandemic is a forgone conclusion.
Phase 5	Characterized by human-to-human spread of the virus into at least two countries in one WHO region. While most countries will not be affected at this stage, the declaration of Phase 5 is a strong signal that a pandemic is imminent and that the time to finalize the organization, communication, and implementation of the planned mitigation measures is short.
Phase 6	Characterized by community level outbreaks in at least one other country in a different WHO region in addition to the criteria defined in Phase 5. Designation of this phase will indicate that a global pandemic is under way.
Post-Peak Period	Pandemic disease levels in most countries with adequate surveillance will have dropped below peak observed levels. The post-peak period signifies that pandemic activity appears to be decreasing; however, it is uncertain if additional waves will occur and countries will need to be prepared for a second wave.
Post-Pandemic Period	Influenza disease activity will have returned to levels normally seen for seasonal influenza. It is expected that the pandemic virus will behave as a seasonal influenza A virus. At this stage, it is important to maintain surveillance and update pandemic preparedness and response plans accordingly. An intensive phase of recovery and evaluation may be required.

[283] Pandemic Influenza Preparedness and Response: A WHO Guidance Document. (2009.) The WHO Pandemic Phases. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK143061/

Historical Frequency

Three pandemics occurred in the 20th century: 1918, 1957 and 1968. While two occurred in the 21st century: 2009, and 2019. A notable public health emergency in addition to COVID-19 during 2019 was the outbreak of Mumps at a wedding in Nebraska.

1918 (Spanish Flu)-The influenza pandemic of 1918-1919 was one of the deadliest epidemics in history, causing influenza-related symptoms in more than 20 percent of the world's population and claiming more than 21 million lives worldwide. It spread along trade routes and shipping lines. Outbreaks swept through North America, Europe, Asia, Africa, Brazil, and the South Pacific. The Great War (i.e., World War I), with its mass movements of men in armies and aboard ships, probably aided in its rapid diffusion and attack. The origins of the deadly flu disease were unknown but widely speculated upon. Some of the allies thought of the epidemic as a biological warfare tool of the Germans. Many thought it was a result of trench warfare, the use of mustard gases and the generated "smoke and fumes" of the war. A national campaign began using the ready rhetoric of war to fight the new enemy of microscopic proportions. A study attempted to reason why the disease had been so devastating in certain localized regions, looking at the climate, the weather, and the racial composition of cities. They found humidity to be linked with more severe epidemics.

1957 (Asian Pandemic Flu-H2N2)-The 1957 Asian Flu Pandemic was much milder than that of the 1918 occurrence. The global death toll was estimated to be around 2 million. In 1957, the Asian flu pandemic resulted in about 70,000 deaths in the United States. Immunity to this strain was rare in people less than 65 years of age, and a pandemic was predicted. In preparation, vaccine production began in late May 1957, and health officials increased surveillance for flu outbreaks. The 1957 pandemic is instructive in that the first US cases occurred in June, but no community outbreaks occurred until August and the first wave of illness peaked in October. The 1957 pandemic was associated with the emergence and spread of the H2N2 virus (this virus subtype stopped circulating in 1968). Vaccine was available in limited supply by August 1957.

1968 (Hong Kong Flu-H3N2)-The 1968 pandemic was milder than that of 1957, and spread more slowly than previous pandemics, apart from in the Unites States, where it was introduced by troops returning home from Vietnam. There the disease spread from California to the rest of America in just three months, affecting mostly the very old and those with underlying medical conditions. But in Europe symptoms were relatively mild, and the death count not as high as in previous epidemics. Between one and four million people are estimated to have died worldwide, and around 30,000 people were killed in England and Wales. Some experts believe the 1968 pandemic may have been milder than the previous two because those exposed to the 1957 strain may have built up a partial protection against the virus.

2009 (Swine Flu-H1N1)**-**H1N1 was first detected in the United States in April 2009. This virus was a unique combination of influenza virus genes never previously identified in either animals or people. The virus genes were a combination of genes most closely related to North American swine-lineage H1N1 and Eurasian lineage swine-origin H1N1 influenza viruses. Because of this, initial reports referred to the virus as a swine origin influenza virus. However, investigations of initial human cases did not identify exposures to pigs and quickly it became apparent that this new virus was circulating among humans and not among U.S. pig herds. The CDC estimates about 55 million people were infected, 246,000 H1N1-related hospitalizations, and 11,160 H1N1-related deaths in 2009.

2019 (Multistate Mumps Outbreak- Nebraska Origin)-On August 26, 2019, the Nebraska Department of Health and Human Services (NDHHS) was notified by a South Dakota hospital of three suspected mumps cases (awaiting laboratory confirmation) in patients who had attended a wedding in Nebraska on August 3. On August 28, an attendee list including 176 families (approximately 325 attendees) was obtained from the bride. She identified 25 wedding attendees that she believed to be ill, including an attendee who developed symptoms <24 hours after the wedding and 15 days before symptom onset in the next earliest ill person identified. Attendees on the list resided in 14 states: Arizona, Arkansas, Colorado, Georgia, Idaho, Iowa, Kansas, Minnesota, Nebraska, North Dakota, Oklahoma, Pennsylvania, South Dakota, and Wyoming. That same day, NDHHS issued an alert and call for cases using Epi-X to public health partners nationwide that emphasized the potential for the outbreak to reach to multiple states. The following day, statewide Health Alert Network advisories were sent to providers in Nebraska and South Dakota, and a media statement was released in Nebraska.[284]

2019 (The Coronavirus of 2019 (COVID19)) – The Coronavirus of 19 began in December 2019 and originated in China, spreading globally within three months. The virus was new, no one had immunity and there was no medication to cure it or vaccination to prevent it from spreading. COVID 19 is spread person to person through droplets or aerosols, airborne transmission, or surface transmission. In the beginning phase, many were hospitalized, and fatalities skyrocketed, death rates globally were unprecedented. The best solution before the vaccine was made available, was to slow/stop the movement of people. This resulted in mandatory stay-at-home orders. Schools for all grade levels transitioned to fully online and all non-essential business were closed for prolonged periods of time. The global economy tanked and there was a supply shortage in personal protective equipment, anything related to sanitizing areas, and food. There has also been a shortage of employees because front line workers experienced burnout from working 24 hours, 7 days a week, high rates of fatality in some communities, and the increase of entrepreneurship for internet-based businesses and remote jobs that allow people to travel and work anywhere in the world. As of March 23, 2023, the World Health Organization reported 761,071,826 confirmed cases of COVID-19, including 6,879,677 deaths. COVID was declared a disaster in Nebraska on April 4th, 2020, and a state of emergency was activated. The declaration ended on May 11th, 2023.[285]

Probability and Frequency

Public health emergencies have occurred before, and recently. Therefore, they should be considered to be a medium level of probability. Outbreaks of pathogens are highly variable and unpredictable. Some pandemic events of the past have even been globally significant, particularly the Spanish flu pandemic incident of 1918 and the Coronavirus disease outbreak of 2019.

Vulnerability and Impact

The following table provides information related to regional vulnerabilities; for jurisdictional- specific vulnerabilities, refer to *Volume II*.

[284] Donahue M, Hendrickson B, Julian D, et al. Multistate Mumps Outbreak Originating from Asymptomatic Transmission at a Nebraska Wedding — Six States, August–October (2019). MMWR Morb Mortal Wkly Rep 2020;69:666–669. DOI: http://dx.doi.org/10.15585/mmwr.mm6922a2. Retrieved from https://www.cdc.gov/mmwr/volumes/69/wr/mm6922a2.htm

[285] Nebraska Emergency Management Agency. (n.d.). COVID-19 Pandemic. Retrieved from https://nema.nebraska.gov/fema-dr-4521.php

Life Safety and Health: A public health emergency presents a direct threat to a population's safety and health. Depending on the disease or emergency, the effects on an individual's health will likely vary, ranging from minor to severe injury or death. This wide range was seen with COVID-19, as a notable number of individuals were asymptomatic; not presenting any symptoms or discomfort. On the other end of the spectrum, COVID-19 caused severe illness and death to the infected individuals.[286] The effects of a public health emergency may range from minor to severe illness. Vaccinations can reduce illness or death, but depending on the health emergency, may or may not be available at the time of the outbreak.

Property Damage and Critical Infrastructure: Infectious diseases and pandemics do not directly impact property damage and critical infrastructure. However, critical infrastructure may suffer from worker shortages due to a pandemic, leading to reduced services. Healthcare facilities may become overwhelmed due to the number of patients in a widespread public health emergency, leading to lack of care for affected individuals.

Economy: Depending on the scope and scale of the public health emergency, the impact to the economy may be extremely localized, or span over the entire nation over a long period of time. As demonstrated during the COVID-19 Pandemic, the economic impact may be extreme, leading to the loss of tens of millions of jobs and significant economic hardship.[287] However, if the public health emergency is largely contained and limited to a small area, the impact would be minimalized.

Changes in Development and Impact of Future Development: An infectious disease or pandemic would impact the planning area's current and future development by potentially slowing any planned expansions or maintenance projects. This could be due to decreased annual revenue and/or loss of personnel during a pandemic.

Underserved and At Risk Population: As with other disasters, pandemics can disproportionately affect underserved and at risk populations.[288] This may especially vary depending on the type of pathogen that is spreading. Lack of health care, support systems, and reliance on public transportation (increased risk of exposure to the infectious disease) are all additional factors that increase the risk to the underserved and at risk populations.

Furthermore, individuals with existing health conditions may be more susceptible to serious illness, even if the majority of the population only experiences mild symptoms. Special populations to consider are those with weakened immunity such as infants and the elderly, those with autoimmune disease, and individuals with respiratory complications. However, pandemics in the past have also affected those with healthy immunity such as young adults because of the massive immune response certain strains have generated.

Those most at risk for influenza in the planning area include:

- Children younger than 2 years old*
- Adults 65 years and older
- Pregnant women and women up to 2 weeks from end of pregnancy

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[286] National Institute of Health. (2023). Clinical Spectrum of SARS-CoV-2 Infection. Retrieved from https://www.covid19treatmentguidelines.nih.gov/overview/clinical-spectrum/

[287] Center on Budget and Policy Priorities. (2022). Tracking the COVID-19 Economy's Effects on Food, Housing, and Employment Hardships. Retrieved from https://www.cbpp.org/research/poverty-and-inequality/tracking-the-covid-19-recessions-effects-on-food-housing-and

[288] Madhav, N. et. al. (2017). Disease Control Priorities: Improving Health and Reducing Poverty (3rd Edition), Chapter 17 – Pandemics: Risks, Impacts, and Mitigation. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK525302/.

- People with certain chronic medical conditions (such as asthma, heart failure, chronic lung disease) and people with a weak immune system (due to illnesses such as diabetes and HIV)
- People younger than 19 years of age who are receiving long-term aspirin therapy
- Those who do not have medical insurance
- Non-English speakers

**Children who are 2 years through 4 years of age also have a higher rate of complications compared to older children, although the risk for these children is lower than the risk for children younger than 2 years.*

Effects of Climate Change in Severity of Impacts: Climate change has indirect impacts on infectious diseases and pandemics. As global average temperatures continue to rise, the reproduction rate, resilience, and distribution of vector-borne diseases (e.g., malaria, West Nile, Zika, Chikungunya) will increase.[289]

FEMA NRI Expected Annual Loss Estimates

The FEMA NRI estimated annual loss data does not include public health emergencies.

Total Risk Score

Table 129 represents the Public Health Emergency Total Risk Score for the Lower Elkhorn planning area, based on the Risk Assessment Methodology, as defined in this Plan.

Table 129 Public Health Emergency Total Risk Score

Public Health Emergency Total Risk Score						
Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Public Health Emergency	2	8	6	13	27	31
Consequence: Sum of all weighted factors. *Extent: Sum of the weighted Extent factors.* *Vulnerability: Sum of the weighted Vulnerability factors.*				*Impact: Sum of the weighted Impact factors.* *Total Risk Score = Probability x Consequence* ** Normalized to 100*		

Total Risk Score Legend						
Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 50
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	51 – 75
The legend—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The Consequence Score represents the sum of the Extent, Vulnerability, and Impact Factors. The Total Risk Score is a measure of Probability and Consequence.						

[289] Pan American Health Organization. (n.d.). Climate Change and Health. Retrieved from https://www.paho.org/en/topics/climate-change-and-health.

Severe Weather

Hazard Description

Severe Thunderstorms

Severe thunderstorms are common 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. The hazards produced by thunderstorms, for the purpose of this plan, will be described as Strong Winds, Tornadoes, Hail, and Lightning.

Thunderstorms can develop in fewer than 30 minutes and can grow to an elevation of eight miles into the atmosphere.[290] 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.

Economically, thunderstorms are generally beneficial in that they provide moisture necessary to support Nebraska's largest industry, agriculture. The majority of thunderstorms do not cause damage, but when they escalate to severe storms, 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.

Table 130 illustrates the severe thunderstorm outlook categories used by SPC when issuing Severe Thunderstorm Outlooks.

Table 130: National Weather Service Severe Weather Advisories[291]

Type	Description
Severe Thunderstorm Watch	Issued by the NOAA SPC when conditions are favorable for the development of severe thunderstorms in and close to the watch area. The size of the watch can vary depending on the weather situation. Severe thunderstorm watches are usually issued for a duration of four (4) to eight (8) hours. They are normally issued well in advance of the actual occurrence of severe weather.
Severe Thunderstorm Warning	Issued by the local NWS Forecast Office when either a severe thunderstorm is indicated by radar, or a spotter reports a thunderstorm producing hail one (1) inch or larger in diameter and/or winds equal or exceed 58 mph. Severe thunderstorm warnings are usually issued for a duration of one (1) hour. They can be issued without a Severe Thunderstorm Watch being already in effect. Severe thunderstorms can produce tornadoes with little or no advance warning.
Tornado Watch	Issued by the SPC when conditions are favorable for the development of tornadoes in and close to the watch area. The size of the watch can vary

[290] National Oceanic and Atmospheric Administration. (n.d.). Life Cycle of a Thunderstorm. Retrieved from https://www.noaa.gov/jetstream/thunderstorms/life-cycle-of-thunderstorm

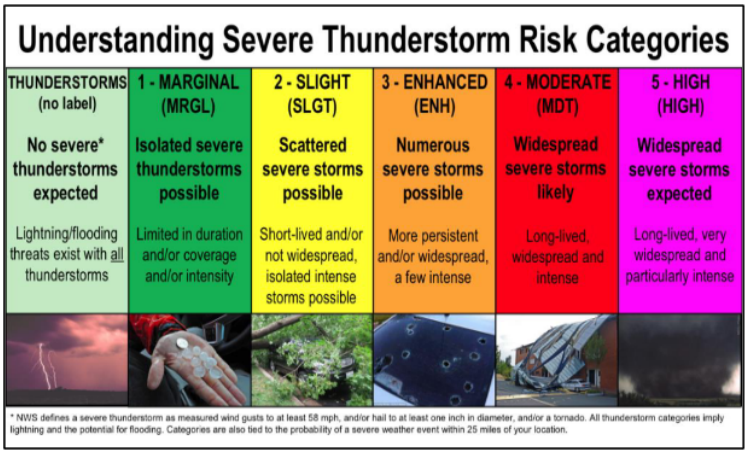
[291] National Weather Service. (n.d.). National Weather Service Glossary. Retrieved from https://w1.weather.gov/glossary/

Type	Description
	depending on the weather situation. Tornado watches are usually issued for a duration of four (4) to eight (8) hours. They are normally issued well in advance of the actual occurrence of tornadoes.
Tornado Warning	Issued by the local NWS Forecast Office when either a tornado is indicated by radar, or sighted by spotters. Tornado warnings are usually issued for a duration of around 30 minutes. They can be issued without a Tornado Watch being already in effect
Gale Watch	Issued by the local NWS Forecast Office for locations along the water when one (1) or both of the following conditions is possible to begin within 36 hours and is not directly associated with a tropical cyclone – sustained winds of 34 to 47 knots (39 to 55 mph) or frequent gusts (duration of two (2) or more hours) between 34 to 47 knots (39 to 55 mph).
Gale Warning	Issued by the local NWS Forecast Office for locations along the water when one (1) or both of the following conditions is expected to begin within 36 hours and is not directly associated with a tropical cyclone – sustained winds of 34 to 47 knots (39 to 55 mph) or frequent gusts (duration of two (2) or more hours) between 34 to 47 knots (39 to 55 mph). At this point, vessel need to be secure at port.

For details on NWS Houston/Galveston Outlook, Watch, Warning, and Advisory criteria, please visit the following link: https://www.weather.gov/hgx/WWA_criteria.

The following figure illustrates the different categories of severe thunderstorm risk.

Figure 49: Severe Thunderstorm Risk Categories[292]



- The categorical forecast specifies the level of the overall severe weather threat via numbers (e.g., 5), descriptive labeling (e.g., HIGH), and colors (e.g., magenta).
- The probabilistic forecast directly expresses the best estimate of a severe weather event occurring within 25 miles of a point.
- The categories: TSTM (light green) non-severe, 1-MRGL (dark green), 2-SLGT (yellow), 3-ENH (orange), 4-MDT (red) and 5-HIGH (magenta)
- SPC Severe Thunderstorm Risk Categories has an ENH category while WPC Excessive Rainfall Risk does not.
- Low probabilities due to the uncommon occurrence at any one location.
- Scale matches with shaded areas

[292] National Weather Service. (n.d.). Storm Prediction Center Severe Risk Categories. Retrieved from https://www.weather.gov/media/ewx/iwt/SPC_WPC_Differences.pdf

Strong Winds

High winds typically accompany severe thunderstorms, severe winter storms, 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.[69] The NWS issues High Wind Advisories when there are sustained winds of 25 to 39 miles per hour and/or gusts to 57 mph.

Most severe thunderstorm winds that cause damage at the ground are a result of outflow generated by the downdraft of a thunderstorm. **Table 131** outlines the different types of strong winds.

Table 131: Types of Strong Winds

Type	Description
Straight-line Wind	Term used to define any thunderstorm wind that is not associated with a rotation and is used mainly to differentiate from tornadic winds.
Downdraft	A small-scale column of air that rapidly winds towards the ground.
Macroburst	An outward burst of strong winds at or near the surface with horizontal dimensions larger than 2.5 miles and occurs when a strong downdraft reaches the surface. Macroburst winds may begin over a smaller area and then spread out over a wider area, sometimes producing damage similar to a tornado. Although usually associated with thunderstorms, macrobursts can occur with showers too weak to produce thunder.
Microburst	A small, concentrated downburst that produces an outward burst of strong winds at or near the surface. Microbursts are small (less than 2.5 miles across) and short-lived (five (5) to 10 minutes) with maximum windspeeds sometimes exceeding 100 mph. There are two (2) kinds of microbursts – wet and dry. A wet microburst is accompanied by heavy precipitation at the surface. Dry microbursts, common in places like the high plains and the intermountain west, occur with little or no precipitation reaching the ground.
Gust Front	The leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. Gust fronts are characterized by a wind shift, temperature drop, and gusty winds out ahead of a thunderstorm. Sometimes the winds push up air above them, forming a shelf cloud or detached roll cloud.
Derecho	A widespread, long-lived windstorm that is associated with a band of rapidly moving showers or thunderstorms. A typical derecho consists of numerous downbursts and downburst clusters. By definition, if the wind damage swath extends more than 240 miles and includes wind gusts of at least 58 mph or greater along most of its length, then the event may be classified as a derecho.
Haboob	A wall of dust that is pushed out along the ground from a thunderstorm downdraft at high speeds.

Tornado

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 over 100 miles and reach over 11 miles above ground. Tornadoes usually stay on the ground no more than 20 minutes. Nationally, the tornado season typically occurs between March and August. On average, 80 percent of tornadoes occur between noon and midnight.[293]

Tornadoes are among the most violent phenomena of all atmospheric storms and atmospheric scientists continue to conduct research to better understand how tornadoes form. Tornadoes come from mainly two (2) types of thunderstorms – supercell and non-supercell. [294]

Table 132 outlines the types of tornadoes.

