Cedar and Dixon Counties

Multi-Jurisdictional Hazard Mitigation Plan

May 2016

JEO CONSULTING GROUP INC

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LIST OF ACRONYMS

ACS – American Community Survey
CDC – Cedar and Dixon Counties
CF – Critical Facilities
CFR – Code of Federal Regulations
CIKR – Critical Infrastructure and Key Resources
CRS – Community Rating System
CWD – Chronic Wasting Disease
DEM – Digital Elevation Model
DFIRM – Digital Flood Insurance Rate Map
DHS – Department of Homeland Security
DMA 2000 – Disaster Mitigation Act of 2000
EAB – Emerald Ash Borer
EAP – Emergency Action Plan
EHD – Epizootic Hemorrhagic Disease
ELAP – Emergency Assistance for Livestock, Honeybees, and Farm-Raised Fish Program
FBI – Federal Bureau of Investigations
FEMA – Federal Emergency Management Agency
FIRM – Flood Insurance Rate Map
FMA – Flood Mitigation Assistance Program
FR – FEMA's Final Rule
GIS – Geographic Information System
HAZUS-MH – Hazards United States-Multi Hazard
HMA – Hazard Mitigation Assistance
HMGP – Hazard Mitigation Grant Program
HMP – Hazard Mitigation Plan
HPAI – Highly Pathogenic Avian Influenza
HSAS – Homeland Security Advisory System
HUD – Department of Housing and Urban Development
IBC – International Building Code
JEO – JEO Consulting Group, Inc.
LFD – Livestock Forage Disaster Assistance Program
LGA – Liquid Gallon
LIP – Livestock Indemnity Program
MRCC – Midwestern Regional Climate Center
NCDC – National Climactic Data Center
NDA – Nebraska Department of Agriculture
NDEQ – Nebraska Department of Environmental Quality
NDMC – National Drought Mitigation Center
NDNR – Nebraska Department of Natural Resources
NEMA – Nebraska Emergency Management Agency
NFIP – National Flood Insurance Program
NFS – Nebraska Forest Service
NIPP – National Infrastructure Protection Plan
NOAA – National Oceanic and Atmospheric Administration
NPMS – National Pipeline Mapping System
NRC – National Response Center
NRD – Natural Resources District
NTAS – National Terrorism Advisory System
NWS – National Weather Service
PAL – Provisionally Accredited Levee

PDM – Pre-Disaster Mitigation Program
PDSI – Palmer Drought Severity Index
PHMSA – U.S. Pipeline and Hazardous Material Safety Administration
RMA – Risk Management Agency
SBA – Small Business Administration
SFHA – Special Flood Hazard Area
SPIA – Sperry-Piltz Ice Accumulation Index
SSA – Sector-Specific Agency
START – National Consortium for the Study of Terrorism and Responses to Terrorism
SURE – Supplemental Revenue Assistance Payments
TAP – Tree Assistance Program
USACE – U.S. Army Corps of Engineers
USDA – United States Department of Agriculture
USGS – United States Geological Survey
VS – Vesicular Stomatitis
WUI – Wildland Urban Interface

EXECUTIVE SUMMARY

INTRODUCTION

This plan is an update to the Cedar and Dixon Counties (CDC) Multi-Jurisdictional Hazard Mitigation Plan (HMP) approved in 2010. The plan update was developed in compliance with the requirements of the Disaster Mitigation Act of 2000 (DMA 2000). Hazard mitigation planning is a process in which hazards are identified and profiled; people and facilities at risk are identified and assessed for threats and potential vulnerabilities; and, strategies and mitigation measures are identified. The goal of the process is to reduce risk and vulnerability in order to lessen impacts to life, the economy, and infrastructure. Hazard mitigation planning increases the ability of communities to effectively function in the face of natural and man-made disasters.

A total of 23 jurisdictions participated in the planning process. This includes two counties, two cities, 12 villages, five school districts, one natural resources district (NRD), and one public health district. The communities of Belden, Concord, Laurel, Randolph, and Wakefield participated in the Lower Elkhorn NRD HMP, which was approved in May 2015.

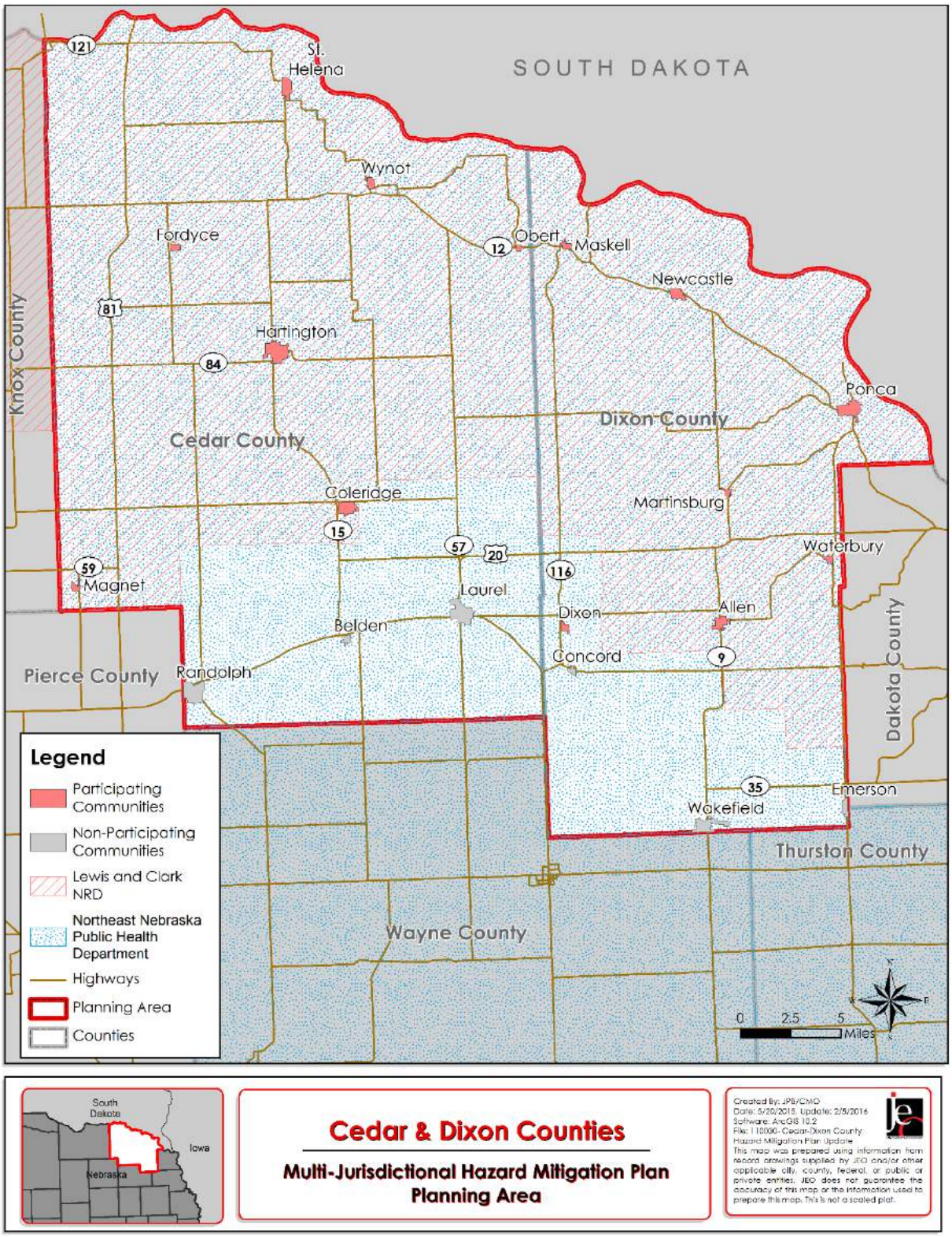
Table 1: Participating Jurisdictions

Participating Jurisdictions	
Cedar County	Dixon County
Village of Coleridge	Village of Allen
Village of Fordyce	Village of Dixon
City of Hartington	Village of Martinsburg
Village of Magnet	Village of Maskell
Village of Obert	Village of Newcastle
Village of St. Helena	City of Ponca
Village of Wynot	Village of Waterbury
Hartington-Newcastle Public School District	Ponca Public School District
Laurel-Concord-Coleridge Public School District	
Randolph Public School District	
Wynot Public School District	
Lewis and Clark NRD	Northeast Nebraska Public Health

This plan includes both natural and man-made hazards in order to maintain consistency between local and state level planning efforts. The hazards identified by the State of Nebraska Hazard Mitigation Plan 2014 were utilized as the starting point for the local planning effort. The list of hazards addressed includes:

- Agricultural Animal and Plant Disease
- Chemical Fixed Site Spills
- Chemical Transportation Spills
- Dam Failure
- Drought
- Earthquake
- Extreme Heat
- Flooding
- Grass/Wildfire
- Hail
- High Winds
- Landslide
- Levee Failure
- Severe Thunderstorm
- Severe Winter Storm
- Terrorism
- Tornados
- Urban Fire

Figure 1: Map of Planning Area



GOALS AND OBJECTIVES

The goals and objectives for this planning process are as follows:

Goal 1: Protect the Health and Safety of Residents

Objective 1.1: *Reduce or prevent damage to property or prevent loss of life or serious injury (overall intent of the plan).*

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 community structures to mitigate for 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 most likely to affect them, potential impacts of the hazards, where they occur, and what they can do to be better prepared.*

Goal 4: Improve Emergency Management Capabilities

Objective 4.1: *Develop or improve community and/or County Emergency Response Plan(s) 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.*

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.*

Goal 6: Enhance Overall Resilience and Promote Sustainability

Objective 6.1: *Incorporate hazard mitigation and adaptation into updating other local planning endeavors (e.g. comprehensive plans, zoning ordinance, subdivision regulation, etc.)*

SUMMARY OF CHANGES

The following table identifies how this plan has evolved from the previous Cedar and Dixon Counties HMP developed in 2010.

Table 2: Summary of Changes

ORIGINAL PLAN TABLE OF CONTENTS	UPDATED PLAN TABLE OF CONTENTS	UPDATE STATUS
Section 1: Introduction	**Section One: Introduction**	Section reviewed and reorganized.
Cedar and Dixon Counties	Hazard Mitigation Planning	Sub-sections reviewed and reorganized.

ORIGINAL PLAN TABLE OF CONTENTS	UPDATED PLAN TABLE OF CONTENTS	UPDATE STATUS
Purpose of the Plan	Disaster Mitigation Act of 2000	
Utilizing the 'Multi-jurisdictional Approach'	Hazard Mitigation Assistance	Sub-section moved from Section Five to Section One. Original section moved to Section Two.
Plan Financing and Preparation	Plan Financing and Preparation	Sub-section reviewed and updated. Details added.
Plan Implementation and Maintenance		Moved to Section Two
Section 2: Cedar and Dixon Counties Planning Process	**Section Two: Planning Process**	Section reviewed. New sub-sections added.
Methodology	Introduction	Sub-section reviewed and updated. Details added.
Elected Officials and Key Stakeholders Involved	Multi-Jurisdictional Approach	
Public Involvement and Participation	Hazard Mitigation Planning Process	New Sub-section.
Risk Assessment	Organization of Resources	Sub-section reviewed and updated. Details added. Process refined.
General Plans, Documents, and Information Used	Assessment of Risk	
	Mitigation Plan Development	New Sub-section.
	Plan Implementation and Progress Monitoring	Moved from Section One.
	Section Three: Demographics and Asset Inventory	New Section added. Reviewed data from original Section 3 Risk Assessment. Sub-section reviewed and updated.
	Introduction	
	Planning Area Geographic Summary	
	Demographics	
	Built Environment and Structural Inventory	New Sub-section.
	Agricultural Asset Inventory	New Sub-section.
Section 3.: Risk Assessment	**Section Four: Risk Assessment**	Section reviewed. New sub-sections added.
Introduction	Introduction	Assessment criteria reviewed, updated, and better defined.
Lewis and Clark Natural Resources District		Original sub-section moved to own participant section in Section Seven.
Critical Facilities		
Highly Vulnerable Areas and Populations		Original sub-section moved to Section Three.
Non-occurring Hazards	Methodology	Sub-section reviewed and updated.
	Average Annual Damages and Frequency	New potential losses methodology.
Hazards within the Planning Area	Hazard Identification	Sub-section reviewed and updated.
	Agricultural Animal and Plant Disease	New Sub-sections.
	Chemical Fixed Sites	
	Chemical Transportation	
Dam Failure	Dam Failure	Sub-sections reviewed and updated.
Drought	Drought	
Earthquakes	Earthquakes	
Extreme Heat	Extreme Heat	
Flooding	Flooding	
Wildfires	Grass/Wildfire	
	Hail	New Sub-section.

ORIGINAL PLAN TABLE OF CONTENTS	UPDATED PLAN TABLE OF CONTENTS	UPDATE STATUS
Tornados and High Winds	High Winds	High winds and Tornados given their own sub-sections.
Landslides	Landslides	Sub-sections reviewed and updated.
Levee Failure	Levee Failure	
Severe Thunderstorms	Severe Thunderstorms	
Severe Winter Storms	Severe Winter Storms	
	Terrorism	New Sub-section.
	Tornados	High winds and Tornados given their own sub-sections.
	Urban Fire	New Sub-section.
Section 4: Mitigation Strategy	**Section Five: Mitigation Strategy**	Section reviewed and updated.
Introduction	Introduction	Sub-section reviewed.
Development of Goals	Goals and Objectives	Goals and objectives reevaluated to correlate with multi-jurisdictional plan.
Cedar/Dixon Counties Mitigation Alternatives (Action Items)	Mitigation Alternatives (Action Items)	Original projects reevaluated. New projects added.
Cedar and Dixon Counties Previous Mitigation Efforts	Completed Mitigation Efforts	Sub-section reviewed.
Section 5: Plan Implementation and Maintenance	**Section Six: Plan Implementation and Maintenance**	Section divided into sub-sections.
Monitoring, Evaluation, and Updating the Plan	Monitoring, Evaluating, and Updating the Plan	Sub-section created. Information reviewed and updated. Details added.
Continued Public Involvement	Continued Public Involvement	
	Unforeseen Opportunities	New Sub-section.
Incorporation into Existing Planning Mechanisms	Incorporation into Existing Planning Mechanisms	Sub-section created. Information reviewed and updated.
Hazard Mitigation Assistance (HMA)		Sub-section moved to Section One.
List of Participant Sections	**Section Seven: Participant Sections**	New section added. Participant sections in original plan were reviewed and updated.
	Purpose of Participant Sections	

PLAN IMPLEMENTATION

Various communities across the Counties have implemented hazard mitigation projects following the 2010 Hazard Mitigation Plan. Many of these projects are related to hazard monitoring, warning systems and/or educating community members. Examples include: updating or improving warning and alert systems at the community level, constructing tornado safe rooms in schools, and back-up power generators.

In order to build upon these prior successes and to continue to implement mitigation projects, despite limited resources, communities will need to continue relying upon multi-agency coordination as a means of leveraging resources. Communities across Cedar and Dixon Counties 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): the Lewis and Clark NRD, Cedar County, Dixon County, Silver Jackets, Nebraska Department of Natural Resources (NDNR), Nebraska Emergency Management Agency (NEMA), and others.

HAZARD PROFILES

The Hazard Mitigation Plan includes a description of the hazards considered, including a risk and vulnerability assessment. Data considered during the risk assessment process includes: historic occurrence and recurrence interval, historic losses (physical and monetary), impacts to the built environment (including privately owned structures as well as critical facilities), and the local risk assessment. These components were used to develop a balanced and well-rounded risk assessment. The following table provides an overview of the risk assessment for each hazard.

Table 3: Hazard Occurrence

Regional Risk Assessment			
Hazard	**Previous Occurrence Events/Years**	**Approximate Annual Probability**	**Likely Extent**
Agricultural Animal Disease	2,320/1.9	100%	Unavailable
Agricultural Plant Disease	90/15	100%	Unavailable
Chemical Fixed Sites	3/33	10%	Localized to the facilities and adjacent surroundings
Chemical Transportation	0/46	1%	Limited (<0.5 mile from release site)
Dam Failure	0	1%	Total inundation in floodplain downstream from dam as defined by inundation maps
Drought	64/121	53%	Mild Drought
Earthquakes	0/42	<1%	<4.0
Extreme Heat	35/1	100%	>90°F
Flooding	36/19.5	100%	Some inundation of structures* (<1% of structures) and roads near streams. Some evacuations of people may be necessary (<1% of population)
Grass/Wildfires	274/15	100%	<100 acres
Hail	262/19.5	100%	H3 (0.8 – 1.00 inches)
High Winds	35/19.5	100%	9 BWF (47 – 54 mph)
Landslides	17/Unknown	<5%	Localized rotational slide
Levee Failure	0/Unknown	1%	Inundation of agricultural fields
Severe Thunderstorms	136/19.5	100%	Wind ≥ 58 mph and/or Hail ≤ 1.00 inch
Severe Winter Storms	131/19.5	100%	<0.50 ice 20 - 40°F below zero (wind chills) 4 – 8" snow 25 - 40 mph winds
Terrorism	0/45	<1%	Isolated to a single building
Tornados	27/19.5	100%	EF0 - EF1
Urban Fire	642/6	100%	Single structure

**Quantification of vulnerable structures provided in Section Seven: Participant Sections*

Table 4: Hazard Loss History

Hazard Type	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Agricultural Animal Disease	N/A	N/A	Unknown	Unknown
Agricultural Plant Disease	N/A	N/A	$511,057	$34,071
Chemical Fixed Sites	$0	$0	$0	$0
Chemical Transportation	$0	$0	Unknown	Unknown
Dam Failure	$0	$0	$0	$0
Drought	$0	$0	$134,226,317	$8,948,421
Earthquake	$0	$0	$0	$0
Extreme Heat	$0	$0	$20,491,150	$1,366,077
Flooding	$2,926,000	$150,051	$1,439,965	$95,998
Grass/Wildfires[3]	$0	$0	$62,785	$4,186
Hail Events	$395,000	$20,256	$21,145,306	$1,409,687
High Winds	$143,000	$7,333	$2,227,918	$148,528
Landslides	$65,000	N/A	N/A	N/A
Levee Failure	$0	$0	$0	$0
Severe Thunderstorms	$1,221,000	$62,615	$3,545,120	$236,341
Severe Winter Storms	$45,000	$2,308	$621,302	$41,420
Terrorism	$0	$0	N/A	N/A
Tornados	$6,670,000	$342,051	$987,904	$65,860
Urban Fire	Unknown	Unknown	N/A	N/A

1 Indicates data is from NCDC (January 1996 to June 2015)
2 Indicates data is from USDA (2000 to 2014)
3 Indicates data is from NFS (2000 to 2014)

Many of the natural hazards can be expected to occur annually within the planning area. Events like agricultural disease, flooding, extreme heat, grass and wildfires, severe thunderstorms, and severe winter storms will occur annually. Other natural hazards, like drought, will occur less often. The scope of events and how they will manifest themselves locally is not known regarding hazard occurrences. Historically, tornados, flooding, and severe thunderstorms have resulted in the most significant structural damage within the planning area. These three hazards in addition to agricultural animal disease, drought, extreme heat, and severe winter storms are summarized below.

TORNADOS

Tornados occur in the planning area on a near annual basis. The NCDC reports 27 tornados for the two county area since 1996. Of the 27 reported events, 15 were F/EF0, five were F/EF1 tornados, four were F/EF2, one was an EF3, and one was an EF4 tornado. (One tornado was not rated.) The most damaging tornado since 1996 struck the Village of Coleridge on June 23, 2003. It crossed northern sections of the village uprooting trees, downing power lines, and destroying some grain bins. A construction business in a garage was also destroyed. A 70-year old man was killed at his farm just north of town. Many livestock were also killed from this ¾ of a mile wide F4 tornado. In total, 11 homes received substantial damage and

between 100 and 200 utility poles were downed. The total property damages from this tornado were estimated at $3.7 million.

Vulnerable populations within the planning area include residents living in mobile homes (six percent of all housing units), facilities without storm shelters which house large numbers of people (such as nursing homes, schools, factories, etc.), homeowners without storm shelters or basements, and residents with decreased mobility. All communities in the planning area have outdoor warning sirens.

FLOODING

Flooding is the second most costly hazard in property damage in the planning area behind tornados. Flash flooding and riverine flooding are common for the planning area due to the regular occurrence of severe thunderstorms in spring and summer, and the Missouri River forming the northern border of the two counties. Flooding can occur on a local level, only affecting a few streets, but can also extend throughout an entire district, affecting whole drainage basins. During the spring and summer of 2011, the Missouri River flooded for months due to record releases from Gavins Point Dam and heavy rains in May over the Missouri River basin. The dam release was in response to record snowfall and heavy rains in Montana. Both counties were impacted with flooding of lowland areas, farmland, and some seasonal and permanent homes along the river. The river at Ponca reached a peak level in early August of 8.6 feet above flood stage before slowly decreasing through September.

The planning area expects flooding to occur on an annual basis with 36 flooding events being recorded by the National Climate Data Center (NCDC) over 19 years. These 36 events have resulted in no fatalities and approximately $2,926,000 in property losses.

Vulnerable populations include low income and minority populations, which may lack the resources needed for evacuation, response, or to mitigate the potential for flooding. The elderly and young children are also at risk due to decreased mobility. Economic impacts to the area could be long-lasting if businesses are closed or damaged from flooding, and road closures could impact the commercial transportation of goods. There are some communities that don't participate in the NFIP, but many of these communities identified joining the NFIP as a priority in the coming years.

SEVERE THUNDERSTORMS

Thunderstorms differ from many other hazards in that they are generally large in magnitude, have a long duration, and travel across large areas and through multiple jurisdictions within a single region. Additionally, thunderstorms often occur in a series, with one area having the potential to be impacted multiple times in one day. Severe thunderstorms are most likely to occur between the months of April and September with the highest number of events occurring in July. Typical impacts resulting from severe thunderstorms include (but are not limited to): loss of power, obstruction to transportation routes, grass/wildfires starting from lightning strikes, localized flooding, and damages discussed in the hazard profiles for hail and high winds as these are typical component of severe thunderstorms.

Vulnerable populations related to severe thunderstorms include: residents of mobile homes (six percent of housing units), citizens with decreased mobility, and those caught outside during storm events. Most residents within the planning area are familiar with severe thunderstorms and know how to appropriately prepare and respond to events. Many participating jurisdictions have reported updates or improvements to risk communication and outdoor warning systems.

AGRICULTURAL ANIMAL DISEASE

Animal diseases are biological diseases or infections that can reduce the quality and/or quantity of livestock. Section Four contains a list of animal diseases that are monitored across the state, including the planning area. It is difficult to gather data related to animal disease for the planning area and across the state in

general. There were 2,320 reported incident of animal disease in Cedar and Dixon Counties in 2014 – 2015. One event in particular lead to a significant depopulation of chickens in the poultry industry. An outbreak of the Highly Pathogenic Avian Influenza (HPAI) began in May 2015 in Dixon County after one poultry farm tested positive for the disease. A quarantine and perimeter were immediately set up for the farm, and a state of emergency was declared to ensure the availability of resources to respond to the outbreak. In all, six farms were impacted, which were in close proximity to one another in Dixon County, and 4.9 million chickens were depopulated. By mid-July, the disposal of the affected poultry was complete, and the cleaning and disinfection of the farms was well underway or completed. With the help of an interagency response, which included the Nebraska Department of Agriculture, Nebraska Department of Environmental Quality, local and neighboring Emergency Managers, Nebraska Emergency Management Agency, and the Northeast Nebraska Public Health Department, the outbreak of HPAI was contained and did not spread outside the area in Dixon County.

Most of the vulnerability related to animal disease is related to local economies. In total, the market value in 2012 of livestock sales for the planning area resulted in over $323 million. Nearly 13 percent of the population is employed in the agricultural industry, and continued widespread disease could significantly impact local economies. It is unlikely at this time that diseases which occur in animal populations would be transmitted to the human population.

DROUGHT

Drought is a regular and reoccurring phenomenon in the planning area and the state of Nebraska. Historic data shows that droughts have occurred with regularity across the planning area, and recent research indicates that trend will continue and potentially intensify. The most common impacts resulting from drought are focused on the agricultural industry. Over $134 million in total crop loss was reported for the planning area since 2000.

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

EXTREME HEAT

It is known and understood that high and extreme temperatures are a regular part of the climate for the two county planning area. The months of June, July, and August are the warmest months for the planning area with an average of 35 days annually where max temperatures are 90°F or greater. To date, extreme heat hasn't caused any reported property damages. However since 2000, extreme heat has caused over $20 million in crop losses.

Extreme heat impacts people, the built environment, and the agricultural sector. Anticipated impacts include (but are not limited to): heat exhaustion in both human and animal populations, heat stroke, possible death in both human and animal populations, power outages, depletion of water sources, damages to transportation routes, and crop losses.

SEVERE WINTER STORMS

Severe winter storms are an annual occurrence for the planning area. Winter storms can bring extreme cold temperatures, freezing rain and ice, and heavy or drifting snow. Blizzards are particularly dangerous and can have significant impacts throughout the planning area. Severe winter storms typically occur between November and March but early and late season storms have occurred in the past and can have dramatic impacts in the planning area. Impacts resulting from severe winter storms include (but are not limited to): hypothermia and frost bite, death to those trapped outdoors, closure of transportation routes, downed power

lines and prolonged power outages, collapse of roofs from heavy snow loads, death of livestock, and closure of critical facilities.

The most vulnerable citizens within the planning area are children (13 percent of the total population), elderly (20 percent of the total population), individuals and families below the poverty line (10.3 percent of the total population), and those new to the area or state. Given the probability of occurrence and potential impacts, participating jurisdictions identified a number of strategies that can help reduce the level of vulnerability related to severe winter storms. Multiple communities identified the increase of risk communication and warnings, developing a database of vulnerable populations, and improving snow routes and snow removal processes.

MITIGATION STRATEGIES

There are a wide variety of strategies that can be used to reduce the impacts of hazards for the residents of Cedar and Dixon Counties as well as the built environment. The following table shows the most common mitigation actions that can be used for each hazard.

Table 5: Key Mitigation Strategies

Hazard	Mitigation Strategies
Animal and Plant Disease	• Public education and awareness • Purchase crop insurance • Livestock insurance
Chemical Transportation and Fixed Sites	• Public education and awareness • Training exercises
Dam Failure	• Evacuation Plan • Dam failure exercise • Public education and awareness
Drought	• Identify and develop new/additional water sources (municipal wells) • Develop ground water/irrigation management plan(s) • Establish drought best management practices and develop an implementation plan • Upgrade rural water infrastructure
Extreme Heat	• Public education • Increased monitoring and community awareness • Developing a vulnerable populations database within the community
Flooding	• Limit or restrict development in flood-prone areas • Participate in the NFIP • Property acquisition or flood-proofing of structures in the floodplain
Grass/Wildfire	• Public education and awareness • Acquire training and equipment for local fire departments
Hail	• Use of hail resistant building materials • Bury power lines and electrical service • Looped electrical systems • Increased monitoring and community awareness
High Winds	• Design and construct storm shelters

Hazard	Mitigation Strategies
	• Bury power lines and electric service • Looped electrical systems • Join Tree City USA (develop tree care program)
Severe Thunderstorms	• Bury power lines and electric service • Looped electrical systems • Join Tree City USA (develop tree care program) • Install static detectors
Severe Winter Storms	• Incorporate the use of snow fences to protect vulnerable transportation routes • Bury power lines and electrical service • Looped electrical systems • Back-up power generators • Review and improve snow/ice removal protocols • Install windbreaks and living snow fences • Increased monitoring and community awareness
Tornados	• Design and construct storm shelters • Bury power lines and electric service • Looped electrical systems • Join Tree City USA (develop tree care program)

SUMMARY

This document is an update to the 2010 Cedar and Dixon Counties Multi-Jurisdictional Hazard Mitigation Plan. For this update the hazards found to be of greatest concern for participating jurisdictions include: animal disease, chemical spills (fixed site or transportation), flooding, hail, severe thunderstorms, severe winter storms, and tornados. Jurisdictions have worked over recent years to reduce local vulnerabilities and have identified measures that they will incorporate in the future to continue to reduce local vulnerabilities.

HAZARD MITIGATION PLANNING

Hazard events are inevitable. The uncertainty of their effects resides in the intensity (or extent) and how well prepared the community is for such an event. Mitigation reduces risk and is a socially and economically responsible action to prevent long term risks from natural and man-made hazard events.

FEMA definition of Hazard Mitigation

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

Natural hazards, such as severe winter storms, tornados and high winds, severe thunderstorms, flooding, extreme heat, drought, agriculture diseases (plant and animal), earthquakes, landslides, and wildfires are a part of the world around us. Their occurrence is natural and inevitable, and there is little we can do to control their force and intensity. Man-made hazards are a product of the society that we live in and can occur with significant impacts to communities. Man-made hazards include levee failure, dam failure, chemical and radiological fixed site hazards, major transportation incidents, terrorism, civil disorder, and urban fire. These hazard events can occur naturally or as a result of human error. All jurisdictions participating in this planning process are vulnerable to a wide range of natural and man-made hazards that threaten the safety of residents, and have the potential to damage or destroy both public and private property, cause environmental degradation, or disrupt the local economy and overall quality of life.

Cedar and Dixon Counties prepared this multi-jurisdictional hazard mitigation plan in an effort to reduce impacts from natural and man-made hazards and to better protect the people and property of the region from the effects of hazards. This plan demonstrates the communities' commitment to reducing risks from hazards and serves as a tool to help decision makers establish mitigation activities and resources. This plan was developed to make Cedar and Dixon Counties and participating jurisdictions eligible for federal pre-disaster funding programs and to accomplish the following objectives:

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

DISASTER MITIGATION ACT OF 2000

The U.S. Congress passed the DMA 2000 to amend the Robert T. Stafford Disaster Relief and Emergency Assistance Act. Section 322 of the DMA 2000 requires that state and local governments develop, adopt, and routinely update a hazard mitigation plan in order to remain eligible for pre- and post-disaster mitigation funding. These funds include the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation Program (PDM), and the Flood Mitigation Assistance Program (FMA). These programs are administered by FEMA under the Department of Homeland Security (DHS).

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

HAZARD MITIGATION ASSISTANCE

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

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

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

- **HMGP:** To qualify for post-disaster mitigation funds, local jurisdictions must have adopted a mitigation plan that is approved by FEMA. HMGP provides funds to states, territories, Indian tribal governments, local governments, and eligible private non-profits following a presidential disaster declaration. The DMA 2000 authorizes up to seven percent of HMGP funds available to a state after a disaster to be used for the development of state, tribal, and local mitigation plans.
- **FMA:** To qualify to receive grant funds to implement projects such as acquisition or elevation of flood-prone homes, local jurisdictions must prepare a mitigation plan. Furthermore, local jurisdictions must be participating communities in the NFIP. The goal of FMA is to reduce or eliminate claims under the NFIP.
- **PDM:** To qualify for pre-disaster mitigation funds, local jurisdictions must adopt a mitigation plan that is approved by FEMA. PDM assists states, territories, Indian tribal governments, and local governments in implementing a sustained pre-disaster hazard mitigation program.

PLAN FINANCING AND PREPARATION

In regards to plan financing and preparation, in general, the local government of Cedar or Dixon Counties is the "sub-applicant" that is the eligible entity that submits a sub-application for FEMA assistance to the "Applicant". The "Applicant," in this case is the State of Nebraska. If HMA funding is awarded, the sub-applicant becomes the "sub-grantee" and is responsible for managing the sub-grant and complying with program requirements and other applicable federal, state, territorial, tribal, and local laws and regulation.

INTRODUCTION

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

***Requirement §201.6(b)**: Planning process. An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:*
(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and
(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

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

MULTI-JURISDICTIONAL APPROACH

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

FEMA recommends the multi-jurisdictional approach under the DMA 2000 for the following reasons:

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

Both FEMA and the Nebraska Emergency Management Agency (NEMA) recommend this multi-jurisdictional approach through a combination of counties and regional emergency management districts. Cedar and Dixon Counties utilized the multi-jurisdiction planning process recommended by FEMA (Local Mitigation Plan Review Guide [October 2011], Local Mitigation Planning Handbook [March 2013], and Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards [January 2013]) 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 not unusual 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 may result in new goals or additional risk assessment.