Table 132: Types of Tornadoes[295]

Type	Description
Supercell	The most common and destructive tornadoes occur from supercells. A supercell is a rotating thunderstorm with a well-defined radar circulation called a mesocyclone. *Supercells can also produce damaging hail, severe non-tornadic winds, frequent lightning, and flash floods.* The rotating updraft from a supercell is the key development for a tornado. One way a column of air can begin to rotate is from wind shear when winds at two (2) different levels above the ground blow at different speeds or in different directions. Once the updraft is rotating and fed with warm moist air flowing in the ground level, a tornado can form.
Non-Supercell	Nearly 20% of all tornadoes are associated with lines of strong thunderstorms called quasi-linear convective systems (QLCS). QLCS tornadoes frequently occur during the late night and early morning hours. These tornadoes, however, tend to be weaker and shorter-lived on average than those associated with supercell thunderstorms. NOAA's National Severe Storms Laboratory (NSSL) researchers are looking for ways to detect QLCS tornadoes more effectively.

Another type of non-supercell tornado is a landspout. A landspout is a tornado with a narrow, rope-like condensation funnel that forms while the thunderstorm cloud is still growing and there is no rotating updraft - the spinning motion originates near the ground.

Nebraska has averaged 40 tornadoes/year from 2005-2020,[296] and ranks 11th in the most tornadoes in the United States (utilizing 2022 occurrences.)[297]

Hail

Hail is commonly associated with severe thunderstorms, and this association makes hail just as unpredictable as severe thunderstorms. Additionally, hail events in thunderstorms often occur in series, with one area having the potential to be hit multiple times in one day.

[293] Be Ready: United States Air Force. (n.d.). Tornadoes. Retrieved from https://www.beready.af.mil/Disasters-Emergencies/Natural-Disasters/Tornadoes/

[294] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Tornado Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/tornadoes/.

[295] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Types of Tornadoes. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/tornadoes/types/.

[296] University of Nebraska-Lincoln. Lincoln Weather and Climate. (n.d.). Nebraska Monthly Tornadoes. Retrieved from https://lincolnweather.unl.edu/nebraska-monthly-tornadoes

[297] World Population Review. Tornado Alley States 2023. (n.d.). Tornadoes 2022. Retrieved from https://worldpopulationreview.com/state-rankings/tornado-alley-states

Severe thunderstorms in the planning area usually occur in the evening during the spring and summer months. These, often large, storms can include heavy rain, hail, lightning, and high winds. Severe thunderstorms can also produce tornadoes with little or no advanced warning. Furthermore, hail can destroy property and crops with sheer force, as some hail stones can fall at speeds up to 100 mph.

While the moisture from thunderstorms associated with hail events can be beneficial, when thunderstorms do produce hail, there is potential for crop losses, property losses due to building and automobile damages, and personal injury from people not seeking shelter during these events or standing near windows. The potential for damage increases as the size of the hail increases.

There is much uncertainty in the average speed hail falls; however, the National Oceanic and Atmospheric Administration (NOAA) developed the estimates shown on **Table 133.**

Table 133: Hail Speed Estimates[298]

Hail Size (inches)	Fall Speed (mph)
Less than 1	9 – 25
1 – 1.75	20 – 40
2 – 4	44 – 72
4 or greater	Over 100

Lightning

Lightning is a giant spark of electricity in the atmosphere between clouds, the air, or the ground and it is one of the oldest observed natural phenomena on Earth. Initially, air acts as an insulator between the negative and positive charges in the cloud and between the cloud and the ground. Once the opposite charges build up enough, the insulating capacity of the air breaks and a rapid electricity discharge occurs resulting in lightning. The flash equalizes the charged regions in the atmosphere until opposite changes build up again. The energy from a lightning channel briefly heats the air to around 50,000 degrees Fahrenheit.[299]

Most of the time, lightning begins inside a thunderstorm and travels through the clouds. The lightning can stay within the cloud (i.e., intra-cloud lightning) or continue to travel through the open air and eventually make contact with ground or tall objects (e.g., trees and skyscrapers). There are about five (5) to 10 times as many flashes that remain in the cloud versus how many make it to the ground. Additionally, lightning can strike in locations where it is not raining or before rain reaches the ground; and it can even be seen in volcanic eruptions, extremely intense forest fires, surface nuclear detonations, and heavy snowstorms.[300]

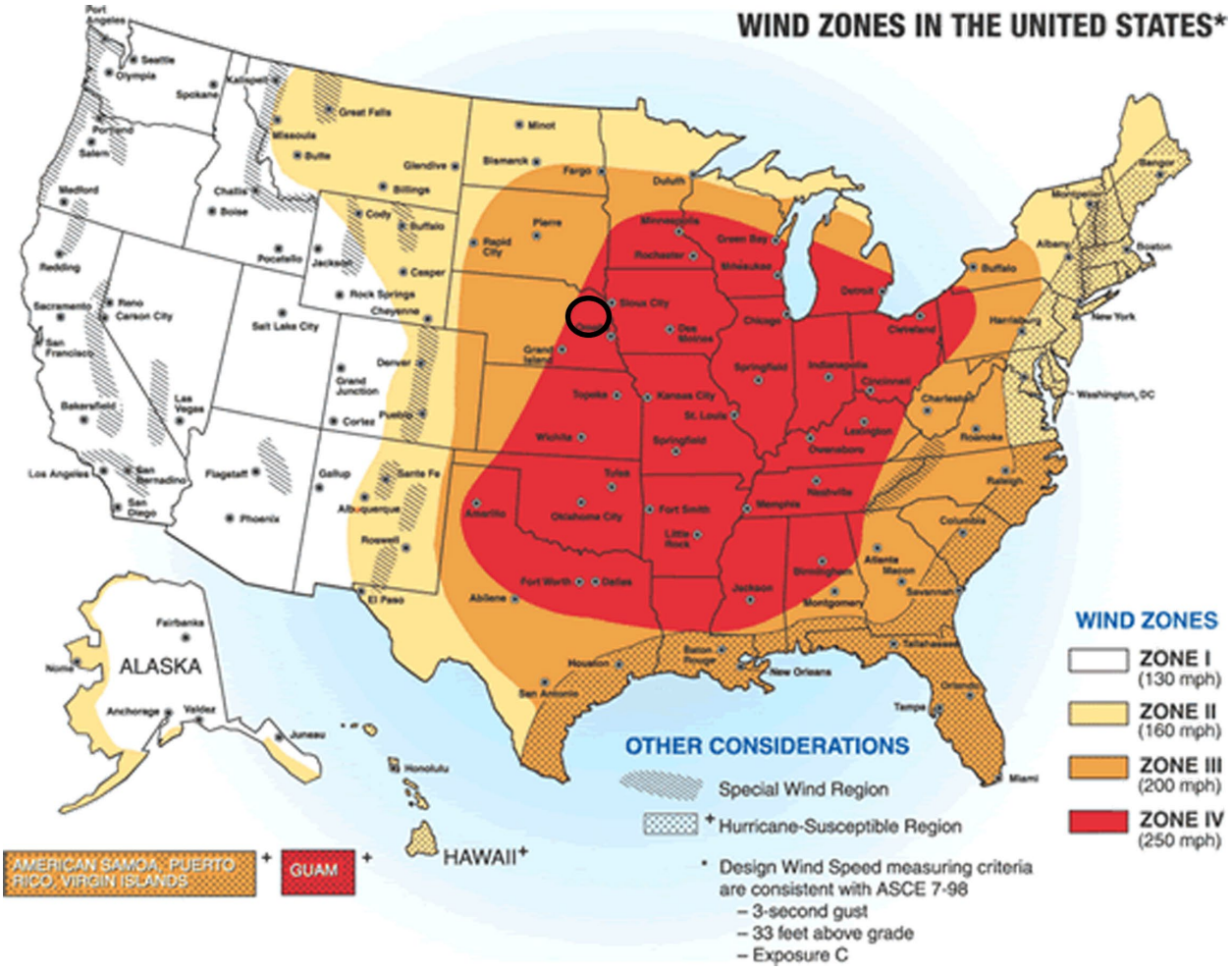
Location

The entire planning area is at risk of severe weather (Strong Winds, Tornadoes, Hail, and Lightning.) Maps for Wind Zone and Tornadoes are listed below.

Figure 50 illustrates the Wind Zones within the United States. The planning area is located within Zone III/IV which has maximum winds of 250 mph equivalent to an EF5 tornado.

[298] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Hail Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/hail/.
[299] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Lightning Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/lightning/.
[300] Ibid.

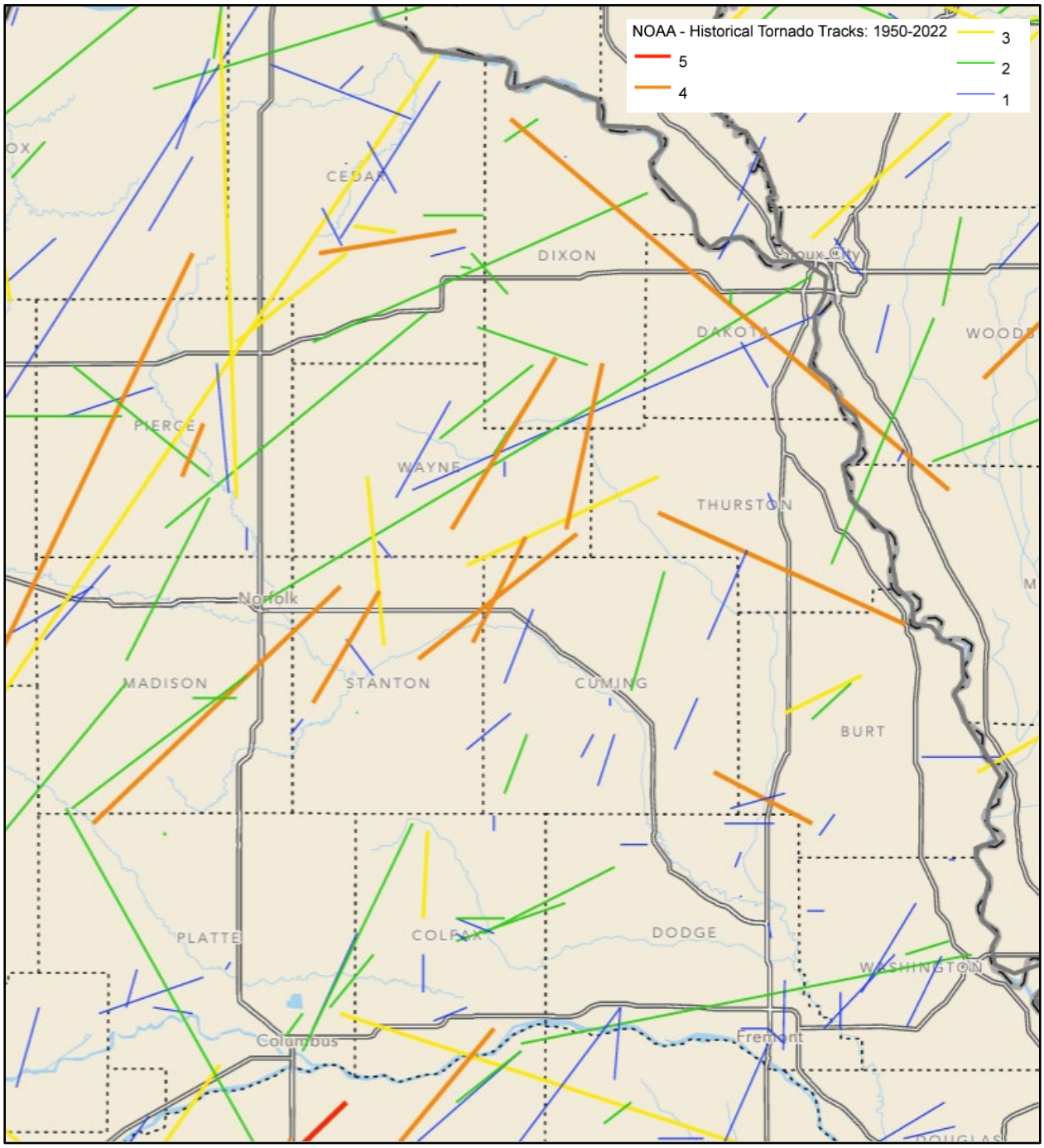
Figure 50: Wind Zones in the United States[301]



The impacts of tornadoes in particular would likely be greater in more densely populated areas. The following map shows the historical track locations across the region from 1950 to 2022. Note that this map shows tornado tracks for EF-0 and EF-4.

[301] National Institute of Standards and Technology. (2011). FEMA. Wind Zone Map. Retrieved from https://www.nist.gov/image/windzonemapjpg

Figure 51: Historic Tornado Tracks (1950-2022)

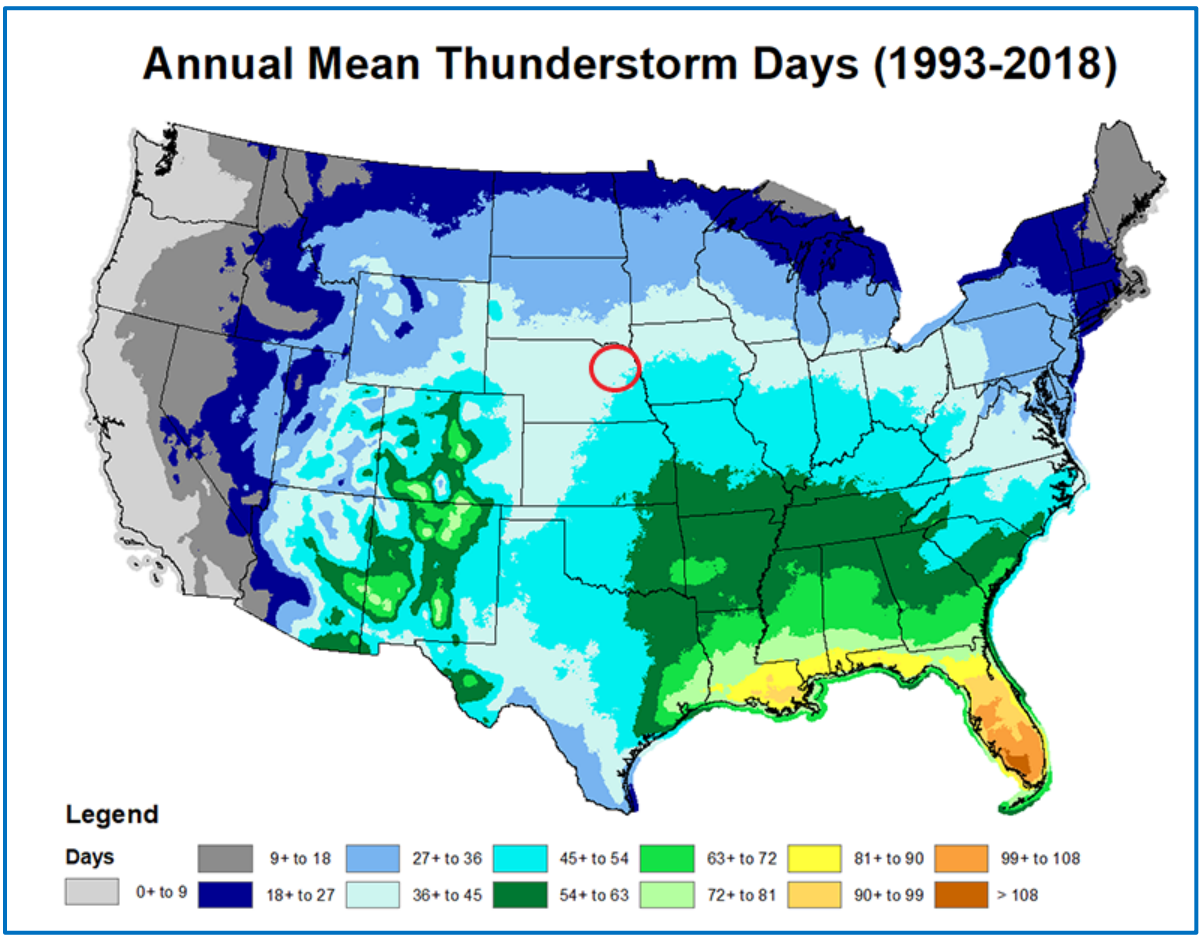


Extent

The geographic extent of severe weather event may be large enough to impact the entire planning area. Severe thunderstorms (of which the previously listed hazards are largely produced from) can exist in a few forms such as in the case of a squall line, derecho, or long-lived supercell, and cover an extremely wide area 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 wind gusts of 58 mph or higher.[302] **Figure 52** displays the annual mean thunderstorm days across the country each year. The planning area experiences an average of forty to fifty thunderstorms over the course of one year.

Figure 52: Annual Mean Thunderstorm Days[303]



Strong Winds

The Beaufort Wind Scale was developed to estimate and report wind speeds when a measuring apparatus is not available (e.g, open sea). It was invented in 1805 by Sir Francis Beaufort of the British Navy as a way to interpret wind conditions at sea. Since then, the scale has been modified to include the effects on land. **Figure 53** outlines the 13 force-classifications that comprise the Beaufort Wind Scale.

[302] National Weather Service. (n.d.). What Constitutes a Severe Thunderstorm? Retrieved from https://www.weather.gov/bmx/outreach_svr

[303] National Oceanic and Atmospheric Administration. (n.d.). Thunderstorms: Introduction to Thunderstorms. Retrieved from https://www.noaa.gov/jetstream/thunderstorms

Figure 53: Beaufort Wind Scale[304]

Force	Wind	Classification	On the Water	On Land
0	< 1	Calm	Sea surface smooth and mirror-like.	Calm, smoke rises vertically.
1	1 – 3	Light Air	Scaly ripples and no foam crests.	Smoke drift indicates wind direction and still wind vanes.
2	4 – 6	Light Breeze	Small wavelets, crests glassy, and no breaking.	Wind felt on face, leaves rustle, and vanes begin to move.
3	7 – 10	Gentle Breeze	Large wavelets, crests begin to break, and scattered whitecaps.	Leaves and small twigs constantly moving, and light flags extended.
4	11 – 16	Moderate Breeze	Small waves of one (1) to four (4) feet becoming longer with numerous whitecaps.	Dust, leaves, and loose paper lifted, and small tree branches move.
5	17 – 21	Fresh Breeze	Moderate waves of four (4) to eight (8) feet taking longer form, many whitecaps, and some spray.	Small trees and leaves begin to sway.
6	22 – 27	Strong Breeze	Larger waves of eight (8) to 13 feet, whitecaps are common, and more spray.	Larger tree branches moving and whistling in wires.
7	28 – 33	Near Gale	Sea heaps up, waves are 13 to 19 feet, white foam streaks off breakers.	Whole trees moving and resistance felt walking against wind.
8	34 – 40	Gale	Moderately high waves (18 to 25 feet) of greater length, edges of crests begin to break into spindrift, and foam blown in streaks.	Twigs breaking off trees and generally impedes progress.
9	41 – 47	Strong Gale	High waves (23 to 32 feet), sea begins to roll, dense streaks of foam, and spray may reduce visibility.	Slight structural damage occurs, and slate blows off roofs.
10	48 – 55	Storm	Very high waves (29 to 41 feet) with overhanging crests, sea white with densely blown foam, heavy rolling, and lowered visibility.	Seldom experienced on land, trees broken or uprooted, and considerable structural damage.
11	56 – 63	Violent Storm	Exceptionally high waves (37 to 52 feet), foam patches cover sea, and visibility more reduced.	--
12	> 63	Hurricane	Air filled with foam, waves over 45 feet, sea completely white with driving spray, and visibility greatly reduced.	See Saffir-Simpson Hurricane Wind Scale.