- Organization of Resources
    - Focus on the resources needed for a successful mitigation planning process. Essential steps include:
        - Organizing interested community members
        - Identifying technical expertise needed
- Assessment of Risks
    - Identify the characteristics and potential consequences of the hazard. Identify how much of the jurisdiction can be affected by specific hazards and the impacts they could have on local assets.
- Mitigation Plan Development
    - Determine priorities and identify possible solutions to avoid or minimize the undesired effects. The result is a hazard mitigation plan and strategy for implementation.
- Plan Implementation and Progress Monitoring
    - Bring the plan to life by implementing specific mitigation projects and changing day-to-day operations. It is critical that the plan remains relevant to succeed. Thus, it is important to conduct periodic evaluations and revisions, as needed.

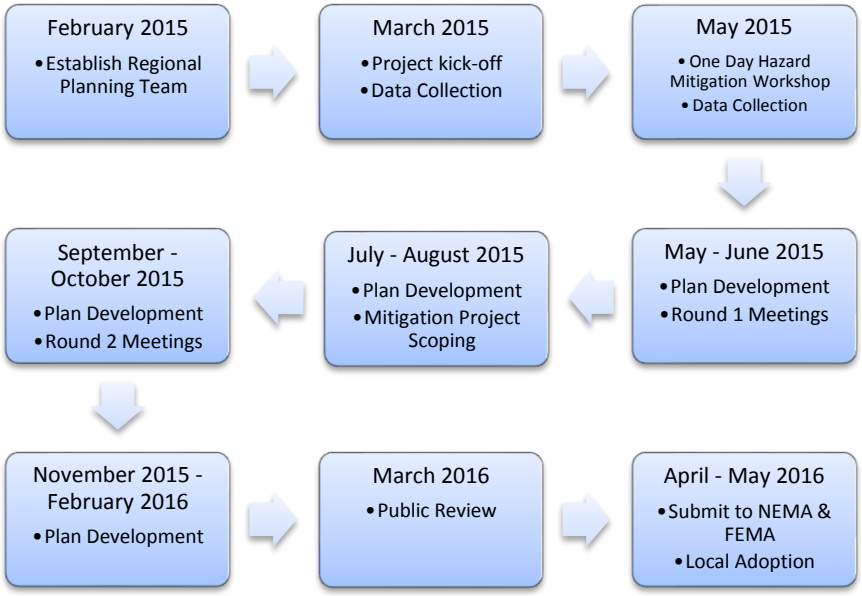
ORGANIZATION OF RESOURCES

PLAN UPDATE PROCESS

Cedar and Dixon Counties began the process of securing funding for their multi-jurisdictional Hazard Mitigation Plan on September 25, 2013. JEO was contracted in January 2015 to guide and facilitate the planning process and assemble the multi-jurisdictional Hazard Mitigation Plan. For the planning area, Kevin Garvin (Cedar County Emergency Manager) and Shea Scollard (Dixon County Emergency Manager) led the development of the plan and served as primary points-of-contact throughout the project.

The first activity in the development process for the Cedar and Dixon Counties HMP update was coordination of efforts with local, state, and federal agencies and organizations. NDNR and NEMA became involved in the planning process. Cedar and Dixon Counties and JEO worked together to identify elected officials and key stakeholders to lead the planning effort. A clear timeline of this plan update progress is provided in Figure 2, Project Timeline.

Figure 2: Project Timeline



The project kick-off meeting was held March 26, 2015 with potential Regional Planning Team members attending, which included the Emergency Managers from each county, additional community members, and JEO staff. The meeting provided an overview and discussion of the work to be completed over the next several months, including: final establishment of the Regional Planning Team, whether to host a hazard mitigation workshop for plan participants, when and where to host Round 1 meetings, plan goals and objectives, discussion of what types of information would be needed to be collected for the HMP, and public outreach methods.

REGIONAL PLANNING TEAM

At the beginning of the planning process, the Regional Planning Team, comprised of local participants and the consultant, was established to guide the planning process, review the plan, and serve as a liaison to plan participants throughout the planning area. A list of Regional Planning Team members can be found in Table 6. Additional technical support was provided to the Regional Planning Team through staff from NEMA and the NDNR.

Table 6: Hazard Mitigation Regional Planning Team

Name	Title	Jurisdiction
Kevin Garvin	Emergency Management Director	Cedar County
Shea Scollard	Emergency Management Director	Dixon County
Carla Schmidt	Highway Superintendent	Cedar County
Tom Moser	General Manager	Lewis and Clark NRD
Monte Roeber	Fire Chief	Martinsburg
Jeff Henson*	Department Manager/Senior Planner	JEO
Rebecca Appleford*	Project Coordinator/Planner	JEO
Phil Luebbert*	Planner	JEO
Caitlin Olson*	Planner Intern	JEO

In addition to the first planning team meeting, which was also the project kick-off meeting, a second Regional Planning Team meeting was held on July 30, 2015. The meeting provided an update on the progress to date, the current list of participants, meeting attendance and worksheets completed thus far by jurisdictions, brainstorming additional ways and who to contact in order to get additional jurisdictions to participate, and what to expect over the coming months.

Table 7 shows the date and location of meetings held for the Regional Planning Team.

Table 7: Meeting Locations and Times

Date	Location	Agenda Items
March 26, 2015	Martinsburg Fire Station - Dixon County and Cedar County Courthouse	Overview of HMP update, public involvement, planning process and schedule, next steps
July 30, 2015	Conference Call	Review progress to date, meeting attendance and worksheets collected, public outreach, scheduling round 2 meetings, next steps

HMP WORKSHOP

A Hazard Mitigation Planning Workshop was also held prior to the start of Round 1 meetings on May 20, 2015. All jurisdictions within the planning area were invited to attend. The workshop enabled plan participants to better understand the hazard mitigation planning process. A tornado scenario table-top exercise kicked off the workshop where attendees discussed the response needed and the impacts a tornado may have on their communities. The exercise was then followed by an introduction to hazard mitigation, the risk assessment process, identifying mitigation actions, and the importance of public outreach.

PUBLIC INVOLVEMENT AND OUTREACH

At the beginning of the planning process, the Regional Planning Team worked to identify stakeholder groups that could serve as "hubs of communication" throughout the planning process. A wide range of stakeholder groups were contacted and encouraged to participate. The following groups were invited to participate in the planning process.

Table 8: Notified Stakeholder Groups

Organization	Name	Title	Participation Summary
Avera Sacred Heart Medical Clinic	Kyle Tacke	Administrator	Did not participate
Ponca Mercy Medical Clinic	Patty Limoges	Administrator	Did not participate
Colonial Estates	Thomas Guenther	Administrator	Did not participate
Golden Living Center – Hartington	Leigh Bloomquist	Administrator	Did not participate
Hillcrest Assisted Living	Heather Eagle	Administrator	Did not participate
Park View Haven/The Embers	Sheryl Kalin	Administrator	Did not participate
Elms Health Care Center	Kim Conrad	Administrator	Did not participate
Wakefield Health Care Center	Terrence Hoffman	Administrator	Did not participate
Nebraska VOAD	Brent Curtis	Voluntary Agency Liaison	Did not participate

Organization	Name	Title	Participation Summary
Hartington Municipal Airport	Tom Becker	Manager	Did not participate
Union Pacific Railroad Company	Kelli O'Brien	Director, Public Affairs Nebraska	Did not participate
Burlington Northern Santa Fe Railroad	Andy Williams	Director, Public Affairs Nebraska	Did not participate
Nebraska Resource and Referral System	Charlotte Lewis	Director	Did not participate
Nebraska Public Power District	Doug Klug	Distribution Superintendent	Did not participate
Northeast NPPD	Mark Shults	General Manager	Did not participate
Cedar Knox Public Power District	Dan Leise	General Manager	Did not participate
Project Interfaith	John Levy	Board President	Did not participate
Red Cross – Wayne, NE		Administrator	Did not participate
Hartington Chamber of Commerce	Karma Schulte	President	Participated
Ponca Area Community Club	Andrea Johansen	President	Did not participate
Gateway Development of Corporation	Sean Johnson	Executive Director	Did not participate
Siouxland Chamber of Commerce		President	Did not participate
Cedar County Historical Museum		Administrator	Did not participate
Northeast Nebraska Public Health District	Kim Schultz	Emergency Response Coordinator	Participated

NEIGHBORING JURISDICTIONS

Neighboring jurisdictions were notified and invited as well. The following table indicates which neighboring communities were notified of the planning process. Letters were sent to county clerks, county Emergency Managers, and NRDs, at their respective jurisdictions and disseminated appropriately.

Table 9: Neighboring Jurisdictions Notified

Notified Nebraska Jurisdictions	
Thurston County	Pierce County
Dakota County	Knox County
Wayne County	Lower Elkhorn NRD
Notified South Dakota Jurisdictions	
Union County	Yankton County
Clay County	Gavins Point Project

PARTICIPANT INVOLVEMENT

Elected officials, key stakeholders, and residents within Cedar and Dixon Counties experience the area hazards first hand and are vital in providing local information necessary to complete the plan. Participants play a crucial role in reviewing goals and objectives; identification of 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.

In order to be a participant in the development of this plan update, jurisdictions were strongly encouraged to have, at minimum, one representative present at the Round 1 and Round 2 meeting. Some jurisdictions were able to send multiple representatives to meetings. Jurisdictions also were encouraged to invite stakeholder groups from within their communities to participate in the public meetings. Sign-in sheets from all public meetings can be found in *Appendix B.*

Jurisdictions that were unable to attend the scheduled public meetings were able to request a meeting with members of the Regional Planning Team that would 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 call and email reminders of upcoming meetings, and invitations to complete surveys required for the planning process. Table 10 provides a summary of outreach activities utilized in this process.

Table 10: Outreach Activity Summary

Action	Intent
Project Website	To inform the public and local/regional planning team members of past, current, and future activities (http://jeo.com/cdhmp/)
Posting of 2010 Cedar and Dixon Counties HMP	Current HMP posted for public viewing on JEO Hazard Mitigation Planning project website (http://jeo.com/cdhmp/)
Regional Planning Team Letter (30/15 day notification)	Informed the Regional Planning Team of upcoming meetings
Round 1 Meeting Letters (30/15 day notification)	Sent to participants to discuss the agenda/dates/times/locations of the first round of public meetings
Round 2 Meeting Letters (30/15 day notification)	Sent to participants to discuss the agenda/dates/times/locations of the second round of public meetings
Neighboring Jurisdictions Letter	Informed neighboring jurisdictions about the planning effort
Stakeholder Group Letters	Notification regarding the planning process and project meeting dates and locations
Press Release	Sent to local newspapers to describe the purpose of the plan
Notification Phone Calls	Potential participants were called 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 at multiple locations throughout the planning area about the HMP and how to get involved
Word-of-Mouth	Staff discussed the plan with jurisdictions throughout the planning process

ASSESSMENT OF RISK

ROUND 1 MEETINGS: HAZARD IDENTIFICATION

Cedar and Dixon Counties are vulnerable to a wide array of natural, man-made, and technological hazards that threaten life and property. At the Round 1 meetings, jurisdictional representatives (i.e. the local planning team) reviewed the hazards consistent with the 2014 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 *Section Four: Risk Assessment.)* Table 11 shows the dates and locations of meetings held for the Round 1 meeting phase of the project.

Table 11: Round 1 Meeting Dates and Locations

Agenda Items	
General overview of the HMP planning process, discuss participation requirements, begin the process of risk assessment and impact reporting, update critical facilities, capabilities assessment, and status update on current mitigation projects	
Location and Time	**Date**
Cedar County: Hartington, NE 6:30 PM	June 4, 2015
Dixon County: Allen, NE 6:30 PM	June 2, 2015

The intent of these meetings was to provide the public and jurisdictional representatives with an overview of the work to be completed over the next several months, discuss what types of information that would need to be provided to complete the plan, and preliminary data collection. Information regarding the completion of project worksheets, data that would be required for the update process, and the project schedule was provided to each jurisdiction. This information was distributed to provide an opportunity to gather input on the identification of hazards, records of historical occurrences, establishment of goals and objectives, and potential mitigation alternatives from jurisdictional representatives (refer to *Appendix B*). The local planning teams for each jurisdiction also completed worksheets to identify or update their jurisdiction's critical facilities, a capabilities assessment, and a status update on the mitigation projects from the 2010 HMP, if applicable. Meeting attendees are identified in Table 12.

Table 12: Round 1 Meeting Attendees

Name	Jurisdiction	Title
Cedar County – June 4, 2015		
Terence Pinkelman	Cedar County	County Commissioner
Carla Schmidt	Cedar County	Cedar County Hwy Superintendent
Kevin Garvin	Cedar County	Director Emergency Management
George Hefner	Coleridge	Village Board Chairman
Diane Limoges	Fordyce	Village Clerk
Karma Schulte	Hartington	Chamber of Commerce President
Brad Peitz	Hartington	Mayor
Randy Kathol	Hartington Fire Department	Hartington Fire Chief
A.J. Johnson	Hartington-Newcastle Schools	Superintendent
Sarah Edwards	Hartington-Newcastle Schools	Elementary Principal
Randall Klooz	Laurel-Concord-Coleridge Schools	Superintendent
Tom Moser	Lewis and Clark NRD	General Manager
Jason Becker	Magnet	Village Board Chairman
Kim Schultz	Northeast Neb. Public Health	Emergency Response Coordinator
Gordon Hamilton	Obert	Village Board Member
Stan Wieseler	Obert	Village Board Member
Jeff Hoesing	Randolph Public Schools	Superintendent
Victor Paltz	St. Helena	Village Board Chairman
John Eskins, Jr.	Wynot	Village Board Chairman
Greg Foxhoven	Wynot Fire Department	Wynot Fireman
Jeff Mesersmith	Wynot Public Schools	Superintendent
Phil Luebbert	JEO Consulting Group, Inc.	Planner
Becky Appleford	JEO Consulting Group, Inc.	Project Coordinator
Dixon County – June 2, 2015		
Doug Ellis	Allen	Village Board Member
Rod Strivens	Allen Fire Department	Allen Fire Chief
Sara Kumm	Allen Fire Department	Allen/Waterbury Rescue Captain
Rob Bock	Allen Fire Department	Assistant Fire Chief

Name	Jurisdiction	Title
Shea Scollard	Dixon County	Director of Emergency Management
Lynn Eifert	Dixon County	Deputy Emergency Manager/911 Director
Chip Young	Village of Dixon	Dixon Fire Chief
Jeff Hartung	Village of Dixon	Village Board Chairman
Doug Smith	Martinsburg	Village Board Chairman
Austin Roeber	Martinsburg Fire Department	Martinsburg Assistant Fire Chief
Jeanne Blatchford	Maskell	Village Clerk
John Kneifl	Newcastle Fire Department	Newcastle Fire Chief
Kim Schultz	Northeast Nebraska Public Health	Emergency Response Coordinator
Brad Krohn	Ponca Fire Department	Ponca Fire Chief
Brian Scollard	Ponca Fire Department	Ponca 2nd Assistant Chief
Lorrie Huston	Ponca Public Schools	Superintendent
Ruth Greenough	Waterbury	Village Clerk
Jeff Henson	JEO Consulting Group, Inc.	Department Manager
Phil Luebbert	JEO Consulting Group, Inc.	Planner
Becky Appleford	JEO Consulting Group, Inc.	Project Coordinator

MITIGATION PLAN DEVELOPMENT

ROUND 2 MEETINGS: MITIGATION STRATEGIES

The identification and prioritization of mitigation measures are essential components in developing effective hazard mitigation plans. At the Round 2 meetings, participating jurisdictions identified new mitigation actions in addition to the mitigation actions continued from the 2010 HMP to address the hazards of concern for their jurisdiction. Participating jurisdictions were also asked to review the information collected from the Round 1 meeting related to their community through this planning process. Local planning teams were asked to ensure all information included was up to date and accurate. Information/data reviewed include (but was not limited to): local risk assessment results, identified critical facilities and their location within the community, concentrations of populations identified as 'highly vulnerable', future development areas, and expected growth trends (refer to *Appendix C*).

There was also a brief discussion about the last months of 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. Table 13 shows the dates and locations of meetings held for the Mitigation Strategies phase of this project.

Table 13: Round 2 Meeting Dates and Locations

Agenda Items	
Identify new mitigation measures, review of local data, annual review process, and applying for grants	
Location and Time	**Date**
Cedar County: Hartington, NE 6:30 PM	September 24, 2015
Dixon County: Martinsburg, NE 6:30 PM	September 3, 2015

Meeting attendees are identified in Table 14.

Table 14: Round 2 Meeting Attendees

Name	Jurisdiction	Title
Cedar County		
Terry Pinkelman	Cedar County	County Commissioner
Kevin Garvin	Cedar County	Director of Emergency Management
Carla Schmidt	Cedar County	Highway Superintendent
George Hefner	Coleridge	Village Board Chairman
Diane Limoges	Fordyce	Village Clerk
Brad Peitz	Hartington	Mayor
A.J. Johnson	Hartington-Newcastle Public Schools	Superintendent
Randall Klooz	Laurel-Concord-Coleridge Schools	Superintendent
Chad Reifenrath	Lewis and Clark NRD	Project Manager
Jason R. Becker	Magnet	Village Board Chairman
James Cautrell	Magnet	Water Operator
Kim Schultz	Northeast Nebraska Public Health	Emergency Response Coordinator
Stan Wieseler	Obert	Village Board Member
Jeff Hoesing	Randolph Public Schools	Superintendent
Victor Paltz	St. Helena	Village Board Chairman
John Eskins Jr.	Wynot	Village Board Chairman
Gregory Foxhoven	Wynot Fire Department	Training Officer
Jeff Messersmith	Wynot Public Schools	Superintendent
Caitlin Olson	JEO Consulting Group, Inc.	Planner Intern
Becky Appleford	JEO Consulting Group, Inc.	Project Coordinator
Dixon County		
Sara Kumm	Allen	Rescue Captain
Doug Ellis	Allen	Village Board Member
Lynn Eifert	Dixon County	Deputy Emergency Manager/911 Director
Shea Scollard	Dixon County	Director of Emergency Management
Kevin Garvin	Village of Dixon	Dixon Fire/EMS
Chip John Young	Village of Dixon	Dixon Fire
Monte Roeber	Martinsburg	Fire Chief
Lance Anderson	Martinsburg	Martinsburg Fire
Austin Roeber	Martinsburg	Martinsburg Fire
Doug Smith	Martinsburg	Village Board Chairman
Bill Blatchford	Maskell	Maskell
John Kneifl	Newcastle	Fire Chief
Denise Peterson	Ponca	City Clerk/Floodplain Administrator
Michelle Rinas	Ponca Public Schools	7-12 Principal
Joan Reznicek	Ponca Public Schools	Superintendent
Ruth Greenough	Waterbury	Village Clerk
Caitlin Olson	JEO Consulting Group, Inc.	Planner Intern
Becky Appleford	JEO Consulting Group, Inc.	Project Coordinator

PLAN INTEGRATION

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.

Table 15: General Plans, Documents, and Information

Documents	Source
Disaster Mitigation Act of 2000 (DMA)	http://www.fema.gov/media-library/assets/documents/4596?id=1935
Final Rule (2007)	http://www.fema.gov
Hazard Mitigation Assistance Unified Guidance (2013)	http://www.fema.gov/hazard-mitigation-assistance
Local Mitigation Plan Review Guide (2013)	http://www.fema.gov
Local Mitigation Planning Handbook (2013)	http://www.fema.gov/media-library-data/20130726-1910-25045-9160/fema_local_mitigation_handbook.pdf
Local Multi-Hazard Mitigation Planning Guidance (Blue Book) (2008)	http://www.fema.gov
National Flood Insurance Program Community Status Book (2014)	http://www.fema.gov/cis/NE.html
The Census of Agriculture (2012)	http://www.agcensus.usda.gov/
What is a Benefit: Guidance on Benefit-Cost Analysis on Hazard Mitigation Projects	http://www.fema.gov/benefit-cost-analysis
Plans/Studies	**Source**
Community Comprehensive Plans/Zoning and Subdivision regulations	From respective communities
Flood Insurance Studies (where applicable)	http://www.fema.gov/floodplain-management/flood-insurance-study
Nebraska Drought Mitigation and Response Plan (2000)	http://carc.nebraska.gov/docs/NebraskaDrought.pdf
Nebraska Geological Survey Landslide Study (2006)	http://snr.unl.edu/csd/surveyareas/geology.asp
State of Nebraska Hazard Mitigation Plan (2014)	http://www.nema.ne.gov/pdf/hazmitplan.pdf
Data Sources/Technical Resources	**Source**
Federal Emergency Management Agency	http://www.fema.gov
FEMA Map Service Center	http://www.msc.fema.gov
High Hazard Dam Inundation Area/Information	http://dnr.ne.gov/website
Midwestern Regional Climate Center	http://mrcc.isws.illinois.edu/
National Agricultural Statistics Service	http://www.nass.usda.gov/
National Climatic Data Center	http://www.ncdc.noaa.gov
Nebraska Department of Education	http://reportcard.education.ne.gov/ http://educdirsrc.education.ne.gov/
Data Sources/Technical Resources	**Source**
National Drought Mitigation Center – Drought Impact Reporter	http://www.droughtreporter.unl.edu
National Drought Mitigation Center – Drought Monitor	http://drought.unl.edu/dm/monitor.html
National Environmental Satellite, Data, and Information Service	http://www.nesdis.noaa.gov/
National Flood Insurance Program	http://www.fema.gov http://dnrdata.dnr.ne.gov
National Flood Insurance Program Bureau and Statistical Agent	http://www.fema.gov/national-flood-insurance-program
National Historic Registry	http://www.nps.gov/nr

National Oceanic Atmospheric Administration	http://www.noaa.gov/
National Pipeline Mapping System (NPMS)	https://www.npms.phmsa.dot.gov/
Natural Resources Conservation Service	www.ne.nrcs.usda.gov
Nebraska Association of Resources Districts	http://www.nrdnet.org
Nebraska Climate Assessment Response Committee	http://carc.agr.ne.gov
Nebraska Department of Agriculture	http://www.nda.nebraska.gov/index.html
Nebraska Department of Natural Resource – GIS	http://dnrdata.dnr.ne.gov
Nebraska Department of Natural Resources	http://www.dnr.ne.gov
Nebraska Department of Natural Resources – Dam Inventory	http://dnrdata.dnr.ne.gov/Dams/Search.aspx?mode=county
Nebraska Department of Natural Resources – Soils Data	http://www.dnr.ne.gov/databank/soilsall.html
Nebraska Department of Revenue – Property Assessment Division	www.revenue.ne.gov/PAD
Nebraska Emergency Management Agency	http://www.nema.ne.gov
Nebraska Forest Service	http://www.nfs.unl.edu/
Nebraska Forest Service – Wildland Fire Protection Program	http://nfs.unl.edu/program-wildlandfireprotection.asp
Storm Prediction Center Statistics	http://www.spc.noaa.gov
United States Census Bureau	http://www.census.gov
United States Department of Agriculture	http://www.usda.gov
United States Department of Agriculture – Risk Assessment Agency	http://www.rma.usda.gov
United States Department of Commerce	http://www.commerce.gov/
United States Geological Survey	http://www.usgs.gov/
United States Small Business Administration	http://www.sba.gov
UNL – College of Agricultural Sciences and Natural Resources – Schools of Natural Resources	http://casnr.unl.edu

PUBLIC REVIEW

Once the draft of the HMP was completed, a public review period was opened to allow for participants and community members at large to review the plan and provide comments and changes, if any, at that time. The public review period was open from March 7 through April 7, 2016. Participating jurisdictions were emailed and mailed a letter notifying them of this public review period. The HMP was also made available on the project website (http://jeo.com/cdhmp/) for download. Comments and changes that were received were incorporated into the plan.

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 and objectives and action items.

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

Once adopted, participants are responsible for implementing and updating the plan every five years. 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. Copies of resolutions approved by each participant are located in *Appendix A*.

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

SECTION THREE: DEMOGRAPHICS AND ASSET INVENTORY

INTRODUCTION

This section includes information on: geography of the planning area; census data for each participating jurisdiction; structural inventory data; government owned lands; and an inventory of agricultural assets. The census data used in this plan update includes total population (2000, 2010, 2015 estimated); total housing units; housing tenure; housing occupancy (owner occupied, renter occupied, and vacant); selected housing characteristics; and relevant statistics related to at risk populations. Structural evaluation includes a structural inventory for participating jurisdictions; properties included on the National Historic Registry; state and federal owned facilities; and total count of critical facilities by type. The inventoried items related to agricultural assets include: number of farms (2007 and 2012); agricultural acreage; crops by acre; livestock population; and market value of agricultural products (2007 and 2012).

PLANNING AREA GEOGRAPHIC SUMMARY

Cedar and Dixon Counties cover a total of 1,229 square miles in northeastern Nebraska. The northern border of both counties is formed by the Missouri River.

Figure 3: Image of Rural Cedar County

Source: JEO Photo

DEMOGRAPHICS

Demographic and asset information can be used to determine differing levels of vulnerability by analyzing data on population and housing, structural inventories and valuations, critical facilities, and highly vulnerable areas and populations for each participating jurisdiction.

DEMOGRAPHIC CHANGES

As populations change, either growing or declining, the vulnerability of the community is impacted. If a community experiences rapid growth it may lack sufficient resources to adequately provide services for all members of the community in a reasonable timeframe. Examples of potential growth related complications include: insufficient snow removal and roadway maintenance; lack of emergency storm shelters in vulnerable areas; inability to complete repairs to damaged infrastructure; and tracking the location of vulnerable populations. Communities experiencing population decline may be more vulnerable to hazards due to: vacant and/or dilapidated structures; an inability to properly maintain critical facilities and/or infrastructure; and higher levels of unemployment and populations living in poverty. It is important for communities to monitor their population changes and ensure that those issues are incorporated into hazard mitigation plans, as well as other planning mechanisms within the community.

The following tables summarize various population characteristics such as: population trends; population by age; at risk populations; care facilities; and educational facilities.

In general, the planning area is rural in nature with some metropolitan areas. According to the US Census, the regional population for 2010 is 14,852 persons. This represents a decline of more than six percent from the 2000 census. The region accounts for less than one percent the total population for the state (2010 census).

Table 16 provides a summary of population from 2000, 2010, and an estimate for 2015. The percent change (2000 -2010) was utilized to project the population for 2020. This is a relatively simple method to predict population change and it does not account for predominant age cohorts in the community, birth and death rates, or in and out migration which will likely impact the rate of growth or decline.

Table 16: Population Trends 2000-2010

Jurisdiction	2000 Population	2010 Population	Population Change 2000-2010	2015 Population Estimated	2020 Projected Population
Cedar County	9,615	8,852	-7.94%	8,501	8,150
Village of Coleridge	541	473	-12.57%	443	414
Village of Fordyce	182	139	-23.63%	123	106
City of Hartington	1,640	1,554	-5.24%	1,513	1,473
Village of Magnet	265	57	-78.49%	35	12
Village of Obert	49	23	-53.06%	17	11
Village of Saint Helena	86	96	11.63%	102	107
Village of Wynot	191	166	-13.09%	155	144
Dixon County	6,339	6,000	-5.35%	5,840	5,679
City of Ponca	1,062	961	-9.51%	915	870
Village of Newcastle	299	325	8.70%	339	353
Village of Allen	411	377	-8.27%	361	346
Village of Martinsburg	103	94	-8.74%	90	86
Village of Maskell	67	76	13.43%	81	86
Village of Waterbury	89	73	-17.98%	66	60
Village of Dixon	108	87	-19.44%	79	70
Planning Area Total	**15,954**	**14,852**	**-6.91%**	**14,339**	**13,826**

Source: U.S. Census Bureau – 2000, 2010

Across the planning area, 9 of the 17 jurisdictions are experiencing significant population change greater than +/- 10 percent. Jurisdictions with a population change greater than +10 percent include: Village of St. Helena and the Village of Maskell. Jurisdictions with a population change greater than -10 percent include: Village of Coleridge, Village of Fordyce, Village of Magnet, Village of Obert, Village of Wynot, Village of Waterbury, and the Village of Dixon.

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 principles may be considered when discussing potentially at risk populations, including:

- Not all people who are considered "at risk" are at risk
- Outward appearance does not necessarily mark a person as at risk
- A hazard event will, in many cases, impact at risk populations in different ways

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

Table 17 provides a breakdown of the population by age. The table shows that the largest demographic cohort for the planning area is that of residents between the ages of 35 and 54 years. Minors (ages 0 to 19) constitute an estimated 13 percent of the population while seniors (age 65 to >85) comprise approximately 20 percent of the total population.

Table 17: Population by Age

Jurisdiction	<9	10 - 19	20 - 34	35 - 54	55 - 64	65 - 84	>85	Median	Total
Cedar County	1,159	1,265	1,138	2,239	1,176	1,439	374	44.6	8,790
	13.2%	14.4%	12.9%	25.5%	13.4%	16.4%	4.3%		100%
Village of Coleridge	96	79	68	156	73	107	52	45.9	631
	15.2%	12.5%	10.8%	24.7%	11.6%	17.0%	8.2%		100%
Village of Fordyce	17	23	16	35	37	18	5	51.1	151
	11.3%	15.2%	10.6%	23.2%	24.5%	11.9%	3.3%		100%
City of Hartington	258	246	224	339	162	310	121	42.4	1,660
	15.5%	14.8%	13.5%	20.4%	9.8%	18.7%	7.3%		100%
Village of Magnet	3	6	0	6	12	4	0	56.2	31
	9.7%	19.4%	0.0%	19.4%	38.7%	12.9%	0.0%		100%
Village of Obert	0	0	0	14	0	7	0	53.3	21
	0.0%	0.0%	0.0%	66.7%	0.0%	33.3%	0.0%		100%
Village of Saint Helena	3	18	8	29	8	23	2	46.7	91
	3.3%	19.8%	8.8%	31.9%	8.8%	25.3%	2.2%		100%
Village of Wynot	14	14	12	41	21	28	2	48.2	132
	10.6%	10.6%	9.1%	31.1%	15.9%	21.2%	1.5%		100%
Dixon County	780	876	867	1,474	844	905	207	41	5,953
	13.1%	14.7%	14.6%	24.8%	14.2%	15.2%	3.5%		100%

Jurisdiction	<9	10 - 19	20 - 34	35 - 54	55 - 64	65 - 84	>85	Median	Total
Village of Allen	27	56	36	63	24	77	2	42.8	285
	9.5%	19.6%	12.6%	22.1%	8.4%	27.0%	0.7%		100%
Village of Dixon	4	8	5	20	17	18	0	54.5	72
	5.6%	11.1%	6.9%	27.8%	23.6%	25.0%	0.0%		100%
Village of Martinsburg	5	5	3	17	8	15	0	53.9	53
	9.4%	9.4%	5.7%	32.1%	15.1%	28.3%	0.0%		100%
Village of Maskell	14	19	12	17	30	14	0	36.7	106
	13.2%	17.9%	11.3%	16.0%	28.3%	13.2%	0.0%		100%
Village of Newcastle	41	34	33	72	46	47	15	45.2	288
	14.2%	11.8%	11.5%	25.0%	16.0%	16.3%	5.2%		100%
City of Ponca	109	147	175	252	149	175	51	43.2	1,058
	10.3%	13.9%	16.5%	23.8%	14.1%	16.5%	4.8%		100%
Village of Waterbury	1	9	12	26	8	8	0	48.3	64
	1.6%	14.1%	18.8%	40.6%	12.5%	12.5%	0.0%		100%
Planning Area	**1,939**	**2,141**	**2,005**	**3,713**	**2,020**	**2,344**	**581**	**47.1**	**14,743**
	13%	**15%**	**14%**	**25%**	**14%**	**16%**	**4%**		**100%**

Source: U.S. Census Bureau – ACS 2013 5-year estimate

Community specific demographics which have a significant deviation from the regional data (20 percent) with population over the age of 65 include: Village of Obert with a third of the population, Village of St. Helena with 25 percent of the population, Village of Wynot with 21 percent, Village of Allen with 27 percent, Village of Martinsburg with 28 percent, and the Village of Dixon with 25 percent.

Communities with a significant deviation from the regional data (28 percent) with population under the age of 19 include: Village of St. Helena with 23 percent, Village of Wynot with 21 percent, Village of Martinsburg with 19 percent, Village of Maskell with 31 percent, and the Village of Dixon with 17 percent. Additionally, the Village of Obert does not have any residents 34 or younger.

Residents under the age of 18 experience higher levels of vulnerability related to hazards for a range of reasons. General vulnerabilities that can be identified for this group include: lack of independent transportation, significant concentrations of the demographic during daytime hours (attending schools), and the potential for greater impacts resulting from environmental stimuli (chemical release, extreme temperatures, contamination of air/water). As a result this demographic group experiences increased vulnerability to the following list of hazards: tornados (especially daytime events), severe thunderstorms, severe winter storms, extreme heat, water shortage created by drought, and chemical releases. Lack of awareness can be, at times, a concern for people in this age range as well as an inability to recognize and respond to environmental stimuli. This could lead to increased vulnerability to flooding (especially flash flooding), severe thunderstorms, tornados, and severe winter storms.