Tornadoes

Tornado rating, based on the Enhance Fujita Scale (EF Scale), is assigned after tornado-related damage is surveyed. The EF Scale is based on the estimated wind speeds and related damage. **Table 134** outlines the EF Scale. When tornado damages are surveyed, they are compared to a list of Damage Indicators and Degrees of Damage which help to better estimate the range of wind speeds the tornado likely produced. The EF Scale was revised from the original Fujita Scale and became operational in February 2007.

[304] National Weather Service. (n.d.). Beaufort Wind Scale. Retrieved from https://www.spc.noaa.gov/faq/tornado/beaufort.html

Table 134: Enhanced Fujita Scale[305]

EF Rating	3 Second Gust (mph)
0	65 – 85
1	86 – 110
2	111 – 135
3	136 – 165
4	166 – 200
5	Over 200

Table 135: Enhanced Fujita Scale Damage Indicator[306]

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 home	17	Low-rise (1-4 story) bldg.
4	Double-wide mobile home	18	Mid-rise (5-20 story) bldg.
5	Apartment, condo, townhouse (3 stories or less)	19	High-rise (over 20 stories)
6	Motel	20	Institutional bldg. (hospital, govt. or university)
7	Masonry apartment or motel	21	Metal building system
8	Small retail bldg. (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 bldg.	26	Free standing pole (light, flag, luminary)
13	Automobile showroom	27	Tree - hardwood
14	Automotive service building	28	Tree - softwood

Hail

Hail can vary in shapes and sizes, and only the very large hailstones pose a serious risk to life safety. NWS reports hail size by comparing the hailstone with traditional object to size conversion for assessment and translation of severe hail reports. **Table 136** lists the traditional conversion of hail size descriptions.

Table 136: Converting traditional Hail Size Descriptions[307]

Hail Size (inches)	Object Analog Reported
0.25	Pea
0.50	Mothball
0.75	Penny
0.88	Nickel
1.00	Quarter
1.50	Walnut, ping pong
1.75	Golf ball
2.50	Tennis ball
2.75	Baseball

[305] National Weather Service. (n.d.). The Enhance Fujita Scale (EF Scale). Retrieved from https://www.weather.gov/oun/efscale

[306] National Weather Service. (n.d.). The Enhance Fujita Scale (EF Scale). Retrieved from https://www.weather.gov/oun/efscale

[307] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Hail Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/hail/

3.00	Teacup
4.00	Softball
4.50	Grapefruit

Additionally, the TORRO Hailstorm Intensity scale is utilized to categorize and measure hailstorms, using a 0-10 scale to classify the damage as shown in **Figure 54**.

Figure 54: TORRO Hailstorm Intensity Scale (H0 to H10)[308]

Scale	Intensity category	Typical hail diameter (mm)*	Probable kinetic energy J m^{-2}	Typical damage impacts
H0	Hard hail	5	0-20	No damage
H1	Potentially damaging	5-**15**	>20	Slight general damage to plants, crops
H2	Significant	10-**20**	>100	Significant damage to fruit, crops, vegetation
H3	Severe	20-**30**	>300	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	25-**40**	>500	Widespread glass damage, vehicle bodywork damage
H5	Destructive	30-**50**	>800	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	40-**60**		Bodywork of grounded aircraft dented, brick walls pitted
H7	Destructive	50-**75**		Severe roof damage, risk of serious injuries
H8	Destructive	60-**90**		(Severest recorded in the British Isles) Severe damage to aircraft bodywork
H9	Super Hailstorms	75-**100**		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	>100		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

* Approximate range (typical maximum size in bold), since other factors (e.g. number and density of hailstones, hail fall speed and surface wind speeds) affect severity.

Lightning

Lightning is measured by activity level. **Table 137** illustrates the Lightning Activity Levels (LAL) utilized by the National Weather Service. The scale is labeled 1-6.

Table 137: Lightning Activity Level Scale (LAL)[309]

Scale	Description
LAL 1	No thunderstorms
LAL 2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud to ground strikes in a five minute period.
LAL 3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud to ground strikes in a 5 minute period.
LAL 4	Scattered thunderstorms. Moderate rain is commonly produced Lightning is frequent, 11 to 15 cloud to ground strikes in a 5 minute period.
LAL 5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater then 15 cloud to ground strikes in a 5 minute period.

[308] The Tornado and Storm Research Organization. (n.d.). Retrieved from https://www.torro.org.uk/research/hail/hscale

[309] National Weather Service. (n.d.). Lightning Activity Level (LAL). Retrieved from https://graphical.weather.gov/definitions/defineLAL.html

LAL 6	Dry lightning (same as LAL 3 but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag Warning.

Historical Frequency

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, especially due to the often multiple hazards produced. As detailed in **Table 138** the NCEI reports a total of 423 Severe Weather events (Thunderstorm/Strong Wind, Tornado, & Lightning) in the planning area during a 3-year period, from January 2020 to November 2023. Notably, during July of 2023, a significant damaging windstorm swept across eastern Nebraska. The storm produced a few embedded tornadoes. Their strength ranged from EF-0 to a strong EF-2. No injuries or fatalities were reported.[310]

Table 138: Severe Weather (2020-2023)[311]

Location	County / Zone	State	Date	Type	Death	Injury	Property Damage	Crop Damage
Bazile Mills	Knox Co.	NE	5/5/2020	Hail	0	0	0.00K	0.00K
Tilden	Madison Co.	NE	5/24/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Newman Grove	Madison Co.	NE	5/24/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Madison	Madison Co.	NE	5/24/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Enola	Madison Co.	NE	5/24/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Monroe	Platte Co.	NE	5/24/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	5/24/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Creston	Platte Co.	NE	5/24/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Bancroft	Cuming Co.	NE	5/24/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Richland	Colfax Co.	NE	6/20/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Duncan	Platte Co.	NE	6/20/2020	Hail	0	0	0.00K	0.00K
Mc Lean	Pierce Co.	NE	6/22/2020	Hail	0	0	0.00K	0.00K
Belden	Cedar Co.	NE	6/22/2020	Thunderstorm Wind	0	0	0.00K	0.00K

[310] National Weather Service. National Oceanic and Atmospheric Administration. (n.d.). July 12, 2023, Severe Weather Event. Retrieved from https://www.weather.gov/oax/july122023

[311] National Centers for Environmental Information. (n.d.). Storm Events Database. Retrieved from https://www.ncdc.noaa.gov/stormevents/

Location	County / Zone	State	Date	Type	Death	Injury	Property Damage	Crop Damage
Howells	Colfax Co.	NE	6/22/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Ames	Dodge Co.	NE	6/22/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Humphrey	Platte Co.	NE	6/30/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Pilger	Stanton Co.	NE	6/30/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Wayne	Wayne Co.	NE	6/30/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Pender	Thurston Co.	NE	6/30/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Wayne	Wayne Co.	NE	7/1/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Pender	Thurston Co.	NE	7/1/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Creighton	Knox Co.	NE	7/6/2020	Hail	0	0	0.00K	0.00K
Creighton	Knox Co.	NE	7/6/2020	Hail	0	0	0.00K	0.00K
Creighton	Knox Co.	NE	7/6/2020	Hail	0	0	0.00K	0.00K
Wynot	Cedar Co.	NE	7/6/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Maskell	Dixon Co.	NE	7/6/2020	Hail	0	0	0.00K	6.00K
Maskell	Dixon Co.	NE	7/6/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Creighton	Knox Co.	NE	7/6/2020	Hail	0	0	0.00K	0.00K
Ponca	Dixon Co.	NE	7/6/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Ponca	Dixon Co.	NE	7/6/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Newman Grove	Madison Co.	NE	7/6/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Newman Grove	Madison Co.	NE	7/6/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Lindsay	Platte Co.	NE	7/6/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Cornlea	Platte Co.	NE	7/6/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Creighton	Knox Co.	NE	7/8/2020	Thunderstorm Wind	0	0	0.00K	0.00K
(Ofk)Stefan Fld Norf	Madison Co.	NE	7/10/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Pilger	Stanton Co.	NE	7/10/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Wisner	Cuming Co.	NE	7/10/2020	Thunderstorm Wind	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Type	Death	Injury	Property Damage	Crop Damage
Beemer	Cuming Co.	NE	7/10/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Bancroft	Cuming Co.	NE	7/10/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Santee	Knox Co.	NE	7/17/2020	Hail	0	0	0.00K	0.00K
Fremont	Dodge Co.	NE	8/9/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Fremont Arpt	Dodge Co.	NE	8/9/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Niobrara	Knox Co.	NE	8/10/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Pender	Thurston Co.	NE	8/10/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Walthill	Thurston Co.	NE	8/10/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Craig	Burt Co.	NE	8/10/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Craig	Burt Co.	NE	8/10/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Tekamah Arpt	Burt Co.	NE	8/10/2020	Thunderstorm Wind	0	0	0.00K	0.00K
Emerson	Thurston Co.	NE	8/14/2020	Hail	0	0	0.00K	0.00K
Thurston	Thurston Co.	NE	8/14/2020	Hail	0	0	0.00K	0.00K
Bay State	Dodge Co.	NE	8/16/2020	Hail	0	0	0.00K	0.00K
Snyder	Dodge Co.	NE	8/16/2020	Hail	0	0	0.00K	0.00K
Richland	Colfax Co.	NE	8/16/2020	Hail	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	8/31/2020	Hail	0	0	0.00K	0.00K
Ponca	Dixon Co.	NE	8/31/2020	Hail	0	0	0.00K	0.00K
Enola	Madison Co.	NE	10/11/2020	Hail	0	0	0.00K	0.00K
Madison	Madison Co.	NE	10/11/2020	Hail	0	0	0.00K	0.00K
Humphrey	Platte Co.	NE	10/11/2020	Hail	0	0	0.00K	0.00K
Allen	Dixon Co.	NE	10/11/2020	Hail	0	0	0.00K	0.00K
Creston	Platte Co.	NE	10/11/2020	Hail	0	0	0.00K	0.00K
Leigh	Colfax Co.	NE	10/11/2020	Hail	0	0	0.00K	0.00K
Leigh	Colfax Co.	NE	10/11/2020	Hail	0	0	0.00K	0.00K
Clarkson	Colfax Co.	NE	10/11/2020	Thunderstorm Wind	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Type	Death	Injury	Property Damage	Crop Damage
Dodge	Dodge Co.	NE	10/11/2020	Hail	0	0	0.00K	0.00K
West Pt	Cuming Co.	NE	10/11/2020	Hail	0	0	0.00K	0.00K
Monterey	Cuming Co.	NE	10/11/2020	Hail	0	0	0.00K	0.00K
(Olu)Columbus Arpt	Platte Co.	NE	4/4/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Oakland	Burt Co.	NE	5/2/2021	Hail	0	0	0.00K	0.00K
Leigh	Colfax Co.	NE	5/2/2021	Hail	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	5/5/2021	Hail	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	5/5/2021	Hail	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	5/5/2021	Tornado	0	0	0.00K	0.00K
Bow Vly	Cedar Co.	NE	5/5/2021	Hail	0	0	0.00K	0.00K
Madison	Madison Co.	NE	5/5/2021	Hail	0	0	0.00K	0.00K
Hartington	Cedar Co.	NE	5/5/2021	Tornado	0	0	0.00K	0.00K
Columbus	Platte Co.	NE	6/11/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Schuyler	Colfax Co.	NE	6/11/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Schuyler	Colfax Co.	NE	6/11/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Tilden	Madison Co.	NE	6/22/2021	Hail	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	6/22/2021	Hail	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	6/22/2021	Hail	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	6/22/2021	Hail	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	6/22/2021	Hail	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	6/22/2021	Hail	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	6/22/2021	Hail	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	6/22/2021	Hail	0	0	0.00K	0.00K
Madison	Madison Co.	NE	6/22/2021	Hail	0	0	0.00K	0.00K
Monroe	Platte Co.	NE	6/22/2021	Hail	0	0	0.00K	0.00K
Monroe	Platte Co.	NE	6/22/2021	Hail	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Type	Death	Injury	Property Damage	Crop Damage
Monroe	Platte Co.	NE	6/22/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Monroe	Platte Co.	NE	6/22/2021	Hail	0	0	0.00K	0.00K
Duncan	Platte Co.	NE	6/22/2021	Hail	0	0	0.00K	0.00K
Duncan	Platte Co.	NE	6/22/2021	Hail	0	0	0.00K	0.00K
Newman Grove	Madison Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Humphrey	Platte Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Madison	Madison Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Norfolk	Madison Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Columbus	Platte Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
(Olu)Columbus Arpt	Platte Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Columbus	Platte Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Howells	Colfax Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
North Bend	Dodge Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Scribner	Dodge Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Monterey	Cuming Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Madison	Madison Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Scribner	Dodge Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
West Pt	Cuming Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Fremont	Dodge Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Winslow	Dodge Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Winslow	Dodge Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Bancroft	Cuming Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Fremont Arpt	Dodge Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Tekamah	Burt Co.	NE	6/24/2021	Thunderstorm Wind	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Type	Death	Injury	Property Damage	Crop Damage
Dixon	Dixon Co.	NE	7/8/2021	Hail	0	0	0.00K	0.00K
Martinsburg	Dixon Co.	NE	7/8/2021	Hail	0	0	0.00K	0.00K
Tilden	Madison Co.	NE	7/9/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Schuyler	Colfax Co.	NE	7/9/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Pierce	Pierce Co.	NE	7/9/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Foster	Pierce Co.	NE	7/9/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Bancroft	Cuming Co.	NE	7/9/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Battle Creek	Madison Co.	NE	7/9/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	7/9/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	7/9/2021	Thunderstorm Wind	0	0	0.00K	0.00K
(Ofk)Stefan Fld Norf	Madison Co.	NE	7/9/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Pilger	Stanton Co.	NE	7/9/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Battle Creek	Madison Co.	NE	7/9/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	7/9/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Craig	Burt Co.	NE	7/9/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Schuyler	Colfax Co.	NE	7/9/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Tekamah Arpt	Burt Co.	NE	7/9/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Fordyce	Cedar Co.	NE	8/25/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Norfolk	Madison Co.	NE	8/26/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Enola	Madison Co.	NE	8/28/2021	Thunderstorm Wind	0	0	0.00K	0.00K
(Ofk)Stefan Fld Norf	Madison Co.	NE	8/28/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	8/28/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	8/28/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Carroll	Wayne Co.	NE	8/30/2021	Hail	0	0	0.00K	0.00K
Osmond	Pierce Co.	NE	8/30/2021	Hail	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Type	Death	Injury	Property Damage	Crop Damage
Pierce	Pierce Co.	NE	8/30/2021	Hail	0	0	0.00K	0.00K
Osmond	Pierce Co.	NE	8/30/2021	Hail	0	0	0.00K	0.00K
Winside	Wayne Co.	NE	8/30/2021	Hail	0	0	0.00K	0.00K
Bow Vly	Cedar Co.	NE	8/30/2021	Hail	0	0	0.00K	0.00K
Bow Vly	Cedar Co.	NE	8/30/2021	Hail	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	8/30/2021	Hail	0	0	0.00K	0.00K
Pilger	Stanton Co.	NE	8/30/2021	Hail	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	8/30/2021	Hail	0	0	0.00K	0.00K
Verdigre	Knox Co.	NE	8/30/2021	Hail	0	0	0.00K	0.00K
Verdigre	Knox Co.	NE	8/30/2021	Hail	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	8/30/2021	Hail	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	8/30/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Hadar	Pierce Co.	NE	8/30/2021	Hail	0	0	0.00K	0.00K
Snyder	Dodge Co.	NE	8/30/2021	Hail	0	0	0.00K	0.00K
Fremont	Dodge Co.	NE	8/31/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Columbus	Platte Co.	NE	12/15/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Columbus	Platte Co.	NE	12/15/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Platte Center	Platte Co.	NE	12/15/2021	Tornado	0	0	0.00K	0.00K
Columbus	Platte Co.	NE	12/15/2021	Hail	0	0	0.00K	0.00K
Columbus	Platte Co.	NE	12/15/2021	Tornado	0	2	0.00K	0.00K
(Olu)Columbus Arpt	Platte Co.	NE	12/15/2021	Hail	0	0	0.00K	0.00K
(Olu)Columbus Arpt	Platte Co.	NE	12/15/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Schuyler	Colfax Co.	NE	12/15/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Howells	Colfax Co.	NE	12/15/2021	Tornado	0	0	0.00K	0.00K
Monterey	Cuming Co.	NE	12/15/2021	Tornado	0	0	0.00K	0.00K
Howells	Colfax Co.	NE	12/15/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Monterey	Cuming Co.	NE	12/15/2021	Tornado	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Type	Death	Injury	Property Damage	Crop Damage
Monterey	Cuming Co.	NE	12/15/2021	Tornado	0	0	0.00K	0.00K
Beemer	Cuming Co.	NE	12/15/2021	Tornado	0	0	0.00K	0.00K
Beemer	Cuming Co.	NE	12/15/2021	Tornado	0	0	0.00K	0.00K
Beemer	Cuming Co.	NE	12/15/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Bancroft	Cuming Co.	NE	12/15/2021	Tornado	0	0	0.00K	0.00K
Oakland	Burt Co.	NE	12/15/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Rosalie	Thurston Co.	NE	12/15/2021	Tornado	0	0	0.00K	0.00K
Fremont	Dodge Co.	NE	12/15/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Tekamah	Burt Co.	NE	12/15/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Fremont	Dodge Co.	NE	12/15/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Oakland	Burt Co.	NE	12/15/2021	Thunderstorm Wind	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	3/25/2022	Strong Wind	0	0	0.00K	0.00K
Bay State	Dodge Co.	NE	4/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Snyder	Dodge Co.	NE	4/12/2022	Hail	0	0	0.00K	0.00K
North Bend	Dodge Co.	NE	4/12/2022	Hail	0	0	0.00K	0.00K
Snyder	Dodge Co.	NE	4/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
West Pt	Cuming Co.	NE	4/12/2022	Hail	0	0	0.00K	0.00K
Tekamah Arpt	Burt Co.	NE	4/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Platte Center	Platte Co.	NE	4/28/2022	Hail	0	0	0.00K	0.00K
Platte Center	Platte Co.	NE	4/28/2022	Hail	0	0	0.00K	0.00K
Platte Center	Platte Co.	NE	4/28/2022	Hail	0	0	0.00K	0.00K
Bancroft	Cuming Co.	NE	4/29/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Battle Creek	Madison Co.	NE	4/29/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Schuyler	Colfax Co.	NE	4/29/2022	Tornado	0	0	0.00K	0.00K
Leigh	Colfax Co.	NE	4/29/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Craig	Burt Co.	NE	4/29/2022	Hail	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Type	Death	Injury	Property Damage	Crop Damage
Wynot	Cedar Co.	NE	5/11/2022	Hail	0	0	0.00K	0.00K
Plainview	Pierce Co.	NE	5/11/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	5/12/2022	Hail	0	0	0.00K	0.00K
Plainview	Pierce Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Niobrara	Knox Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Pierce	Pierce Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
(Ofk)Stefan Fld Norf	Madison Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Osmond	Pierce Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Verdigre	Knox Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Niobrara	Knox Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Norfolk	Madison Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Niobrara	Knox Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Carroll	Wayne Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Fordyce	Cedar Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Hartington	Cedar Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Hartington	Cedar Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Battle Creek	Madison Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Newcastle	Dixon Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Ponca	Dixon Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Platte Center	Platte Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Platte Center	Platte Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Creston	Platte Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Type	Death	Injury	Property Damage	Crop Damage
Knievel Arpt	Cuming Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Monterey	Cuming Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Ames	Dodge Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Craig	Burt Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Wakefield	Dixon Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	8.00K
Wisner	Cuming Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Rosalie	Thurston Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Tekamah Arpt	Burt Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Allen	Dixon Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Lyons	Burt Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Tekamah Arpt	Burt Co.	NE	5/12/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Winside	Wayne Co.	NE	5/17/2022	Hail	0	0	0.00K	0.00K
Lindy	Knox Co.	NE	5/29/2022	Hail	0	0	0.00K	0.00K
Hartington	Cedar Co.	NE	5/30/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Hartington	Cedar Co.	NE	5/30/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Bow Vly	Cedar Co.	NE	5/30/2022	Tornado	0	0	0.00K	0.00K
Wynot	Cedar Co.	NE	5/30/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Verdel	Knox Co.	NE	5/30/2022	Hail	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	5/30/2022	Thunderstorm Wind	0	0	0.00K	0.00K
(Ofk)Stefan Fld Norf	Madison Co.	NE	5/30/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Schuyler	Colfax Co.	NE	6/4/2022	Hail	0	0	0.00K	0.00K
Scribner	Dodge Co.	NE	6/4/2022	Hail	0	0	0.00K	0.00K
Scribner	Dodge Co.	NE	6/4/2022	Hail	0	0	0.00K	0.00K
Rosenburg	Platte Co.	NE	6/6/2022	Hail	0	0	0.00K	0.00K
Monroe	Platte Co.	NE	6/7/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Monroe	Platte Co.	NE	6/7/2022	Hail	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Type	Death	Injury	Property Damage	Crop Damage
Duncan	Platte Co.	NE	6/7/2022	Hail	0	0	0.00K	0.00K
Creighton	Knox Co.	NE	6/14/2022	Hail	0	0	0.00K	0.00K
Verdel	Knox Co.	NE	7/5/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Verdigre	Knox Co.	NE	7/5/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Crofton	Knox Co.	NE	7/5/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Menominee	Cedar Co.	NE	7/5/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Fordyce	Cedar Co.	NE	7/5/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Obert	Cedar Co.	NE	7/5/2022	Thunderstorm Wind	0	0	0.00K	0.00K
(Ofk)Stefan Fld Norf	Madison Co.	NE	7/5/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Lindsay	Platte Co.	NE	7/11/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Lindsay	Platte Co.	NE	7/11/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Creston	Platte Co.	NE	7/11/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Creston	Platte Co.	NE	7/11/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Howells	Colfax Co.	NE	7/11/2022	Thunderstorm Wind	0	0	0.00K	0.00K
West Pt	Cuming Co.	NE	7/11/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Tekamah Arpt	Burt Co.	NE	7/11/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Tekamah Arpt	Burt Co.	NE	7/11/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Fremont	Dodge Co.	NE	7/21/2022	Thunderstorm Wind	0	0	0.00K	0.00K
(Ofk)Stefan Fld Norf	Madison Co.	NE	7/23/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Creston	Platte Co.	NE	7/23/2022	Thunderstorm Wind	0	0	0.00K	0.00K
(Ofk)Stefan Fld Norf	Madison Co.	NE	7/23/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Craig	Burt Co.	NE	7/23/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Tekamah Arpt	Burt Co.	NE	7/23/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Tekamah Arpt	Burt Co.	NE	7/23/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Rosenburg	Platte Co.	NE	8/18/2022	Hail	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Type	Death	Injury	Property Damage	Crop Damage
Rosenburg	Platte Co.	NE	8/18/2022	Hail	0	0	0.00K	0.00K
Rosenburg	Platte Co.	NE	8/18/2022	Hail	0	0	0.00K	0.00K
Bancroft	Cuming Co.	NE	8/18/2022	Hail	0	0	0.00K	0.00K
Decatur	Burt Co.	NE	8/18/2022	Hail	0	0	0.00K	0.00K
Decatur	Burt Co.	NE	8/18/2022	Hail	0	0	0.00K	0.00K
Norfolk	Madison Co.	NE	8/19/2022	Hail	0	0	0.00K	0.00K
Battle Creek	Madison Co.	NE	10/23/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	10/23/2022	Hail	0	0	0.00K	0.00K
Pierce	Pierce Co.	NE	10/23/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Stefan Meml Arpt	Madison Co.	NE	10/23/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Newcastle	Dixon Co.	NE	10/23/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Hartington	Cedar Co.	NE	10/23/2022	Thunderstorm Wind	0	0	0.00K	0.00K
Niobrara	Knox Co.	NE	3/30/2023	Hail	0	0	0.00K	0.00K
Foster	Pierce Co.	NE	4/18/2023	Hail	0	0	0.00K	0.00K
Osmond	Pierce Co.	NE	4/19/2023	Hail	0	0	0.00K	0.00K
Winslow	Dodge Co.	NE	4/19/2023	Hail	0	0	0.00K	0.00K
Uehling	Dodge Co.	NE	4/19/2023	Hail	0	0	0.00K	0.00K
Ponca	Dixon Co.	NE	4/19/2023	Hail	0	0	0.00K	0.00K
Ponca	Dixon Co.	NE	4/19/2023	Hail	0	0	0.00K	0.00K
Dixon (Zone)	Dixon (Zone)	NE	4/30/2023	Strong Wind	0	0	0.00K	0.00K
Rosenburg	Platte Co.	NE	5/12/2023	Tornado	0	0	0.00K	0.00K
Rosenburg	Platte Co.	NE	5/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Platte Center	Platte Co.	NE	5/12/2023	Hail	0	0	0.00K	0.00K
Newman Grove	Madison Co.	NE	5/12/2023	Tornado	0	0	0.00K	0.00K
(Olu)Columbus Arpt	Platte Co.	NE	5/12/2023	Hail	0	0	0.00K	0.00K
Platte Center	Platte Co.	NE	5/12/2023	Hail	0	0	0.00K	0.00K
Tarnov	Platte Co.	NE	5/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Type	Death	Injury	Property Damage	Crop Damage
Creston	Platte Co.	NE	5/12/2023	Hail	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	5/12/2023	Tornado	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	5/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Battle Creek	Madison Co.	NE	5/12/2023	Tornado	0	0	0.00K	0.00K
Meadow Grove	Madison Co.	NE	5/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Ames	Dodge Co.	NE	5/12/2023	Tornado	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	5/12/2023	Tornado	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	5/12/2023	Tornado	0	0	0.00K	0.00K
Bay State	Dodge Co.	NE	5/12/2023	Hail	0	0	0.00K	0.00K
Pilger	Stanton Co.	NE	5/12/2023	Tornado	0	0	0.00K	0.00K
Scribner Arpt	Dodge Co.	NE	5/12/2023	Tornado	0	0	0.00K	0.00K
North Bend	Dodge Co.	NE	5/12/2023	Hail	0	0	0.00K	0.00K
North Bend	Dodge Co.	NE	5/12/2023	Hail	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	5/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Scribner Arpt	Dodge Co.	NE	5/12/2023	Tornado	0	0	0.00K	0.00K
Pilger	Stanton Co.	NE	5/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Pilger	Stanton Co.	NE	5/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Pilger	Stanton Co.	NE	5/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Oakland	Burt Co.	NE	5/12/2023	Tornado	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	5/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Ames	Dodge Co.	NE	5/12/2023	Hail	0	0	0.00K	0.00K
Oakland	Burt Co.	NE	5/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Oakland	Burt Co.	NE	5/12/2023	Tornado	0	0	0.00K	0.00K
Wayne	Wayne Co.	NE	5/12/2023	Tornado	0	0	0.00K	0.00K
Oakland	Burt Co.	NE	5/12/2023	Tornado	0	2	0.00K	0.00K
Wayne	Wayne Co.	NE	5/12/2023	Tornado	0	0	0.00K	0.00K
West Pt	Cuming Co.	NE	5/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Type	Death	Injury	Property Damage	Crop Damage
Winslow	Dodge Co.	NE	5/12/2023	Hail	0	0	0.00K	0.00K
Craig	Burt Co.	NE	5/12/2023	Tornado	0	0	0.00K	0.00K
Decatur	Burt Co.	NE	5/12/2023	Hail	0	0	0.00K	0.00K
Tekamah Arpt	Burt Co.	NE	5/12/2023	Tornado	0	0	0.00K	0.00K
Newman Grove	Madison Co.	NE	6/16/2023	Hail	0	0	0.00K	0.00K
Fordyce	Cedar Co.	NE	6/23/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Hartington	Cedar Co.	NE	6/23/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Laurel	Cedar Co.	NE	6/23/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Bloomfield Muni Arpt	Knox Co.	NE	6/24/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Crofton	Knox Co.	NE	6/24/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Verdel	Knox Co.	NE	6/24/2023	Hail	0	0	0.00K	0.00K
Niobrara	Knox Co.	NE	6/24/2023	Hail	0	0	0.00K	0.00K
Coleridge	Cedar Co.	NE	6/24/2023	Hail	0	0	0.00K	0.00K
Foster	Pierce Co.	NE	7/4/2023	Hail	0	0	0.00K	0.00K
Rosenburg	Platte Co.	NE	7/4/2023	Hail	0	0	0.00K	0.00K
Rosenburg	Platte Co.	NE	7/4/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Humphrey	Platte Co.	NE	7/4/2023	Hail	0	0	0.00K	0.00K
Humphrey	Platte Co.	NE	7/4/2023	Hail	0	0	0.00K	0.00K
Humphrey	Platte Co.	NE	7/4/2023	Hail	0	0	0.00K	0.00K
Enola	Madison Co.	NE	7/4/2023	Hail	0	0	0.00K	0.00K
Tarnov	Platte Co.	NE	7/4/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Tarnov	Platte Co.	NE	7/4/2023	Hail	0	0	0.00K	0.00K
Tarnov	Platte Co.	NE	7/4/2023	Hail	0	0	0.00K	0.00K
Enola	Madison Co.	NE	7/4/2023	Hail	0	0	0.00K	0.00K
Platte Center	Platte Co.	NE	7/4/2023	Hail	0	0	0.00K	0.00K
Monroe	Platte Co.	NE	7/4/2023	Hail	0	0	0.00K	0.00K
Martinsburg	Dixon Co.	NE	7/4/2023	Thunderstorm Wind	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Type	Death	Injury	Property Damage	Crop Damage
Monroe	Platte Co.	NE	7/4/2023	Hail	0	0	0.00K	0.00K
Monroe	Platte Co.	NE	7/4/2023	Hail	0	0	0.00K	0.00K
Monroe	Platte Co.	NE	7/4/2023	Hail	0	0	0.00K	0.00K
Emerson	Thurston Co.	NE	7/4/2023	Hail	0	0	0.00K	0.00K
Niobrara	Knox Co.	NE	7/10/2023	Hail	0	0	0.00K	0.00K
Niobrara	Knox Co.	NE	7/10/2023	Hail	0	0	0.00K	0.00K
Niobrara	Knox Co.	NE	7/10/2023	Hail	0	0	0.00K	0.00K
Bloomfield	Knox Co.	NE	7/10/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Center	Knox Co.	NE	7/10/2023	Hail	0	0	0.00K	0.00K
Wausa	Knox Co.	NE	7/10/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Center	Knox Co.	NE	7/10/2023	Hail	0	0	0.00K	0.00K
Wausa	Knox Co.	NE	7/10/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Wausa	Knox Co.	NE	7/10/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Magnet	Cedar Co.	NE	7/10/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Creighton	Knox Co.	NE	7/10/2023	Hail	0	0	0.00K	0.00K
Mc Lean	Pierce Co.	NE	7/10/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Bazile Mills	Knox Co.	NE	7/10/2023	Hail	0	0	0.00K	0.00K
Plainview	Pierce Co.	NE	7/10/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Creighton	Knox Co.	NE	7/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Sholes	Wayne Co.	NE	7/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
(Ofk)Stefan Fld Norf	Madison Co.	NE	7/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Wayne	Wayne Co.	NE	7/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	7/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Pilger	Stanton Co.	NE	7/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Wisner	Cuming Co.	NE	7/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Wisner	Cuming Co.	NE	7/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Type	Death	Injury	Property Damage	Crop Damage
Wakefield	Wayne Co.	NE	7/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Wisner	Cuming Co.	NE	7/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Howells	Colfax Co.	NE	7/12/2023	Tornado	0	0	0.00K	0.00K
Howells	Colfax Co.	NE	7/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Bancroft	Cuming Co.	NE	7/12/2023	Tornado	0	0	0.00K	0.00K
Bancroft	Cuming Co.	NE	7/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Oakland	Burt Co.	NE	7/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Pilger	Stanton Co.	NE	7/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Uehling	Dodge Co.	NE	7/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Tekamah	Burt Co.	NE	7/12/2023	Tornado	0	0	0.00K	0.00K
Fremont Arpt	Dodge Co.	NE	7/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Fremont	Dodge Co.	NE	7/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	7/12/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Creston	Platte Co.	NE	7/17/2023	Hail	0	0	0.00K	0.00K
Leigh	Colfax Co.	NE	7/17/2023	Hail	0	0	0.00K	0.00K
Nickerson	Dodge Co.	NE	7/17/2023	Hail	0	0	0.00K	0.00K
Lindy	Knox Co.	NE	7/19/2023	Hail	0	0	0.00K	0.00K
Creighton	Knox Co.	NE	7/24/2023	Hail	0	0	0.00K	0.00K
Osmond	Pierce Co.	NE	7/24/2023	Hail	0	0	0.00K	0.00K
Mc Lean	Pierce Co.	NE	7/24/2023	Hail	0	0	0.00K	0.00K
Concord	Dixon Co.	NE	7/24/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Pilger	Stanton Co.	NE	7/24/2023	Hail	0	0	0.00K	0.00K
Concord	Dixon Co.	NE	7/24/2023	Hail	0	0	0.00K	0.00K
Rogers	Colfax Co.	NE	7/24/2023	Hail	0	0	0.00K	0.00K
Nickerson	Dodge Co.	NE	7/28/2023	Hail	0	0	0.00K	0.00K
Nickerson	Dodge Co.	NE	7/28/2023	Hail	0	0	0.00K	0.00K