In addition, there are a number of 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 on evenings and weekends. The following table identifies the various school districts located within the planning area, and Figure 4 shows the school district boundaries. This list is comprehensive for public schools and does not only represent the public school districts that are participating in this plan.

Table 18: School Inventory

School District	Total Enrollment (2014-2015)
Allen Consolidated School District	212
Crofton Community School District	341
Emerson-Hubbard Public School District	278
Hartington-Newcastle Public School District	326
Laurel-Concord-Coleridge Public School District	438
Ponca Public School District	467
Randolph Public School District	248
Wakefield Public School District	458
Wausa Public School District	253
Wayne Community School District	900
Wynot Public School District	162

Source: Nebraska Department of Education

Like minors, seniors (age 65 and greater) are often times more significantly impacted by temperature extremes. During prolonged heat waves, seniors may lack resources to effectively address the hazards and as a result may incur injury or potentially death. Prolonged power outages (either standalone events or as the result of other contributing factors) can have significant impacts on any citizen relying on medical devices for proper bodily functions. One study conducted by the Center for Injury Research and Policy found that increases in vulnerability related to severe winter storms (with significant snow accumulations) begin at age 55. The 2011 study found that on average there are 11,500 injuries and 100 deaths annually related to snow removal. People, especially males, over the age of 55 are 4.25 times more likely to experience cardiac symptoms during snow removal.

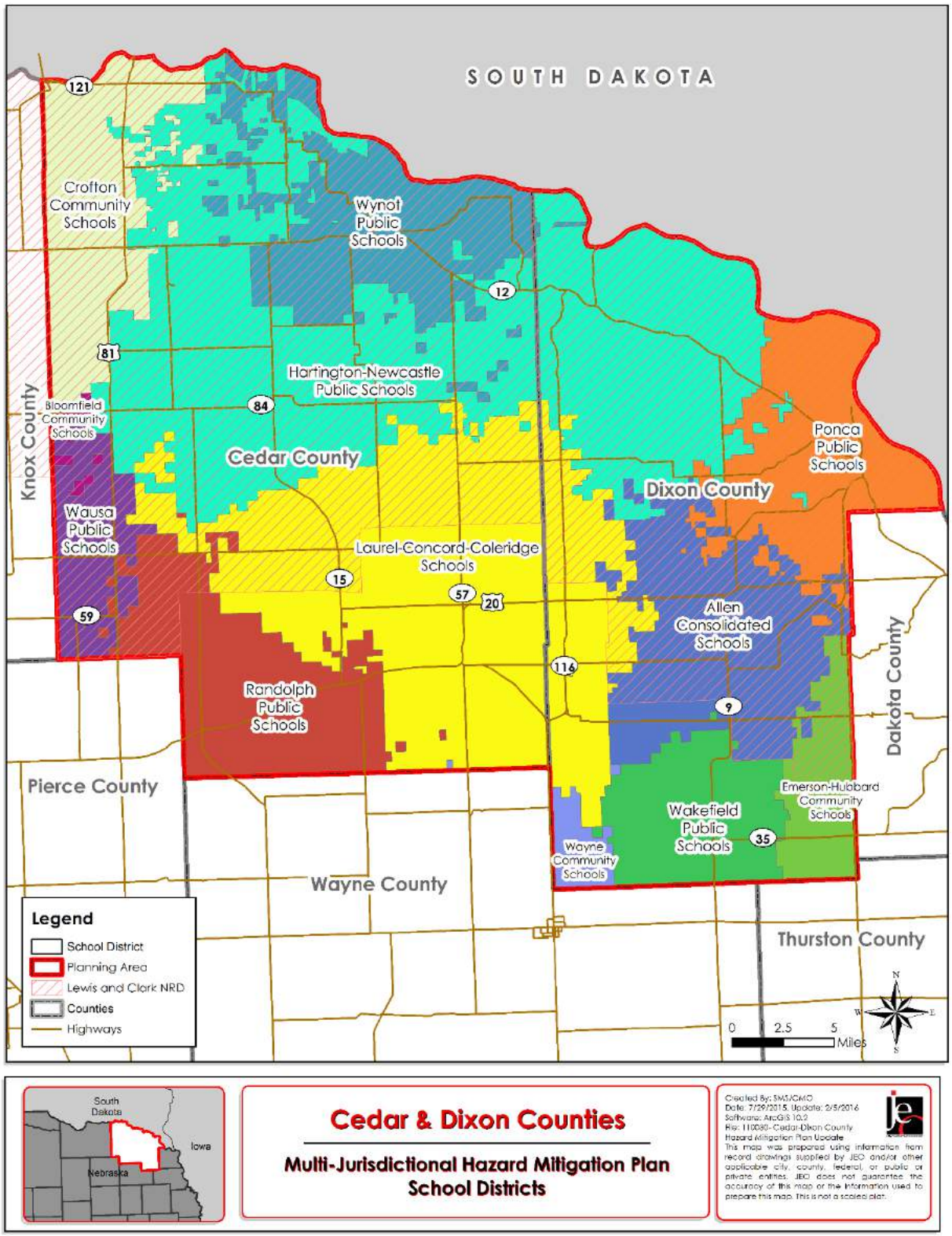
While the previously identified populations do live throughout the planning area, there is the potential that they will be located in higher concentrations at care facilities. The following table identifies the location and capacity of care facilities throughout the planning area.

Table 19: Inventory of Care Facilities

Jurisdiction	Number of Hospitals	Number of Hospital Beds	Adult Care Home	Adult Care Beds	Assisted Living Homes	Assisted Living Beds	Child Care Facilities
Cedar County	0	0	4	162	4	76	14
Dixon County	0	0	2	91	2	29	5

Source: Nebraska Department of Health and Human Services

Figure 4*:* Regional School Districts



In addition to residents being classified as at risk by age, there are other specific groups within the planning area that experience vulnerabilities related to their ability to communicate or their economic status. Table 20 provides statistics per county regarding households with English as a second language (ESL) and population reported as in poverty within the past 12 months.

Table 20: At Risk Populations

County	Population that speaks English as Second Language	Percent of Total Population	Population Below Poverty Level	Percent of Total Population
Cedar County	201	2.4%	871	10.1%
Dixon County	475	8.5%	652	11.2%

Source: Language Spoken at Home: 2009 – 2013 ACS 5-year estimate, Selected Economic Characteristics: 2009 – 2013 ACS 5-year estimate

Resident who speak English as a second language may struggle with a range of issues before, during, and after hazard events. General vulnerabilities revolve around what could be an inability to effectively communicate with others or an inability to comprehend materials aimed at notification and/or education. When presented with a hazardous situation, it is important that all community members be able to receive, decipher, and act on relevant information. An inability to understand warnings and notifications may prevent not native English speakers from reacting in a timely manner. Further, often times educational materials related to regional hazards are developed in English, which is the dominant language for the area, and residents who struggle with English in the written form may not have sufficient information related to local concerns to effectively mitigate potential impacts. Residents with limited English proficiency are at an increased vulnerability to all hazards within the planning area.

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

BUILT ENVIRONMENT AND STRUCTURAL INVENTORY

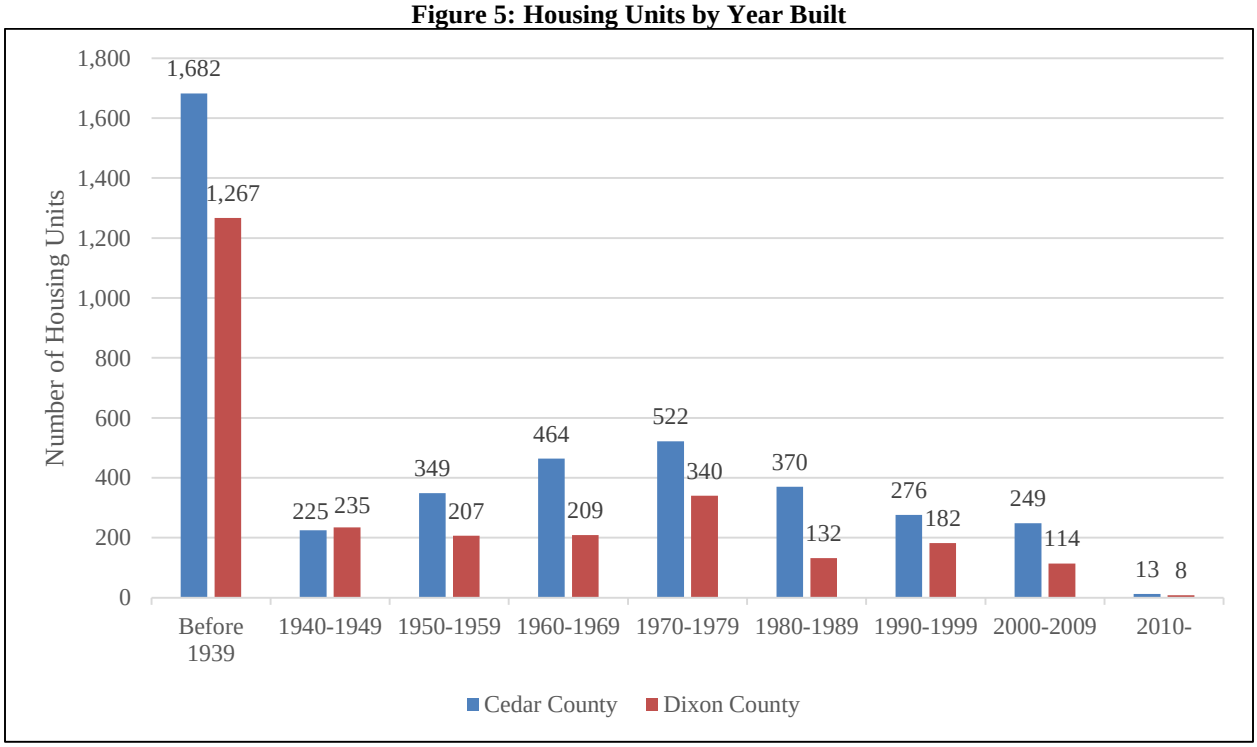
Data related to the built environment is an important component for a hazard mitigation plan. It is essential that during the planning process communities and participating jurisdictions display an understanding of their built environment and work to identify needs that may exist within their planning area. This section includes: inventory of housing units by year built; percent of owner occupied housing; percent of renter occupied housing; percent of vacant housing; selected housing characteristics; properties included on the National Historic Registry; regional inventory of critical facilities; state and federally owned properties; and community specific structural inventories.

HOUSING STATISTICS

Figure 5 displays the age of housing units across the planning area. Most of the housing units within the planning area were constructed before the 1960s. Across the state, the first building codes were adopted in 1987. Prior to this time, codes and building standards were established (or not) by each county and community. The state of Nebraska later adopted the IBC 2000 codes (adopted in 2003) and most recently updated code requirements to the IBC 2009 codes (adopted in 2010). Structures built prior to 1987 (or 1990 for the data provided in this document) may have been built to standards less restrictive and potentially less sturdy than what is required for structures since that time. According to the Department of Housing and Urban Development (HUD), older homes are at greater risk of poor repair and dilapidation resulting in blighted or substandard properties. This is significant in assessing hazard vulnerability because these housing units may result in living quarters that are prone to higher damages during disaster events which

include high winds, tornados, hail, severe thunderstorms, and severe winter storms. For the planning area, 88 percent of housing units were built prior to 1990 when IBC codes were first introduced across the state.

Figure 5: Housing Units by Year Built



Source: Selected Housing Characteristics: 2009 – 2013 ACS 5-year estimate

Housing occupancy has a direct correlation to mitigation planning. It is generally accepted that occupied housing units are better maintained and less likely to contribute to dangerous or hazardous situations. Owner occupied units are generally better maintained and updated. Rental housing often does not receive many of the updates and retrofits required for hazard resilience. Multi-family rental units may present specific concerns (such as lack of wind resistant building practices or storm shelters). Vacant homes are more likely to become derelict or fall into disrepair over time. This tendency can result in higher levels of vulnerability for communities. If vacant homes deteriorate, they can be more easily damaged or destroyed during hazard events (specifically high winds, thunderstorms, and tornados). This can result in materials that once were homes becoming projectiles and wind-borne debris. Wind-borne debris can injury people, damage vehicles and other structures, as well as creating a post impact environment where debris management is intensified.

Table 21 provides occupancy and tenure for housing units in the planning area. According to 2009-2013 ACS 5 year estimates, there are 6,844 housing units in the planning area. Of the 6,844 housing units, nearly 14 percent of housing units are vacant. Of the occupied housing units, more than 20 percent are renter occupied.

Table 21: Housing Occupancy and Tenure

Jurisdiction	Total Housing Units				Occupied Housing Units			
	Occupied		Vacant		Owner		Renter	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Cedar County	3,529	85.0%	621	15.0%	2,867	81.2%	662	18.8%
Village of Coleridge	273	86.9%	41	13.1%	178	65.2%	95	34.8%
Village of Fordyce	63	91.3%	6	8.7%	54	85.7%	9	14.3%
City of Hartington	673	93.5%	47	6.5%	534	79.3%	139	20.7%
Village of Magnet	14	51.9%	13	48.1%	10	71.4%	4	28.6%
Village of Obert	9	45.0%	11	55.0%	7	77.8%	2	22.2%
Village of Saint Helena	37	78.7%	10	21.3%	37	100.0%	0	0.0%
Village of Wynot	58	73.4%	21	26.6%	54	93.1%	4	6.9%
Dixon County	2,348	87.2%	346	12.8%	1,804	76.8%	544	23.2%
Village of Allen	116	82.3%	25	17.7%	91	78.4%	25	21.6%
Village of Dixon	38	79.2%	10	20.8%	34	89.5%	4	10.5%
Village of Martinsburg	28	84.8%	5	15.2%	25	89.3%	3	10.7%
Village of Maskell	38	88.4%	5	11.6%	29	76.3%	9	23.7%
Village of Newcastle	128	87.7%	18	12.3%	103	80.5%	25	19.5%
City of Ponca	416	91.0%	41	9.0%	341	82.0%	75	18.0%
Village of Waterbury	24	75.0%	8	25.0%	18	75.0%	6	25.0%
Total	**5,877**	**85.9%**	**967**	**14.1%**	**4,671**	**79.5%**	**1,206**	**20.5%**

Source: Selected Housing Characteristics: 2009 – 2013 ACS 5-year estimate

The U.S. Census provides some additional information related to housing units and potential areas of vulnerability. This information is taken from the 2009 – 2013 ACS 5-year estimate data regarding selected housing characteristics. The selected characteristic examined in Table 22 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 22: Selected Housing Characteristics

	Cedar County	Dixon County	Total
Occupied housing units	**3,529**	**2,348**	**5,877**
Lacking complete plumbing facilities	13 (0.4%)	17 (0.7%)	**30 (0.5%)**
Lacking complete kitchen facilities	87 (2.5%)	38 (1.6%)	**125 (2.1%)**
No telephone service available	48 (1.4%)	30 (1.3%)	**78 (1.3%)**
Mobile Homes	230 (5.5%)	148 (5.5%)	**378 (6.4%)**
Housing Unit with No vehicles available	120 (3.4%)	112 (4.8%)	**232 (3.9%)**

Indicated percentage is determined based on total housing units
Source: Selected Housing Characteristics: 2009 – 2013 ACS 5-year estimate

Approximately 1.3 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 service does represent a population at increased risk to disaster impacts. Reverse 911 systems are designed to contact households via landline services and as a result, some homes in hazard prone areas may not receive notification of potential impacts in time to take protective actions. Emergency managers should work to promote the registration of cell phone numbers with Reverse 911 systems.

Over six percent of housing units in the planning area are mobile homes. Mobile homes are at a higher risk of sustaining damages during high wind events, tornados, 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.

NATIONAL HISTORIC REGISTRY

A list of national historic sites as provided by the Nebraska State Historical Society and a summary of the total number located within the planning area is shown below. Detailed information of the historic sites including a list of historic properties located within the floodplain is presented in *Section Seven: Participant Section* by participants. Structures identified as cultural or historic resources represent assets that are unique to the planning area and are, in many situations, irreplaceable and have local significance.

Table 23: National Historic Registry

County	Buildings	Districts	Site	Structure	Total
Cedar	9	1	2	1	**13**
Dixon	3	2	0	0	**5**

Source: Nebraska National Register

CRITICAL INFRASTRUCTURE/KEY RESOURCES

According to FEMA, "A critical facility is a structure that, if flooded (or damaged), would present an immediate threat to life, public health, and safety." Examples of critical facilities include hospitals, emergency operations centers, schools, wells, and sanitary sewer lift stations, etc.

Each participating jurisdiction identified critical facilities as vital for disaster response, providing shelter to the public, and essential for returning the jurisdiction's functions to normal during and after a disaster. Critical facilities were identified during the last Hazard Mitigation Plan development. As an update of the previous efforts, a critical facilities' survey was conducted at the 'hazard identification' public meetings through the meeting worksheets (refer to *Appendix C*) to verify whether critical facilities identified from the last plan were still current or required any removals or additions. Below is a summary of the critical facilities for the entire planning area. To view jurisdiction specific critical facility maps, refer to *Section Seven: Participant Sections*.

STATE AND FEDERALLY OWNED PROPERTIES

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

Table 24: State and Federally Owned Facilities

County	Facility	Nearest Community
Cedar	Tatanka State Wildlife Management Area	Aten
	Missouri National Recreation River	Wynot, St. Helena
Dixon	Ponca State Park	Ponca
	Missouri National Recreation River	Maskell, Newcastle, Ponca
	Buckskin Hills State Wildlife Management Area	Newcastle
	Tarbox Hollow Living Prairie	Dixon

PARCEL INVENTORY

To better understand the potential for losses in the planning area, a parcel inventory was completed for the corporate limits of each incorporated jurisdiction in the planning area using GIS data. Parcel inventories were completed in order to determine the number of parcels and the value of their improved structures within each jurisdiction. This inventory provided valuable information on the vulnerability and potential losses to each plan participant.

Parcel inventory data was collected from GIS Workshop, a private firm handling all GIS work for both counties. GIS Workshop was able to provide a data set which includes the location of the parcel, parcel value, and value for improvements (structures), number of parcels, and parcel land value. This information was used for assessing risk to structures related to hazards with known geographic locations such as flooding.

Structures are categorized into the following classifications:

- *Improvement*, including all residential structures, such as a house, apartment, or other place of residence.
- *Land Value*, price of the property, independent of any land improvements.
- *Outbuilding*, any nonresidential structure on a parcel.

The following table displays the structural valuation summaries for both the cities and counties in the planning area. An inventory for each jurisdiction can be found in the *Section Seven: Participant Sections*.

Table 25: Structural Inventory and Valuation Summary

Jurisdiction	Improvement	Land Value	Outbuilding	Total Value	Total Number of Parcels
Cedar County	$107,498,323	$2,047,857,465	$280,371,993	$2,435,727,781	9,466
Village of Coleridge	$1,628,340	$4,536,460	$8,298,930	$14,463,730	417
Village of Fordyce	$2,588,750	$3,008,240	$3,322,330	$89,119,320	131
City of Hartington	$15,118,185	$13,502,190	$54,414,655	$83,035,030	1,015
Village of Magnet	$640,835	$3,297,375	$614,410	$4,552,620	91
Village of Obert	$118,510	$775,340	$298,545	$1,192,395	61

Jurisdiction	Improvement	Land Value	Outbuilding	Total Value	Total Number of Parcels
Village of Saint Helena	$154,650	$766,125	$2,135,165	$3,055,940	139
Village of Wynot	$1,104,275	$3,894,190	$4,060,650	$9,059,115	179
Dixon County	$67,935,370	$1,227,004,470	$153,976,300	$1,448,916,140	6,423
Village of Allen	$140,415	$2,786,295	$1,828,090	$4,754,800	138
Village of Dixon	$243,130	$1,540,075	$1,329,020	$3,112,225	96
Village of Martinsburg	$1,013,530	$4,316,075	$6,186,860	$11,516,465	261
Village of Maskell	$37,935	$130,050	$2,317,175	$3,685,160	79
Village of Newcastle	$746,110	$3,973,925	$8,542,705	$13,262,740	298
City of Ponca	$151,690	$5,560,840	$30,665,790	$36,378,320	735
Village of Waterbury	$381,615	$1,996,625	$1,130,250	$3,508,490	82

Source: GIS Workshop

AGRICULTURAL ASSET INVENTORY

Agriculture is a major component of the economy for the planning area and the rest of the state. According to the Nebraska Department of Agriculture:

- The livestock industry contributes more than $6 billion annually to the state's economy
- Farmlands across the state accounted for 92 percent of the state's total land area
- More than 8.3 million acres of farmland are irrigated (44 percent of all farmland) in 2012
- 1 in 4 jobs are related to agriculture

The following tables present information from the United States Department of Agriculture (USDA) 2007 and 2012 Agricultural Census.

Table 26: Regional Farm Data

County	Number of Farms, 2007	Number of Farms, 2012	Percent Change	Farm Acreage, 2007	Farm Acreage, 2012	Percent Change
Cedar	924	939	1.6%	474,744	466,473	-1.8%
Dixon	568	570	0.4%	248,506	298,996	16.9%
Total	**1492**	**1509**	**1.1%**	**723,250**	**765,469**	**5.5%**

Source: USDA 2007 and 2012 Agricultural Census

CROP INVENTORY

The following table provide information related to the crops grown within the planning area. The data was collected from the 2012 USDA Agricultural Census.

Table 27: Crops by County

County	Wheat (acres)	Soybeans (acres)	Forage (acres)	Corn (acres)
Cedar	791	115,315	28,258	167,878
Dixon	244	81,557	9,455	111,027
Total	**1,035**	**196,872**	**37,713**	**278,905**

Source: 2012 USDA Agricultural Census

LIVESTOCK INVENTORY

The following table provide information related to the livestock within the planning area. The data was collected from the 2012 USDA Agricultural Census.

Table 28: Livestock Inventory by County

County	Cattle and Calves	Hogs and Pigs	Horse and Ponies	Poultry Egg Layers	Poultry Broilers	Sheep and Lambs
Cedar	121,679	71,112	13	4047	948	1073
Dixon	46,274	33438	70	N/A	N/A	899
Total	**167,953**	**104,550**	**83**	**4047**	**948**	**1972**

Source: 2012 USDA Agricultural Census

AGRICULTURAL VALUATION PER COUNTY

The following table provide information related to the market value of agricultural resources located within the planning area. The data was collected from the 2007 and 2012 USDA Agricultural Census.

Table 29: Market Value of Agricultural Products Sold

County	Market Value of Products Sold, 2007	Market Value of Products Sold, 2012	Percent Change
Cedar	$268,026,000	$388,734,000	31.1%
Dixon	$143,307,000	$169,128,000	15.3%
Total	**$411,333,000**	**$557,862,000**	**26.3%**

Source: USDA 2007 and 2012 Agricultural Census

INTRODUCTION

The ultimate purpose of this Hazard Mitigation Plan is to minimize the loss of life and property 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 are able to develop specific strategies to address areas of concern identified through this process. The following table defines terms that will be used throughout this section of the plan.

Table 30: Term Definitions

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

METHODOLOGY

The risk assessment methodology utilized for this plan follows the risk assessment methodology outlined in the FEMA Local Mitigation Planning Handbook (March 2013). This process consists of four primary steps: 1) Describe the hazard; 2) Identify vulnerable community assets; 3) Analyze Risk; and 4) Summarize vulnerability.

When describing the hazard, this plan will examine the following items: previous occurrences of the hazard within the planning area; locations where the hazard has occurred in the past or is likely to occur in the future; extent of past events and likely extent for future occurrences; and probability of future occurrences. The identification of vulnerable assets will be across the entire planning area, *Section Seven: Participant Sections* will include discussion of community specific assets at risk for relevant hazards. Analysis for regional risk will examine historic impacts and losses and what is possible should the hazard occur in the future. Risk analysis will include both qualitative (i.e. description of historic or potential impacts) and quantitative data (i.e. assigning values and

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

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

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

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

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

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

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

measurements for potential loss of assets). Finally, for each hazard identified the plan will provide a summary statement encapsulating the information provided during each of the previous steps of the risk assessment process.

For each of the hazards profiled, the best and most appropriate data available will be considered. The following table outlines the data sources utilized to examine each individual hazard. Further discussion relative to each hazard is discussed in the hazard profile portion of this section.

Table 31: Risk Assessment Data Sources

Type of Data	Data Source
Modified Mercalli Intensity Scale	Federal Emergency Management Agency (FEMA)
Richter Scale	FEMA
Wind Zones in the United States	FEMA
Days Above 90F Per Year Average Monthly Precipitation Monthly Normal and Record Temperatures Monthly Normal Snowfall	Midwestern Regional Climate Center (MRCC)
Global Terrorism Database, 1970-2014	National Consortium for the Study of Terrorism and Responses to Terrorism
Historical Drought Intensity	National Drought Mitigation Center, University of Nebraska-Lincoln
NFIP Claims Statistics	National Flood Insurance Program Loss Statistics
Monthly Tornado Averages	National Oceanic and Atmospheric Administration (NOAA)
Palmer Drought Severity Index	National Climatic Data Center (NCDC) Climate Data Online
Mapped Locations of Liquid and Gas Pipelines	National Pipeline Mapping System
Sperry-Piltz Ice Accumulation Index (SPIA)	National Weather Service (NWS)
Property Damage*, 1996-2015	NCDC Storm Events Database
Recorded Animal Diseases, 2014-2015 HPAI Outbreak Information, 2015	Nebraska Department of Agriculture
Dams in the Planning Area	Nebraska Department of Natural Resources
Fault Lines in Nebraska	Nebraska Department of Natural Resources
NFIP Policies - December 2012	Nebraska Department of Natural Resources, National Flood Insurance Program
NFIP Status	Nebraska Department of Natural Resources, National Flood Insurance Program
Acres Burned by County, 2000-2014	Nebraska Forest Service
Number of Wildfires by Cause, 2000-2014	Nebraska Forest Service
Landslide Hazard Map of Nebraska	Nebraska Geologic Survey Landslide Study
Number of Urban Fires by Fire Department, 2007-2012	Nebraska State Fire Marshall
Heat Index	NOAA
Tornado Time of Occurrence	NOAA
Beaufort Wind Force Rankings	NOAA Storm Prediction Center (SPC)
Tornado Activity in the United States	NOAA SPC
Average Number of Thunderstorms per Year	NWS
Wind Chill Index Chart	NWS
Chemical Spills (Transportation), 1970-2015	Pipeline and Hazardous Materials Safety Administration
Database of Dam Failures	Stanford University's National Performance of Dams Program
TORRO Hailstone Scale	The Tornado and Storm Research Organization

Type of Data	Data Source
Varnes Classification Scale Landslides in Nebraska Database	UNL School of Natural Resources
Database of Chemical Releases from Fixed Sites	U.S. Coast Guard's National Response Center
Fire Death Rates for the State of Nebraska	U.S. Fire Administration
USDA Secretarial Disaster Designations USDA Census of Agriculture, 2012	U.S. Department of Agriculture
Nebraska Seismic Hazard Map	United States Geological Survey
Nebraska WUI Map, 2010	University of Wisconsin SILVIS Lab
Dam Releases in 2011 Missouri River Flood	US Army Corps of Engineers
Crop Damage, 2000-2014	USDA Risk Management Agency (RMA)

**NCDC data was used for property damage, unless otherwise noted*

AVERAGE ANNUAL DAMAGES AND FREQUENCY

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

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

- **Total Damages in Dollars:** This is the total dollar amount of all property damages and crop damages as recorded in federal, state, and local data sources. The limitation to these data sources is that dollar figures usually are estimates and often do not include all damages from every event, but rather only officially recorded damages from reported events.
- **Total Years of Record:** This is the span of years there is data available for recorded events. Vetted and cleaned up NCDC data is available for January 1996 to July 2015. Although some data is available back to 1950, this plan update utilizes only the more current and more accurate data available. Wildfire data is available from the Nebraska Forest Service from 2000 to 2014.
- **Number of Hazard Event:** This shows how often an event occurs. The frequency of a hazard event will affect how a community responds. A thunderstorm may not cause much damage each time, but multiple storms can have an incremental effect on housing and utilities. In contrast, a rare tornado can have a widespread effect on a city.

An example of the Event Damage Estimate is found below:

$$\textbf{Annual Frequency}\ (\#) = \frac{Total\ Events\ Recorded\ (\#)}{Total\ Years\ of\ Record\ (\#)}$$

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

Each hazard will be included, while those which have caused significant damages or occur in significant numbers are discussed in detail. It should be noted that the table below is calculated for the entire planning area, including all the NCDC data (both county-based and zonal). It should be noted that NCDC data is not all inclusive and provides very limited information on crop losses. In order to provide a better picture of the crop losses associated with the hazards within the planning area, crop loss information provided by the

Risk Management Agency (RMA) of the USDA was also utilized for this update of the plan. The collected data was from 2000 to 2014. Data for all the hazards are not always available, so only those with an available datasets are included in the loss estimation table (Table 34).

HAZARD IDENTIFICATION

The identification of relevant hazards for the planning area began with a review of the 2014 State of Nebraska Hazard Mitigation Plan. The Regional Planning Team and participating jurisdictions reviewed the list of hazards addressed in the State Hazard Mitigation Plan and determined which hazards were appropriate for discussion relative to the planning area. The hazards for which a risk assessment was completed for this planning process are included in the following table.

Table 32: Hazards Address in the Plan

Hazards Addressed in the Plan		
Agricultural Disease (Animal and Plant)	Extreme Heat	Levee Failure
Chemical Fixed Sites	Flooding	Severe Thunderstorms
Chemical Transportation	Grass/Wildfires	Severe Winter Storms
Dam Failure	Hail	Terrorism
Drought	High Winds	Tornados
Earthquakes	Landslides	Urban Fire

HAZARD ELIMINATION

Given the location and history of the planning area, the following hazards were eliminated from further review. An explanation of how and why the hazards were eliminated is provided.

Avalanche: No historic occurrence; due to topography of the planning area this type of hazard has a very low probability of future occurrence.

Civil Disorder: For the entire state, there have been a small number of civil disorder events reported, most reported events date back to the 1960s. The absence of civil unrest in recent years does not necessarily indicate there will not be events in the future, but there are other planning mechanisms in place to address this concern. This approach is consistent with the 2014 Nebraska State Hazard Mitigation Plan.

Coastal Erosion: While it is likely that the planning area will be impacted by a changing climate, there is no coast line located in the planning area, for this reason this hazard has been eliminated.

Expansive Soils: Consistent with the 2014 Nebraska HMP, this hazard has been eliminated from further examination. There is not sufficient data available to examine historic impacts or project future probability or losses. Any impact from expansive soils in Nebraska (and the planning area) are likely to be manifested as localized flooding and will be reported as such. This approach is consistent with the 2014 Nebraska HMP.

Hurricane: Given the location of the planning area in the central plains, hurricanes are not expected to occur. This is supported by the historical record.

Land Subsistence (Sinkholes): Land subsistence is common in areas of karst topography; there are no recognized areas of true karst topography in planning area nor in Nebraska. This approach is consistent with the 2014 Nebraska HMP.

Radiological Fixed Sites: Both state and local agencies have developed appropriate and extensive plans and protocols relative to the two nuclear facilities located in the state. The existing plans and protocols are reviewed, updated, and exercised on a regular basis. Due to the extensive planning and regulations related to this threat, it will not be further profiled in this plan. This approach is consistent with the 2014 Nebraska State Hazard Mitigation Plan.

Radiological Transportation: There have been no incidents reported in the planning area or the state that have required assistance beyond what is considered regular roadside services. Further, the transportation of radiological materials is heavily regulated and monitored. There are other plans across the state that have thoroughly addressed this threat. Therefore, it will not be profiled further for this plan. This approach is consistent with the 2014 Nebraska HMP.

Tsunami: Given the location of the planning area in the central plains, tsunami are not expected to occur. This is supported by the historical record.

Volcano: Given the location of the planning area, volcano eruptions are not expected to occur. This is supported by the historical record.

HAZARD ASSESSMENT SUMMARY TABLES

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

Table 33: Regional Risk Assessment

Regional Risk Assessment			
Hazard	**Previous Occurrence Events/Years**	**Approximate Annual Probability**	**Likely Extent**
Agricultural Animal Disease	2,320/1.9	100%	Unavailable
Agricultural Plant Disease	90/15	100%	Unavailable
Chemical Fixed Sites	3/33	10%	Localized to the facilities and adjacent surroundings
Chemical Transportation	0/46	1%	Limited (<0.5 mile from release site)
Dam Failure	0	1%	Total inundation in floodplain downstream from dam as defined by inundation maps
Drought	64/121	53%	Mild Drought
Earthquakes	0/42	<1%	<4.0
Extreme Heat	35/1	100%	>90°F
Flooding	36/19.5	100%	Some inundation of structures* (<1% of structures) and roads near streams. Some evacuations of people may be necessary (<1% of population)
Grass/Wildfires	274/15	100%	<100 acres
Hail	262/19.5	100%	H3 (0.8 – 1.00 inches)
High Winds	35/19.5	100%	9 BWF (47 – 54 mph)
Landslides	17/Unknown	<5%	Localized rotational slide
Levee Failure	0/Unknown	1%	Inundation of agricultural fields

Regional Risk Assessment			
Hazard	**Previous Occurrence Events/Years**	**Approximate Annual Probability**	**Likely Extent**
Severe Thunderstorms	136/19.5	100%	Wind ≥ 58 mph and/or Hail ≤ 1.00 inch
Severe Winter Storms	131/19.5	100%	<0.50 ice 20 - 40°F below zero (wind chills) 4 – 8" snow 25 - 40 mph winds
Terrorism	0/45	<1%	Isolated to a single building
Tornados	27/19.5	100%	EF0 - EF1
Urban Fire	642/6	100%	Single structure

**Quantification of vulnerable structures provided in Section Seven: Participant Sections*

The following table provides loss estimates for hazards with sufficient data. Description of major events are include in the individual hazard profiles later in this section.

Table 34: Loss Estimation for the Planning Area

Hazard Type	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Agricultural Animal Disease	N/A	N/A	Unknown	Unknown
Agricultural Plant Disease	N/A	N/A	$511,057	$34,071
Chemical Fixed Sites	$0	$0	$0	$0
Chemical Transportation	$0	$0	Unknown	Unknown
Dam Failure	$0	$0	$0	$0
Drought	$0	$0	$134,226,317	$8,948,421
Earthquake	$0	$0	$0	$0
Extreme Heat	$0	$0	$20,491,150	$1,366,077
Flooding	$2,926,000	$150,051	$1,439,965	$95,998
Grass/Wildfires[3]	$0	$0	$62,785	$4,186
Hail Events	$395,000	$20,256	$21,145,306	$1,409,687
High Winds	$143,000	$7,333	$2,227,918	$148,528
Landslides	$65,000	N/A	N/A	N/A
Levee Failure	$0	$0	$0	$0
Severe Thunderstorms	$1,221,000	$62,615	$3,545,120	$236,341
Severe Winter Storms	$45,000	$2,308	$621,302	$41,420
Terrorism	$0	$0	N/A	N/A
Tornados	$6,670,000	$342,051	$987,904	$65,860
Urban Fire	Unknown	Unknown	N/A	N/A

1 Indicates data is from NCDC (January 1996 to June 2015)
2 Indicates data is from USDA (2000 to 2014)

3 Indicates data is from NFS (2000 to 2014)

HISTORICAL DISASTER DECLARATIONS

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

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.

Table 35: SBA Declarations

Disaster Declaration Number	Declaration Date	Description	Primary Counties	Contiguous Counties
NE-00008	9/27/2006	High Temperatures, High Winds, Excessive Heat, Hail, Tornados, and Ongoing Drought	Cedar, Dixon	N/A
NE-00011	1/7/2007	Severe Winter Storms	Cedar, Dixon	N/A
NE-00027	7/31/2009, 8/10/2009	Severe Storms, Tornados, and Flooding	Dixon	N/A
NE-00033	2/25/2010, 3/26/2010	Severe Winter Storms, and Snowstorm	Cedar, Dixon	N/A
NE-00035	4/21/2010, 6/10/2010	Severe Storms, Ice Jams, and Flooding	Dixon	N/A
NE-00041	9/7/2011, 8/12/2011, 11/18/2011	Flooding	Dixon	Cedar
NE-00042	7/18/2011	Flooding	Cedar, Dixon	N/A
NE-00049	4/1/2013	Drought	Cedar, Dixon	N/A
NE-00050	4/8/2013*	Drought	Dixon	N/A
NE-00053	12/10/2013*	Drought	Cedar, Dixon	N/A
NE-00055	11/26/2013	Severe Storms, Winter Storms, Tornados, and Flooding	Dixon	N/A
NE-00062	7/24/2014	Severe Storms, Tornados, Straight-line Winds, and Flooding	Cedar, Dixon	N/A

**Denotes date of grant application deadline, rather than disaster declaration date*

PRESIDENTIAL DISASTER DECLARATIONS

The presidential disaster declarations involving the planning area through November 2015 are summarized in the following table. Declarations prior to 1965 are available on the FEMA website, but do not list designated counties.

Table 36: Presidential Disaster Declarations

Disaster Declaration Number	Declaration Date	Disaster Type	Individual Assistance Counties	Total Individual Assistance	Public Assistance Counties	Total Public Assistance Grants
228	7/18/1967	Severe Storms and Flooding	Cedar, Dixon	N/A	Cedar, Dixon	N/A
303	2/23/1971	Floods	Cedar, Dixon	N/A	Cedar, Dixon	N/A
308	7/7/1971	Floods	None	N/A	Cedar, Dixon	N/A
467	5/7/1975	Severe Storms, Tornados	Cedar	N/A	Cedar	N/A
1480	7/21/2003	Severe Storms and Tornados	None	N/A	Cedar, Dixon	$3,891,329
1674	1/7/2007	Severe Winter Storms	None	N/A	Cedar, Dixon	$124,357,843
1878	2/25/2010	Severe Winter Storms and Snowstorm	None	N/A	Cedar, Dixon	$6,577,021
1902	4/21/2010	Severe Storms, Ice Jams, and Flooding	None	N/A	Dixon	$3,112,392
3323	6/18/2011	Flooding	None	N/A	Cedar, Dixon	N/A
4156	11/26/2013	Severe Storms, Winter Storms, Tornados, and Flooding	None	N/A	Dixon	$2,719,433
4183	7/24/2014	Severe Storms, Tornados, Straight-line Winds, and Flooding	None	N/A	Cedar, Dixon	$12,856,285

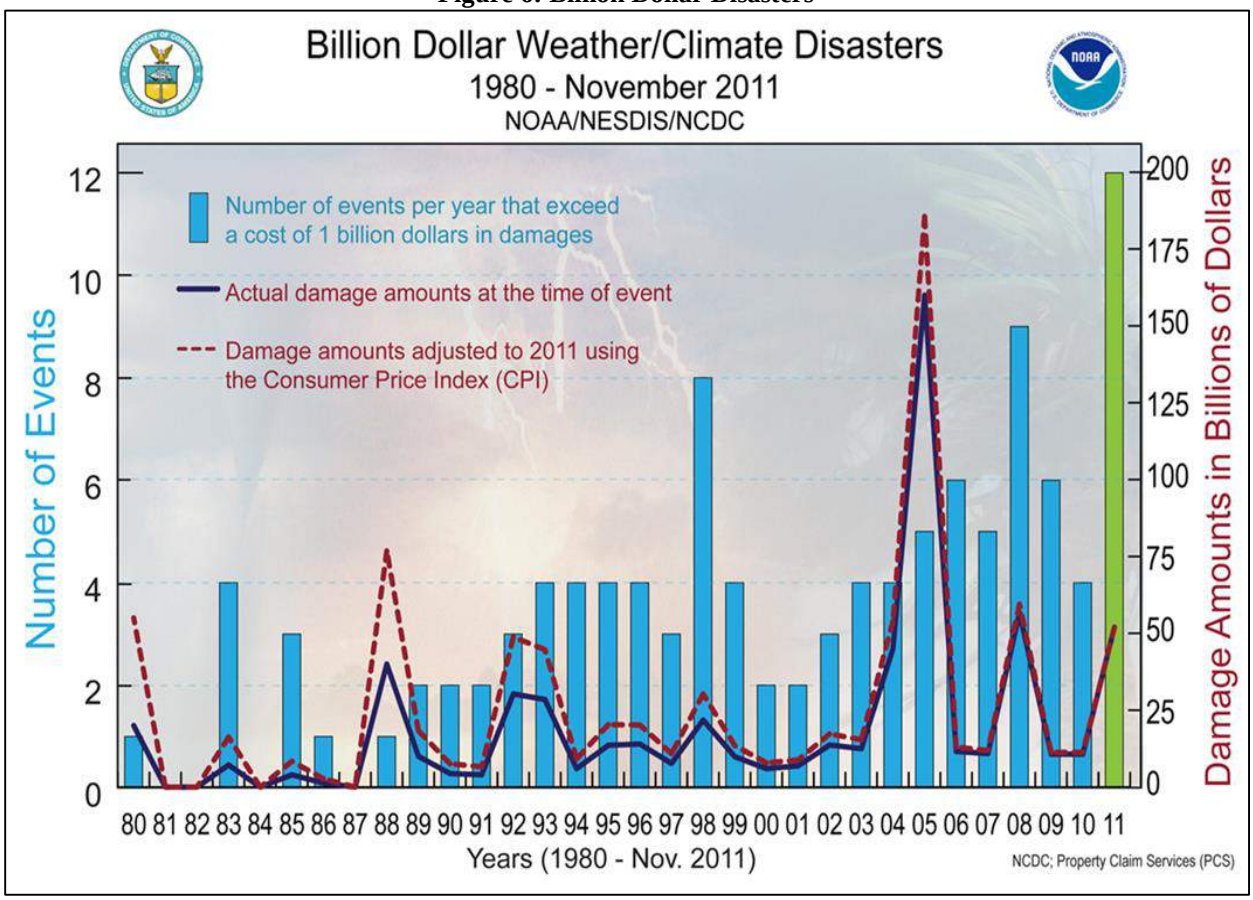
Source: Federal Emergency Management Agency, 1965-2015

CLIMATE ADAPTATION

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

As seen in Figure 6, the United States is experiencing an increase in the number of billion dollar natural disasters. Regardless of whether this trend is due to a change in weather patterns or due to increased development, the trend exists.

Figure 6: Billion Dollar Disasters



Source: NOAA

According to a recent University of Nebraska report (*Understanding and Assessing Climate Change: Implications for Nebraska,* 2014), 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, possibly leading 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.

The planning area will have to adapt to these changes, or experience an increase in economic losses, loss of life, property damages, and crop damages. HMPs have typically been informed by *past* events in order to be more resilient to future events, and this HMP includes strategies for the planning area to address these changes and increase resiliency. 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 PROFILES

Based on research and the experiences of the participating jurisdictions, the hazards profiled were determined to have either 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 *Section Seven: Participant Sections* of this plan.

AGRICULTURAL ANIMAL AND PLANT DISEASE

HAZARD PROFILE

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

The state of Nebraska has one of the country's largest economies that is vested in both livestock and crop sales. According to the Nebraska Department of Agriculture (NDA) in 2012, the market value of agricultural products sold was estimated at more than $23 billion. This total is split between crops (estimated $11.37 billion) and livestock (estimated $11.69 billion). For the planning area, sold agricultural products were estimated at $557,861,000 with the cost split at $234,198,000 for crops and $323,663,000 for livestock.

LOCATION

Given the agricultural presence in the planning area, animal and plant disease have the potential to occur across the area. If a major infestation event were to occur, the economy in the entire planning area would be affected. Table 37 shows that the highest percentage of land use type is planted or cultivated (62.8 percent) with only 4.5 percent of the land as developed. The following figure demonstrates the land use types across the planning area.

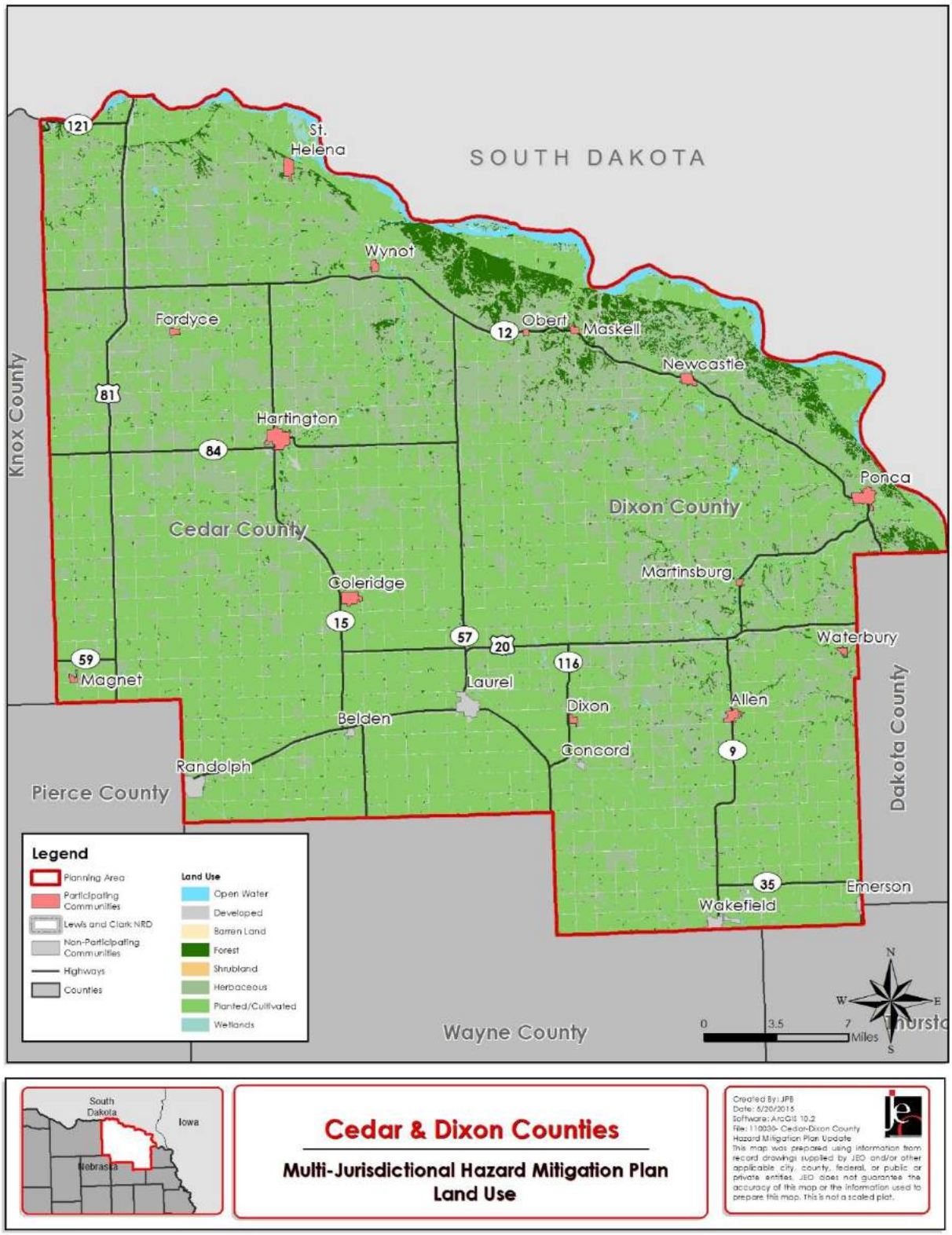
The land use data is from a 2005 dataset, and while some of the uses may have changed since 2005, it is the most recent data available. The main land uses where animal and plant disease will be observed include: agricultural lands, range or pasture lands, and forests. It is possible for animal or plant disease to occur in domestic animals or crops in urban areas.

The following table provides a tabulation of land use by type across the planning area.

Table 37: Land Use Types

Type of Land Use	Total Area in the Planning Area (Square Miles)	Percent of Total Lands
Open Water	19.2	1.6
Developed	55.4	4.5
Barren Land	0.2	0.0
Forest	45.3	3.7
Shrubland	0.0	0.0
Grassland/Herbaceous	326.4	26.6
Planted/Cultivated	771.8	62.8
Wetlands	10.2	0.8

Figure 7: Land Use in the Planning Area



HISTORICAL OCCURRENCES

Animal Disease

According to the 2014 State of Nebraska Hazard Mitigation Plan and the NDA, the following first four diseases with impacts upon livestock were reported as having occurred throughout the 93 counties in Nebraska. In 2015, there was a large Avian Influenza outbreak affecting millions of poultry in Dixon County.

Table 38: Livestock Diseases Reported in Nebraska

Disease	Date(s) Reported	Population Impacted	Effects of the disease
Chronic Wasting Disease (CWD)	1997 – 2006	117 positive test; Deer and Elk (wild populations)	Weight loss, incessant drinking and urination
Vesicular Stomatitis (VS)	2005; 2014	Three horses; Two cows (Wheeler County, NE)	Blistering on lips, tongues, coronary bands, unable to eat or drink causing weight loss
Epizootic Hemorrhagic Disease (EHD) (Blue Tongue)	Ongoing; usually occurs in late summer or fall	Wild deer	Extensive hemorrhaging
Bovine Tuberculosis	2009	Three head of cattle infected; 21,764 head tested; 61 quarantined	Emaciation, lethargy, weakness, anorexia, low-grade fever, and pneumonia with a chronic, moist cough
Highly Pathogenic Avian Influenza (HPAI)	2015	4.9 million chickens disposed across 6 farms (Dixon County)	Decreased egg production; misshapen eggs; swelling of head, eyelids, comb, and wattles; respiratory disease; unstable coordination; sudden death

Source: 2014 State of Nebraska Hazard Mitigation Plan and NDA

Table 39 shows the population of livestock within the planning area. This count does not include wild populations that are also at risk from animal diseases.

Table 39: Livestock Inventory

County	Market Value of 2012 Livestock Sales	Cattle and Calves	Hogs and Pigs	Horse and Ponies	Poultry Egg Layers	Poultry Broilers	Sheep and Lambs
Cedar	$225,621,000	121,679	71,112	13	4,047	948	1,073
Dixon	$98,042,000	46,274	33438	70	N/A	N/A	899
Total	**$323,663,000**	**167,953**	**104,550**	**83**	**4,047**	**948**	**1,972**

Source: 2012 USDA Census of Agriculture

In regard to diseases involving animals, the NDA provides reports on diseases occurring in the planning area. The following table includes those animal diseases and numbers of occurrences within the planning area between January 1, 2014 and November 30, 2015.

Table 40: 2014-2015 Recorded Animal Diseases

Disease	Species Impacted	Number Of Occurrences
Bovine Viral Diarrhea	Bovine	2
Paratuberculosis	Bovine	1
Porcine Epidemic Diarrhea	Porcine	12
Highly Pathogenic Avian Influenza	Poultry	2
Porcine Reproductive and Respiratory Disease	Porcine	2,303
	Total	**2,320**

Source: Nebraska Department of Agriculture, January 2014 - November 2015

Animals could be susceptible to diseases beyond those outlined above. Data related to diseases and rates of disease among "free range game" is limited due to lack of laboratory testing, reporting, and field study.

Highly Pathogenic Avian Influenza Outbreak 2015

In early May 2015, the NDA, in conjunction with the USDA Animal and Plant Health Inspection Service, confirmed the presence of highly pathogenic H5N2 avian influenza (HPAI) in Dixon County. The initial onset of HPAI was found in a commercial layer flock of 1.7 million chickens. The confirmation of HPAI in Dixon County followed other outbreaks in neighboring states earlier in the year, including Iowa and South Dakota.

The farm with the first confirmed HPAI case was immediately quarantined, and the birds on the property were depopulated. A perimeter with a 6.2 mile radius around the farm was set by the NDA. Any poultry farms also located within this perimeter were visited by the NDA to check for additional cases of HPAI.

By May 13, 2015, the governor of Nebraska had declared a state of emergency due to the HPAI, which ensured the availability of resources for state agencies to respond to the outbreak in Dixon County. The following day, the NDA confirmed a second case of HPAI in a second commercial layer flock farm in Dixon County. This farm was in close proximity of the initial farm (referred to as Dixon 1) and had a chicken population of 1.8 million. By the end of May, a third case of HPAI (Dixon 3) was also found in a farm owned by the same producer as the first two farms and had a population of 500,000 birds. A perimeter was maintained for all three locations and birds were depopulated.

All five farms had confirmed cases of HPAI, and a sixth farm within the perimeter voluntarily disposed of the flock to reduce the risk of spreading the disease. Five of these farms were owned by the same poultry producer. By mid-July, the disposal of affected poultry was complete, and the cleaning and disinfection of the farms was well underway or completed across the six farms in Dixon County. For details regarding the outbreak, see Table 41.

Throughout the outbreak, the NDA worked with the Nebraska Department of Environmental Quality (NDEQ) to ensure that the dead birds were disposed of properly. Furthermore, the Nebraska Department of Health and Human Services also worked with the Northeast Nebraska Public Health Department to interview workers about their possible exposure to HPAI and to monitor them if appropriate. There was no transmission of HPAI found between poultry and workers.

For the archived response and press releases by the NDA on the 2015 HPAI outbreak, please visit http://www.nda.nebraska.gov/animal/avian/2015ai.html.

Table 41: Avian Influenza Outbreak Information

Location	Disposal	Flock Size	Flock Type
Dixon 1*	Composting	1.7 million	Laying Hens
Dixon 2*	Composting	1.8 million	Laying Hens
Dixon 3*	Composting	500,000	Pullets (young hens)
Dixon 4*	Composting	200,000	Pullets (young hens)
Dixon 5* (Voluntary)	Composting	700,000	Pullets (young hens)
Dixon 6	Burial	Less than 100	Mixed Fowl

Source: NDA Weekly Briefing Press Release 7/21/2015
**Owned by the same producer*

Plant Disease

A variety of diseases can impact crops, and often vary from year to year. The Department of Agriculture provides information on some of the most common, being:

Table 42: Common Crop Diseases in Nebraska by Crop Types

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 • 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 • 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

In addition to the viral and bacterial diseases that could impact crops, pests can also result in crop loss or detract from the quality of crop. Those pests are:

- Grasshoppers
- Western Bean Cutworm
- European Corn Borer
- Corn Rootworm
- Corn Nematodes, Bean Weevil
- Mexican Bean Beatle
- Soybean Aphids
- Rootworm Beatles

Nebraskan farmers also lose a significant amount of crops each year as a result of wildlife foraging. This can be particularly problematic in two areas; places where natural habitat has been diminished or, in years where weather patterns such as early or late frost, deep snow, or drought have caused the wild food sources to be limited.

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.

Table 43: Land and Value of Farms in the Planning Area

County	Number of Farms	Land in Farms (acres)	Percent of Land Area Used by Farms	Market Value of 2012 Crop Sales
Cedar	939	466,473	98.5%	$163,112,000
Dixon	570	298,996	98.1%	$71,086,000
Total	**1,509**	**765,469**	**98.4%**	**$234,198,000**

Source: 2012 USDA Census of Agriculture

Table 44: Crop Values

County	Corn		Soybeans		Wheat	
	Acres Planted	Value (2012)	Acres Planted	Value (2012)	Acres Planted	Value (2012)
Cedar	167,878,000	$112,918,000	115,315,000	$45,539,000	791	301,000
Dixon	111,027,000	$44,466,000	81,557,000	$24,454,000	244	-

Source: 2012 USDA Census of Agriculture
- Data not available

The crops in Table 44 make up the bulk of the crop portion of the planning area's agricultural product. Cedar County has higher grain production than Dixon County, most likely due to more available land area for cultivating.

Historical plant disease occurrences are provided by the USDA Risk Management Agency (RMA) with two types of cause of loss provided including mycotoxin (aflatoxin) and the generic term of plant disease. The following table lists the 17 records of plant disease across the two counties from 2000 to 2014.

Table 45: 2000-2014 Recorded Plant Diseases

Year	County	Crop	Cause of Loss	Total Crop Loss
2000	Dixon	Corn	Plant Disease	$39,273
2000	Dixon	Soybeans	Plant Disease	$303
2001	Cedar	Soybeans	Plant Disease	$11,202
2002	Cedar	Soybeans	Plant Disease	$1,691
2004	Cedar	Soybeans	Plant Disease	$2,912
2004	Dixon	Soybeans	Plant Disease	$10,099
2005	Cedar	Corn	Plant Disease	$1,795
2005	Dixon	Corn	Plant Disease	$11,217
2006	Cedar	Corn	Plant Disease	$336
2006	Cedar	Soybeans	Plant Disease	$1,941
2007	Cedar	Corn	Mycotoxin (Aflatoxin)	$5,326
2007	Cedar	Corn	Plant Disease	$19,837
2007	Cedar	Corn	Plant Disease	$18,391
2009	Cedar	Wheat	Plant Disease	$7,069
2011	Cedar	Corn	Plant Disease	$2,975
2012	Cedar	Corn	Mycotoxin (Aflatoxin)	$11,055
2012	Cedar	Corn	Mycotoxin (Aflatoxin)	$9,671
			Total	**$155,093**

Source: USDA RMA, 2000-2014

AVERAGE ANNUAL LOSSES

Using data from the USDA RMA (2000-2014), annual crop losses from plant disease, insects, and wildlife can be estimated. However, the RMA does not track losses for livestock, so it is not possible to estimate losses due to animal disease. With this limitation in mind, a total of 2,320 events of animal disease were reported in the planning area over a 1.9 year period by the Nebraska Department of Agriculture.

Table 46: Agricultural Crop Losses

Hazard Type	Number of Events	Total Crop Loss	Average Annual Crop Loss
Plant Disease	17	$155,093	$10,340
Insects	55	$285,097	$19,006
Wildlife	18	$70,867	$4,725
Total	**90**	**$511,057**	**$34,071**

Source: USDA RMA, 2000-2014

EXTENT

There is no standard for measuring the magnitude of animal or plant disease. There have been three animal disease outbreaks that impacted a relatively small number of livestock since January 2014. However, the Porcine Reproductive and Respiratory Disease affected over 2,300 porcine in 2015. During the summer of 2015, the largest number of livestock were impacted when the Highly Pathogenic Avian Influenza lead to 4.9 million birds having to be euthanized across six farms in Dixon County. It should be noted that the NDA reported two Avian Influenza cases, but local reports indicate that four of the six farms had confirmed bird flu cases. The rest of the nearly 5 million birds were disposed out of caution to stop the highly

contagious disease from spreading. The average event to occur in the planning area is the infection of 10 or fewer animals per event, but the occasional large scale event can occur.

Again, there is no standard for measuring the magnitude of plant disease. Further, the RMA data utilized for historic events does not provide a scale or quantification of impacts other than monetary losses. To measure extent related to plant disease, the average annual losses (including plant disease, insects, and wildlife in Table 46) will be divided by the total market value for crops (Table 43) to establish a percent loss annually:

$$Extent = \left(\frac{\$34{,}071}{\$234{,}198{,}000}\right) * (100\%) = 0.02\%\ crop\ loss\ annually$$

PROBABILITY

Given the historic record of occurrence (2,320 counts of animal disease reported in 1.9 years), the annual probability of occurrence for animal disease is 100 percent. For plant disease, the historic record of occurrence (17 number of plant diseases reported in 15 years), the annual probability of occurrence is 100 percent.

FUTURE DEVELOPMENT

The differences between the 2007 to 2012 USDA Census of Agriculture indicate that the number of farms, acres in farmland, and livestock production have increased during this time frame, particularly in Dixon County. Compared to 2007, there were 17 more farms in 2012, an increase of 1.1 percent, and 42,219 more acres dedicated to farming, an increase of 5.8 percent. Many of the smaller participating communities anticipate very little future development over the next five years, and if development were to occur, it would be within municipal boundaries. A small increase in the number of farms will likely continue in Dixon County but will likely hold steady in Cedar County in coming years.

REGIONAL VULNERABILITIES

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

Table 47: Regional Agricultural Vulnerabilities

Sector	Vulnerability
People	-Those in direct contact with infected livestock -Potential food shortage during prolonged events -Residents in poverty if food prices increase
Economic	-12.9% of people are employed in the agricultural industry -Large scale or prolonged events may impact tax revenues and local capabilities
Built Environment	None
Infrastructure	-Transportation routes can be closed during quarantine
Critical Facilities	None

RISK ASSESSMENT SUMMARY

Table 48: Summary

Number of Past Events	2,320 animal disease and 17 plant disease
Vulnerable Locations	Both counties
Extent	10> animal infections/event and 0.02% crop loss annually
Annual Probability	100% (animal and plant disease)
Averaged Annual Losses	Animal losses not available and $34,071 (crops)

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Most agricultural producers purchase crop insurance
- USDA and Farm Service Agency (FSA) provide educational materials
- UNL Extension Offices provide community outreach materials

CHEMICAL FIXED SITES

HAZARD PROFILE

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

> Chemicals are found everywhere. They purify drinking water, are used in agriculture and industrial production, fuel our vehicles and machines, and simplify household chores. But chemicals also can be hazardous to humans or the environment if used or released improperly. Hazards can occur during production, storage, transportation, use, or disposal. The community is at risk if a chemical is used unsafely or released in harmful amounts.

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

Source of hazardous materials include chemical manufacturers, service stations, hospitals, and hazardous materials waste sites. Varying quantities of hazardous materials are manufactured, used, or stored at an estimated 4.5 million facilities in the United States—from major industrial plants to local dry cleaning establishments and gardening supply stores.

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

The 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.

Fixed-sites are those that involve chemical manufacturing sites and stationary storage facilities. Table 49 demonstrates the nine classes of hazardous material according to the 2012 Emergency Response Guidebook.

Table 49: Hazardous Material Classes

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

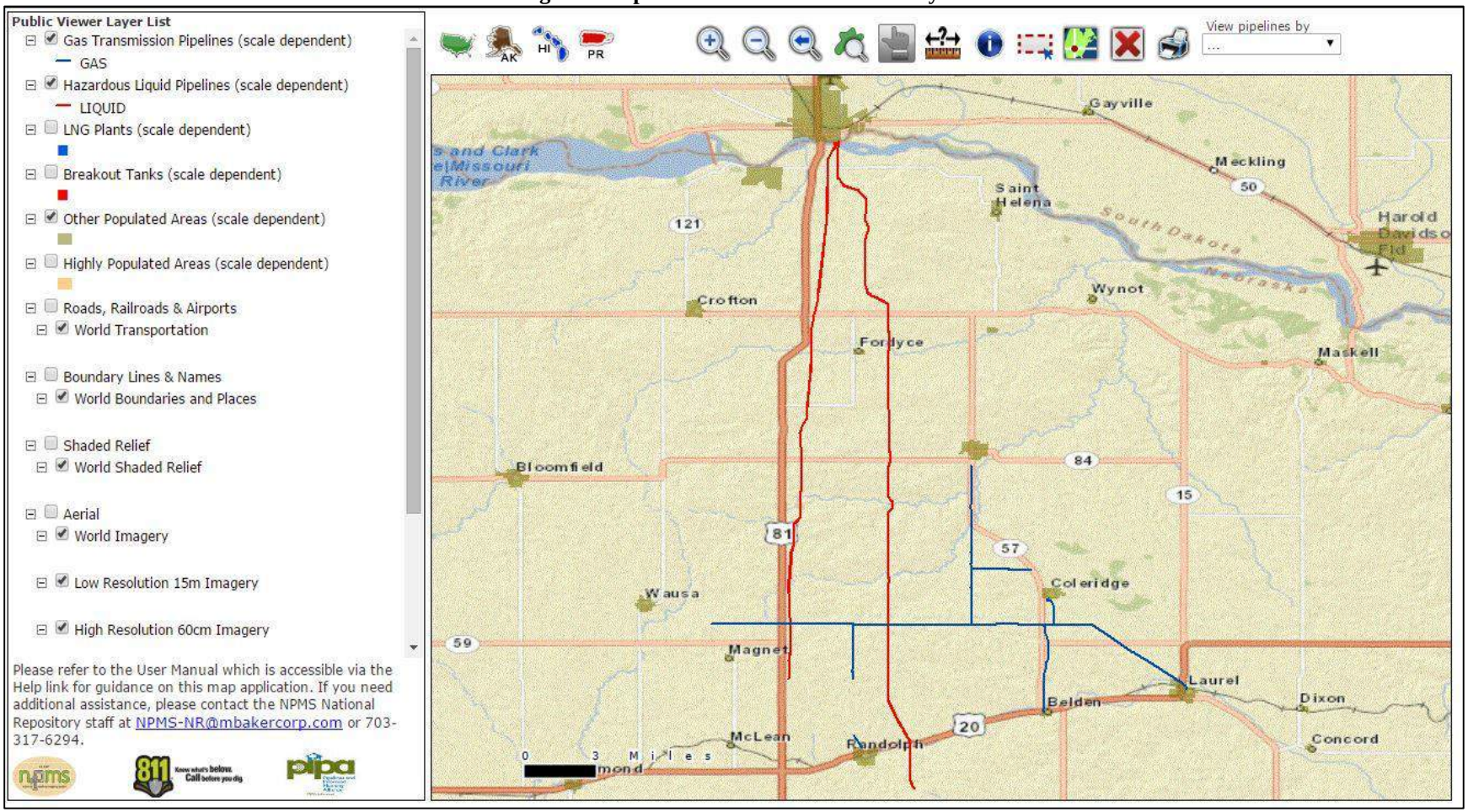
Source: Emergency Response Guidebook, 2012

LOCATION

There are dozens of locations across the planning area that house hazardous materials, according to the Tier II reports submitted to the NDEQ in 2014. A listing of chemical storage sites can be found in *Section Seven: Participant Sections* for each jurisdiction.