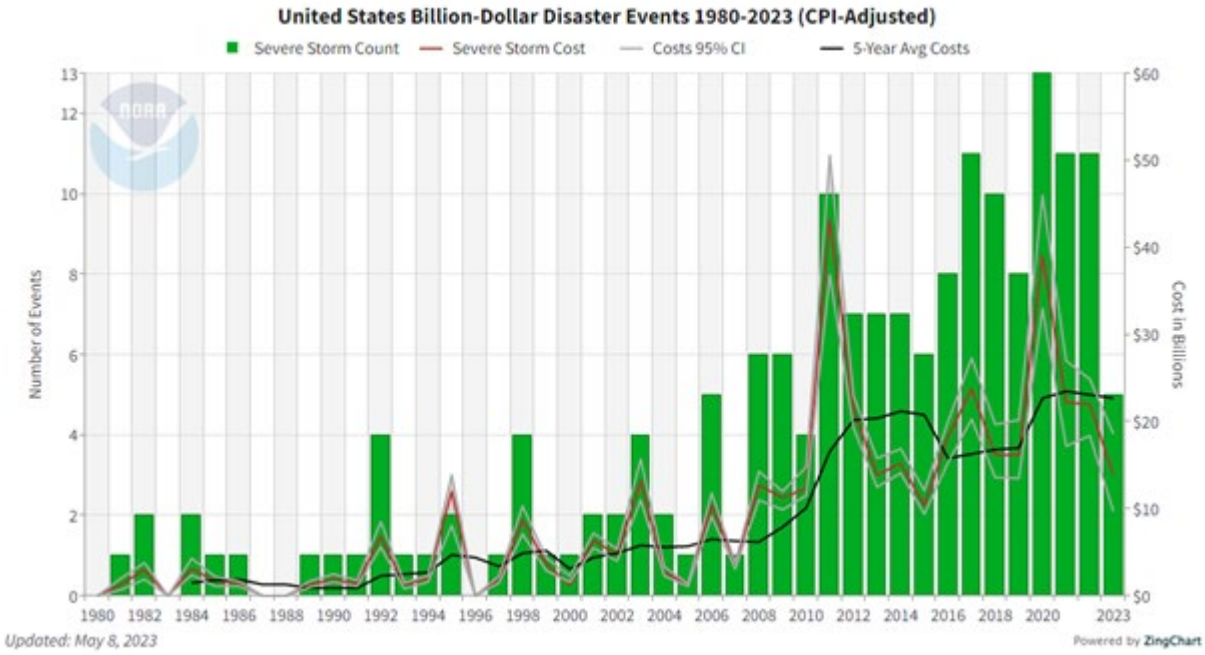
Location	County / Zone	State	Date	Type	Death	Injury	Property Damage	Crop Damage
Fremont	Dodge Co.	NE	7/28/2023	Hail	0	0	0.00K	0.00K
Fremont Arpt	Dodge Co.	NE	7/28/2023	Hail	0	0	0.00K	0.00K
Fremont	Dodge Co.	NE	7/28/2023	Hail	0	0	0.00K	0.00K
Fremont	Dodge Co.	NE	7/28/2023	Hail	0	0	0.00K	0.00K
Fremont	Dodge Co.	NE	7/28/2023	Hail	0	0	0.00K	0.00K
Fremont	Dodge Co.	NE	7/28/2023	Hail	0	0	0.00K	0.00K
Fremont	Dodge Co.	NE	7/28/2023	Hail	0	0	0.00K	0.00K
Fremont	Dodge Co.	NE	7/28/2023	Hail	0	0	0.00K	0.00K
Fremont	Dodge Co.	NE	7/28/2023	Hail	0	0	0.00K	0.00K
Fremont	Dodge Co.	NE	7/28/2023	Hail	0	0	0.00K	0.00K
Fremont	Dodge Co.	NE	7/28/2023	Hail	0	0	0.00K	0.00K
Wakefield	Dixon Co.	NE	7/30/2023	Hail	0	0	0.00K	0.00K
Wakefield	Dixon Co.	NE	7/30/2023	Hail	0	0	0.00K	0.00K
Pender Muni Arpt	Thurston Co.	NE	7/30/2023	Hail	0	0	0.00K	0.00K
Madison	Madison Co.	NE	7/30/2023	Hail	0	0	0.00K	0.00K
Pender Muni Arpt	Thurston Co.	NE	7/30/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Humphrey	Platte Co.	NE	7/30/2023	Hail	0	0	0.00K	0.00K
(Ofk)Stefan Fld Norf	Madison Co.	NE	8/2/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Stanton	Stanton Co.	NE	8/2/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Crowell	Dodge Co.	NE	8/5/2023	Tornado	0	0	0.00K	0.00K
Columbus	Platte Co.	NE	8/8/2023	Thunderstorm Wind	0	0	0.00K	0.00K
Totals					**0**	**4**	**0.00K**	**14.00K**

Probability and Frequency

Based on historical records and reported events, severe weather is likely to occur on an annual basis. As previously mentioned, NCEI reported 423 severe weather events between 2020 and 2023; resulting in 100 percent chance annually for severe weather.

As the baseline temperature around the world rises, the threat of severe storms (and damages) increases. It is anticipated that the trend demonstrated in **Figure 55** will continue into the future.

Figure 55: Billion Dollar Disaster Events in Relation to Severe Storms[312]



Strong Wind

The strong wind annualized frequency value represents the average number of recorded strong wind hazard occurrences, in event days, per year over the period of record (34 years). **Table 139** outlines the annualized frequency for strong winds, based on FEMA NRI data, for the Lower Elkhorn planning area.

Table 139: Strong Wind Annualized Frequency for Lower Elkhorn Planning Area[313]

Location	Events on Record *(1986– 2021)*	Annualized Frequency
Burt County *(Census Tract 9632, 9634)*	302	4.45 events per year
Cedar County	115	3.4 events per year
Colfax County	137	4 events per year
Cuming County	137	4 events per year
Dixon County	129	3.8 events per year
Dodge County *(Census Tract 9636)*	147	4.3 events per year
Knox County *(Census Tract 9763)*	103	3 events per year
Madison County	101	3 events per year
Pierce County	100	2.9 events per year
Platte County	103	3 events per year

[312] Cybersecurity & Infrastructure Security Agency/National Oceanic and Atmospheric Administration. (2023.) Retrieved from https://www.cisa.gov/topics/critical-infrastructure-security-and-resilience/extreme-weather-and-climate-change/severe-storms
[313] National Risk Index. (n.d.). Annualized Losses. Annualized Frequency. Retrieved from https://hazards.fema.gov/nri/map#

Location	Events on Record *(1986– 2021)*	Annualized Frequency
(Census Tract 9651)		
Stanton County	119	3.5 events per year
Thurston County	137	4 events per year
Wayne County	118	3.5 events per year

Tornadoes

The tornado annualized frequency value represents the average number of recorded tornado hazard occurrences, in event days, per year over the period of record (72 years). **Table 140** outlines the annualized frequency for tornadoes, based on FEMA NRI data, for the Lower Elkhorn planning area.