According to the National Pipeline Mapping System (NPMS) Public Map Viewer (https://www.npms.phmsa.dot.gov/), there are gas transmission pipelines and hazardous liquid pipelines located in Cedar County. There are no shown pipelines located in Dixon County. As shown in the following map, the liquid pipelines stretch between Yankton, SD and Magnet and also to Randolph. The gas pipelines are located in central Cedar County between Hartington, Coleridge, Magnet, Belden, and Laurel.

Figure 8: Pipelines located in Cedar County



Source: National Pipeline Mapping System https://www.npms.phmsa.dot.gov/PublicViewer/

EXTENT

The extent of chemical spills at fixed sites varies. The extent depends on the type of chemical that is released, but a majority of spills are small in nature and localized to the facility. Three releases have occurred in the planning area, and the total amount spilled ranged from unknown to 10 gallons. Based on historic records, it is likely that any spill involving hazardous materials will be localized. However, it is possible that an evacuation radius be implemented in the future and would likely not affect an area larger than a quarter mile from the spill location.

HISTORICAL OCCURRENCES

According to the U.S. Coast Guard's National Response Center database (NRC), there have been three fixed site chemical spills from 1982 – 2014 in the planning area, and there were no property damages reported. There were also no evacuations or people injured during these three events. The following table shows the three spills recorded in the planning area.

Table 50: Fixed Site Chemical Spills

Date of Event	Location of Release	Quantity Spilled	Material Involved	Number of Injuries	Property Damage
5/18/1993	Dixon (Village of)	Unknown	Gasoline: Automotive	0	$0
7/20/2010	Fordyce	Unknown	Unknown Material	0	$0
8/19/2010	Hartington	10 Gallons	Oil: Crude	0	$0
			Totals	**0**	**$0**

Source: National Response Center, 1982-2014

AVERAGE ANNUAL DAMAGES

Using data from Table 50, average annual damages from chemical fixed site spills can be estimated.

Table 51: Chemical Fixed Site Average Annual Losses

Hazard Type	Number of Events	Events Per Year	Total Damages	Average Annual Chemical Spill Loss
Chemical Spills	3	0.1	$0	$0

Source: National Response Center, 1982-2014

PROBABILITY

Chemical releases at fixed site storage areas are likely in the future. Given the historic record of occurrence (3 chemical fixed site spills reported in 33 years), the annual probability of occurrence for chemical fixed site spills is 10 percent.

FUTURE DEVELOPMENT

Future development should encourage chemical storage and manufacturing facilities to be built away from critical facilities such as hospitals, schools, daycares, nursing homes, and other residential areas. This measure will reduce the risk to people and property damage.

REGIONAL VULNERABILITIES

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

Table 52: Regional Chemical Fixed Site Vulnerabilities

Sector	Vulnerability
People	-Those in close proximity could have minor to moderate health impacts -Possible evacuation -Hospitals, nursing homes, and the elderly at greater risk due to low mobility
Economic	-A chemical plant shutdown in smaller communities would have significant impacts to the local economy
Built Environment	-Risk of fire or explosion
Infrastructure	-Transportation routes can be closed during evacuations
Critical Facilities	-Critical facilities at risk of evacuation

RISK ASSESSMENT SUMMARY

Table 53: Summary

Number of Past Events	3 chemical fixed site spills
Vulnerable Locations	Locations with fixed chemical storage or manufacturing facilities
Extent	Quarter mile or less evacuation radius for chemical spills
Annual Probability	10% for small, localized chemical spills
Averaged Annual Losses	$0

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Maintain a database of vulnerable populations
- Educational materials provided to residents, particularly those living near a chemical fixed site
- Conduct training exercises on how to respond to an event
    - Fire departments and Emergency Management are trained
- Have all hazard weather radios in critical facilities
- Ensure emergency alert sirens are in working order

CHEMICAL TRANSPORTATION

HAZARD PROFILE

The transportation of hazardous materials is defined by the U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA) as a substance that has been determined to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce.

These items can be transported by highway, rail, air, or pipeline. They can include anhydrous ammonia, chlorine gas, hydrochloric acid, natural gas liquids, derivatives of petroleum, white phosphorus, pesticides, solvents, and many other corrosive, toxic, unstable, or explosive chemicals and materials. Hazardous materials releases can occur from vehicle accidents, defective valves or hoses on tankers, train derailments, pipeline ruptures or explosions, storage tank overtopping during delivery of products, and many other scenarios.

According to PHMSA, hazardous materials traffic in the U.S. now exceeds 800,000 shipments per day, transporting 3.1 billion tons of hazardous materials annually.

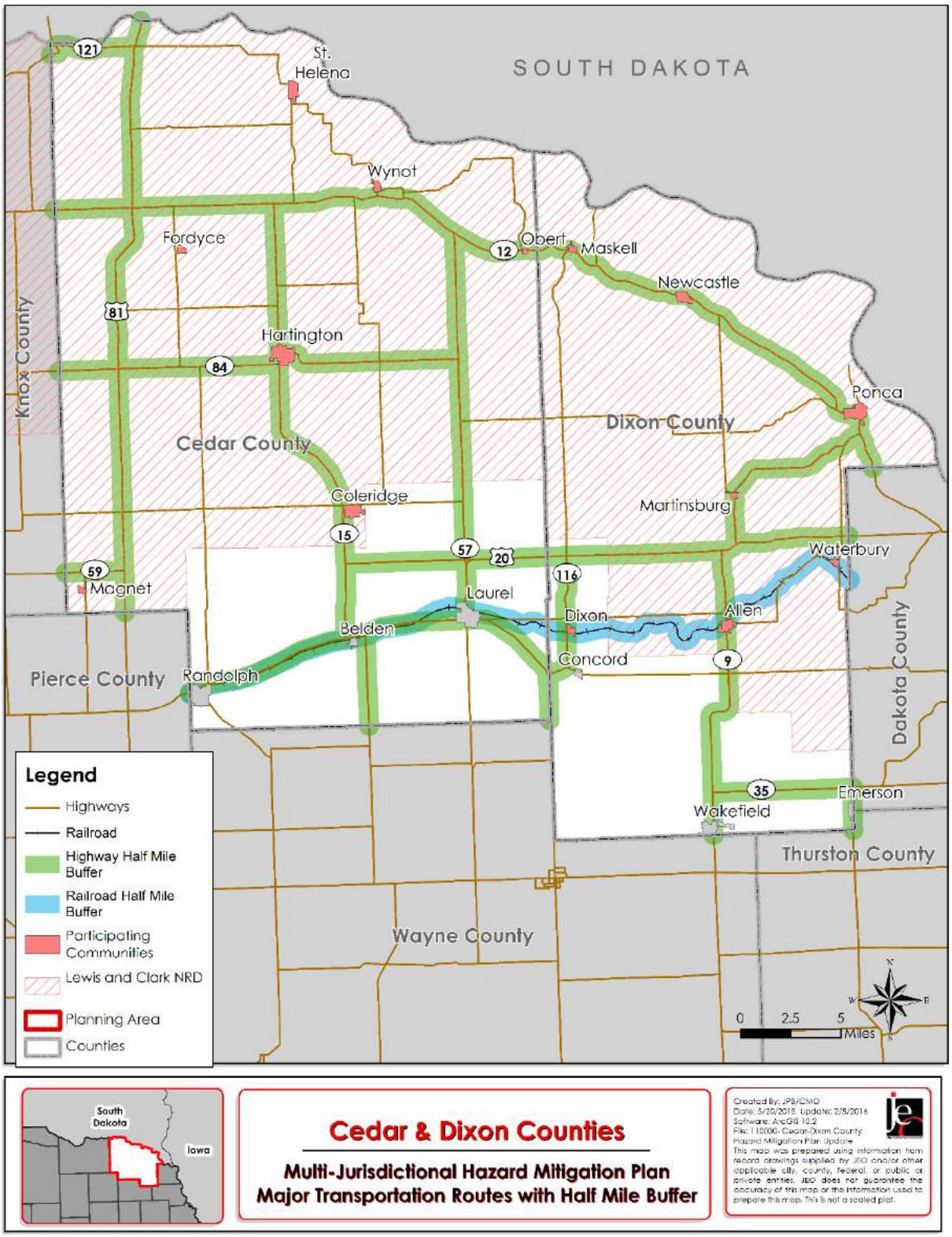
Nationally, the U.S. averages 28 deaths per year due to accidents resulting from the transportation of hazardous materials. While such fatalities are a low probability risk, even one event can harm many people. For example, a train derailment in Crete, Nebraska in 1969 allowed anhydrous ammonia to leak from a rupture tanker. The resulting poisonous fog killed nine people and injured 53.

The U.S. Department of Transportation, through PHMSA, has broad jurisdiction to regulate the transportation of hazardous materials, including the discretion to decide which materials shall be classified as hazardous. These materials are placed into one of nine hazard classes based on their chemical and physical properties. The hazard schedules may be further subdivided into divisions based on their characteristics. Because the properties and characteristics of materials are crucial in understanding the dynamics of a spill during a transportation incident, it is important for response personnel to understand the hazard classes and their divisions.

LOCATION

Chemical releases are more likely to occur during transportation primarily on major transportation routes as identified in Figure 9. A large number of spills also occur during the loading and unloading of chemicals. Participating communities specifically reported transportation along railroads 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 9: Major Transportation Routes with Half Mile Buffer



EXTENT

The probable extent of chemical spills during transportation is difficult to anticipate, and depends on the type of chemical released. According to PHMSA, there have been no reported releases of chemicals or hazardous materials during transportation in the planning area. Although there have not been any incidents since at least 1970, it is possible that a future event could occur, and that an evacuation around the hazardous material spill would be mandated. If an evacuation order is made, it is most likely that the evacuation radius would not impact an area larger than a half mile.

HISTORICAL OCCURRENCES

PHMSA reports that no chemical spills occurred during transportation in the planning area between January 1, 1970 and December 31, 2015.

AVERAGE ANNUAL DAMAGES

Since there have not been any reported chemical spills as a result of transportation, average annual damages was not calculated.

PROBABILITY

Based on the lack of previous occurrences, chemical spills during transportation have a low probability of occurring in the future. The plan recognizes that while there have not been occurrences in the past, that is not necessarily indicative of future occurrences. For the purpose of this plan, the probability of chemical spills during transportation as one percent annually.

FUTURE DEVELOPMENT

Future development and critical facilities could minimize their risk to this hazard by building away from major transportation corridors. Presently, there are a number of critical facilities that were identified during this planning process located adjacent to heavily trafficked corridors and may be vulnerable to this hazard. Please see *Section Seven: Participant Sections* for information regarding these critical facilities.

REGIONAL VULNERABILITIES

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

Table 54: Regional Chemical Transportation Vulnerabilities

Sector	Vulnerability
People	-Those in close proximity to transportation corridors -Possible evacuation -Hospitals, nursing homes, and the elderly at greater risk due to low mobility
Economic	-Evacuations and closed transportation routes could impact businesses near spill
Built Environment	-Risk of fire or explosion
Infrastructure	-Transportation routes can be closed
Critical Facilities	-Critical facilities near major transportation corridors at risk

RISK ASSESSMENT SUMMARY

Table 55: Summary

Number of Past Events	0 chemical spills during transportation
Vulnerable Locations	Residents and businesses near major transportation corridors, especially hospitals, nursing homes, the young, and the elderly
Extent	Half mile or less evacuation radius
Annual Probability	1%
Averaged Annual Losses	N/A

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Drills and exercises within potential impact zones
- Provide educational materials
- Studies to identify the primary hazardous materials transported along specific routes;
    - Highly dangerous chemicals and radiological materials are required to provide routing information

DAM FAILURE

HAZARD PROFILE

According to the Nebraska Administrative Code, Title 458, Chapter 1, Part 001.09, 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. Dam does 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."

The NDNR uses a classification system for dams throughout the State including those areas participating this plan. The classification system includes three classes, which are defined as:

Table 56: Dam Size Classification

Size	Effective Height (feet) x Effective Storage (acre-feet)	Effective Height
Small	$\leq$ 3,000 acre-feet	and $\leq$ 35 feet
Intermediate	> 3,000 acre-feet to < 30,000 acre-feet	or > 35 feet
Large	$\geq$ 30,000 acre-feet	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. The effective storage is defined as the total storage volume in acre-feet in the reservoir below the elevation of the crest of the auxiliary spillway. If the dam does not have an auxiliary spillway, the effective height and effective storage should be measured at the top of dam elevation.

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

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

NDNR 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.

Dams that are 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. These procedures are created to respond within sufficient time to take mitigating actions and to notify the appropriate Emergency Management officials of possible, impending, or actual failure of the dam. The EAP may also be used to provide notification when flood releases will create major flooding. An emergency situation can occur at any time; however, emergencies are more likely to happen when extreme conditions are present. The EAP includes information regarding the efficiency of emergency response entities so that proper action can be taken to prevent the loss of life and property. Local emergency response entities generally included in an EAP include but are not limited to 911 Dispatch, County Sheriffs, Local Fire Departments, Emergency Management Agency Director, County Highway Department, and the National Weather Service (NWS).

Table 57 lists those dams classified as "High Hazard Potential." Gavins Point Dam, located in extreme northwest corner of Cedar County on the South Dakota border, was ranked number two on the top 30 high hazard dams in the State of Nebraska based on population at risk (2014 Nebraska HMP).

Table 57: High Hazard Dams

NID	Dam Name	Owner	Location	Stream Name	Maximum Storage (acre-feet)	Last Inspection Date
Cedar County						
NE02394	Laurel Norris Dam	City of Laurel	Laurel*	Trib. to Middle Logan Creek	34	9/24/2015
NE09968	Hartington Dam	City of Hartington	Hartington	Trib. to Norwegian Creek	112	9/24/2015

NID	Dam Name	Owner	Location	Stream Name	Maximum Storage (acre-feet)	Last Inspection Date
SD01094	Gavins Point Dam	USACOE	Yankton, SD	Missouri River	540,000	9/21/2011
Dixon County						
NONE						

Source: NDNR
**Not a participant in this plan*

In total, there are 56 dams located within the planning area with classifications ranging from low hazard to high hazard. Most of the dams (47) are rated low, 6 are significant, and 3 are rated a high hazard dam. Figure 10 maps the location of these dams in the planning area.

Table 58: Dams in the Planning Area

County	Minimal Hazard	Low Hazard	Significant Hazard	High Hazard
Cedar	0	9	0	3
Dixon	0	38	6	0
Total	**0**	**47**	**6**	**3**

Source: NDNR

Upstream Dams Outside the Planning Area

Several dams and reservoirs are located in the Missouri River basin upstream from Cedar and Dixon Counties. Five dams are located on the main stem of the Missouri River and provide the majority of the flood peak discharge reduction for Cedar and Dixon Counties from the Missouri River. Data on these dams are provided in the following table.

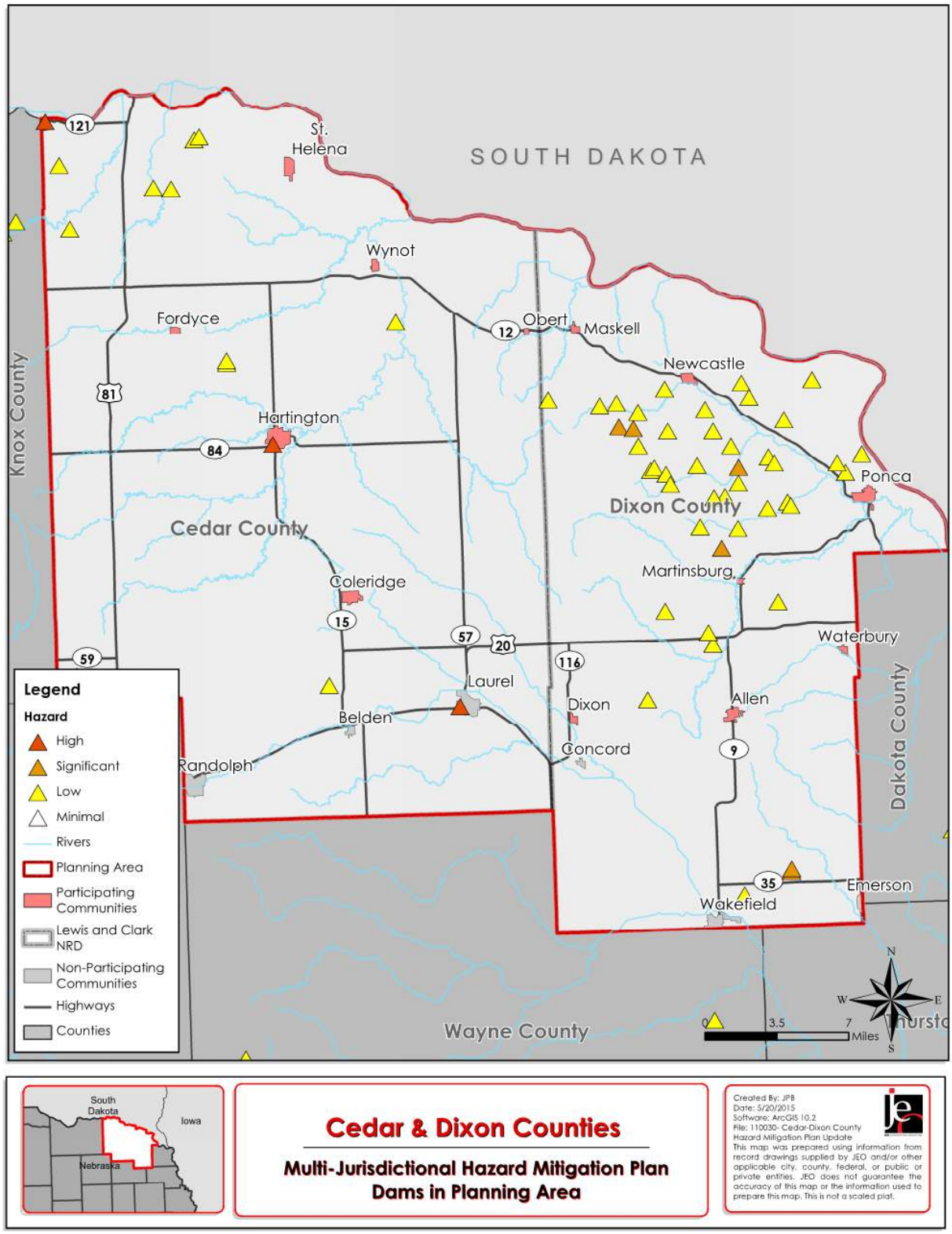
Table 59: Upstream Missouri River Dams

Dam	Location	Year Operational
Big Bend	Fort Thompson, South Dakota	1964
Fort Peck	Fort Peck, Montana	1940
Fort Randall	Pickstown, South Dakota	1953
Garrison	Riverdale, North Dakota	1955
Oahe	Pierre, South Dakota	1962

All dams are inspected on a regular basis, and after area flash flood events. If problems are found during an inspection, the proper course of action is taken to ensure the structural integrity of the dam is preserved. In the event that dam failure is imminent, the EAP for the dam governs the course of action. For more information, a request can be made to the county Emergency Managers or NDNR.

Due to public safety concerns, dam breach inundation maps are not provided in this plan, and it is against NDNR's policy to provide inundation maps for use in HMPs. Therefore, neither jurisdiction-specific inundation data nor maps will be included in this plan update. A request can be made at NDNR to view inundation maps at their offices and will be decided on a case-by-case basis. For more information on dams in the planning area or to make a request to view an EAP, contact the county Emergency Manager.

Figure 10: Dam Locations



LOCATION

Communities or areas downstream of a dam, especially high hazard dams, are at greatest risk of dam failure. Figure 10 shows the location of the dams. To view the mapped location of dams by county or jurisdiction, please see *Section Seven: Participant Sections.* As noted earlier, inundation maps are not available for inclusion in this plan.

EXTENT

While a breach of a high hazard dam would certainly impact those in inundation areas, the total number of people and property exposed to this threat would vary based on the dam location. Since inundation maps are not made publicly available for security reasons, the following is provided as a description of areas affected in the inundation area from the County's Local Emergency Operations Plan (LEOP) where available for specific high hazard dams. Note that only information for Gavins Point Dam was available for both counties.

Cedar County

Gavins Point Dam – The inundation area would affect the Missouri River along the northern edge of the County. In Cedar County, the area affected would be slightly greater than the 1 percent annual chance floodplain. Seasonal cabins/residences, businesses, and campgrounds directly downstream from the dam that would be almost immediately affected. There are no towns that would be affected by the failure of this dam.

Approximately five percent of the population of Cedar County could be affected by the failure of this dam.

Dixon County

Gavins Point Dam – The inundation area would affect the Missouri River as far south as Rulo, Nebraska located in far southeastern Nebraska. In Dixon County, the area affected would be slightly greater than the 1 percent annual chance floodplain with the greatest effect on Ponca.

Approximately six percent of the population of Dixon County could be affected by the failure of this dam.

HISTORICAL OCCURRENCES

To determine previous occurrences of dam failure within CDC, the previous Mitigation Plan was referenced as well as the 2014 Nebraska HMP and the Stanford University's National Performance of Dams Program. No record of dam failure within the CDC was found.

AVERAGE ANNUAL DAMAGES

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

PROBABILITY

Dam failure has a low probability of occurring in the future. The plan recognizes that while there have not been occurrences in the past, that is not necessarily indicative of future occurrences. For the purpose of this plan, the probability of dam failure will be stated as one percent annually.

FUTURE DEVELOPMENT

According to the *Classification of Dams (2013)* developed and updated by NDNR, "the potential for future development must be taken into consideration when determining the hazard potential class for a dam. Any dam located in close proximity to a city or village as detailed in Table 60 must be designed to meet the requirements for a high hazard potential structure. The design requirements can be adjusted if development

in the downstream breach inundation area is sufficiently curtailed due to zoning restrictions, easements, deed restrictions, or other methods of restriction acceptable to the Department."

Table 60: Distance from Dam

Incorporated Class	Population	Located Within or Within Given Distance of Jurisdictional Limits of City or of Village
Metropolitan	≥ 300,000	3 miles
Primary	> 100,000 up to 300,000	3 miles
First	> 5,000 up to 100,000	2 miles
Second	> 800 up to 5,000	1 mile
Village	100 up to 800	1 mile

Sources: NDNR

REGIONAL VULNERABILITIES

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

Table 61: Regional Dam Failure Vulnerabilities

Sector	Vulnerability
People	-Those living or working downstream of high hazard dams -Evacuation likely with high hazard dams -Hospitals, nursing homes, and the elderly at greater risk due to low mobility
Economic	-Businesses located in the inundation areas would be impacted and closed for an extended period of time -Employees working in the inundation area may be out of work for an extended period of time
Built Environment	-Damage to homes and buildings
Infrastructure	-Transportation routes could be closed for extended period of time
Critical Facilities	-Critical facilities in inundation areas are vulnerable to damages

RISK ASSESSMENT SUMMARY

Table 62: Summary

Number of Past Events	None
Vulnerable Locations	Residents, businesses, and transportation corridors downstream of dams
Extent	Total inundation in floodplain downstream from dam
Annual Probability	1%
Average Annual Losses	N/A

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Evacuation Plan
- Land-use regulations preventing development in area protected by existing dams
- Encourage structures protected by dams to purchase flood insurance
- Education on the potential impacts of a dam failure
- Preserve natural open spaces in floodplains
- Emergency exercises

DROUGHT

HAZARD PROFILE

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 actually 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.

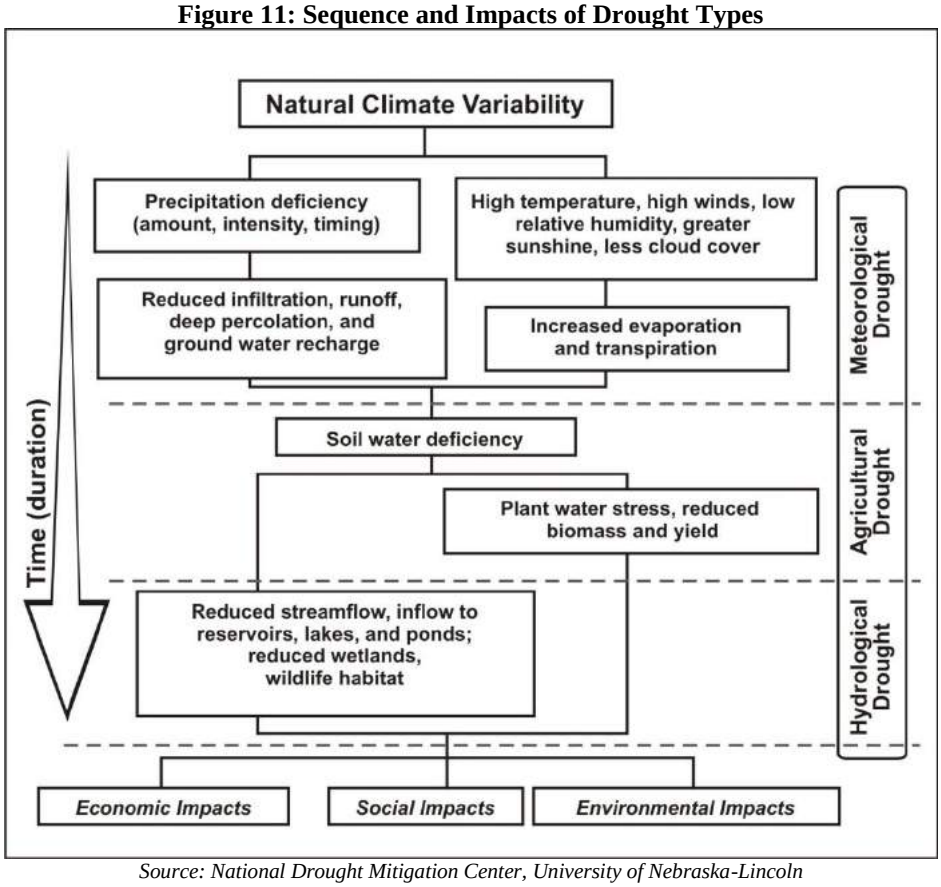
*According to the National Drought Mitigation Center, "**drought** is a normal, recurrent feature of climate, although many erroneously consider it a rare and random event. It occurs in virtually all climatic zones, but its characteristics vary significantly from one region to another."*

Drought is a slow-onset, creeping phenomenon that can effect 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. According to the National Drought Mitigation Center (NDMC), droughts are classified into four major types:

- **Meteorological Drought** – is defined based on the degree of dryness and the duration of the dry period. Meteorological drought is often the first type of drought to be identified and should be defined regionally as precipitation rates and frequencies ("norms") vary.
- **Agricultural Drought** – occurs when there is deficient moisture that hinders planting germination, leading to low plant population per hectare and a reduction of final yield. Agricultural drought is closely linked with meteorological and hydrological drought, as agricultural water supplies are contingent upon the two sectors.
- **Hydrologic Drought** – occurs when water available in aquifers, lakes, and reservoirs falls below the statistical average. This situation can arise even when the area of interest receives average precipitation. This is due to the reserves diminishing from increased water usage, usually from agricultural use or high levels of evapotranspiration, resulting from prolonged high temperatures. Hydrological drought often is identified later than meteorological and agricultural drought. Impacts from hydrological drought may manifest themselves in decreased hydropower production and loss of water based recreation.
- **Socioeconomic Drought** – occurs when the demand for an economic good exceeds supply due to a weather-related shortfall in water supply. The supply of many economic goods include, but are not limited to, water, forage, food grains, fish, and hydroelectric power.

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

Figure 11: Sequence and Impacts of Drought Types



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

HISTORICAL OCCURRENCES

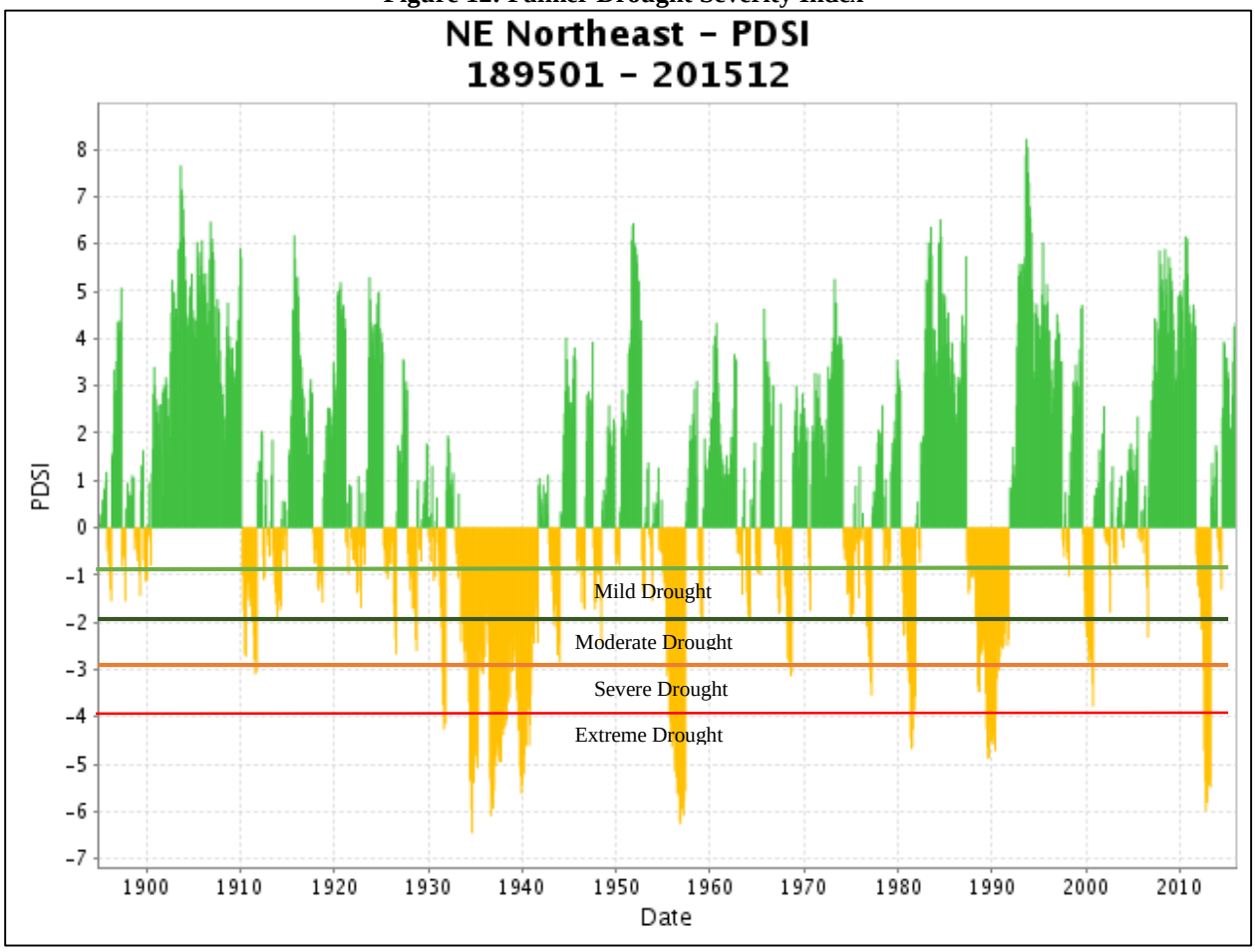
The Palmer Drought Severity Index (PDSI) is utilized by climatologists to standardize global long-term drought analysis. The PDSI was developed in 1965 to measure dryness based on recent precipitation and temperatures. The PDSI has data for more than one hundred years, which allows for the review and analysis of past drought trends. The data for the planning area was collected from Climate Division 3 – Northeast Nebraska, which includes the planning area, between the years of 1895 and 2015. Figure 11 shows the data from this time period. The negative Y axis represents a drought, for which '-2' indicates a moderate drought, '-3' a severe drought, and '-4' an extreme drought. Table 63 shows the details of the Palmer classifications. According to this dataset, extreme droughts were recorded every 15-20 years dating back to 1895 and major events include the Dust Bowl in the 1930s, 1950s, 1980s, and the recent 2012 drought.