Table 140: Tornado Annualized Frequency for Lower Elkhorn Planning Area

Location	Events on Record (1986-2021)	Location
Burt County *(Census Tract 9632, 9634)*	10	0.4 events per year
Cedar County	25	0.6 events per year
Colfax County	24	0.4 events per year
Cuming County	26	0.5 events per year
Dixon County	21	0.5 events per year
Dodge County *(Census Tract 9636)*	11	0.2 events per year
Knox County *(Census Tract 9763)*	12	0.2 events per year
Madison County	27	0.4 events per year
Pierce County	26	0.5 events per year
Platte County *(Census Tract 9651)*	12	0.3 events per year
Stanton County	22	0.3 events per year
Thurston County	11	0.3 events per year
Wayne County	17	0.3 events per year

Hail

The hail annualized frequency value represents the average number of recorded hail hazard occurrences, in event days, per year over the period of record (34 years). **Table 141** outlines the annualized frequency for hail, based on FEMA NRI data, for the Lower Elkhorn planning area.

Table 141: Hail Annualized Frequency for Lower Elkhorn Planning Area[314]

Location	Events on Record (1986-2021)	Location
Burt County *(Census Tract 9632, 9634)*	462	6.8 events per year
Cedar County	218	6.4 events per year
Colfax County	241	7.1 events per year
Cuming County	231	6.8 events per year
Dixon County	228	6.7 events per year

[314] National Risk Index. (n.d.). Annualized Losses. Annualized Frequency. Retrieved from https://hazards.fema.gov/nri/map#

Location	Events on Record (1986-2021)	Location
Dodge County *(Census Tract 9636)*	235	6.9 events per year
Knox County *(Census Tract 9763)*	209	6.1 events per year
Madison County	211	6.2 events per year
Pierce County	211	6.2 events per year
Platte County *(Census Tract 9651)*	210	6.2 events per year
Stanton County	221	6.5 events per year
Thurston County	222	6.5 events per year
Wayne County	219	6.4 events per year

Lightning

The lightning annualized frequency value represents the average number of recorded lightning hazard occurrences, in event days, per year over the period of record (22 years). Table 142 outlines the annualized frequency for lightning, based on FEMA NRI data, for the Lower Elkhorn planning area.

Table 142: Lightning Annualized Frequency for Lower Elkhorn Planning Area[315]

Location	Events on Record (1991-2012)	Location
Burt County *(Census Tract 9632, 9634)*	2,178	49.45 events per year
Cedar County	771	35 events per year
Colfax County	1,048	47.6 events per year
Cuming County	983	44.7 events per year
Dixon County	793	36 events per year
Dodge County *(Census Tract 9636)*	1,023	46.5 events per year
Knox County *(Census Tract 9763)*	773	35.1 events per year
Madison County	880	40 events per year
Pierce County	733	33.3 events per year
Platte County *(Census Tract 9651)*	949	43.1 events per year
Stanton County	853	38.8 events per year
Thurston County	965	43.9 events per year
Wayne County	751	34.1 events per year

Vulnerability and Impact

The following table provides information related to regional vulnerabilities; for jurisdictional- specific vulnerabilities, refer to *Volume II*.

Life Safety and Health: Severe weather can post multiple dangers to an individual's health. Strong winds can break off branches, knock over trees, damage structures, and make driving conditions hazardous. Hail can be produced by severe thunderstorms and reach softball or larger size, posing a danger to both property

[315] National Risk Index. (n.d.). Annualized Losses. Annualized Frequency. Retrieved from https://hazards.fema.gov/nri/map#

and individuals.[316] Lightning can cause wildfires, but direct danger is extremely rare. Tornadoes can pose extreme danger to the safety of anyone in the area, as the winds can easily hurl debris through the air, destroying buildings and vehicles alike. Potential, but rarer risks due to hail, given Nebraska's massive agricultural economy, is the potential for mycotoxins to contaminate feed/grain due to direct damage to ears of corn.[317] Ingestion of mycotoxins can produce illness or death in both livestock and humans, and thus impacted crops need close monitoring.

Property Damage and Critical Infrastructure: During a severe thunderstorm and the subsequent hazards, the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Because the county's entire infrastructure is equally vulnerable, it is important to emphasize that any number of these structures could become damaged during a severe thunderstorm. The impacts to these structures include broken, failed, or impassable roadways, broken or failed utility lines (e.g., loss of power or gas to community), or railway failure from broken or impassable railways. Bridges could fail or become impassable, causing risk to traffic. Tornadoes have the capacity to damage or destroy most structures and infrastructure. Additionally, damage from hail, lightning, or general strong winds is possible to both structures and vehicles, especially exposed equipment such as AC units.

Economy: As the majority of Nebraska's land is utilized for agriculture, a severe storm would primarily impact that sector of the economy. If severe enough, the hazards produced by a severe thunderstorm could damage or destroy crops and/or livestock. While a tornado or hail may destroy agricultural products, longer-term damage is possible. Hail has been shown to increase the risk of bacterial pathogens in both corn and soybeans, of which are extremely difficult to treat. Hail damage also increases the likelihood of infestation of sap beetles for corn crops during the plant's reproductive stages. Direct damage to corn by hail can cause secondary pathogens and toxins such as mycotoxins, which can pose a threat to livestock if ingested from their grain or feed.[318] This long-term damage, in addition to direct losses to crops and livestock could greatly impact both the regional and local economies, potentially raising prices until yields stabilize. In terms of economic security, closed outdoor job sites (agriculture,) and transportation routes would likewise impact the jobs of individuals.

Changes in Development and Impact of Future Development: As severe weather is a regular occurrence in both the general state of Nebraska and the planning area, current and future developments should take into account the potential hazards when planning developments. If in a high-risk area, additional mitigation measures for new or existing structures may be feasible, such as securing roofs, building tornado safe rooms, and sheltering any greenhouses from the hazards produced by severe storms.

Underserved and At-Risk Population: Severe weather poses similar dangers as other disasters to underserved and at-risk populations. Economic impacts due to severe weather such as closed outdoor job sites (agriculture,) and transportation routes would impact the jobs of individuals, disproportionately affecting those who are financially insecure. Elderly populations are generally more vulnerable and experience more casualties after natural disasters, and that risk is demonstrated to hazards such as tornadoes.[319] The Elderly

[316] National Weather Service. (n.d.). Severe Thunderstorm Safety. Retrieved from https://www.weather.gov/safety/thunderstorm

[317] Institute of Agriculture and Natural Resources. Cropwatch. (n.d.).; Managing Post-Hail Threats from Disease and Insects. Retrieved from https://cropwatch.unl.edu/hail-know/managing-recovering-crop

[318] Ibid.

[319] American Red Cross. (2020.) Older Adults More Vulnerable after Disasters. Retrieved from https://www.redcross.org/about-us/news-and-events/news/2020/new-research-older-adults-more-vulnerable-after-disasters.html

are less mobile and may not have the means or knowledge to receive alerts for the hazard, especially at night. Additionally, non-English speaking individuals are at a disadvantage in regard to receiving emergency alerts. In areas with non-English speaking populations, additional steps to alert these populations should be considered.[320]

Individuals living in mobile homes would additionally not have access to a tornado shelter, and the homes would be more vulnerable to hazards produced by severe thunderstorms such as wind, hail, and tornadoes.

Effects of Climate Change in Severity of Impacts: Assessing how climate change impacts severe thunderstorms (hail, strong winds, tornadoes) is challenging because these are complex, short-lived, and local. Furthermore, it remains unclear how the wind shear that generates a tornado's spin is affected by climate change. One way of understanding the effects of climate change in severe weather (i.e., severe thunderstorms) is understanding how it is affecting the convective available potential energy (CAPE). CAPE is the amount energy available for warm, rising air (needed for thunderstorm formation). The higher CAPE values, the more energy is available in the atmosphere for greater potential of thunderstorm development. Annually, high CAPE value days have become more frequent in the eastern United States, but less frequent in the western United States, depending on the season.[321]

FEMA NRI Expected Annual Loss Estimates

Table 143: Strong Wind Expected Annual Loss[322]

Location	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Burt County *(Census Tract 9632, 9634)*	$84,899	$62,918	$2,887	$150,703	91.4	Relatively High
Cedar County	$120,023	$133,606	$363	$253,993	44.2	Relatively Low
Colfax County	$191,156	$50,993	$752	$242,901	42.6	Relatively Low
Cuming County	$158,754	$168,519	$622	$327,894	51.7	Relatively Low
Dixon County	$92,442	$327,860	$278,378	$698,681	74.8	Relatively Moderate
Dodge County *(Census Tract 9636)*	$68,146	$3,320	$153	$71,619	90.9	Relatively High
Knox County *(Census Tract 9763)*	$34,064	$9,844	$61	$43,969	84.0	Relatively High

[320] Ahlborn L, Franc JM. Tornado hazard communication disparities among Spanish-speaking individuals in an English-speaking community. (2012) Prehosp Disaster Med. Feb;27(1):98-102. doi: 10.1017/S1049023X12000015. Epub 2012 Mar 23. PMID: 22445029. Retrieved from https://pubmed.ncbi.nlm.nih.gov/22445029/

[321] Climate Central. (2022). Changing Thunderstorm Potential. Retrieved from https://www.climatecentral.org/climate-matters/changing-thunderstorm-potential.

[322] FEMA National Risk Index. Community Report. (n.d.). Retrieved from https://hazards.fema.gov/nri/map

Location	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Madison County	$457,914	$63,107	$382	$521,403	66.8	Relatively Moderate
Pierce County	$93,668	$54,662	$467	$148,797	30.5	Relatively Low
Platte County *(Census Tract 9651)*	$48,078	$37,575	$101	$85,754	92.9	Relatively High
Stanton County	$160,031	$223,893	$10,374	$394,298	57.3	Relatively Moderate
Thurston County	$88,386	$11,762	$132,531	$232,678	41.2	Relatively Low
Wayne County	$153,400	$33,551	$774	$187,725	35.6	Relatively Low

Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).

Table 144: Tornado Expected Annual Loss[323]

Location	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Burt County *(Census Tract 9632, 9634)*	$327,476	$385,475	$2,198	$715,148	92.35	Relatively High
Cedar County	$276,325	$759,383	$17,399	$1,053,107	52.6	Relatively Low
Colfax County	$915,472	$840,947	$17,290	$1,773,709	67.6	Relatively Low
Cuming County	$801,920	$1,230,670	$43,513	$2,076,103	71.2	Relatively Moderate
Dixon County	$466,617	$356,770	$12,769	$836,156	46.5	Relatively Low
Dodge County *(Census Tract 9636)*	$373,335	$536,317	$2,126	$911,778	99.5	Very High
Knox County *(Census Tract 9763)*	$121,116	$212,669	$1,143	$334,928	91.5	Relatively High
Madison County	$2,602,391	$2,332,210	$10,722	$4,945,322	87.3	Relatively Moderate
Pierce County	$525,175	$616,131	$9,655	$1,150,960	55.6	Relatively Low
Platte County *(Census Tract 9651)*	$374,102	$740,012	$9,472	$1,123,586	99.7	Very High

[323] FEMA National Risk Index. Community Report. (n.d.). Retrieved from https://hazards.fema.gov/nri/map

Location	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Stanton County	$423,667	$412,844	$9,846	$846,356	46.7	Relatively Low
Thurston County	$520,850	$365,220	$3,543	$889,613	48.0	Relatively Low
Wayne County	$638,522	$747,645	$8,337	$1,394,503	61.6	Relatively Low
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

Table 145: Hail Expected Annual Loss[324]

Location	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Burt County *(Census Tract 9632, 9634)*	$56	$404,464	$437,086	$841,604	99.25	Very High
Cedar County	$104	$784,939	$621,018	$1,406,061	93.0	Relatively Moderate
Colfax County	$152	$956,499	$46,945	$1,003,596	89.8	Relatively Moderate
Cuming County	$120	$418,701	$19,351	$438,171	80.5	Relatively Moderate
Dixon County	$73	$184,836	$593,508	$778s,417	87.5	Relatively Moderate
Dodge County *(Census Tract 9636)*	$64	$584,723	$490,235	$1,075,022	99.9	Very High
Knox County *(Census Tract 9763)*	$28	$129,376	$79,832	$209,236	97.2	Very High
Madison County	$431	$860	$583,281	$584,572	83.8	Relatively Moderate
Pierce County	$89	$4,717	$257,665	$262,470	72.3	Relatively Low
Platte County *(Census Tract 9651)*	$44	$450,099	$286,708	$736,851	99.8	Very High
Stanton County	$72	$57,884	$52,123	$110,078	55.0	Relatively Low
Thurston County	$86	$381,803	$655,322	$1,037,210	90.0	Relatively Moderate
Wayne County	$123	$698,536	$703,712	$1,402,371	93.0	Relatively Moderate
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

[324] FEMA National Risk Index. Community Report. (n.d.). Retrieved from https://hazards.fema.gov/nri/map

Table 146: Lightning Expected Annual Loss[325]

Location	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Burt County *(Census Tract 9632, 9634)*	$4,899	$1,187	n/a	$6,085	40.85	Relatively Low
Cedar County	$27,605	$11,283	n/a	$38,887	25.2	Very Low
Colfax County	$48,120	$9,239	n/a	$57,359	36.6	Relatively Low
Cuming County	$38,497	$2,880	n/a	$41,377	26.4	Relatively Low
Dixon County	$18,160	$775	n/a	$18,935	12.7	Very Low
Dodge County *(Census Tract 9636)*	$5,269	$3,831	n/a	$9,100	64.5	Relatively Moderate
Knox County *(Census Tract 9763)*	$7,449	$27	n/a	$7,476	58.4	Relatively Moderate
Madison County	$96,862	$11,568	n/a	$108,430	56.6	Relatively Low
Pierce County	$22,142	$6,777	n/a	$28,920	19.4	Very Low
Platte County *(Census Tract 9651)*	$14,438	$1,021	n/a	$15,459	80.3	Relatively High
Stanton County	$19,819	$4,032	n/a	$23,851	16.1	Very Low
Thurston County	$7,275	$1,903	n/a	$9,178	5.5	Very Low
Wayne County	$29,185	$2,334	n/a	$31,519	21.0	Very Low

Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).

Total Risk Score

Severe Weather:

Table 147 represents the Severe Weather Total Risk Score for the Lower Elkhorn planning area, based on the Risk Assessment Methodology, as defined in this Plan.

[325] FEMA National Risk Index. Community Report. (n.d.). Retrieved from https://hazards.fema.gov/nri/map

Table 147: Severe Weather Total Risk Score

Severe Weather Total Risk Score						
Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Severe Weather (Strong Wind, Tornado, Hail, Lightning)	3	12	17	33	62	91
Consequence: Sum of all weighted factors.				*Impact: Sum of the weighted Impact factors.*		
Extent: Sum of the weighted Extent factors.				*Total Risk Score = Probability x Consequence*		
Vulnerability: Sum of the weighted Vulnerability factors.				** Normalized to 100*		

Total Risk Score Legend						
Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 50
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	51 – 75
The legend—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The Consequence Score represents the sum of the Extent, Vulnerability, and Impact Factors. The Total Risk Score is a measure of Probability and Consequence.						

Terrorism

Hazard Description

According to the Federal Bureau of Investigation (FBI), there is no single, universally accepted definition of terrorism. Terrorism is defined in the Code of Federal Regulations as "the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or social objectives."[326]

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

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

International terrorism involves violent acts or acts dangerous to human life that are a violation of the criminal laws of the United States or any state, or that would be a criminal violation if committed within the jurisdiction of the United States or any state. These acts appear to be intended to intimidate or coerce a civilian population, influence the policy of a government by intimidation or coercion, or affect the conduct of a government by assassination or kidnapping. International terrorist acts occur outside the United States or transcend national boundaries in terms of the means by which they are accomplished, the persons they appear intended to coerce or intimidate, or the locale in which their perpetrators operate or seek asylum.[327]

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

- Bio-terrorism
- Cyber-terrorism
- Eco-terrorism
- Nuclear-terrorism
- Narco-terrorism
  Agro-terrorism

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

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

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

[326] Department of Justice. 28 C.F.R. Section 0.85. (n.d.). Retrieved from https://www.justice.gov/archive/ag/annualreports/ar2003/pdf/p2sg1.pdf
[327] U.S Government Publishing Office. (2009). United States Code, 2009 Edition. Title 18, Part I, Chapter 113B. Sec. 2331. Retrieved from https://www.govinfo.gov/content/pkg/USCODE-2009-title18/html/USCODE-2009-title18-partI-chap113B-sec2331.htm

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

Note: The FBI investigates terrorism-related matters without regard to race, religion, national origin, or gender. Reference to individual members of any political, ethnic, or religious group in this report is not meant to imply that all members of that group are terrorists. Terrorists represent a small criminal minority in any larger social context.

Terrorist attacks can vary greatly in scale and magnitude, depending on the location of the attack. This may range from a localized attack (mass shooting,) to a regional disaster (such as the contamination of a water supply, chemical weapon use, etc.) The most recent terrorist attacks in the United States have utilized Incendiary devices and Firearms ahead of all other methods.[328] This is demonstrated in **Figure 56**.

As the majority of Nebraska is utilized for agricultural purposes, Agro-Terrorism is a more significant threat than traditional methods.

Agro-Terrorism is a subset of bioterrorism and is defined as the deliberate introduction of an animal or plant disease with the goal of generating fear, causing economic losses, and/or undermining social stability. The goal of agroterrorism is not to kill cows or plants. These are the means to the end of causing economic damage, social unrest, and loss of confidence in government. Human health could be at risk if contaminated food reaches the table or if an animal pathogen is transmissible to humans zoonotic. While agriculture may not be a terrorists first choice because it lacks the shock factor of more traditional terrorist targets, many analysts consider it a viable secondary target.[329]

Location

Terrorist activities could occur throughout the entire planning area. In rural areas, there would be a heightened risk related to agro-terrorism and tampering with water supplies. In urban areas, concerns are related to political unrest, activist groups, and others that may be targeting businesses, police, and federal buildings. While there is an extremely low likelihood, the threat of a terrorist attack spans the entire planning area, especially in the realm of agro-terrorism.

Extent

The Department of Homeland Security and its affiliated agencies are responsible for disseminating any information regarding terrorist activities in the country. The system in place is the National Terrorism Advisory System (NTAS). In 2011, NTAS replaced the Homeland Security Advisory System which was the color-coded system put in place after the September 11th attacks by Presidential Directive 5 and 8 in March of 2002.

[328] National Consortium for the Study of Terrorism and Responses to Terrorism. (2020). University of Maryland. GTD Search Results (Weapon Type). Retrieved from https://www.start.umd.edu/gtd/search/Results.aspx?charttype=line&chart=weapon&casualties_type=&casualties_max=&country=217

[329] Defense Technical Information Center. (2006). Agroterrorism: Threats and Preparedness. Retrieved from https://apps.dtic.mil/sti/citations/ADA456167

NTAS is based on a system of analyzing threat levels and providing either an imminent threat alert or an elevated threat alert.[330]

An ***Imminent Threat Alert*** warns of a credible, specific and impending terrorist threat against the United States.

An ***Elevated Threat Alert*** warns of a credible terrorist threat against the United States.

The Department of Homeland Security, in conjunction with other federal agencies, will decide which level of threat alert should be issued, should credible information be available.

Each alert provides a statement summarizing the potential threat and what, if anything, should be done to ensure public safety.