Table 63: Palmer Drought Severity Index Classification

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

Source: Climate Prediction Center

Figure 12: Palmer Drought Severity Index



Source: NCDC

Using the data from the PDSI, the planning area had extreme droughts 16 times since 1895 (1931, 1934-1940, 1955-1957, 1981, 1989-1990, and 2012-2013). Severe droughts occurred six times: 1911, 1933, 1968, 1977, 1988, and 2000. Over half of all years dating back to 1895 experienced precipitation levels below what is considered normal for the planning area. The most recent drought of note for the planning area began in 2012 and ended in early 2013. Local planning teams reported a few impacts from the 2012 drought which were primarily lower water well levels and some communities encouraged voluntary water conservation during the drought.

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 nearly 700 drought related impacts throughout the planning area. Table 64 demonstrates the sectors that have previously reported impacts in the planning area. The table shows the number of drought impacts reported for the planning area since 2000, based on media reports, public reports, NWS Drought Statements, burn bans issued by local governments, or water restrictions. Although somewhat skewed by the number of media reports, generally a higher number of reported drought impacts to the National Drought Mitigation Center is correlated with the severity of a drought.

Examples of reported drought impacts include:

- Drought since 2011 has led to a payout of more than $4 billion through the Livestock Disaster Assistance program;
- Flows from Gavins Point Dam increased to compensate for low flow in Kansas River ; and
- Drought led to an uptick in new wells in the Lewis and Clark NRD in northeastern Nebraska

Table 64: Reported Drought Impacts (January 2000 to December 2015)

Report Type	Agricultural	Business and Industry	Energy	Fire	Plant and Wildlife	Relief, Response, and Restrictions	Society and Public Health	Tourism and Recreation	Water Supply and Quality
Planning Area	250	45	8	32	50	129	68	8	100

Source: NDMC

LOCATION

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

EXTENT

Using the data presented in Figure 12 (PDSI) it is reasonable to expect extreme drought to occur in 13 percent of years for the planning area (16 extreme drought years in 121 years). Severe drought occurred in approximately 6 years of the 121 years of record (5 percent of years). Moderate drought occurred in approximately 11 years of the period reviewed (9 percent of years), and mild drought occurred in approximately 31 of the 121 years recorded (26 percent of years). Non-drought conditions (incipient dry spell, near normal, or wet spell conditions) occurred in 47 percent of years. It is important to remember that any given year can include months with some or all of the drought conditions. For instance, a year that starts out rainy and ends very dry can include months with no drought, mild drought, and moderate drought.

AVERAGE ANNUAL DAMAGES

The annual property estimate was determined based upon NCDC Storm Events Database since 1996. The annual crop loss was determined based upon the RMA Cause of Loss Historical Database since 2000. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life.

Table 65: Loss Estimate for Drought

Hazard Type	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Drought	$0	$0	$134,226,317	$8,948,421

1 Indicates the data is from NCDC (January 1996 to July 2015); 2 Indicates data is from USDA RMA (2000 to 2014)

The extreme drought in 2012 significantly affected the agricultural sector of the state. Although the full impacts are yet to be studied, the USDA reported a total of $139,957,809 in drought relief to Nebraska from 2008 to 2011 for all five disaster programs: Supplemental Revenue Assistance Payments (SURE), Livestock Forage Disaster Assistance Program (LFD), Emergency Assistance for Livestock, Honeybees, and Emergency Assistance for Livestock, Honey Bees, and Farm-Raised Fish Program (ELAP), Livestock Indemnity Program (LIP), and Tree Assistance Program (TAP).

PROBABILITY

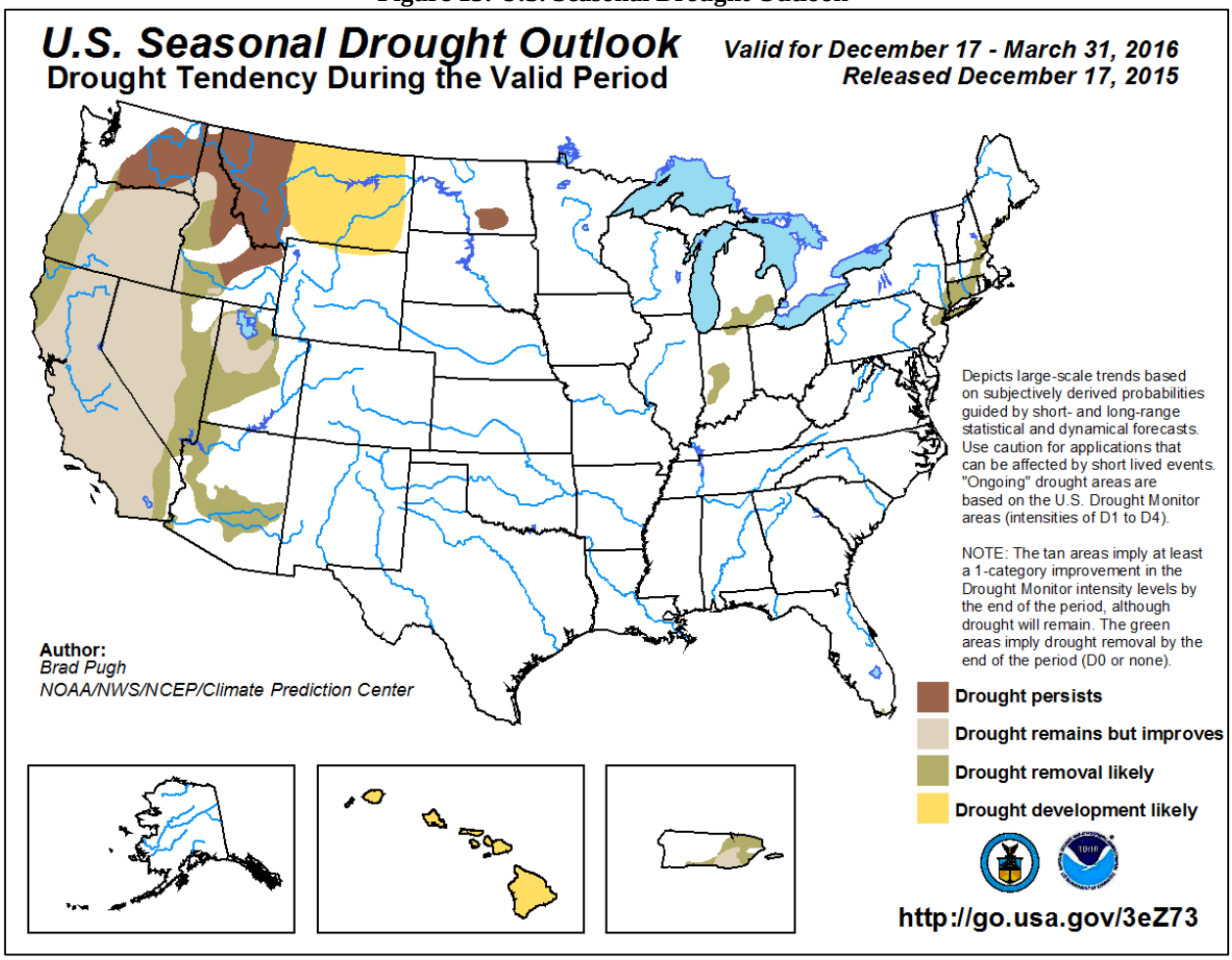
The following table summarizes the magnitude of drought and annual probability of occurrence.

Table 66: Drought Magnitude and Probability

Magnitude	Years of Record	Annual Probability
No Drought	57/121	47%
Mild Drought	31/121	26%
Moderate Drought	11/121	9%
Severe Drought	6/121	5%
Extreme Drought	16/121	13%

The U.S. Seasonal Drought Outlook 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 December 17, 2015 through March 2016. According to the U.S. Seasonal Drought Outlook, drought is likely to persist in the northwestern United States with some improvement in the southwest, but the planning area should experience seasonal norms relative to precipitation and temperatures.

Figure 13: U.S. Seasonal Drought Outlook



Source: NOAA CPC

FUTURE DEVELOPMENT

Future development and growth would likely increase the intensity of drought impacts across the planning area. Future development and growth would likely have the following impacts:

- Increase demand on water systems and supply
- Increased demand on electricity providers
- Increased dependence on the agricultural industry

As stated in the Agricultural Animal and Plant Disease Section, there has been an increase in the number of farms (1.1 percent) and an increase in acres dedicated to farming (5.8 percent) over a five year period in Dixon County. Drought impacts in this region would likely have increased economic impacts as drought stresses the agricultural industry.

REGIONAL VULNERABILITIES

The following table provides information related to regional vulnerabilities. For jurisdictional specific vulnerabilities, refer to *Section Seven: Participant Sections*.

Table 67: Regional Drought Vulnerabilities

Sector	Vulnerability
People	-Insufficient water supply -Loss of jobs in agricultural sector -Residents in poverty if food prices increase
Economic	-12.9% of people are employed in the agricultural industry -Closure of water intensive businesses (carwashes, pools, etc.) -Loss of tourism dollars
Built Environment	-Cracking of foundations (residential and commercial structures) -Damages to landscapes
Infrastructure	-Damages to waterlines below ground -Damages to roadways (prolonged extreme events) -Stressing of electrical systems (brownouts during peak usage)
Critical Facilities	None
Other	-Increase in wildfires and wildfire intensity

RISK ASSESSMENT SUMMARY

Table 68: Summary

Number of Past Events	16 years with extreme drought; 6 years with severe drought
Vulnerable Locations	Entire planning area
Extent	Mild drought most likely at 26%
Annual Probability	Extreme Drought = 13%; Severe Drought = 5%; Moderate Drought = 9%
Averaged Annual Crop Losses	$8,948,421

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

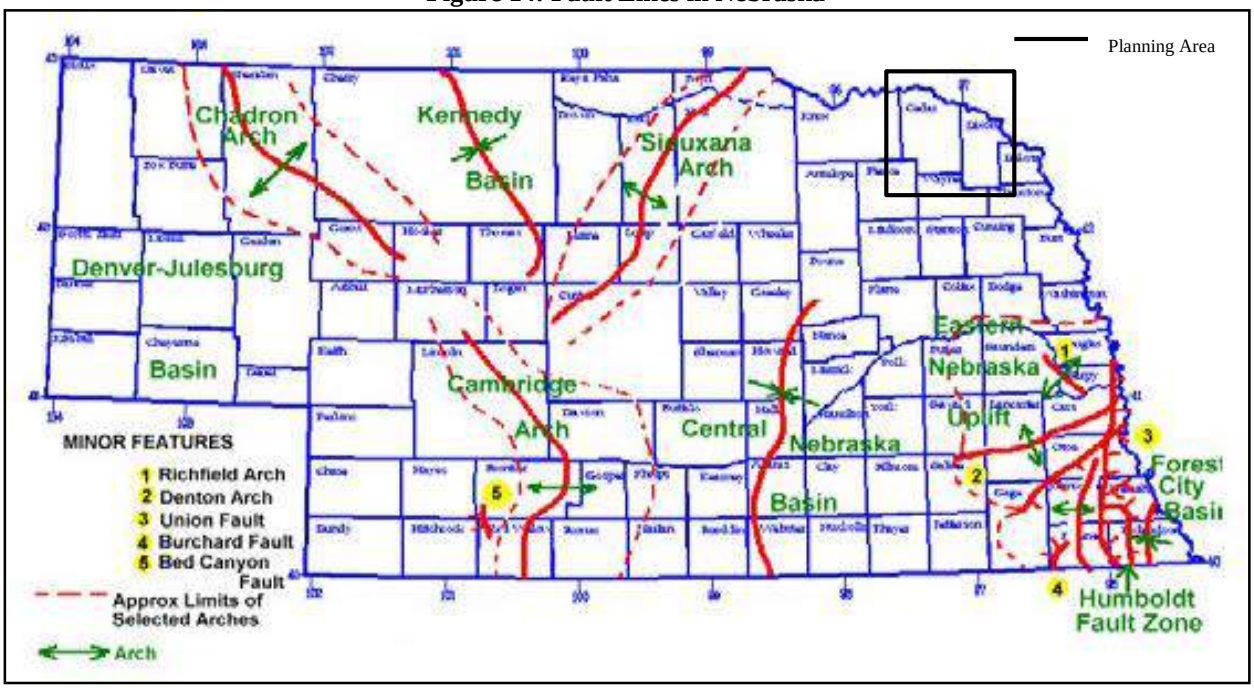
- Most agricultural producers purchase crop insurance
- USDA and FSA provide educational materials

EARTHQUAKES

HAZARD PROFILE

An earthquake is the result of a sudden release of energy in the Earth's tectonic plates that creates seismic waves. The seismic activity of an area refers to the frequency, type, and size of earthquakes experienced over a period of time. Although rather uncommon, earthquakes do occur in Nebraska and are usually small, generally not felt, and cause little to no damage. Earthquakes are measured by magnitude and intensity. Magnitude is measured by the Richter Scale, a base-10 logarithmic scale, which uses seismographs around the world to measure the amount of energy released by an earthquake. Intensity is measured by the Modified Mercalli Intensity Scale, which determines the intensity of an earthquake by comparing actual damage against damage patterns of earthquakes with known intensities. The following figure shows the fault lines in Nebraska and the following tables summarize the Richter Scale and Modified Mercalli Scale.

Figure 14: Fault Lines in Nebraska



Source: Nebraska Department of Natural Resources

Table 69: Richter Scale

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

Source: Federal Emergency Management Agency

Table 70: Modified Mercalli Intensity Scale

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

Source: Federal Emergency Management Agency

LOCATION

There are no faults identified in either county. Thus there is a low probability of an earthquake occurrence, which does not vary across the planning area.

EXTENT

If an earthquake were to occur in the planning area, it would likely measure 4.0 or less on the Richter Scale.

HISTORICAL OCCURRENCES

According to the USGS Earthquake Hazards Program, the closest earthquake occurred in neighboring Knox County in 1996. It was measured at a 3.6 on the Richter Scale, and there were no reports of damage in Knox, Cedar, or Dixon County. Otherwise, no earthquakes in recent history have occurred within Cedar and Dixon Counties (Figure 15).

AVERAGED ANNUAL DAMAGES

Due to the lack of sufficient earthquake data, limited resources, extremely low earthquake risk for the area, and zero reports of historical occurrences with recorded damages, it is not feasible to utilize the 'event damage estimate formula' to estimate potential losses for the planning area.

PROBABILITY

Figure 16 summarizes the probability of a 5.0 or greater earthquake occurring in the planning area within 100 years, which is less than 0.2 percent.

Figure 15: Historic Earthquake Locations near Planning Area

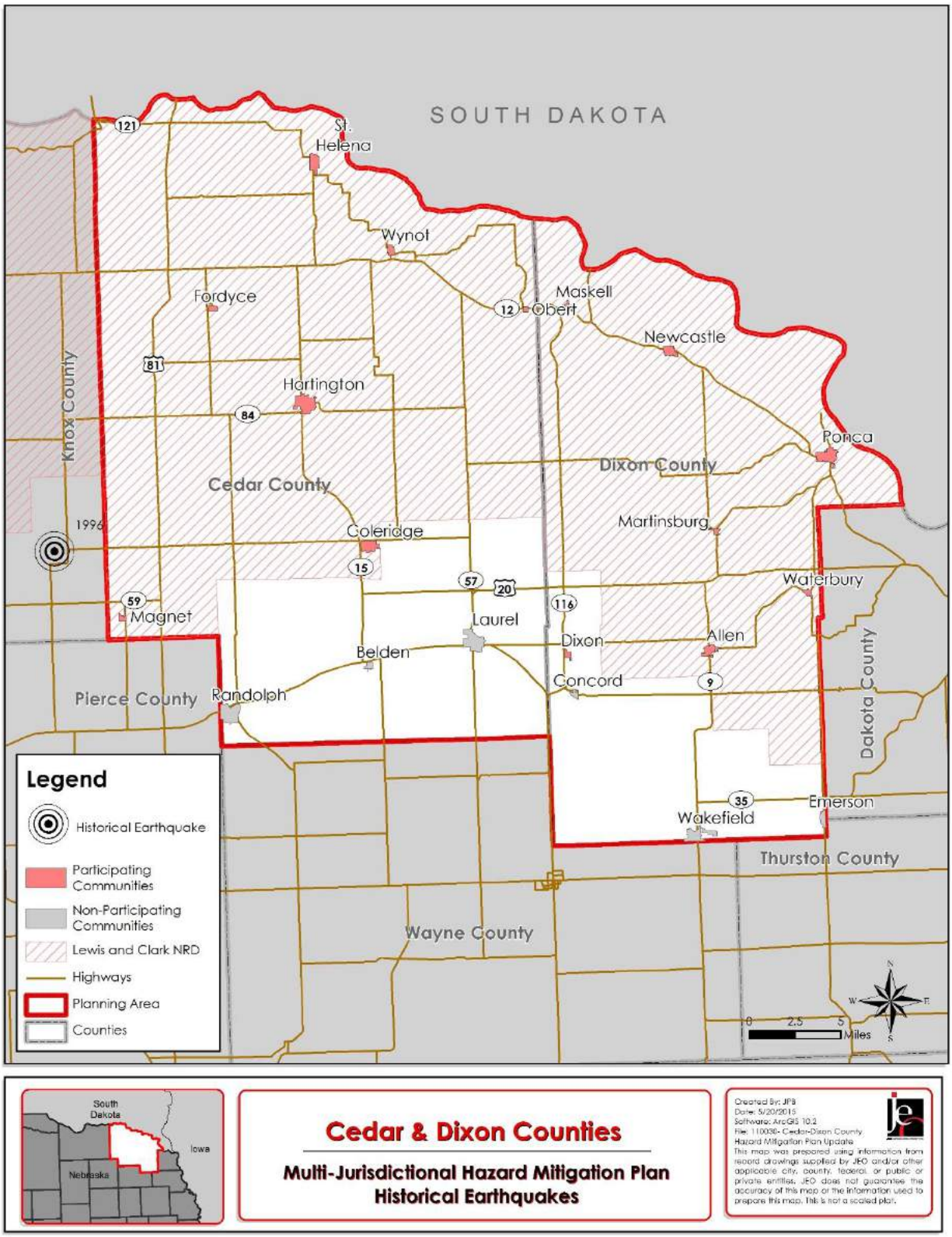
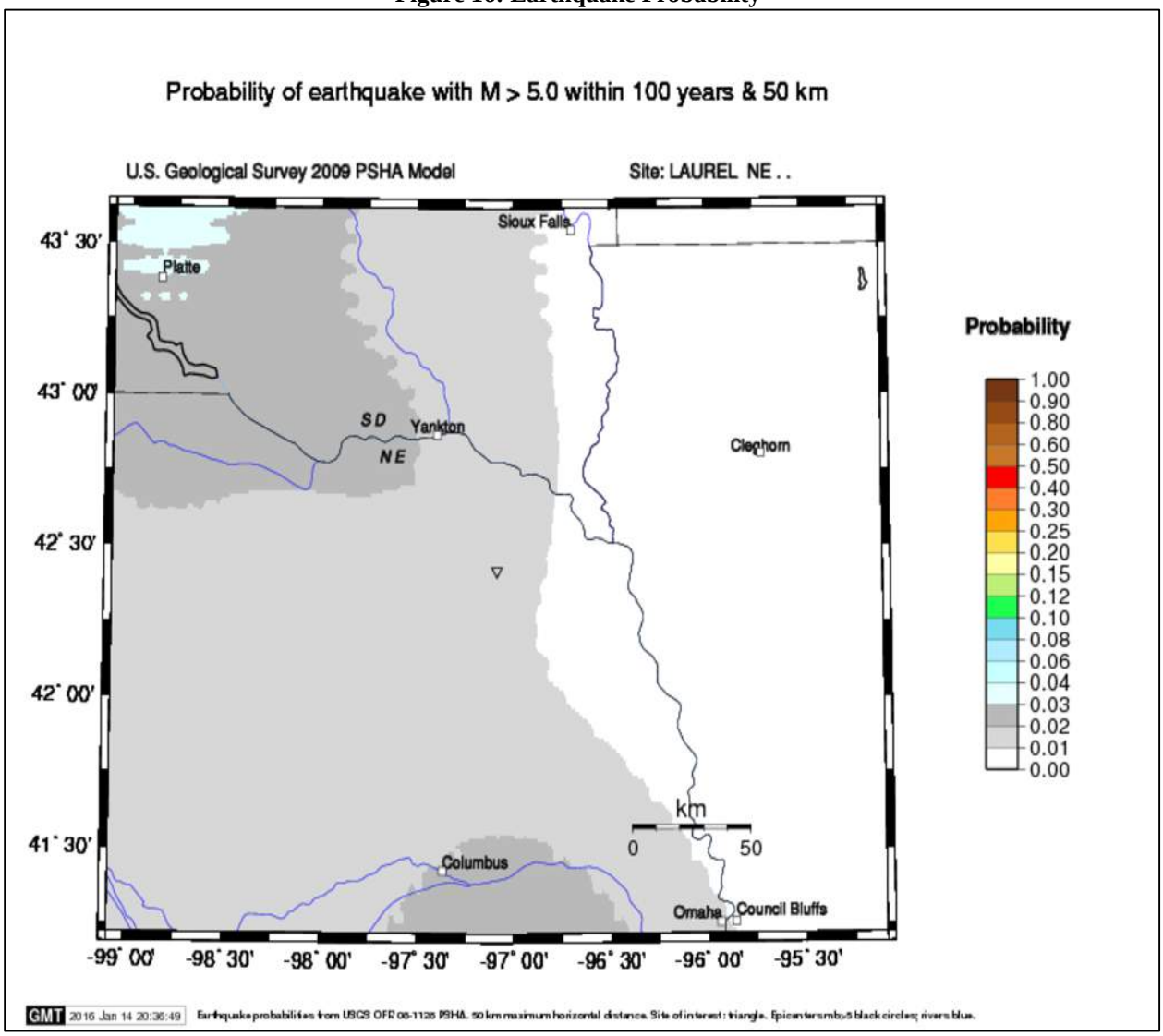


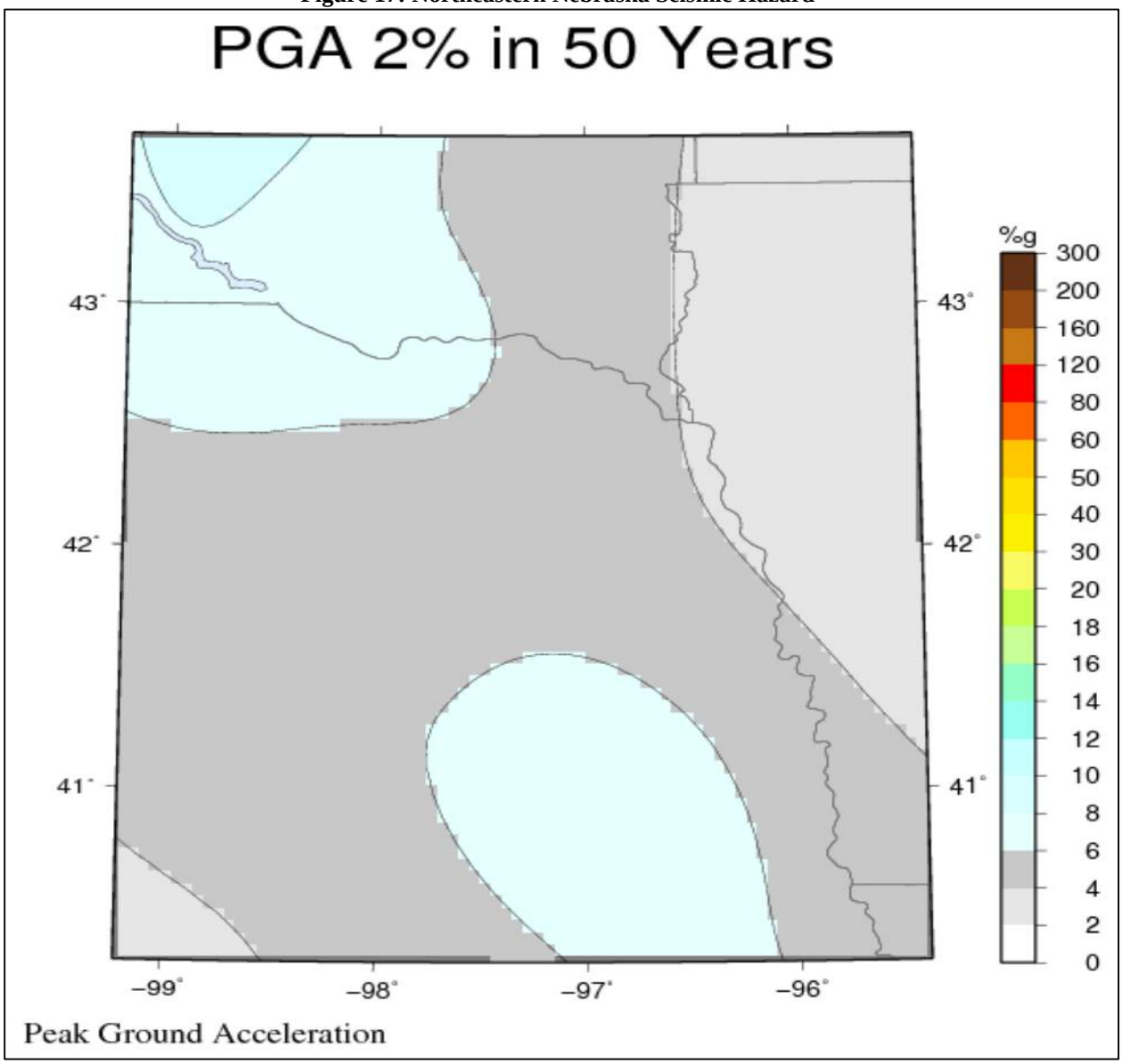
Figure 16: Earthquake Probability



Source: USGS 2009 Earthquake Probability Mapping

The following figure presents a worst-case scenario, depicting the shaking level that has a 2 percent chance of being exceeded over a period of 50 years. Typically, significant earthquake damage occurs when accelerations are greater than 30 percent of gravity.

Figure 17: Northeastern Nebraska Seismic Hazard



Source: United States Geological Survey

FUTURE DEVELOPMENT

Future development and growth would likely increase the intensity of earthquake impacts across the planning area. Future development and growth would likely have the following impacts:

- Increased development near dams (increased potential for failure during earthquakes)
- Increased density in urban areas
- New structures built without reinforcements

REGIONAL VULNERABILITIES

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

Table 71: Regional Earthquake Vulnerabilities

Sector	Vulnerability
People	-Falling objects
Economic	-Short-term interruption of business
Built Environment	-Cracking of foundations (residential and commercial structures) -Damage to structures
Infrastructure	-Damages to subterranean infrastructure (e.g. waterlines, gas lines, etc.) -Damages to roadways
Critical Facilities	-Same as all other structures

RISK ASSESSMENT SUMMARY

Table 72: Summary

Number of Past Events	None since 1973
Vulnerable Locations	Equal low chances in Cedar and Dixon County
Extent	M < 4.0
Annual Probability	<1%
Averaged Annual Losses	N/A

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Building codes updated
- Education outreach and participating in national ShakeOut day

EXTREME HEAT

HAZARD PROFILE

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.

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

Other related hazards include water shortages brought on by drought-like conditions and high demand. Local advisories, which list priorities for water use and rationing, are common during heat waves. Government authorities report that civil disturbances and riots are also more likely to occur during heat waves. In cities, pollution becomes a problem because the heat traps pollutants in densely populated urban areas. Adding pollution to the stresses associated with the heat magnifies the health threat to the urban population.

For the planning area, the months with the highest temperatures are May, June, July, August, and September. The National Weather Service is responsible for issuing excessive heat outlooks, excessive heat watches, and excessive heat warnings. Excessive heat outlooks are issued when the potential exists for an excessive heat event in the next 3 to 7 days. Excessive heat outlooks can be utilized by public utility staffs, emergency managers, and public health officials to plan for extreme heat events. Excessive heat watches are issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours. Finally, excessive heat warnings are issued when an excessive heat event is expected in the next 36 hours. Excessive heat warnings are issued when an extreme heat event is occurring, is imminent, or has a very high probability of occurring.

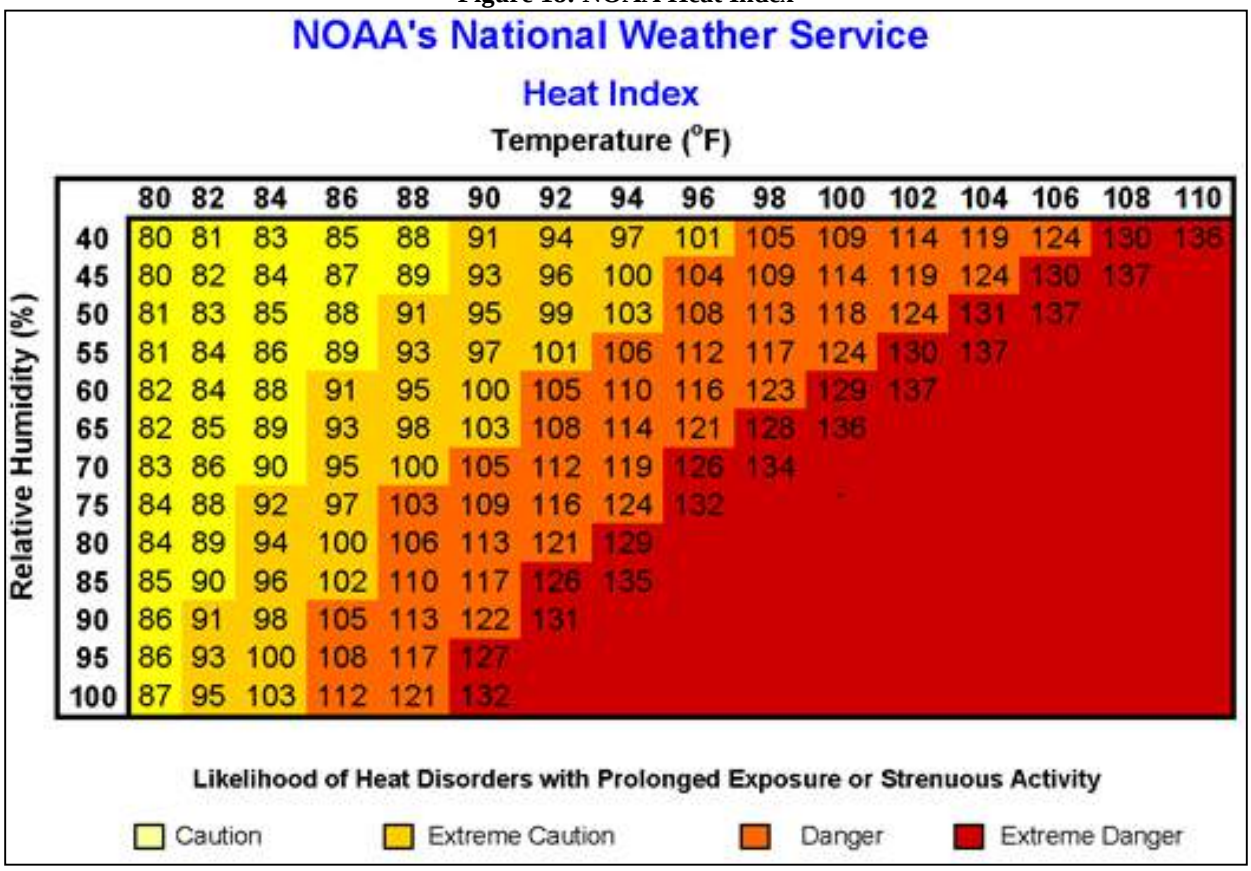
LOCATION

This hazard may occur anywhere in the planning area.

EXTENT

A key factor to consider in regards to extreme heat situations is the humidity level relative to the temperature. As is indicated in the following figure, 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 where as a Relative Humidity of 50 percent, require 94°F. The combination of Relative Humidity and Temperature result in a Heat Index: 100 percent Relative Humidity + 86°F = 112° Heat Index.

Figure 18: NOAA Heat Index



Source: NOAA

For the purpose of this plan extreme heat is being defined as temperatures of 90°F or greater.