The NTAS Alerts will be based on the nature of the threat: in some cases, alerts will be sent directly to law enforcement or affected areas of the private sector, while in others, alerts will be issued more broadly to the American people through both official and media channels.

An individual threat alert is issued for a specific time period and automatically expires. It may be extended if new information becomes available or the threat evolves. The ***sunset provision*** contains a specific date when the alert expires, as there will not be a constant NTAS Alert or blanket warning of an overarching threat. If threat information changes for an alert, the Secretary of Homeland Security may announce an updated NTAS Alert. All changes, including the announcement that cancels an NTAS Alert, will be distributed the same way as the original alert.

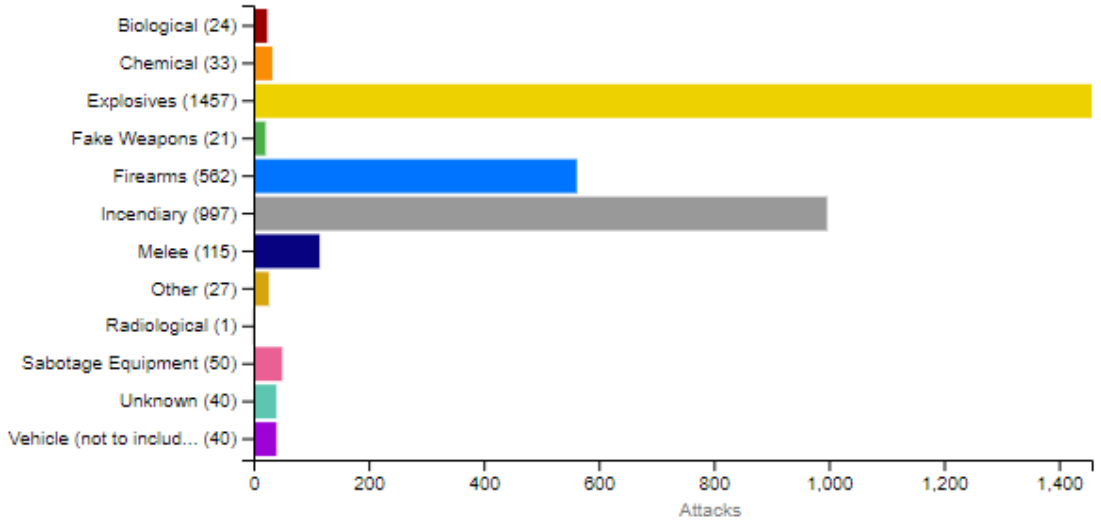
Historical Frequency

As per the Nebraska State Hazard Mitigation Plan, there have been no terrorist events within the planning area.[331] However, there have been multiple attacks within the U.S (and Nebraska), in general, as illustrated by **Figure 56**, depicting the most common weapons used.

[330] Department of Homeland Security. (n.d.). National Terrorist Advisory System. Retrieved from https://www.dhs.gov/national-terrorism-advisory-system

[331] State of Nebraska Hazard Mitigation Plan. (2021). Retrieved from https://nema.nebraska.gov/assets/files/hazard-mitigation/hazmitplan2021.pdf

Figure 56: Terrorist Attacks in the United States: Weapon Type[332]



Probability and Frequency

While there have been zero incidences within the planning area, this does not indicate that a terrorist event will never occur, only that the likelihood of such an event is incredibly low.

Vulnerability and Impact

The following table provides information related to regional vulnerabilities; for jurisdictional- specific vulnerabilities, refer to *Volume II*.

Life Safety and Health: Terrorism events pose a direct threat towards the life and safety of both the general population as well as first responders. An attack can cause injury or death. Depending on the attack, dangers include long-term effects (infrastructure damage,) or immediate threats such as mass shootings, as demonstrated by recent events.[333] Agro-terrorism could lead to illness or death if livestock or crops are contaminated and subsequently ingested or handled.

Property Damage and Critical Infrastructure: Recent planned terrorist attacks in the United States have involved directly attacking critical infrastructure, such as substations or emergency responder locations.[334] Infrastructure vital to the health and function of individuals and governments should be considered a potential target. Buildings that are targeted may be damaged, destroyed, or otherwise rendered unusable.

Economy: Depending on the scale and scope of a terrorist attack, the impact to the economy will vary. If the attack is in the realm of agro-terrorism, the economic impact would be disproportionate to the planning area

[332] National Consortium for the Study of Terrorism and Responses to Terrorism. (2020). University of Maryland. GTD Search Results (Weapon Type). Retrieved from https://www.start.umd.edu/gtd/search/Results.aspx?charttype=line&chart=weapon&casualties_type=&casualties_max=&country=217

[333] Department of Homeland Security. (2023.) National Terrorism Advisory System: Bulletin. Summary of Terrorism-Related Threat to the United States. Retrieved from https://www.dhs.gov/ntas/advisory/national-terrorism-advisory-system-bulletin-may-24-2023

[334] Ibid.

due to the majority of land in Nebraska being utilized for agricultural purposes. A large-scale attack likewise has the potential to disrupt the economy across the entire state and/or nation, depending on the severity. Businesses affected by a localized terrorist event (bombing, for example,) would be damaged or destroyed and incur economic loss.

Changes in Development and Impact of Future Development: As the risk for terrorist activities within the planning area is extremely low, there should be little to no impact for current or future developments.

Underserved and At Risk Population: At-risk populations are more vulnerable during emergencies. Factors impacting vulnerability include socioeconomic status, age, medical issues, and disability. [335] Terrorist attacks may target individuals who are unable to flee or retaliate, and therefore vulnerable populations may be a target.

Effects of Climate Change in Severity of Impacts: Climate change is not anticipated to affect the severity of this hazard.

FEMA NRI Expected Annual Loss Estimates

The National Risk Index does not include data for Terrorist hazards.

Total Risk Score

Table 148 represents the Terrorism Total Risk Score for the Lower Elkhorn planning area, based on the Risk Assessment Methodology, as defined in this Plan.

Table 148: Terrorism Total Risk Score

Terrorism Total Risk Score						
Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Terrorism	1	3	6	16	25	16
Consequence: Sum of all weighted factors. *Extent: Sum of the weighted Extent factors.* *Vulnerability: Sum of the weighted Vulnerability factors.* *Impact: Sum of the weighted Impact factors.* *Total Risk Score = Probability x Consequence* ** Normalized to 100*						
Total Risk Score Legend						
Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 50
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	51 – 75
The legend—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The Consequence Score represents the sum of the Extent, Vulnerability, and Impact Factors. The Total Risk Score is a measure of Probability and Consequence.						

[335] Centers for Disease Control and Prevention. (2015.) Planning for an Emergency: Strategies for Identifying and Engaging At-Risk Groups. Retrieved from https://www.cdc.gov/nceh/hsb/disaster/atriskguidance.pdf

5. Mitigation Goals and Strategy

Introduction

The mitigation strategy aims to establish clear goals and objectives and to identify actionable steps to minimize the impact of hazards on existing infrastructure and property in a way that is both cost-effective and technically feasible. The process of defining these goals and objectives occurred during the Planning Team meetings.

During these meetings, participants reviewed the goals outlined in the 2020 Hazard Mitigation Plan (HMP) and discussed potential additions and adjustments. The primary purpose of each goal and its accompanying set of objectives is to devise strategies to address risks stemming from various hazards and to devise means of reducing or removing these risks. Following each goal and set of objectives are "mitigation alternatives," which represent potential actions to be taken.

A preliminary list of goals and objectives was presented to the Planning Team and participants during the Steering Committee meetings. The Planning Team voted to retain the same list of goals outlined in the 2020 HMP. Furthermore, participating jurisdictions decided to stick with the same set of goals.

Goals

Below is the final list of goals as determined by the participants and Planning Team. These goals provide direction to guide participants in reducing future hazard related losses.

Goal 1: Protect the Health and Safety of the Public

Goal 2: Reduce Future Losses from Hazard Events

Goal 3: Increase Public Awareness and Educate on the Vulnerability to Hazards

Goal 4: Improve Emergency Management Capabilities

Goal 5: Pursue Multi-Objective Opportunities (Whenever Possible)

Goal 6: Enhance Overall Resilience and Promote Sustainability

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 Planning Team reviewed and approved goals which helped guide the process of identifying both broad-based and community-specific mitigation strategies and projects that will, if implemented, reduce their vulnerability, and help build stronger, more resilient communities.

These goals were reviewed, and the Planning Team agreed that they are still relevant and applicable for this plan update. Jurisdictions that participated in this plan update agreed that the goals identified in 2020 would be carried forward and utilized for the 2025 plan. The goals for this plan update are as follows:

Goal 1: Protect the Health and Safety of Residents

Objective 1.1: Identify and implement equitable and inclusive actions to reduce or prevent damage to property or prevent loss of life or serious injury (overall intent of the plan).

Objective 1.2: Identify potential public health threats and related mitigation measures.

Goal 2: Reduce Future Losses from Hazard Events

Objective 2.1: Provide protection for existing structures, future development, critical facilities, services, utilities, and trees to the extent possible.

Objective 2.2: Develop hazard specific plans, conduct studies or assessments, and retrofit jurisdiction to mitigate hazards and minimize their impact.

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

Goal 3: Increase Public Awareness and Educate on the Vulnerability to Hazards

Objective 3.1: Develop and provide information to residents and businesses about the types of hazards they are exposed to, what the effects may be, where they 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 and procedures and abilities.

Objective 4.2: Develop or improve Evacuation Plan and procedures.

Objective 4.3: Improve warning systems and ability to communicate to residents and businesses during and following a disaster or emergency.

Objective 4.4: Develop a plan for shelters/field sites for public health emergencies.

Goal 5: Pursue Multi-Objective Opportunities (whenever possible)

Objective 5.1: When possible, use existing resources, agencies, and programs to implement the projects.

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

Objective 5.3: Identify and map critical infrastructure, such as levees and dams, that may not be included in local, state, or national inventories.

Goal 6: Enhance Overall Resilience and Promote Sustainability

Objective 6.1: Incorporate hazard mitigation and adaptation into updating other existing planning endeavors (e.g., comprehensive plans, zoning ordinances, subdivision regulations, etc.).

Changes in Priority

The development of the mitigation strategy for this plan update includes the addition of several mitigation actions, revisions to the mitigation alternative selection process, and the incorporation of mitigation actions for the additional hazards addressed in the update.

Mitigation priorities have not changed since the update of the last plan. The following represent critical functions for the planning area.

Persons participating in the original public outreach consistently rated Severe Weather as the most serious risk, followed by extreme temperatures; the third priority was drought. For that reason, when pursuing mitigation actions, the priorities for mitigation will be:

1. Severe Weather (Strong winds, Severe Thunderstorms, Hail, Tornadoes)
2. Extreme Temperature (Heat Wave and Cold Wave)
3. Drought
4. Power Loss
5. Flooding

Mitigation Actions

After establishing the goals, mitigation actions were prioritized. The other options considered included:

- The mitigation actions in the previous plan.
- Additional mitigation actions were discussed during the planning process.
- Recommendations from ISC for additional mitigation actions.

ISC provided each participant with a sample list of mitigation actions to serve as a starting point. The list of sample mitigation actions aided participants in determining the most effective actions for their respective jurisdictions in mitigating damages in the event of a disaster.

These projects are the core of a hazard mitigation plan. The group was instructed that each mitigation action must be directly related to the plan's goals. They must be specific activities that are concise and can be implemented individually.

Mitigation actions were evaluated based on the community's risk and capability assessments. Communities were encouraged to choose mitigation actions that were realistic and relevant to the concerns identified.

A final list of actions was established, including information on the associated hazard mitigated, a description of the action, responsible party, priority, cost estimate, potential funding sources, and timeline. This information was established through input from participants and determination by ISC.

Not all of the mitigation actions identified by a community may ultimately be implemented due to limited capabilities, prohibitive costs, low benefit/cost ratio, or other concerns. 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 additional mitigation actions not identified.

Mitigation Action Plan

The action plan helps to prioritize mitigation initiatives according to a benefit/cost analysis of the proposed projects and their associated costs (44 CFR, Section 201.6(c)(3)(iii)). The action plan also provides the framework for how the proposed projects and initiatives will be implemented and administered over the next five years.

Mitigation Strategy / Action Timeline Parameters

While the preference is to provide definitive project completion dates, this is not possible for every mitigation strategy/action. Therefore, the parameters for the timeline (Projected Completion Date) are as follows:

- **Short-term**—To be completed in 1 to 5 years
- **Long-term**—To be completed in greater than 5 years
- **Ongoing**—Currently being implemented under existing programs but without a definite completion date

Mitigation Strategy / Action Benefit Parameters

Benefit ratings are defined as follows:

- **High**—Project will provide an immediate reduction of risk exposure for life and property.
- **Medium**—Project will have a long-term impact on the reduction of risk exposure for life and property, or project will provide an immediate reduction in the risk exposure for property.
- **Low**—Long-term benefits of the project are difficult to quantify in the short term.

Mitigation Strategy / Action Estimated Cost Parameters

While the preference is to provide definitive costs (dollar figures) for each mitigation strategy/action, this is not possible for every mitigation strategy/action. Therefore, the estimated costs for the mitigation initiatives identified in this plan are identified as high, medium, or low, using the following ranges:

- **High**—Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (e.g., bonds, grants, and fee increases).
- **Medium**—The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
- **Low**—The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.

Mitigation Strategy / Action Prioritization Process

The action plan must be prioritized according to a benefit/cost analysis of the proposed projects and their associated costs (44 CFR, Section 201.6(c)(3)(iii)). The benefits of proposed projects were weighed against estimated costs as part of the project prioritization process. The benefit/cost analysis was not of the detailed variety required by FEMA for project grant eligibility under the Hazard Mitigation Grant Program (HMGP) and Building Resilient Infrastructure and Communities (BRIC) grant program. A less formal approach was used because some projects may not be implemented for up to 10 years, and associated costs and benefits could change dramatically in that time. Therefore, a review of the apparent benefits versus the apparent cost of each project was conducted. Parameters were established for assigning subjective ratings (high, medium, and low) to the costs and benefits of these projects.

The priorities are defined as follows:

- **High**—A project that addressed numerous goals or hazards, has benefits that exceed cost, has funding secured or is an ongoing project, and/or meets eligibility requirements for the HMGP or BRIC grant program. High priority projects can be completed in the short term (1 to 5 years).

- **Medium**—A project that addressed multiple goals and hazards, which has benefits that exceed costs, and for which funding has not been secured but that is grant eligible under HMGP, BRIC, or other grant programs. The project can be completed in the short term once funding is secured. Medium priority projects will become high priority projects once funding is secured.
- **Low**—A project that will address few or no goals, mitigate the risk of one or few hazards, has benefits that do not exceed the costs or are difficult to quantify, for which funding has not been secured, that is not eligible for HMGP or BRIC grant funding, and for which the timeline for completion is long term (1 to 10 years). Low priority projects may be eligible for other sources of grant funding from other programs.

For many of the strategies identified in this action plan, the partners may seek financial assistance under the HMGP or HMA programs, both of which require detailed benefit/cost analyses. These analyses will be performed on projects at the time of application using the FEMA benefit-cost model. For projects not seeking financial assistance from grant programs that require detailed analysis, the partners reserve the right to define "benefits" according to parameters that meet the goals and objectives of this plan.

Participant Mitigation Actions

The following are specific actions listed by participants of the Lower Elkhorn NRD HMP intended to be utilized in the implementation of mitigation alternatives. Each action is described by the following:

- **Mitigation Action** – general title of the action item
- **Description** – brief summary of what the action item(s) will accomplish
- **Hazard(s) Addressed** – which hazard the mitigation action aims to address
- **Estimated Cost** – a general cost estimate for implementing the mitigation action for the appropriate jurisdiction
- **Potential funding** – a list of any potential funding mechanisms to fund the action
- **Timeline** – a general timeline as established by planning participants
- **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 and the size of the local tax base
- **Lead agency** – listing of agencies or departments which may lead or oversee the implementation of the action item
- **Status** – a description of what has been done, if anything, to implement the action item

Implementation of the actions will vary between individual plan participants based upon the availability of existing information, funding opportunities and limitations, and administrative capabilities of communities. 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 ongoing or new mitigation alternatives for each participating jurisdiction can be found in *Volume II*

Mitigation Alternative Project Matrix

During public meetings, each participant was asked to review mitigation projects listed in the 2020 HMP and review a list of potential mitigation alternatives which would lead to action items to reduce the effects of hazards. Selected projects varied from community to community depending upon the significance of each

hazard present. The information listed in **Table 149** is a compilation of the mitigation alternatives identified by jurisdiction and organized by the goal to be met.

Table 149: Mitigation Alternatives Matrix

Mitigation Action	Corresponding Goals & Objectives	Allen, Village of	Bancroft Rosalie Community Schools	Bancroft, Village of	Battle Creek, City of	Beemer, Village of	Belden, Village of	Carroll, Village of	Cedar, County of	Clarkson, City of	Coleridge, Village of	Colfax, County of	Concord, Village of	Craig, Village of	Cuming, County of	Dixon, County of	Dixon, Village of	Dodge, Village of
Adopt a no adverse Impact	2, 5, 6														X			
Outdoor Warning Sirens	1, 4, 5			X					X		X	X						X
Backup Generator	1, 2, 5		X	X		X	X		X	X	X	X		X			X	X
Bridge Assessment	1, 2, 5								X									
Civil Service Improvements	1, 2, 5	X				X	X										X	X
Construct permanent EOC for County with storm shelter & backup communications	4								X									
Coordinate with National Drought Mitigation Center	3, 5			X														
Develop Action Plan to Improve Communication between Agencies	4								X			X						
Develop Comprehensive Disaster/Emergency Response Plan	2, 4, 5	X					X		X	X							X	
Develop Continuity Plans for Critical Services	2			X			X		X									
Develop Evacuation Plan	4			X			X		X	X								X
Emergency Communications	4	X		X											X			
Emergency Exercise	1, 3, 4, 5																	X
Facilities for Vulnerable Populations	1	X																
Grade control structures	1, 2, 5								X	X								

Mitigation Action	Corresponding Goals & Objectives	Allen, Village of	Bancroft Rosalie Community Schools	Bancroft, Village of	Battle Creek, City of	Beemer, Village of	Belden, Village of	Carroll, Village of	Cedar, County of	Clarkson, City of	Coleridge, Village of	Colfax, County of	Concord, Village of	Craig, Village of	Cuming, County of	Dixon, County of	Dixon, Village of	Dodge, Village of
Identify and establish an Emergency Operations Center	4								X									
Identify and remove hazardous limbs and/or trees	1, 2, 5													X				
Identify any existing private or public storm shelters	1, 3, 4								X									
Identify any existing private or public storm shelters.	1, 3, 4										X							
Identify potential flooding sources and flood-vulnerable areas. Explore and prioritize solutions.	1, 2, 5									X								
Implement channel and bridge improvements to increase channel conveyance and decrease the base flood elevation	1, 2, 5								X									
Implement in-building alert systems in crticial facilities and implement public/amss notification system.	1, 2, 5								X									
Implement IPAWS System	1, 2, 5											X						
Improve and revise snow/ice removal program.	2, 5, 6								X					X			X	

Mitigation Action	Corresponding Goals & Objectives	Allen, Village of	Bancroft Rosalie Community Schools	Bancroft, Village of	Battle Creek, City of	Beemer, Village of	Belden, Village of	Carroll, Village of	Cedar, County of	Clarkson, City of	Coleridge, Village of	Colfax, County of	Concord, Village of	Craig, Village of	Cuming, County of	Dixon, County of	Dixon, Village of	Dodge, Village of
Improve emergency rescue and response equipment and facilities by providing additional, or updating existing emergency response equipment.	1, 4, 5								X		X							
Improve subdivision design	2, 5, 6			X														
Improve Warning System	1, 4, 5								X		X							
Intergovernmental Support	5	X							X									
Investigate possible alternatives to address flooding on Maple Creek and design and construct the best solution.	1, 2, 5											X						
Levee/Floodwall Construction and/or Improvements	1, 2, 5									X					X			
MOU Agreements	5								X									
Move Agricultural disease facilty under cover to protect against outside elements (mad cow disease).	1, 2								X									
New municipal well.	1, 2, 5									X								
Participate in the community rating system (CRS)	2									X								
Power and Service Lines	1, 2, 5														X			
Property Acquisition	1, 2, 5					X				X		X			X			

Mitigation Action	Corresponding Goals & Objectives	Allen, Village of	Bancroft Rosalie Community Schools	Bancroft, Village of	Battle Creek, City of	Beemer, Village of	Belden, Village of	Carroll, Village of	Cedar, County of	Clarkson, City of	Coleridge, Village of	Colfax, County of	Concord, Village of	Craig, Village of	Cuming, County of	Dixon, County of	Dixon, Village of	Dodge, Village of
Protect steep slopes. Vegetation placement and management	1, 2, 5								X									
Replace EOC	4											X						
River/Stream Bank Stabilization	1, 2, 5											X						
Safe Room / Storm Shelter	1, 2, 5		X		X		X	X	X		X	X		X	X		X	
Shelter in Place Training	1, 3								X									
Source water contingency plan	2																	
Stabilize/Anchor Fertilizer, Fuel and Propane Tanks	1, 2, 5								X									
Stormwater System and Drainage Improvements	1,2, 5			X	X			X	X	X	X	X			X		X	X
Terracing and Vegetation along Bluffs	1, 2, 5								X									
Tree City USA	1, 2, 3, 5			X	X					X	X							
Update Comprehensive Plan	2, 5, 6	X																
Update county Wide Siren System	1, 2, 5											X						
Update FIRM maps to reflect accurate flood inundation areas within jurisdictions.	2								X									
Warning Systems	4											X			X			X
Water System Improvements	1, 2, 5																X	
Weather Radios	4	X			X				X	X		X			X		X	
Transportation Drainage Improvements	1, 2, 5								X							X		

Mitigation Action	Corresponding Goals & Objectives	Allen, Village of	Bancroft Rosalie Community Schools	Bancroft, Village of	Battle Creek, City of	Beemer, Village of	Belden, Village of	Carroll, Village of	Cedar, County of	Clarkson, City of	Coleridge, Village of	Colfax, County of	Concord, Village of	Craig, Village of	Cuming, County of	Dixon, County of	Dixon, Village of	Dodge, Village of
Obtain Missing Data for Future Updates	2			X					X									
Plan to prioritize flood related projects	2					X												
Tree Inventory	2			X														
Implement Frazier Creek Flood Control Plan	1, 2, 5					X												
Fuel Reduction	2, 4, 5															X		
Participate in the National Flood Insurance Program (NFIP)	2															X		
FIRM Mapping	2															X		
Enhance/Harden Waste Removal System	1, 2, 5	X											X					
First Aid Trainings	4	X																
Emergency Fuel Supply Plan	2, 4, 5	X							X								X	
Databse of Vulnerable Population	2																X	
Develop Comprehensive Plan	2, 4, 5																X	
Purchase Snow plow	1, 2, 5																X	
Fire Safety Training and Education	3, 4							X										
Water Conservation Management Plan and Practices	2																	X
Storm Sewer Improvements	1,2, 5				X													
Flood Diversion Channel	1, 2, 5				X													
Dam Upstream of Battle Creek	1, 2, 5				X													

Mitigation Action	Corresponding Goals & Objectives	Allen, Village of	Bancroft Rosalie Community Schools	Bancroft, Village of	Battle Creek, City of	Beemer, Village of	Belden, Village of	Carroll, Village of	Cedar, County of	Clarkson, City of	Coleridge, Village of	Colfax, County of	Concord, Village of	Craig, Village of	Cuming, County of	Dixon, County of	Dixon, Village of	Dodge, Village of
Flood Risk Resiliency and Mitigation Action Plan	2				X													
Protecting the Water Treatment Facility	1, 2, 5				X													
Increase Flow Capacity	1, 2, 5							X										
Complete Flood Study	1, 2, 5							X										
Backup Records	2	X							X								X	
Emergency Operations	4																	
Improve Building Codes	2, 5, 6			X			X							X				
Madison County's Creek Improvements	1. 2. 5																	
Public Awareness	3	X		X	X	X	X		X	X	X	X	X		X	X	X	X
Anchor Manufactured Homes	1, 2, 5								X					X				
Surge Protectors	1,2, 5						X											
Update Chemical Spill Kit/Storage Unit	1, 2, 5																	X
Update Software and Video Security	2																	X

Mitigation Action	Corresponding Goals & Objectives	Elkhorn Logan Valley Public Health Department	Emerson, Village of	Fordyce, Village Of	Hadar, Village of	Hartington, City of	Hooper, City of	Hoskins, Village of	Howells, Village of	Humphrey, City of	Laurel, City of	Laurel-Concord-Coleridge School	Leigh, Village of	Lewis and Clark NRD	Lower Elkhorn NRD	Lyons, City of	Madison, City of	Madison, County of	Martinsburg, Village of
Coordinate with state on processing of meat	4								X										
Cyber governance and Planning	2, 4															X			
Develop Continuity Plans for Critical Services	2		X																
Enhance Pedestrian Evacuation Routes	1, 2, 5															X			
Flood protection for water treatment facility	1, 2, 5										X								
Improve storm sewers and drainage patters in and around the community	2, 5, 6															X			
Improve subdivision design	2, 5, 6		X																
Increase Culvert Diameter	1, 2, 5												X						
Preserve Natural Floodplain	1, 2, 5, 6		X																
Purchase additional bunker gear to improve the resources and equipment available for firefighting	1, 2, 5					X													
Update Comprehensive Plan	2, 5, 6										X								
Upgrade utility meters	2, 4															X			

Mitigation Action	Corresponding Goals & Objectives	Elkhorn Logan Valley Public Health Department	Emerson, Village of	Fordyce, Village Of	Hadar, Village of	Hartington, City of	Hooper, City of	Hoskins, Village of	Howells, Village of	Humphrey, City of	Laurel, City of	Laurel-Concord-Coleridge School	Leigh, Village of	Lewis and Clark NRD	Lower Elkhorn NRD	Lyons, City of	Madison, City of	Madison, County of	Martinsburg, Village of
Water Restrictions/Burn Permits	1, 2, 5												X						
Short Term Residency Shelters	1, 2, 4, 5																	X	
Plan to prioritize flood related projects	2		X																
Develop Plan for Extreme Weather Events	2		X																
Fire Safety Training and Education	3, 4		X																
Harden Water Treatment Facility	1, 2, 5		X																
Water Conservation Management Plan and Practices	2																		X
Develop a plan to prioritize all flood related projects	2																X		
Protect Light Plant Facility	1, 2, 5																X		
Improve Watershed	1, 2, 5																	X	
Improve Flood Warning System	1, 4, 5								X										
Infrastructure Assessment Study	2									X									
Training	3, 4	X																	

Mitigation Action	Corresponding Goals & Objectives	Elkhorn Logan Valley Public Health Department	Emerson, Village of	Fordyce, Village Of	Hadar, Village of	Hartington, City of	Hooper, City of	Hoskins, Village of	Howells, Village of	Humphrey, City of	Laurel, City of	Laurel-Concord-Coleridge School	Leigh, Village of	Lewis and Clark NRD	Lower Elkhorn NRD	Lyons, City of	Madison, City of	Madison, County of	Martinsburg, Village of
Expand Access	1, 2, 5											X							
Storm Shelter Support	4											X							
Partnership with Local Communities	4, 5											X							
Harden Infrastructure	1, 2, 5											X							
Disease Control	1, 2, 5													X					
Slope Stabilization	1, 2, 5													X					
Complete/Update Wildfire Protection Plans	2													X					
Drought Monitoring Plan and Procedures	2													X					
Update Master Plan to Prioritize Flood Related Projects	2														X				
Randolph Flood Prone Structure Alleviation Projections	1, 2, 5														X				
Willow Creek Dam Rehabilitation	1, 2, 5														X				
Backup Records	2																X		
Madison County's Creek Improvements	1. 2. 5																	X	
Emergency Communications	4									X				X					

Mitigation Action	Corresponding Goals & Objectives	Elkhorn Logan Valley Public Health Department	Emerson, Village of	Fordyce, Village Of	Hadar, Village of	Hartington, City of	Hooper, City of	Hoskins, Village of	Howells, Village of	Humphrey, City of	Laurel, City of	Laurel-Concord-Coleridge School	Leigh, Village of	Lewis and Clark NRD	Lower Elkhorn NRD	Lyons, City of	Madison, City of	Madison, County of	Martinsburg, Village of
Identify vulnerable transmission lines and plan to bury lines underground or retrofit existing structures/infrastructure to be less vulnerable to storm events.	1, 2, 5										X					X			
Levee/Floodwall Construction and/or Improvements	1, 2, 5										X				X				
New municipal well.	1, 2, 5									X	X								
Plan to Prioritize all Flood Related Projects	2								X		X								
Tree City USA	1, 2, 3, 5								X								X		
Participate in the National Flood Insurance Program (NFIP)	2			X															X
Protecting the Water Treatment Facility	1, 2, 5								X	X									
MOUs	5											X				X			
Develop Action Plan to Improve Communication between Agencies	4								X		X		X						
Grade control structures	1, 2, 5										X			X					X
Improve Warning System	1, 4, 5								X		X					X			
Power and Service Lines	1, 2, 5		X					X									X		
Property Acquisition	1, 2, 5										X						X	X	
Warning Systems	4						X						X				X		

Mitigation Action	Corresponding Goals & Objectives	Elkhorn Logan Valley Public Health Department	Emerson, Village of	Fordyce, Village Of	Hadar, Village of	Hartington, City of	Hooper, City of	Hoskins, Village of	Howells, Village of	Humphrey, City of	Laurel, City of	Laurel-Concord-Coleridge School	Leigh, Village of	Lewis and Clark NRD	Lower Elkhorn NRD	Lyons, City of	Madison, City of	Madison, County of	Martinsburg, Village of
Water System Improvements	1, 2, 5		X						X		X								
Improve Building Codes	2, 5, 6		X							X							X		
Coordinate with National Drought Mitigation Center	3, 5		X						X	X						X			
Develop Evacuation Plan	4								X		X		X				X		
Mutual aid agreements	5							X	X		X						X		
Civil Service Improvements	1, 2, 5		X						X		X						X		X
Develop Comprehensive Disaster/Emergency Response Plan	2, 4, 5							X	X	X						X			X
Source water contingency plan	2		X						X	X	X		X						
Obtain Missing Data for Future Updates	2		X						X	X	X						X		
Backup Generator	1, 2, 5			X	X	X				X	X					X			
Improve and revise snow/ice removal program.	2, 5, 6						X	X	X	X	X						X		
Participate in the community rating system (CRS)	2		X				X		X		X						X	X	
Alert Sirens	1, 4, 5			X			X			X			X		X	X	X			
Weather Radios	4		X			X	X				X		X			X	X		X
Stormwater System and Drainage Improvements	1,2, 5		X		X		X	X	X	X	X						X	X	
Safe Room / Storm Shelter	1, 2, 5		X		X	X			X	X	X			X	X	X	X		

Mitigation Action	Corresponding Goals & Objectives	Elkhorn Logan Valley Public Health Department	Emerson, Village of	Fordyce, Village Of	Hadar, Village of	Hartington, City of	Hooper, City of	Hoskins, Village of	Howells, Village of	Humphrey, City of	Laurel, City of	Laurel-Concord-Coleridge School	Leigh, Village of	Lewis and Clark NRD	Lower Elkhorn NRD	Lyons, City of	Madison, City of	Madison, County of	Martinsburg, Village of
Public Awareness	3	X			X		X	X	X		X		X	X	X	X	X	X	X

Mitigation Action	Corresponding Goals & Objectives	Maskell, Village of	McLean, Village of	Newcastle, Village of	Nickerson, Village of	Norfolk Public Schools	Norfolk, City of	Northeast Nebraska Public Health	Oakland, City of	Obert, Village of	Osmond, City of	Pender, Village of	Pierce, City of	Pierce, County of	Planview, City of	Ponca, City of
Complete a review of needs related to the municipal water distribution service and establish a plan to replace water mains as needed.	1, 2, 5								X							
Coordinate with National Drought Mitigation Center	3, 5											X				
Develop Action Plan to Improve Communication between Agencies	4															
Hail Resistant Roofing	1, 2, 5														X	
Identify and remove hazardous limbs and/or trees	1, 2, 5															
Identify vulnerable transmission lines and plan to bury lines underground or retrofit existing structures/infrastructure to be less vulnerable to storm events.	1, 2, 5															
Improve Warning System	1, 4, 5															
Install Vehicular Barriers	1, 2, 3, 5														X	
Intergovernmental Support	5													X		
Plan to Prioritize all Flood Related Projects	2								X							
Plan to Prioritize all Flood Related Projects.	2															

Mitigation Action	Corresponding Goals & Objectives	Maskell, Village of	McLean, Village of	Newcastle, Village of	Nickerson, Village of	Norfolk Public Schools	Norfolk, City of	Northeast Nebraska Public Health	Oakland, City of	Obert, Village of	Osmond, City of	Pender, Village of	Pierce, City of	Pierce, County of	Planview, City of	Ponca, City of
Prohibit the construction of critical facilities within the immediate radius of chemical storage facilities	1, 2, 5															
Randolph Flood-Prone Structure Alleviation Project	1, 2, 5															
Relocate Municipal Infrastructure	1, 2, 5															
River/Stream Bank Stabilization	1, 2, 5															
Source water contingency plan	2															
Storm shelter identification / signage	3															
Utilize exercise to prepare for potential explosion or hazardous spills.	3, 4															
Vulnerable Population Support Database	2														X	
Transportation Drainge Improvements	1, 2, 5						X									
Hazardous Tree Removal	1, 2, 5						X									
Tree Inventory	2						X									
Conduct a Review of Preliminary Study of Flood Mitigation Options	2															X
Emergency Management Exercise	4															X

Mitigation Action	Corresponding Goals & Objectives	Maskell, Village of	McLean, Village of	Newcastle, Village of	Nickerson, Village of	Norfolk Public Schools	Norfolk, City of	Northeast Nebraska Public Health	Oakland, City of	Obert, Village of	Osmond, City of	Pender, Village of	Pierce, City of	Pierce, County of	Planview, City of	Ponca, City of
Maintain Good Standing with the NFIP	1, 2, 5															X
First Aid Trainings	4														X	
Databse of Vulnerable Population	2							X								
Develop Comprehensive Plan	2, 4, 5							X								
New Water Tower	1, 2, 5			X												
Develop a plan to prioritize all flood related projects	2										X					
Protecting the Water Treatment Facility	1, 2, 5											X				
North Fork of the Elkhorn Emergency Stormwater Lift Station	1, 2, 5						X									
Floodplain Management	2, 5, 6						X									
Improve Flood Warning System	1, 4, 5															
Channel Modification and Obstruction Removal	1, 2, 5										X					
Infrastructure Assessment Study	2													X		
Designated Snow Routes	1, 2, 5													X		
Update Bridges	1, 2, 5													X		
Suppression Vehicles	1,2, 5		X													
Sump Pumps	1,2, 5		X													
Harden Infrastructre	1, 2, 5							X								
Public Information	3							X								
MOUs and Agreements	5							X								

Mitigation Action	Corresponding Goals & Objectives	Maskell, Village of	McLean, Village of	Newcastle, Village of	Nickerson, Village of	Norfolk Public Schools	Norfolk, City of	Northeast Nebraska Public Health	Oakland, City of	Obert, Village of	Osmond, City of	Pender, Village of	Pierce, City of	Pierce, County of	Planview, City of	Ponca, City of
Agricultural Disease Education Programs	3							X								
Construct Cooling Stations	1, 2, 5							X								
Cooling Station Database	4							X								
Electrical System Looped Distribution/Redundancies	1, 2, 5							X								
Emergency Operations	4				X											
Water Pollution Control Protections	1, 2, 5						X									
Emergency Exercise	1, 3, 4, 5						X							X		
Improve subdivision design	2, 5, 6											X				
New municipal well.	1, 2, 5	X													X	
Participate in the community rating system (CRS)	2						X									
Warning Systems	4		X									X				
Obtain Missing Data for Future Updates	2														X	
Floodplain Regulation Enforcements and/or Updates	2, 5, 6			X												X
Backup Records	2				X									X		
Develop Continuity Plans for Critical Services	2				X			X							X	
Emergency Communications	4				X							X			X	
Grade control structures	1, 2, 5			X												X

Mitigation Action	Corresponding Goals & Objectives	Maskell, Village of	McLean, Village of	Newcastle, Village of	Nickerson, Village of	Norfolk Public Schools	Norfolk, City of	Northeast Nebraska Public Health	Oakland, City of	Obert, Village of	Osmond, City of	Pender, Village of	Pierce, City of	Pierce, County of	Planview, City of	Ponca, City of
Improve and revise snow/ice removal program.	2, 5, 6											X		X		
Levee/Floodwall Construction and/or Improvements	1, 2, 5										X		X			
Mutual aid agreements	5											X			X	
Power and Service Lines	1, 2, 5						X						X		X	
Tree City USA	1, 2, 3, 5			X												X
Update Comprehensive Plan	2, 5, 6			X			X							X		
Water System Improvements	1, 2, 5								X						X	
Short Term Residency Shelters	1, 2, 4, 5							X				X				
Develop Comprehensive Disaster/Emergency Response Plan	2, 4, 5				X			X	X			X				
Property Acquisition	1, 2, 5						X				X					X
Weather Radios	4	X										X			X	
Drainage Study / Stormwater Master Plan	2			X			X				X			X		
Improve Building Codes	2, 5, 6				X							X			X	
Civil Service Improvements	1, 2, 5		X		X							X			X	
Develop Evacuation Plan	4		X				X					X		X	X	
Alert Sirens	1, 4, 5	X			X		X					X			X	X
Safe Room / Storm Shelter	1, 2, 5		X	X			X		X			X	X			X
Backup Generator	1, 2, 5	X	X	X				X	X	X		X			X	X
Stormwater System and Drainage Improvements	1,2, 5	X		X			X		X		X	X	X	X		X

Mitigation Action	Corresponding Goals & Objectives	Maskell, Village of	McLean, Village of	Newcastle, Village of	Nickerson, Village of	Norfolk Public Schools	Norfolk, City of	Northeast Nebraska Public Health	Oakland, City of	Obert, Village of	Osmond, City of	Pender, Village of	Pierce, City of	Pierce, County of	Planview, City of	Ponca, City of
Public Awareness	3	X		X		X			X	X		X	X	X	X	X

Mitigation Action	Corresponding Goals & Objectives	Randolph, City of	Sanitary & Improvement District #X Wood Park	Scribner, City of	Scribner-Snyder Community School District	St Helena, Village of	Stanton Community Schools	Stanton, City of	Stanton, County of	Thurston, Village of	Tilden, City of	Uehling, Village of
Coordinate with National Drought Mitigation Center	3, 5			X								
Develop Action Plan to Improve Communication between Agencies	4	X										
Hail Resistant Roofing	1, 2, 5										X	
Identify and remove hazardous limbs and/or trees	1, 2, 5	X										
Identify vulnerable transmission lines and plan to bury lines underground or retrofit existing structures/infrastructure to be less vulnerable to storm events.	1, 2, 5	X										
Improve emergency rescue and response equipment and facilities by providing additional or updating existing emergency response equipment.	1, 4, 5					X						
Improve Warning System	1, 4, 5	X										
Install Vehicular Barriers	1, 2, 3, 5						X					
Levee/Floodwall Construction and/or Improvements	1, 2, 5	X										
New municipal well.	1, 2, 5		X									
Plan to Prioritize all Flood Related Projects.	2	X										