HISTORICAL OCCURRENCES

The Midwestern Regional Climate Center (MRCC) reports an average of 35 days annually where max temperatures are 90° Fahrenheit or greater, which generally occur from June through September but are most prevalent in the months of July and August.

The following accounts of extreme heat events in the planning area are from the NCDC Storm Events database (January 1996 – June 2015). There were a total of 15 heat or excessive heat events with no injuries, deaths, or damage reported.

Table 73: Extreme Heat Events (1996-2015)

Date	Type	Deaths	Injuries	Property Damages	Crop Damages	Cedar	Dixon
7/19/1999	Heat	0	0	$0	$0	x	
7/28/1999	Heat	0	0	$0	$0		x
7/22/2005	Heat	0	0	$0	$0	x	
8/8/2010	Heat	0	0	$0	$0	x	
8/12/2010	Heat	0	0	$0	$0	x	

Date	Type	Deaths	Injuries	Property Damages	Crop Damages	Cedar	Dixon
7/15/2011	Excessive Heat	0	0	40	$0		x
7/16/2011	Excessive Heat	0	0	$0	$0	x	
8/1/2011	Heat	0	0	$0	$0	x	
6/27/2012	Excessive Heat	0	0	$0	$0		x
7/2/2012	Excessive Heat	0	0	$0	$0		x
7/3/2012	Heat	0	0	$0	$0	x	
7/15/2012	Excessive Heat	0	0	$0	$0		x
7/17/2012	Heat	0	0	$0	$0	x	
7/18/2012	Excessive Heat	0	0	$0	$0		x
8/1/2012	Excessive Heat	0	0	$0	$0		x
Totals		**0**	**0**	**$0**	**$0**	**8**	**7**

Source: NCDC

The following selected narratives are from the NCDC Storm Events Database.

July 19, 1999 Heat Wave: From July 19th through the 30th, high temperatures over eastern Nebraska and southwest Iowa reached 90 degrees or higher all but a day or two, and even then, highs were well into the 80s. In addition, overnight lows stayed mostly above 70 degrees. The high temperatures were accompanied by high humidity which caused afternoon heat indices to reach between 105 and 120 degrees. The highest temperatures in this period were observed on the 29th and 30th with highs both days in the upper 90s to low 100s across the region.

July 22-24, 2005 Excessive Heat: High temperatures from the upper 90s to around 105 and lows of 75-80 prevailed over much of eastern Nebraska from Friday July 22nd through Sunday July 24th. Afternoon heat index values reached 105-115 degrees across much of the area with the highest values observed Friday.

July 15-20, 2011 Excessive Heat: An extended period of excessive heat produced daytime temperatures reaching the 90s with dew points in the lower 80s, which caused heat indices to reach or even exceed 115. Nighttime temperatures often in the mid-70s to lower 80s with continued high humidity provided little, if any relief. The heat and humidity caused prolonged stress on people and livestock.

June 27, 2012 Heat: Temperatures reaching the 90s and high humidity with dew points in the 70s caused excessive heat, with the heat index peaking between 100 and 108 degrees.

July 2-6 and 18-24, 2012 Excessive Heat: Temperatures reaching the 90s to a few degrees above 100 and high humidity with dew points in the 70s caused and extended period of excessive heat. The heat index peaked at 100-110 degrees each day, and did not fall enough at night to provide much relief to indoor locations that were not otherwise cooled.

AVERAGE ANNUAL DAMAGES

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.

According to the NCDC Database, there were no property damages between 1996 and 2015. However a total of $20,491,150 in crop damages occurred between 2000 and 2015.

Table 74: Extreme Heat Loss Estimation

Hazard Type	Number of Average Days Per Year at 90°F[1]	Property Damages[2]	Average Annual Property Damage	Total Crop Loss[3]	Annual Crop Loss[3]
Extreme Heat	35	$0	N/A	$20,491,150	$1,366,077

Source: 1 indicates the data is from MRCC; 2 NCDC; 3 USDA RMA (2000-2014)

PROBABILITY

Extreme heat is a regular part of the climate for the planning area; there is a 100 percent probability that temperatures greater than 90°F will occur annually.

FUTURE DEVELOPMENT

Future development and growth would likely increase the intensity of extreme heat impacts across the planning area. Future development and growth would likely have the following impacts:

- Increased stress on electrical systems during peak demand times
- Add to exposure by increasing agricultural production within the area

REGIONAL VULNERABILITIES

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

Table 75: Regional Extreme Heat Vulnerabilities

Sector	Vulnerability
People	-Heat exhaustion -Heat Stroke -Vulnerable populations include: -People working outdoors -People without air conditioning -Young children outdoors or without air conditioning -Elderly outdoors or without air conditioning
Economic	-Short-term interruption of business -Loss of power -Agricultural losses
Built Environment	None
Infrastructure	-Overload of electrical systems -Damages to roadways
Critical Facilities	-Loss of power

Estimated Loss of Electricity

According to the FEMA publication "What is a Benefit: Guidance on Benefit-Cost Analysis of Hazard Mitigation Project (June 2009)", if an extreme heat event occurred within the planning area, the following table assumes the event could potentially cause a loss of electricity for 10 percent of the population at a cost of $126 per person per day. In rural areas, the percent of the population affected and duration may increase

during extreme events. The assumed damages do not take into account physical damages to utility equipment and infrastructure.

Table 76: Loss of Electricity - Assumed Damage by Jurisdiction

Jurisdiction	2010 Population	Population Affected (Assumed)	Electric Loss of Use Assumed Damage Per Day
Cedar County	8,852	885	$111,510
Dixon County	6,000	600	$75,600

RISK ASSESSMENT SUMMARY

Table 77: Summary

Number of Past Events	Annually 35 days of 90°F< on average
Vulnerable Locations	Entire planning area
Extent	90°F< and dependent on relative humidity for higher heat indices
Annual Probability	100%
Averaged Annual Losses	$0 property damage; $1,366,077 crop loss

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Assist vulnerable populations (i.e. creating a database to track those individuals at high risk such as the elderly)
- Identify existing community shelters/centers
- Increase awareness of extreme heat risk and safety (i.e. educating citizens regarding the dangers of extreme heat and the steps they can take to protect themselves)
- Installing backup power generators at critical facilities

FLOODING

HAZARD PROFILE

Flood events are the most damaging and costly hazards in the United States, and account for 66 percent of all presidential disaster declarations. Flooding can occur on a local level, sometimes affecting only a few streets, but can also extend throughout an entire area, 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 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 1 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.

Flash Flooding

Flash flooding, faster in nature, 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 less than six hours. Flash floods cause the most flood-related deaths as a result of this shorter timescale. Flooding from excessive rainfall in Nebraska usually occurs between late spring and early fall.

Sheet Flooding

In some cases, flooding may not be directly attributable to a river, stream, or lake overflowing its banks. Rather, it may simply be the combination of excessive rainfall or snowmelt, saturated ground, and inadequate drainage. With no place to go, the water will find the lowest elevations–areas that are often not in a floodplain. This type of flooding, often referred to as sheet flooding, is becoming increasingly prevalent as development exceeds the capacity of the drainage infrastructure. As the capacity of the drainage infrastructure is exceeded, its ability to properly carry and disburse the water flow is limited. Flooding also occurs due to combined storm and sanitary sewers being overwhelmed by the tremendous flow of water that often accompanies storm events. Typically, the result is water backing into basements, which damages mechanical systems and can create serious public health and safety concerns.

Ice Jam Flooding

Ice jams occur when ice breaks up in moving waterways, and then stacks on itself where channels narrow or man-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. In the Missouri River, because of relatively fast velocities, "frazil ice" is not able to form "sheet ice." Instead, the "frazil ice" particles gradually enlarge and combine, forming pads of ice commonly known as "pad ice." As this ice floats downstream, obstructions or constrictions like snags or bridge piers create conditions where ice pads may accumulate or stop flowing. Once this occurs, other ice pads may accumulate, gradually covering the entire river with "pad ice." This is commonly known as an "ice bridge."

This condition can result in severe stage fluctuation as the "ice bridge" forms, consolidates, or breaks up. As additional "pad ice" floats downstream, the "ice bridge" grows in an upstream direction. As the "ice bridge" continues to form, it may thicken to the point where an "ice gorge" blocks the flow of the river in the channel. This can result in extremely rapid increases in upstream water surface elevations (WSELs) and resultant overbank flooding.

LOCATION

Cedar and Dixon Counties cover a total area of 1,229 square miles which drain into the Missouri and Elkhorn River watersheds through rolling hills. Major waterways include Logan, Bow, Aowa, and South Creeks. In *Section Seven: Participant Sections*, the 1 percent annual chance floodplain map is included for each participating jurisdiction, where available.

Table 78 provides a percentage of improvements that have been made in the floodplain for each participating community. Hartington, St. Helena, Newcastle, and Ponca have properties that are located in the floodplain. Cedar and Dixon Counties' unincorporated areas have about a third of their properties located in the floodplain.

Table 78: NFIP Participants

Jurisdiction	Number of Improvements in Floodplain	Total Number of Improvements in Jurisdiction	Percentage of Affected Improvements in Floodplain
Cedar County	696	2,070	33.6%
Coleridge	0	81	0%
Fordyce	0	30	0%
Hartington	8	183	4.4%
Magnet	0	26	0%
Obert	0	10	0%
St. Helena	2	12	16.7%
Wynot	0	37	0%
Dixon County	344	1,015	33.9%
Allen	0	33	0%
Dixon	0	9	0%
Martinsburg	0	8	0%
Maskell	0	7	0%
Newcastle	6	41	14.6%
Ponca	9	15	60.0%
Waterbury	0	8	0%

Source: Nebraska Department of Natural Resources, National Flood Insurance Program

EXTENT

The NWS has three categories to define the severity of a flood as indicated in Table 79. Figure 19 shows the normal average monthly precipitation for the planning area, which is helpful in determining whether any given month is above, below, or near normal in precipitation. As indicated in Figure 20, the most common months for flooding within the planning area are June, July, and August. While it is possible that major flood events will occur, the likely extent of flood events within the planning area between the months

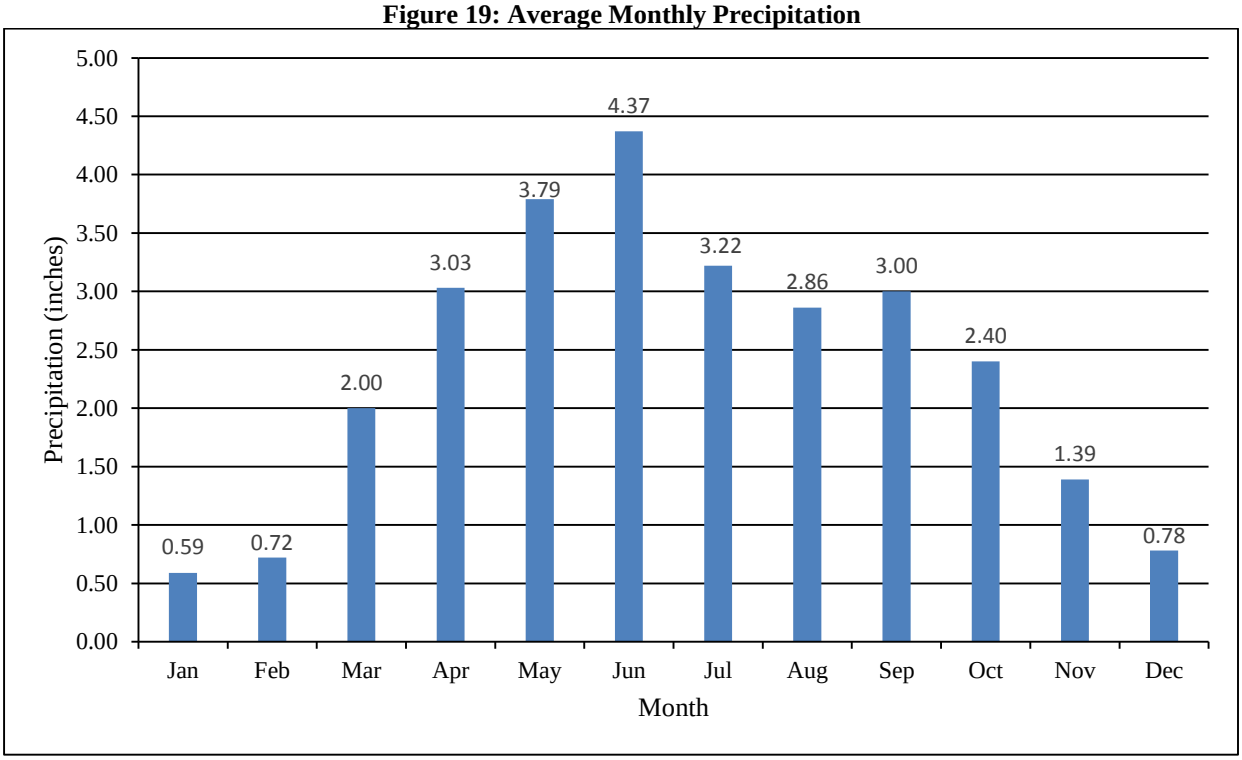
of May and September is moderate flooding (Table 79), which could result in some inundation of structures and roads near streams.

Table 79: Flooding Stages

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

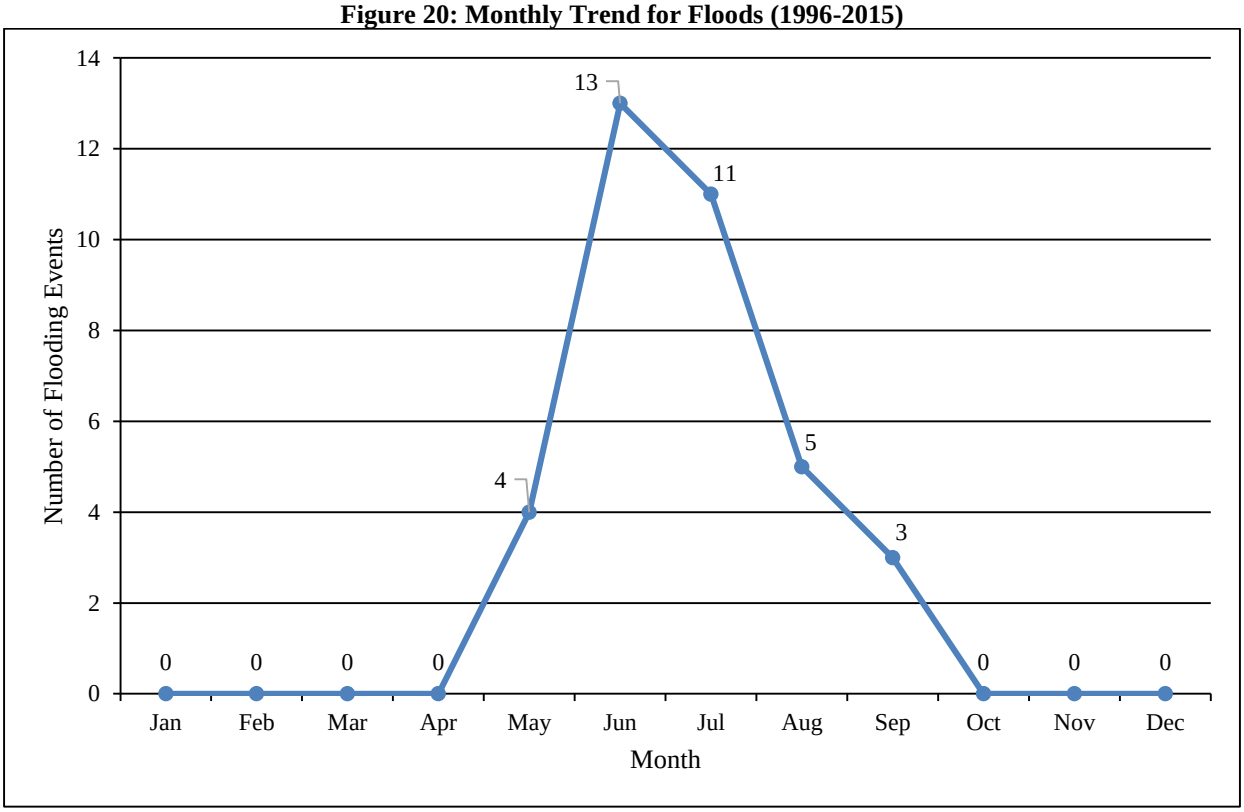
Source: NOAA

Figure 19: Average Monthly Precipitation



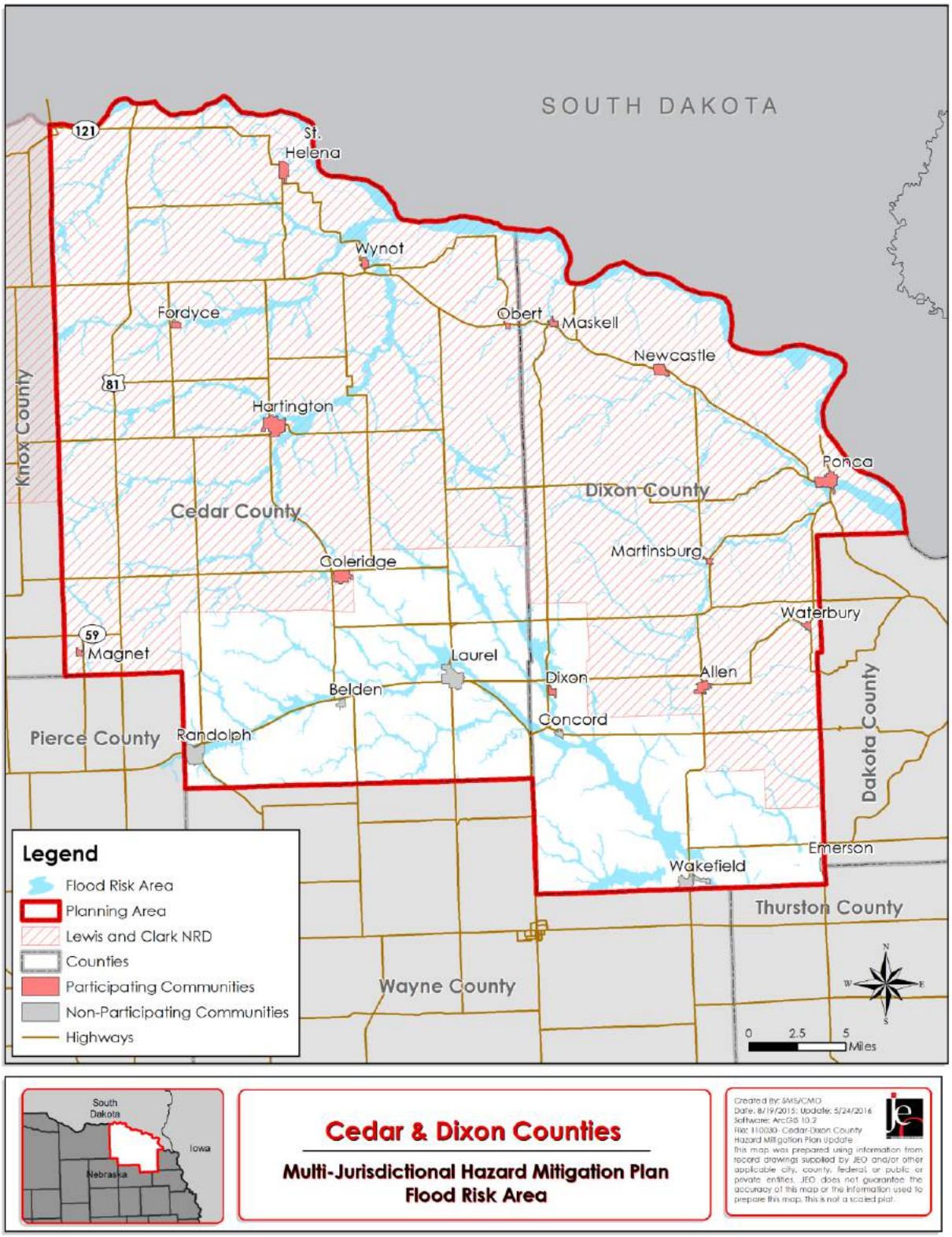
Source: MRCC

Figure 20: Monthly Trend for Floods (1996-2015)



Source: NOAA NCDC

Figure 21: Flood Risk Area



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. It requires flood resistant design and construction practices and transfers the costs of flood losses to the residents of floodplains through flood insurance premiums.

In return for availability of federally backed flood insurance, jurisdictions that participate in the NFIP must agree to adopt and enforce floodplain management standards to regulate development in special flood hazard areas (SFHA) as defined by FEMA's flood maps. One of the strengths of the program has been keeping people away from flooding rather than keeping the flooding away from people - through historically expensive flood control projects.

As of October 2015, Nebraska has 11,279 policies in force representing $2 billion worth of coverage. The following tables summarize NFIP participation and active policies within the planning area.

Table 80: NFIP Participants

Jurisdiction	Eligible-Regular Program	Date Current Map	Sanction	Suspension	Rescinded	Participation in NFIP
Cedar County	-	-	-	-	-	No
Coleridge	-	-	-	-	-	No
Fordyce	-	-	-	-	-	No
Hartington	9/24/1984	12/17/1987	-	-	-	Yes
Magnet	-	-	-	-	-	No
Obert	-	-	-	-	-	No
St. Helena	-	-	-	-	-	No
Wynot	-	-	-	-	3/30/1979	No
Dixon County	-	-	-	-	-	No
Allen	7/2/1987	7/2/1987	-	-	-	Yes
Dixon	-	-	-	-	-	No
Martinsburg	-	-	-	-	-	No
Maskell	-	-	-	-	-	No
Newcastle	8/4/1987	8/4/1987	-	-	-	Yes
Ponca	8/1/1986	8/1/1986	-	-	-	Yes
Waterbury	-	-	-	-	-	No

Source: Nebraska Department of Natural Resources, National Flood Insurance Program

Table 81: NFIP Policies in Place and Total Payments

Jurisdiction	Policies In-force	Total Coverage	Total Premium	Closed Losses*	Total Payments
Cedar County	-	-	-	-	-
Coleridge	-	-	-	-	-
Fordyce	-	-	-	-	-
Hartington	8	$577,900	$6,387	-	-

Jurisdiction	Policies In-force	Total Coverage	Total Premium	Closed Losses*	Total Payments
Magnet	-	-	-	-	-
Obert	-	-	-	-	-
St. Helena	-	-	-	-	-
Wynot	-	-	-	-	-
Dixon County	-	-	-	-	-
Allen	0	-	-	-	-
Dixon	-	-	-	-	-
Martinsburg	-	-	-	-	-
Maskell	-	-	-	-	-
Newcastle	2	$48,500	$763	-	-
Ponca	4	$650,000	$1,347	1	$2,820
Waterbury	-	-	-	-	-
Planning Area Total	**14**	**$1,276,400**	**$8,497**	**1**	**$2,820**

Source: NFIP Community Status Book, January 2016; NFIP Claim Statistics
*N/A: Not Applicable; *Closed Losses are those flood insurance claims that resulted in payment*

This plan highly recommends and strongly encourages each plan participant to remain in good standing and continue involvement with the NFIP. And if a community currently is not participating in the NFIP, it is recommended and encouraged for them to join. Participation and 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 CRS Coordinator's Manual (FIA-15/2013).

In order to qualify for HMA, plan participants must be in compliance with the NFIP, if a mitigation project is located in a Flood Hazard Risk Area. For any questions regarding the NFIP, contact the NDNR.

NFIP REPETITIVE LOSS STRUCTURES

NDNR was contacted to determine if any existing buildings, infrastructure, or critical facilities are classified as NFIP Repetitive Loss Structures. There are no repetitive loss properties in Cedar or Dixon County.

HISTORICAL OCCURRENCES

The NCDC reports 36 flooding events from January 1996 through June 2015. Of these events, 21 were flash flooding and 15 were riverine flooding. According to the NCDC, flash flooding resulted in $1,900,000 in property damage, while riverine flooding cause $1,026,000 in property damage. There were no injuries or deaths reported.

The USDA RMA data does not distinguish the difference between river flooding damages and flash flooding damages. The total crop loss according to the RMA is $1,439,965.

Missouri River Flood 2011

The most recent river flood occurred during the spring and summer of 2011 along the Missouri River, which was the largest on record for the entire basin in terms of volume of water, and record peak flows were also experienced in some reaches. The flooding situation was complex and evolved throughout the summer. The initial trigger of the flood occurred far upstream from the record snowfall in the Rocky Mountains of Montana and Wyoming, which was then compounded by near-record spring rainfall in central and eastern Montana. This lead to all six major dams along the Missouri River to release record amounts of water to

prevent overflow, which led to flood waters threatening unincorporated areas, towns, and cities from Montana south to Missouri. Primarily farmland and low-lying areas along the Missouri River in Cedar and Dixon Counties were inundated with flood waters, and a few permanent and seasonal homes were also threatened.

The USACE attempted to regulate the release of water through 850 miles of river from North Dakota through South Dakota to the confluence with the Mississippi River in St. Louis. The following table indicates the progression of the release flows from the six dams along the Missouri River, which ultimately impacted areas along the Missouri River in the planning area.

Table 82: Release of Water by Dam in 2011

Dam Name	Previous Record Flow	Previous Record Year	Flow May 1, 2011	Flow May 31, 2011	Flow June/July 2011
Fort Peck Dam	35,000	1975	7,000	9,700	65,500
Garrison Dam	65,000	1975	17,400	80,400	150,200
Oahe Dam	59,000	1997	29,400	86,300	160,300
Big Bend Dam	74,000	1997	21,200	83,900	165,000
Fort Randall Dam	67,000	1997	42,300	76,600	157,000
Gavins Point Dam	70,000	1997	45,000	77,000	160,700

Source: USACE

These releases lead to high flood stages all along the Missouri River, including Cedar and Dixon Counties. By the end of May 2011, flooding was underway along the river in Cedar and Dixon Counties. Lowlands flooded, which included some roads and recreational facilities near the river. The river reached its highest May levels at the end of the month, including a peak stage of 2.5 feet above flood stage at Ponca.

Flooding along the Missouri River gradually worsened over the area during June as record releases from Gavins Point Dam brought areas of lowland flooding along the river. In Cedar County, the flooding continued during the first week of June as flows out of Gavins Point Dam reached and exceeded 100,000 cubic feet per second (cfs) on the way to 160,000 cfs. A few seasonal and permanent homes were threatened by the flood waters, but in general, the flooding was confined to low areas and farmland along the river.

In Dixon County during June, lowlands along the river including numerous roads, parks, recreational areas, and homes were flooding. Thousands of acres of usually dry pastureland and cropland were flooded with several farms affected. Losses included farm buildings, equipment, and livestock. The highest stage near Ponca was 8.3 feet above flood stage on June 29th and continued at this level through July 11th.

Flooding continued through the month of July in both counties as record releases from Gavins Point Dam had reached 160,700 cfs. By August 1st, the flood stage at Ponca had reached 8.6 feet above flood stage. However by the end of the month, the releases from the dam began to moderate, which slowly eased the flooding along the river.

By September 1st, the dam releases had dropped significantly, which allowed the flood stage at Ponca to drop to 1.9 feet above flood stage. The flooding along the river continued to improve through September. By the end of the month, the river had returned to normal levels, and flooding had ceased in lowland areas along the river in Cedar and Dixon Counties.

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon NCDC Storm Events Database since 1996 and the number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Flooding causes an average of $150,051 in property damages and $95,998 in crop losses per year for the planning area.

Table 83: Flood Loss Estimate

Hazard Type	Number of Events[1]	Number of Events Per Year	Total Property Loss[1]	Average Annual Property Loss [1]	Total Crop Loss[2]	Average Annual Crop Loss [2]
Flood Events	36	1.8	$2,926,000	$150,051	$1,439,965	$95,998

1 Indicates data from NCDC (January 1996 to June 2015) 2 Indicates data from RMA (2000 to 2014)

PROBABILITY

Based on the historic record and reported incidents by participating communities, there is a 100 percent probability of flooding will occur annually in the planning area.

FUTURE DEVELOPMENT

Any future development in floodplains should be discouraged to protect assets. Land-use regulations should be used to limit development in floodplains and other flood prone areas as well as protecting natural flood mitigation features. Buyout programs can be used to eliminate properties located in floodplains, especially properties that have experienced repetitive losses. Communities may also consider incorporating "Green Infrastructure" to address flooding concerns, and examples of this would include using permeable surfaces for parking areas, using rainwater retention swales, developing rain gardens and green roofs, and establishing greenways. Existing structures can be retrofitted to withstand potential flood events by elevating structures and utilities.

The State of Nebraska has adopted floodplain regulations that are more restrictive than the NFIP minimum standards. Nebraska's minimum standards for floodplain management require that all new construction and substantial improvements of residential structures shall have the lowest floor (including basements) elevated to or above one foot above the base flood elevation. The national standard is that new or substantially improved structures shall have the lowest floor elevated to or above the base flood elevation. Additionally, Nebraska does not allow new structures for human habitation to be built in the floodway. The more stringent requirements for the State of Nebraska will help reduce flood impacts and damages by requiring a one foot "freeboard" to allow for known flood hazards. This requirement for Nebraska will also result in lower premiums for those participating in the NFIP.

Future development maps and one percent annual floodplain maps, when available, can be found in each jurisdiction's profile in *Section Seven: Participant Sections*.

REGIONAL VULNERABILITIES

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

Table 84: Regional Flooding Vulnerabilities

Sector	Vulnerability
People	-Low income and minority populations may lack the resources needed for evacuation, response, or to mitigate the potential for flooding -The elderly have decreased mobility -Residents in low-lying areas, especially campgrounds, are vulnerable during flash flood events -Residents living in the floodplain may need to evacuate for extended periods
Economic	-Business closures or damages may have significant impacts -Agricultural losses from flooded fields -Closed roads and railways would impact commercial transportation of goods
Built Environment	-Buildings damages
Infrastructure	-Damages to roadways and railways
Critical Facilities	-Wastewater facilities are at risk, particularly those in the floodplain -Critical facilities, especially those in the floodplain, are at risk to damage

RISK ASSESSMENT SUMMARY

Table 85: Summary

Number of Past Events	36 or about 2 events/year
Vulnerable Locations	Entire planning area, particularly in the floodplain
Extent	Moderate - Some inundation of structures and roads near streams. Some evacuations of people.
Annual Probability	100%
Averaged Annual Losses	$150,051 in property losses and $95,998 in crop losses

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Limit or restrict development in flood-prone areas
- Revise and update floodplain maps
- Manage the Floodplain Beyond Minimum Requirements (i.e. adopting a " no-rise" in base elevation clause for the flood damage prevention ordinance)
    - All new structures in the floodplain are required to elevate above the base flood elevation
- Participate in the NFIP
    - Currently four communities participate and there are 14 policies
- Encourage property owners in areas protected by dams and levees to purchase flood insurance
- Remove existing structures from flood-prone areas
- Construct flood control measures
- Evaluate and update municipal stormwater systems
- Establish education programs to educate the public about the risks of flooding and ways to protect their families and property

GRASS/WILDFIRE

HAZARD PROFILE

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, and other vegetated areas. Wildfires differ from other fires by their extensive size, the speed at which they can spread out 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, the zone of transition between developed areas and undeveloped wilderness.

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. 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.