Mitigation Action	Corresponding Goals & Objectives	Randolph, City of	Sanitary & Improvement District #X Wood Park	Scribner, City of	Scribner-Snyder Community School District	St Helena, Village of	Stanton Community Schools	Stanton, City of	Stanton, County of	Thurston, Village of	Tilden, City of	Uehling, Village of
Prohibit the construction of critical facilities within the immediate radius of chemical storage facilities	1, 2, 5	X										
Purchase a portable radar speed detection sign and display to warn drivers to slow down.	1, 2, 5					X						
Randolph Flood-Prone Structure Alleviation Project	1, 2, 5	X										
Relocate Municipal Infrastructure	1, 2, 5	X										
Storm shelter identification / signage	3	X										
Utilize exercise to prepare for potential explosion or hazardous spills.	3, 4	X										
Short Term Residency Shelters	1, 2, 4, 5	X										
Fire Safety Training and Education	3, 4								X			
Improve overall resilience and sustainability	1, 4, 5			X								
Infrastructure Hardening	1, 2, 5										X	
Improve Watershed	1, 2, 5										X	
Purchase Snow Blower	1, 2, 5								X			

Mitigation Action	Corresponding Goals & Objectives	Randolph, City of	Sanitary & Improvement District #X Wood Park	Scribner, City of	Scribner-Snyder Community School District	St Helena, Village of	Stanton Community Schools	Stanton, City of	Stanton, County of	Thurston, Village of	Tilden, City of	Uehling, Village of
Public Safety and Response	1, 2, 5								X			
Provide Storm protection	1, 2, 5								X			
Community Safety Website	3								X			
Develop Flood Assistance Strategies	1, 2, 5								X			
Implement Filtration Projects	1, 2, 5								X			
Review and Upgrade Critical Facilities	1, 2, 5								X			
New/Upgraded Fire Hydrants	1, 2, 5		X									
Increase defensible space	1, 2, 5		X									
Improve Emergency Management Capabilities	4				X							
Emergency Operations	4								X			
Surge Protectors	1,2, 5										X	
Grade control structures	1, 2, 5	X		X								
Improve subdivision design	2, 5, 6	X									X	
Property Acquisition	1, 2, 5	X									X	
River/Stream Bank Stabilization	1, 2, 5	X									X	
Source water contingency plan	2	X									X	
Tree City USA	1, 2, 3, 5	X									X	
Water System Improvements	1, 2, 5	X									X	
Hazardous Tree Removal	1, 2, 5										X	X
Improve Flood Warning System	1, 4, 5	X									X	
Improve Building Codes	2, 5, 6	X		X								
Develop Evacuation Plan	4	X		X							X	

Mitigation Action	Corresponding Goals & Objectives	Randolph, City of	Sanitary & Improvement District #X Wood Park	Scribner, City of	Scribner-Snyder Community School District	St Helena, Village of	Stanton Community Schools	Stanton, City of	Stanton, County of	Thurston, Village of	Tilden, City of	Uehling, Village of
Warning Systems	4								X		X	X
Weather Radios	4	X						X			X	
Develop a plan to prioritize all flood related projects	2			X					X		X	
Update Bridges	1, 2, 5							X	X		X	
Develop Comprehensive Disaster/Emergency Response Plan	2, 4, 5		X	X					X		X	
Emergency Communications	4			X			X		X		X	
Improve and revise snow/ice removal program.	2, 5, 6	X		X				X			X	
Mutual aid agreements	5	X				X			X		X	
Participate in the community rating system (CRS)	2	X						X	X		X	
Stormwater System and Drainage Improvements	1,2, 5	X	X					X			X	
Obtain Missing Data for Future Updates	2	X	X				X		X			
Alert Sirens	1, 4, 5	X	X	X					X		X	X
Civil Service Improvements	1, 2, 5	X	X	X				X	X		X	
Public Awareness	3	X					X	X	X	X	X	
Safe Room / Storm Shelter	1, 2, 5	X	X		X		X			X	X	X
Backup Generator	1, 2, 5	X	X		X	X	X	X	X	X	X	X

Mitigation Action	Corresponding Goals & Objectives	Wakefield, City of	Waterbury, Village of	Wausa, Village of	Wayne, City of	Wayne, County of	West Point, City of	Winside, Village of	Winslow, Village of	Wisner, City of	Wynot Rural Fire Department	Wynot, Village of
Adopt a no adverse Impact	2, 5, 6									X		
Develop Evacuation Plan	4	X										
Emergency Exercise	1, 3, 4, 5									X		
Install Vehicular Barriers	1, 2, 3, 5						X					
Intergovernmental Support	5								X			
Levee/Floodwall Construction and/or Improvements	1, 2, 5									X		
Plan to Prioritize all Flood Related Projects	2						X					
Regulate water usage	1, 2, 5											X
Relocate Municipal Infrastructure	1, 2, 5								X			
Source water contingency plan	2	X										
Obtain Missing Data for Future Updates	2									X		
Short Term Residency Shelters	1, 2, 4, 5								X			
Plan to prioritize flood related projects	2									X		
Relocation of Hazardous Storage	1, 2, 5									X		
Emergency Fuel Supply Plan	2, 4, 5								X			
Fire Safety Training and Education	3, 4			X								
Impact Resistant Roof Coverings	1, 2, 5		X									
Develop a plan to prioritize all flood related projects	2	X										
Infrastructure Hardening	1, 2, 5								X			
Protecting the Water Treatment Facility	1, 2, 5	X										
Static Detectors	1, 2, 5					X						

Mitigation Action	Corresponding Goals & Objectives	Wakefield, City of	Waterbury, Village of	Wausa, Village of	Wayne, City of	Wayne, County of	West Point, City of	Winside, Village of	Winslow, Village of	Wisner, City of	Wynot Rural Fire Department	Wynot, Village of
Fire Extinguishers	1, 2, 5										X	
Smoke Detectors	1, 4, 5										X	
Side-by-side Purchase	1, 2, 5										X	
Rescue Boat	1, 2, 5										X	
Grass Rig	1, 2, 5										X	
Fire Pumper Truck	1, 2, 5										X	
Fire Equipment Truck Purchase	1, 2, 5										X	
Emergency Operations	4								X			
Surge Protectors	1,2, 5									X		
Coordinate with National Drought Mitigation Center	3, 5			X						X		
Hail Resistant Roofing	1, 2, 5						X			X		
Improve and revise snow/ice removal program.	2, 5, 6	X								X		
Mutual aid agreements	5				X					X		
Preserve Natural Floodplain	1, 2, 5, 6						X			X		
Promote First Aid	1, 3, 5						X			X		
Update Comprehensive Plan	2, 5, 6								X	X		
Warning Systems	4						X		X			
Hazardous Tree Removal	1, 2, 5		X							X		
First Aid Trainings	4		X						X			
Backup Records	2		X						X			
Grade control structures	1, 2, 5	X				X				X		
Low Impact Development	2, 5, 6	X					X			X		

Mitigation Action	Corresponding Goals & Objectives	Wakefield, City of	Waterbury, Village of	Wausa, Village of	Wayne, City of	Wayne, County of	West Point, City of	Winside, Village of	Winslow, Village of	Wisner, City of	Wynot Rural Fire Department	Wynot, Village of
Participate in the community rating system (CRS)	2	X					X			X		
Tree City USA	1, 2, 3, 5			X			X			X		
Vulnerable Population Support Database	2						X		X	X		
Develop Comprehensive Disaster/Emergency Response Plan	2, 4, 5	X			X	X			X			
Develop Continuity Plans for Critical Services	2	X					X		X	X		
Facilities for Vulnerable Populations	1	X					X		X	X		
New municipal well.	1, 2, 5	X						X		X		X
Property Acquisition	1, 2, 5	X					X		X	X		
River/Stream Bank Stabilization	1, 2, 5	X			X	X				X		
Safe Room / Storm Shelter	1, 2, 5	X				X	X					X
Weather Radios	4	X					X		X			X
Improve Building Codes	2, 5, 6						X	X	X	X		
Alert Sirens	1, 4, 5		X			X	X		X			X
Civil Service Improvements	1, 2, 5	X					X	X	X	X		
Emergency Communications	4	X			X		X		X	X		
Power and Service Lines	1, 2, 5	X			X		X	X		X		
Stormwater System and Drainage Improvements	1,2, 5	X		X		X	X			X		X
Backup Generator	1, 2, 5	X	X	X		X	X	X	X	X	X	X
Public Awareness	3	X	X	X	X	X	X	X	X	X		X

Completed Mitigation Actions

Previously completed mitigation actions identified by the communities can be found in their specific community profile in *Volume II*.

6. Plan Implementation and Maintenance

Monitoring, Evaluating, and Updating the Plan

Participants of the LENRD and LCNRD HMP will be responsible for monitoring (annually at a minimum), evaluating, and updating the plan. Hazard mitigation projects will be prioritized by each participant's governing body with support and suggestions from the public and business owners. Unless otherwise specified by each participant's governing body, the governing body will be responsible for implementation of the recommended projects. The party responsible for the various implementation actions will report on the status of all projects and include which implementation processes worked well, any difficulties encountered, how coordination efforts are proceeding, and which strategies could be revised.

To assist with monitoring the plan, as each recommended project is completed, a detailed timeline of how that project was completed will be written and attached to the plan in a format selected by the governing body. Information that will be included will address project timelines, agencies involved, area(s) benefited, total funding (if complete), etc. At the discretion of each governing body, a local task force will be used to review the original draft of the mitigation plan and to recommend changes.

Review and updating of this plan will occur at least every five years. At the discretion of each governing body, updates may be incorporated more frequently, especially in the event of a major hazard. The governing body will start meetings to discuss mitigation updates at least six months prior to the deadline for completing the plan review. The people overseeing the evaluation process will review the goals and objectives of the previous plan and evaluate them to determine whether they are still pertinent and current. Among other questions, they may want to consider the following:

- Do the goals and objectives address current and expected conditions?
- If any of the recommended projects have been completed, did they have the desired impact on the goal for which they were identified? If not, what was the reason it was not successful (lack of funds/resources, lack of political/popular support, underestimation of the amount of time needed, etc.)?
- Have either the nature, magnitude, and/or type of risks changed?
- Are there implementation problems?
- Are current resources appropriate to implement the plan?
- Were the outcomes as expected?
- Did the plan partners participate as originally planned?
- Are there other agencies which should be included in the revision process?

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

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

Continued Public Involvement

LENRD and LCNRD acknowledge the invaluable role of the public in reviewing and updating the plan. While LENRD, LCNRD and participating jurisdictions are responsible for this task, we highly value the public's input into plan revisions and updates.

To ensure continued plan support and input from the public and business owners, public involvement will remain a top priority for each participant. Public meetings will be held as deemed necessary by the LENRD Assistant Manager. These meetings will provide a forum for the public to express concerns, opinions, or new alternatives that can be included in the plan. Notices for public meetings involving discussions of action on mitigation updates will be published and posted in the following locations at least two weeks in advance:

- Public spaces around the jurisdiction
- City/Village Hall
- Websites
- Local radio stations
- Local newspapers
- Regionally-distributed newspaper

To further facilitate continued public involvement in the planning process, LENRD will ensure:

- A copy of the plan will be kept on hand at their office for public review and comment.
- A public meeting will be held to provide the public with a forum for discussing concerns, opinions, and ideas with the planning team.
- The plan and hazard mitigation project implementation opportunities will be updated at a meeting each year.
- Key community organizations are included to ensure underserved and underrepresented population groups have an opportunity to participate. This includes organizations such as Northeast Nebraska Area Agency on Aging, Orphan Grain Train, and Norfolk Family Coalition.

Five-Year Action Plan

This section outlines the implementation agenda that the hazard mitigation planning team should follow five years following adoption of this plan and then every five years thereafter. The hazard mitigation planning team, led by LENRD Assistant Manager is responsible for ensuring the LENRD and LCNRD Hazard Mitigation Plan is updated every five years.

The hazard mitigation planning team will consider the following action plan for the first five-year planning cycle. It should be noted that the schedule below can be modified, as necessary, and does not include any meetings and/or activities that would be necessary following a disaster event (which would include reconvening the team within 45 days of a disaster or emergency to determine what mitigation projects should be prioritized during the community recovery). If an emergency meeting of the hazard mitigation planning team occurs, this proposed schedule may be altered to fit any new needs.

Year 0:

- 2024/2025: Update Hazard Mitigation Plan, including a series of meetings and public meetings. Submit 2025 LENRD and LCNRD Mitigation Plan for FEMA approval.

- Spring 2025: Work on mitigation actions. LENRD to stay in contact with lead departments to keep tabs on project status.

Year 1

- January 2025 – December 2025: Work on mitigation actions. LENRD to stay in contact with lead departments to keep tabs on project status.
- Fall 2025: Reconvene the hazard mitigation planning team for the annual meeting. Discuss opportunities for mitigation plan integration with other planning documents. Discuss recent hazards. Update status of project. Host public meeting.

Year 2

- January 2026– December 2026: Work on mitigation actions. LENRD to stay in contact with lead departments to keep tabs on project status.
- Fall 2026: Reconvene the hazard mitigation planning team for the annual meeting. Discuss opportunities for mitigation plan integration with other planning documents. Discuss recent hazards. Update status of project. Host public meeting.

Year 3

- January 2027 – December 2027: Work on mitigation actions. LENRD to stay in contact with lead departments to keep tabs on project status.
- Fall 2027: Reconvene the hazard mitigation planning team for the annual meeting. Discuss opportunities for mitigation plan integration with other planning documents. Discuss recent hazards. Update status of project. Host public meeting.

Year 4

- January 2028 – December 2028: Work on mitigation actions. LENRD to stay in contact with lead departments to keep tabs on project status.
- Fall 2028: Reconvene the hazard mitigation planning team for the annual meeting. Discuss opportunities for mitigation plan integration with other planning documents. Discuss recent hazards. Update status of project. Host public meeting.

Year 5

- January 2029 – December 2029: Work on mitigation actions. LENRD to stay in contact with lead departments to keep tabs on project status.
- Winter 2029: Submit 2030 Hazard Mitigation Plan for FEMA approval. Repeat.

Planning Committee Meetings and Documentation

During each hazard mitigation planning team meeting, the team will be responsible for a brief evaluation of the 2025 Hazard Mitigation Plan and review the progress of mitigation actions. Each l meeting must be documented, including the plan evaluation and review of mitigation actions. Mitigation actions have been formatted to facilitate the review process.

Unforeseen Opportunities

If new, innovative mitigation strategies arise that could impact the planning area or elements of this plan, which are determined to be of importance, a plan amendment may be proposed and considered separate from the annual review and other proposed plan amendments. The LENRD will compile a list of proposed amendments received annually and prepare a report for NEMA, by providing applicable information for each proposal, and recommend action on the proposed amendments.

Incorporation into Existing Programs/Planning Mechanisms

Hazard mitigation practices must be incorporated within existing plans, projects, and programs. Therefore, the involvement of all departments in the Lower Elkhorn Natural Resources District, private non-profits, private industry, and jurisdictions is necessary to find mitigation opportunities within existing or planned projects and programs. To execute this LENRD will assist and coordinate resources for the mitigation actions and provide strategic outreach to implement mitigation actions that meet the goals and objectives identified in this plan.

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. Utilizing FEMA's *Integrating the Local Natural Hazard Mitigation Plan into a Community's Comprehensive Plan*[81] guidance, as well as FEMA's *2015 Plan Integration*[82] guide, each community engaged in a plan integration discussion. This discussion was facilitated by a Plan Integration Worksheet, created by the Planning Team. This document offered an easy way for participants to notify the Planning Team of existing planning mechanisms, and if they interface with the HMP.

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

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7. Community Profiles

Purpose of Community Profiles

Community profiles contain information specific to jurisdictions participating in the mitigation 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 participants 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 Level)
- Transportation
- Demographics
- Employment and Economics
- Major Employers
- Housing
- Future Development Trends
- Structural Inventory and Valuation
- Critical Infrastructure/Key Resources
- Historical Occurrences
- Hazard Prioritization
- Governance
- Capability Assessment
- Plan Integration
- Mitigation Strategy

In addition, maps specific to each jurisdiction are included such as: jurisdiction identified critical facilities; flood prone areas; and a future land use map (when available).

The hazard prioritization information, as provided by individual participants varies due in large part to the extent of the geographical area, the jurisdiction's designated representatives (who were responsible for completing meeting worksheets), identification of hazards, and occurrence and risk of each hazard type. For example, a jurisdiction located near a river may list flooding as highly likely in probability and severe in extent of damage, where a jurisdiction located on a hill may list flooding as unlikely in probability and limited in extent of damage. 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 were prioritized by the local planning team based on the identification of hazards of greatest concern, hazard history, and the jurisdiction's capabilities. The hazards not examined in depth can be found in *Section Four: Risk Assessment.*

The Federal Emergency Management Agency (FEMA) encourages multi-jurisdictional planning for hazard mitigation. All participating jurisdictions must meet the requirements of Chapter 44 of the Code of Federal Regulations (CFR), Section 201.6(a)(4), which states that multi-jurisdictional plans (e.g., watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the Plan.

For the LENRD and LCNRD Hazard Mitigation Plan, a Planning Partnership was formed to leverage resources and to meet requirements of the Federal Disaster Mitigation Act (DMA) of 2000 for as many eligible local governments as possible. A local government is defined, per the DMA, any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity.

There are two (2) types of Planning Partners that participated in this process, with distinct needs and capabilities:

- Incorporated municipalities (i.e., cities, towns)
- Special districts (i.e., school districts, water districts, fire protection districts)

The participating jurisdictions (i.e., cities, towns, and special districts) are listed in **Table 150.** and each of these prepared an Annex specific to their jurisdiction. The annexes comprise the Volume 2 of this Hazard Mitigation Plan. The planning process of the development of these annexes is outlined in Volume 1.

Table 150: Participating Counties and Communities

Participating Counties and Communities				
Burt County*				
City of Lyons	City of Oakland	Village of Craig		
Cedar County				
City of Hartington	City of Laurel	City of Randolph	Village of Belden	
Village of Coleridge	Village of Fordyce	Village of Obert	Village of St. Helena	Village of Wynot
Colfax County				
City of Clarkson	Village of Howells	Village of Leigh		
Cuming County				
City of West Point	City Of Wisner	Village of Bancroft	Village of Beemer	
Dixon County				
City of Ponca	Village of Allen	Village of Concord	Village of Dixon	Village of Waterbury
Village of Martinsburg	Village of Maskell	Village of Newcastle		
Dodge County*				
City of Hooper	City of Scribner	Village of Dodge	Village of Nickerson	Village of Winslow
Knox County*				
Village of Wausa				
Madison County				
City of Battle Creek	City of Madison	City of Tilden	Village of Meadow Grove	City of Norfolk
Pierce County				
City of Osmond	City of Pierce	City of Planview	Village of Hadar	Village of McLean
Platte County*				

Participating Counties and Communities				
City of Humphrey				
Stanton County				
City of Stanton	Village of Pilger			
Thurston County*				
Village of Emerson	Village of Pender	Village of Thurston		
Wayne County				
City of Wakefield	City of Wayne	Village of Carroll	Village of Hoskins	Village of Winside
Special Districts				
Bancroft-Rosalie Community School	Clarkson Volunteer Fire Dept.	Coleridge Volunteer Fire Department	Criag Fire & Rescue	Elkhorn Logan Valley Public Health Department
Hadar Fire Department	Laurel-Concord-Coleridge School	Leigh Fire Department	Pierce Fire Department	Lewis and Clark NRD
Lower Elkhorn NRD	Norfolk Public Schools	North Central District Health Department	Northeast Nebraska Public Health Department	Randolph Fire Department
Randolph Public Schools	Sanitary Improvement District 1 (Woodland Park)	Scribner-Snyder Community School District	Stanton Community Schools	West Point Public Schools
Winside Public Schools	Wynot Rural Fire Department			