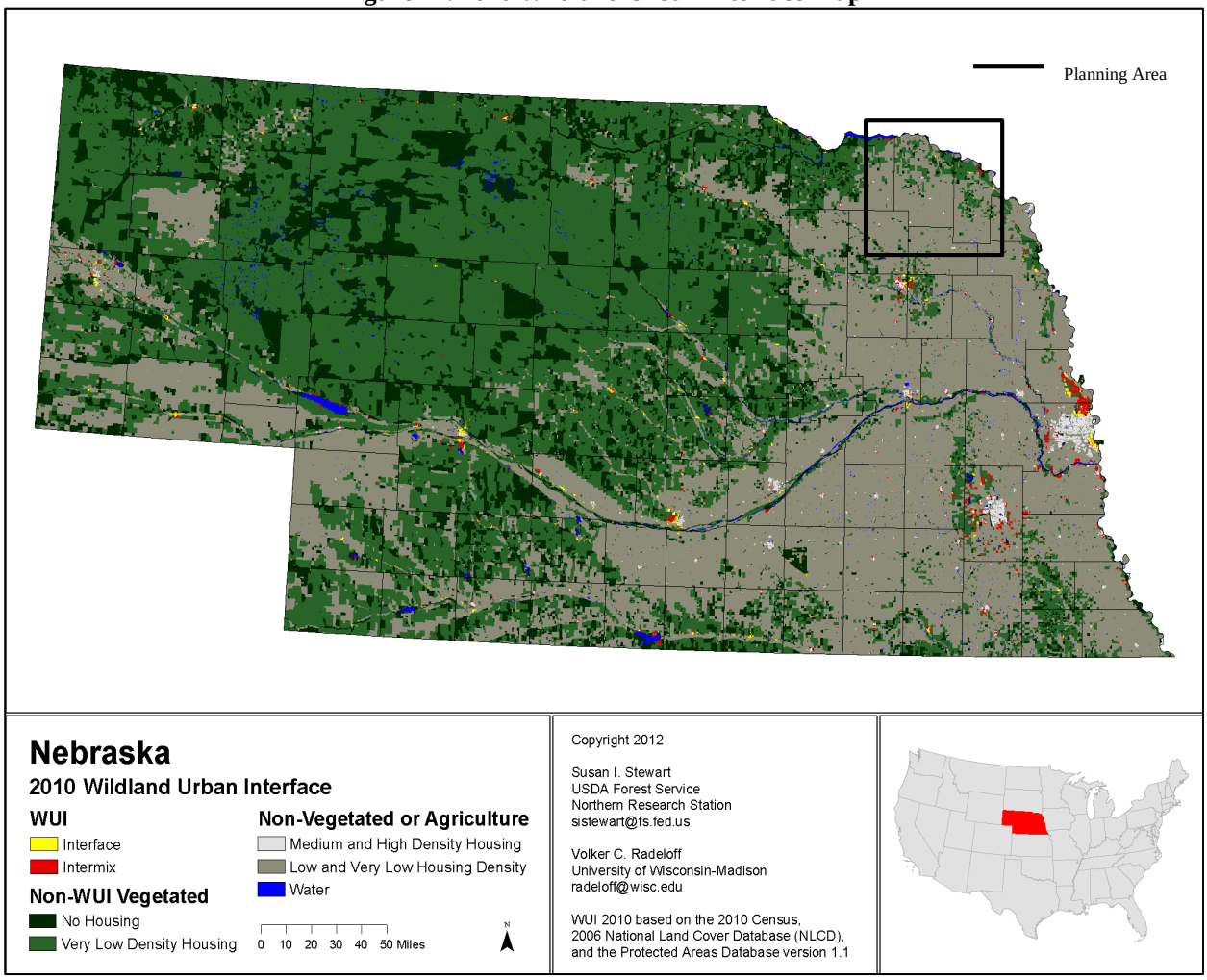
Lightning starts approximately 10,000 ***forest fires*** *each year, yet ninety percent of forest fires are started by humans.*

-National Park Service

Wildfires are characterized in terms of their physical properties including topography, weather, and fuels. Wildfire behavior is often complex and 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.

In recent decades, as the population of the United States has decentralized and residents have moved farther away from the center of villages and cities, the area known as the wildland urban interface (WUI) has developed significantly, in both terms of population and building stock. The WUI is defined as the zone of transition between developed areas and undeveloped wilderness, where structures and other human development meet wildland. The expansion of the WUI increases the likelihood that wildfires will threaten people and homes, making it the focus of the majority of wildfire mitigation efforts. The following map produced by the USDA Forest Service displays the nation's WUI conditions as of 2010. The approximate location of the planning area is indicated by the black outline. Most of the planning area is located in a non-WUI vegetated designated area (Figure 22), with no or low density housing with a mix of vegetated, non-vegetated, and agricultural land.

Figure 22: 2010 Wildland Urban Interface Map



Source: University of Wisconsin SILVIS Lab (http://silvis.forest.wisc.edu/maps/wui/2010/download)

Based on the NFS's 'Wildfire by Cause' report, the most common causes of wildfires include debris burning, equipment use, lightning, and other miscellaneous causes.

LOCATION

The entire planning area is at risk of wildfire where agricultural areas or forests exist. However, Dixon County has reported more wildfires than Cedar County with over 26,000 acres burned since 2000.

Table 86: Reported Wildfires by County

County	Reported Wildfires	Acres Burned
Cedar County	113	762.5
Dixon County	161	26,882.4
Total	**274**	**27,644.9**

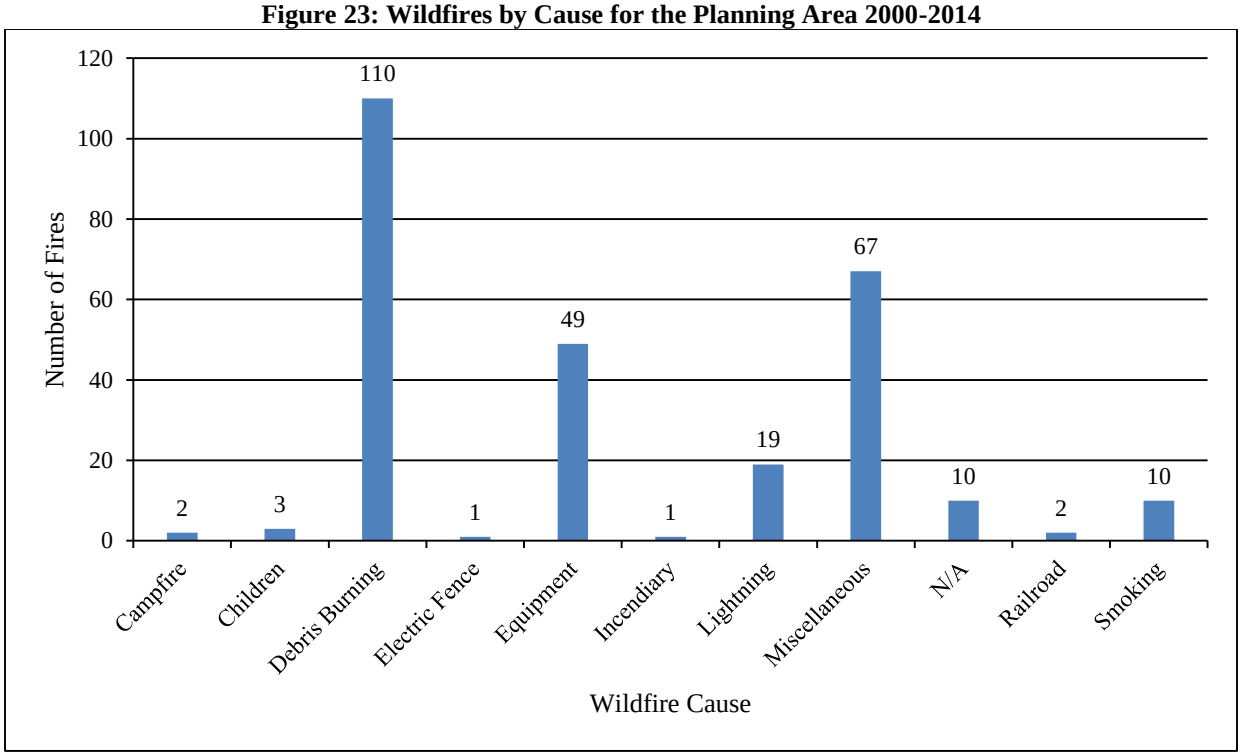
Source: Nebraska Forest Service, 2000-2014

EXTENT

Figure 23 illustrates the number of wildfires by cause in the planning area from 2000 to 2014, which burned 27,645 acres in total. There were 274 reported wildfires in the planning area between 2000 and 2014. Five of the fires burned 100 acres or more, with the largest wildfire burning 20,000 acres in Dixon County in September 2000 and was started by lightning.

Wildfires are most likely to be started by debris burning (40%). Miscellaneous causes (25%) and equipment (18%) 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.

Figure 23: Wildfires by Cause for the Planning Area 2000-2014

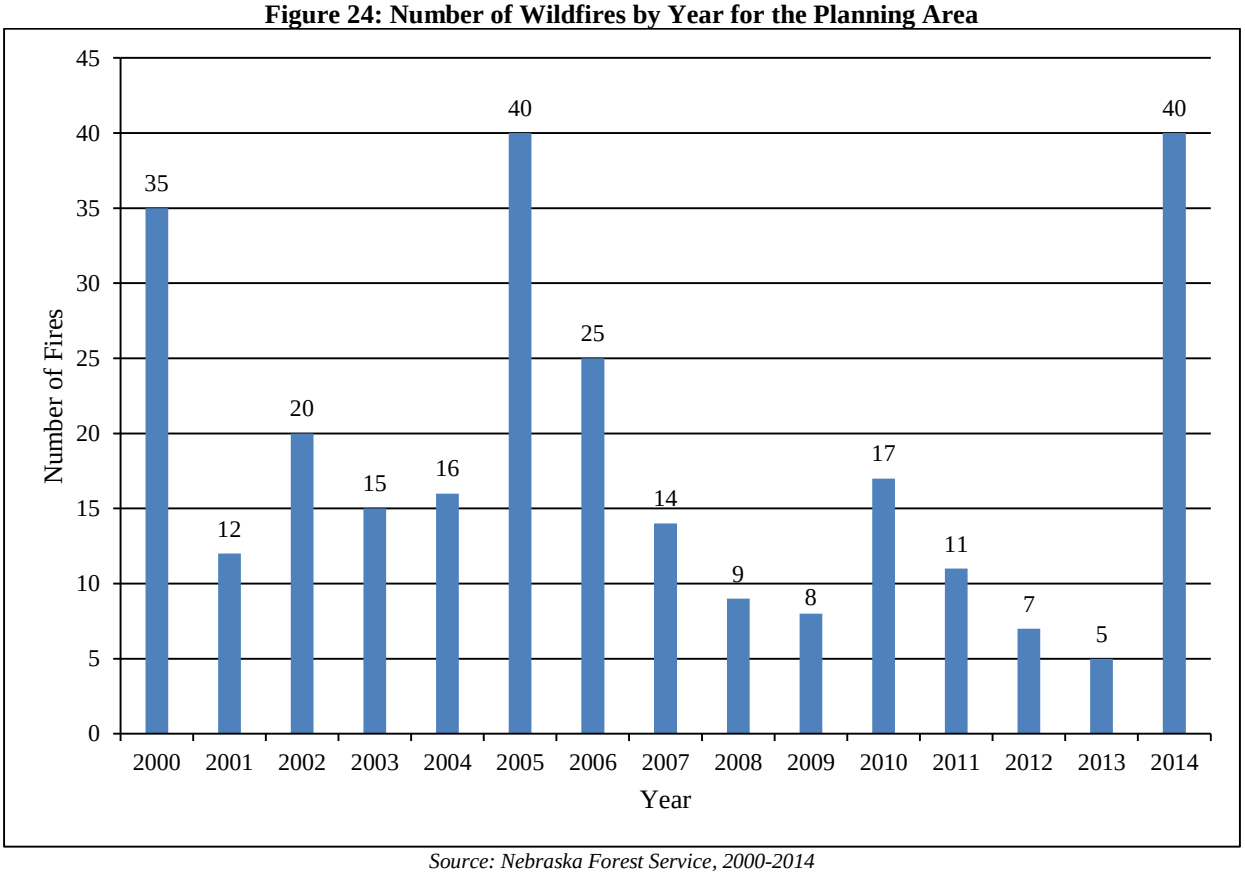


Source: Nebraska Forest Service, 2000-2014

HISTORICAL OCCURRENCES

For the planning area, there were 274 reported wildfires by 12 different fire departments according to the NFS from 2000 to 2014. The reported events burned 26,577 acres of range land, 41 acres of forest land, and 1,027 acres of crop land. The reported fire events caused $62,785 in crop damages according to the NFS. There were no deaths from these wildfires, however there was one injury that occurred during a prescribed burn in April 2014.

Figure 24: Number of Wildfires by Year for the Planning Area



Source: Nebraska Forest Service, 2000-2014

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon NFS wildfires database from 2000 to 2014 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, or sustained injuries. During the 15 year period, wildfires caused no damages in property damage, and $4,186 per year in crop damage in the planning area.

Table 87: Wildfire Loss Estimation

Hazard Type	Number of Events[2]	Events Per Year	Total Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Grass/Wildfires	274	18.3	$0	$62,785	$4,186

1 Indicates data is from NCDC (1996-2015); 2 Indicates data is from NFS (2000 to 2014)

PROBABILITY

Probability of grass/wildfire occurrence is based on the historic record provided by the NFS and reported potential by participating jurisdictions. Based on the historic record, there is a 100 percent annual probability or about 18 wildfires happening in the planning area each year.

FUTURE DEVELOPMENT

Any outward development in the communities increases the risk and vulnerability to wildfires impacting communities. Structures built in the extraterritorial jurisdiction will be more vulnerable to wildfires. Also with an increase in agricultural activities, particularly in Dixon County, structures built to support agriculture operations will be most vulnerable to wildfires.

REGIONAL VULNERABILITIES

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

Table 88: Regional Wildfire Vulnerabilities

Sector	Vulnerability
People	-Risk of injury or death -Displacement of people and loss of homes -Lack of transportation poses risk to low income individuals, families, and elderly
Economic	-Loss of businesses
Built Environment	-Property damages
Infrastructure	-Transportation routes may be closed -Damage to power lines
Critical Facilities	-Risk of damages
Other	-Increase chance of landslides and erosion -May lead to poor water quality

RISK ASSESSMENT SUMMARY

Table 89: Summary

Number of Past Events	274 (~18.3 events/year)
Vulnerable Locations	Entire planning area, particularly in Dixon County
Extent	Most wildfires will be <100 acres
Annual Probability	100%
Averaged Annual Losses	Property = $0; Crop = $4,186

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- New municipal wells
- Civil service improvements (New fire trucks)
- Educate property owners about wildfire mitigation techniques
- Wildland fire fighting training for fire departments
- Emergency exercises

HAIL

HAZARD PROFILE

Hail is usually associated with severe thunderstorms, and this association makes hail just as unpredictable as a severe thunderstorm. Additionally, hail events in thunderstorms often occur in series, with one area having the potential to be hit multiple times in one day.

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, high winds, and can produce tornados with little or no advanced warning. Furthermore, hail can destroy property and crops with their shear force, as some hail stones can fall at 100 mph.

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 damages increases as the size of the hail increases.

LOCATION

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

EXTENT

The TORRO scale is used to classify hailstones and provides some detail related to the potential impacts from hail. Table 90 outlines the TORRO Hailstone Scale.

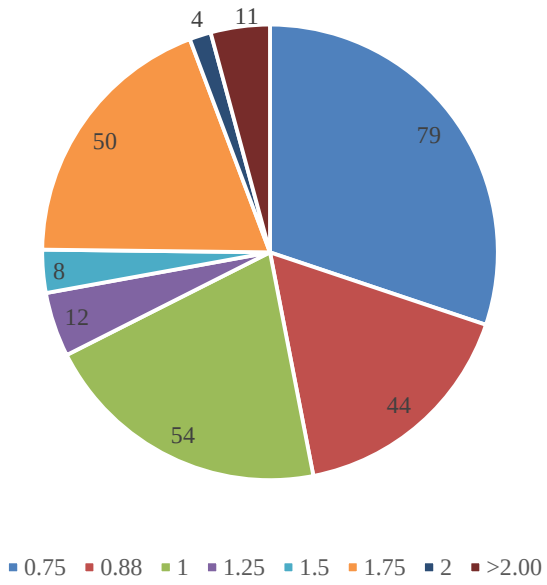
Table 90: TORRO Hail Scale

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

Source: TORRO

Of the 262 hail events reported for the planning area, the average hailstone size is 1.17 inches. Events of this magnitude correlate to an H3 classification. It is reasonable to expect H3 classified events to occur several times in a year throughout the planning area. In addition, it is reasonable, based on the number of occurrences, to expect larger hailstones to occur in the planning area annually. The planning area has endured two H10 hail events (>4.0 inches) during the period of record. For this area, it is realistic to expect an H6 event (2.0-2.4 inches) or larger to occur approximately every other year in the planning area. Figure 25 shows hail events based on the size of the hail.

Figure 25: Hail Events by Size (inches)



Source: NCDC, 1996--2015

HISTORICAL OCCURRENCES

The NCDC reports events as they occur in each community. A single hail event can affect multiple communities and counties at a time; the NCDC reports these large scale, multi-county events as separate events. The result is a single hail event covering a large portion of the planning area that could be reported by the NCDC as several events. The NCDC reports a total of 262 hail events in the planning area between 1996 and June 2015. These events were responsible for $395,000 in property damages and $21,145,306 in crop damages. These events resulted in no injuries or fatalities.

Hail events from NCDC reported by each community are listed in the participant sections in *Section Seven: Participant Sections*.

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was based on the NCDC Storm Events Database since 1996 and number of historical occurrences as described above. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life.

Table 91: Hail Loss Estimate

Hazard Type	Number of Events[1]	Events Per Year	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss [2]
Hail Events	262	13.4	$395,000	$20,256	$21,145,306	$1,409,687

1 Indicates the data is from NCDC (January 1996 to June 2015); 2 Indicates data is from USDA RMA (2000 to 2014)

PROBABILITY

Based on historic records and reported events, severe thunderstorms with hail are likely to occur several times annually within the planning area. The NCDC reported 262 hail events between 1996 and 2015, or on average 13.4 hail occurrences per year.

FUTURE DEVELOPMENT

Future development will increase the risk of damages to buildings and infrastructure from hail. It is recommended that hail resistant materials and hail guards for HVAC systems be considered during construction and renovations. Building codes can be enhanced so that they require or recommend the use of hail resistant material as well. Existing structures can also incorporate hail resistant products, such as concrete roof tiles and siding. Communities can also establish Tree Boards and tree ordinances to ensure urban canopies are safe and healthy, reducing the potential impacts of severe thunderstorms.

REGIONAL VULNERABILITIES

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

Table 92: Regional Hail Vulnerabilities

Sector	Vulnerability
People	-Injuries can occur from: not seeking shelter, standing near windows, and shattered windshields in vehicles
Economic	-Damages to buildings and property can cause significant losses to business owners
Built Environment	-Roofs, siding, windows, gutters, HVAC systems, etc. can incur damage
Infrastructure	-Power lines and utilities can be damaged
Critical Facilities	-Property damages and power outages
Other	-High winds, lightning, heavy rain, and possibly tornados can occur with this hazard

RISK ASSESSMENT SUMMARY

Table 93: Summary

Number of Past Events	262 or about 13 events/year
Vulnerable Locations	Entire planning area
Extent	H3 (0.80-1.00 inches)
Annual Probability	100%
Averaged Annual Losses	Property=$20,256; Crop=$1,409,687

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Continue to participate, or become a participant, in Tree City USA; establish a tree maintenance ordinance
- Establish a tree board to assist in the development of a tree management program
    - This is a requirement of Tree City USA
- Bury power and service lines
    - Many communities have buried some of their power lines
- Establish community severe weather warning protocols
    - Most communities follow National Weather Service protocols
- Incorporate text messaging into severe weather messaging programs
- Incorporate cable TV interruption warning systems
- Purchase and issue weather radios to critical facilities and vulnerable populations
    - Most communities have weather radios and four communities are interested
- Establish mutual aid agreements with neighboring communities and privately owned businesses
    - Agreements exist between most communities
- Establish public education programs to increase awareness of the dangers posed by hail events and ways the public can mitigate the potential impacts
    - Most county emergency managers have some education programs
- Establish data recovery program and backup program for municipal employees
- Use of hail resistant materials
    - Some jurisdictions have hail resistant roofing and hail guards on A/C units on critical facilities

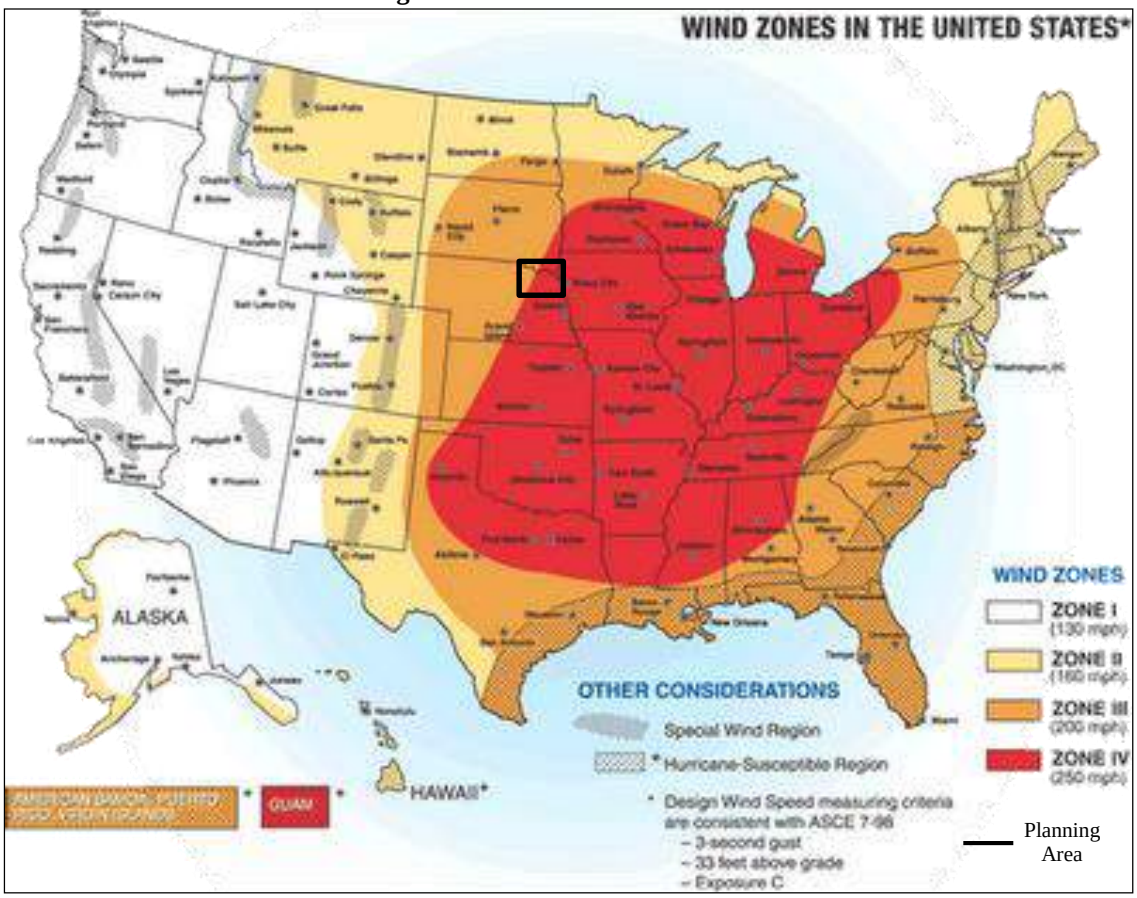
HIGH WINDS

HAZARD PROFILE

High winds typically accompany severe thunderstorms, severe winter storms, and other large low pressure systems, which can cause significant property and crop damage, downed power lines, loss of electricity, obstruction to traffic flow, and significant damage to trees and center-pivot irrigation systems. All building stock and above ground infrastructure, including critical facilities, are at risk of being damaged or affected by high winds. High wind speeds and flying debris can pose a significant threat to human life.

Figure 26 shows the wind zones in the United States. The wind zones are based on the maximum wind speeds that can occur from a tornado or hurricane event. The planning area is located in Zone IV which has maximum winds of 250 mph equivalent to an EF5 tornado.

Figure 26: Wind Zones in the U.S.



Source: FEMA

LOCATION

High winds commonly occur throughout the planning area. Rural, agricultural areas are at a greater risk of damages than the developed areas based on total crop damages versus property damages (see Historical Occurrences).

EXTENT

The 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. The NWS issues High Wind Advisories when there are sustained winds of 25 to 39 miles per hour and/or gusts to 57 mph. The Beaufort Wind Scale can be used

to classify wind strength. Table 94 outlines the scale, providing wind speed ranking, range of wind speeds per ranking, and a brief description of conditions for each ranking.

Table 94: Beaufort Wind Ranking

Beaufort Wind Force Ranking	Range of Wind Speeds	Conditions
0	<1 mph	Smoke rises vertically
1	1 – 3 mph	Direction shown by smoke but not wind vanes
2	4 – 7 mph	Wind felt on face; leaves rustle; wind vanes move
3	8 – 12 mph	Leaves and small twigs in constant motion
4	13 – 18 mph	Raises dust and loose paper; small branches move
5	19 – 24 mph	Small trees in leaf begin to move
6	25 – 31 mph	Large branches in motion; umbrellas used with difficulty
7	32 – 38 mph	Whole trees in motion; inconvenience felt when walking against the wind
8	39 – 46 mph	Breaks twigs off tree; generally impedes progress
9	47 – 54 mph	Slight structural damage; chimneypots and slates removed
10	55 – 63 mph	Trees uprooted; considerable structural damages; improperly or mobiles homes with no anchors turned over
11	64 – 72 mph	Widespread damages; very rarely experienced
12 – 17	72 - >200 mph	Hurricane; devastation

Source: NOAA Storm Prediction Center

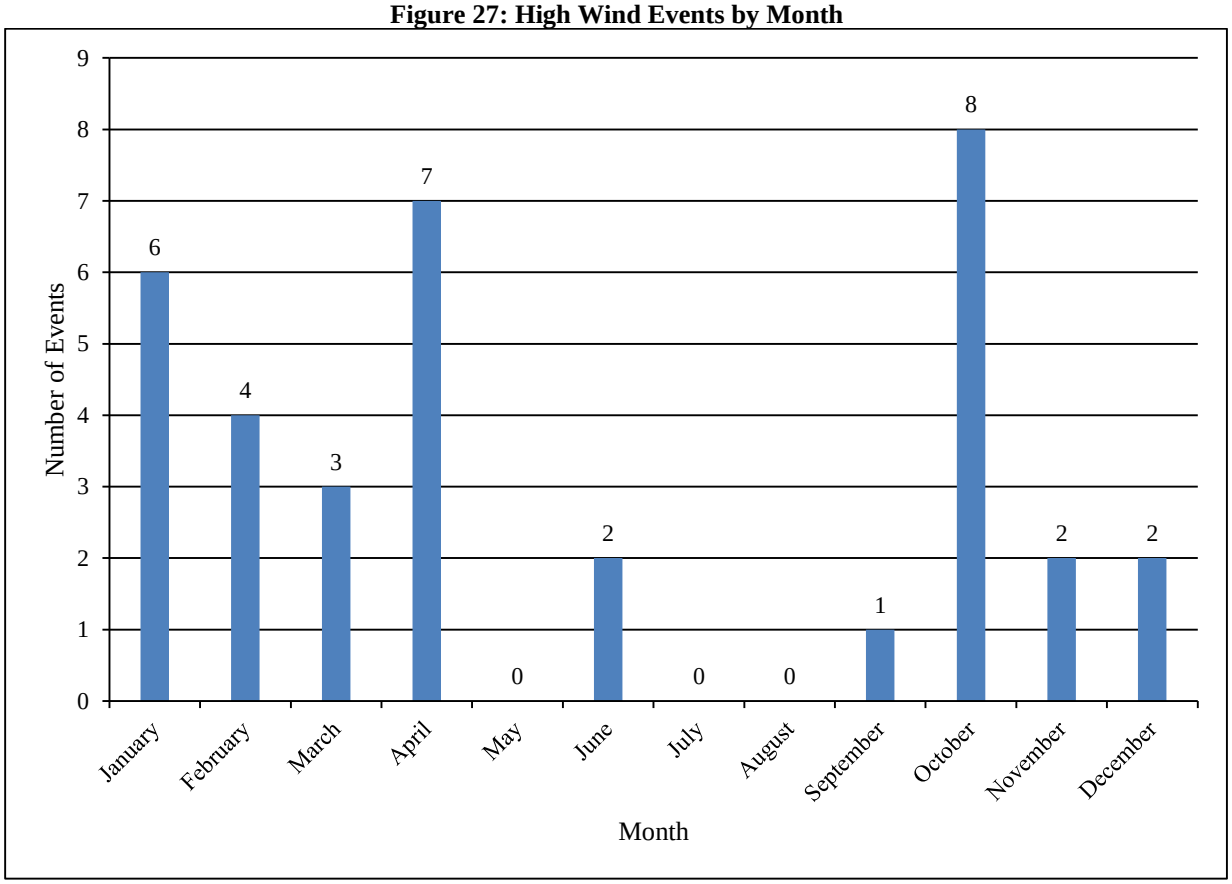
Using the NCDC reported events, the most common high wind event is a level 9. The reported high wind events had an average of 50 mph winds. It is likely that this level of event will occur a couple of times annually.

HISTORICAL OCCURRENCES

Due to the regional scale of high winds, the NCDC reports events as they occur in each county. While a single event can affect both counties at the same time, the NCDC reports them as separate events.

There were 35 high wind events that occurred between January 1996 and June 2015. As seen in Figure 27, most high wind events occur in the fall, winter, and early spring months. There were no reports of injury or death. Furthermore, these recorded events caused a total of $143,000 in property damages. Crop damages total $2,227,918 as a result of a high wind events in the planning area. These events from NCDC reported by county are listed in the county participant sections in *Section Seven: Participant Sections*.

Figure 27: High Wind Events by Month



Source: NCDC, 1996-2015

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon NCDC Storm Events Database since 1996 and number of historical occurrences. This does not include losses from displacement, functional downtime, or economic loss. It is estimated that high wind events can cause an average of $7,333 per year in property damage, and an average of $148,528 per year in crop damage for the planning area.

Table 95: High Wind Loss Estimate

Hazard Type	Number of Events[1]	Events Per Year	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
High Winds	35	1.8	$143,000	$7,333	$2,227,918	$148,528

1 Indicates the data is from NCDC (January 1996 to June 2015); 2 Indicates data is from USDA RMA (2000 to 2014)

PROBABILITY

Based on historical records and reported events, it is likely that high winds will occur within the planning area about twice annually. For the 19.5 years examined, there were 35 reported high wind events reported.

FUTURE DEVELOPMENT

There are some changes that communities can make to partially mitigate against strong winds. Building codes for new structures can be strengthened, requiring increased rebar in foundations, enhanced nailing patterns for wall sheathing, and the use of Simpson Strong Ties and Straps. Building codes can also be strengthened to require the use of anchors and tie-downs on mobile homes. Additionally, individuals can

choose to build to an optional Code Plus Standard, such as Fortified for Safer Living. Safe rooms can be installed in new structures as well as made to adapt to existing structures. In-ground safe rooms can be installed in existing structures for as little as $4,000. The installation of public safe rooms in areas around vulnerable populations, such as mobile home parks, can increase safety of residents in those areas.

REGIONAL VULNERABILITIES

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

Table 96: Regional High Wind Vulnerabilities

Sector	Vulnerability
People	-Vulnerable populations include those living in mobile homes, especially if they are not anchored properly -People outdoors during events
Economic	-Agricultural losses -Damages to businesses and prolonged power outages can cause significant impacts to the local economy
Built Environment	-All building stock are at risk to damages from high winds
Infrastructure	-Downed power lines and power outages -Downed trees blocking road access
Critical Facilities	-All critical facilities are at risk to damages from high winds

RISK ASSESSMENT SUMMARY

Table 97: Summary

Number of Past Events	35 or about 1.8 events/year
Vulnerable Locations	Entire planning area
Extent	Level=9 or an average 50 mph
Annual Probability	100%
Averaged Annual Losses	Property=$7,333 and crop=$148,528

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Bury overhead power lines
    - Many communities have started to bury power lines
- Continue to participate, or become a participant, in Tree City USA; establish a tree maintenance ordinance
    - Many communities participate or are interested in participating
- Establish a Tree Board to assist in the development of a tree management program
    - This is a requirement of Tree City USA
- Encourage the construction of safe rooms
- Enhance building codes to incorporate wind –resistant building techniques
    - State requires home to be built to withstand winds of 130 mph which is what most jurisdictions require
- Establish data recovery program and backup program for municipal employees

LANDSLIDES

HAZARD PROFILE

According to the USGS, a landslide can include but is not limited to rock falls, deep failure slopes, and shallow debris flows. According to the Landslide Hazards Program, landslides occur primarily because the force of gravity acts on steep slopes. However, landslides can occur due to the following factors:

- "erosion by rivers, glaciers, or ocean waves create over steepened slopes
- rock and soil slopes are weakened through saturation by snowmelt or heavy rains
- earthquakes create stresses that make weak slopes fail
- earthquakes of magnitude 4.0 and greater have been known to trigger landslides
- volcanic eruptions produce loose ash deposits, heavy rain, and debris flows
- excess weight from accumulation of rain or snow, stockpiling of rock or ore, from waste piles, or from man-made structures may stress weak slopes to failure and other structures"

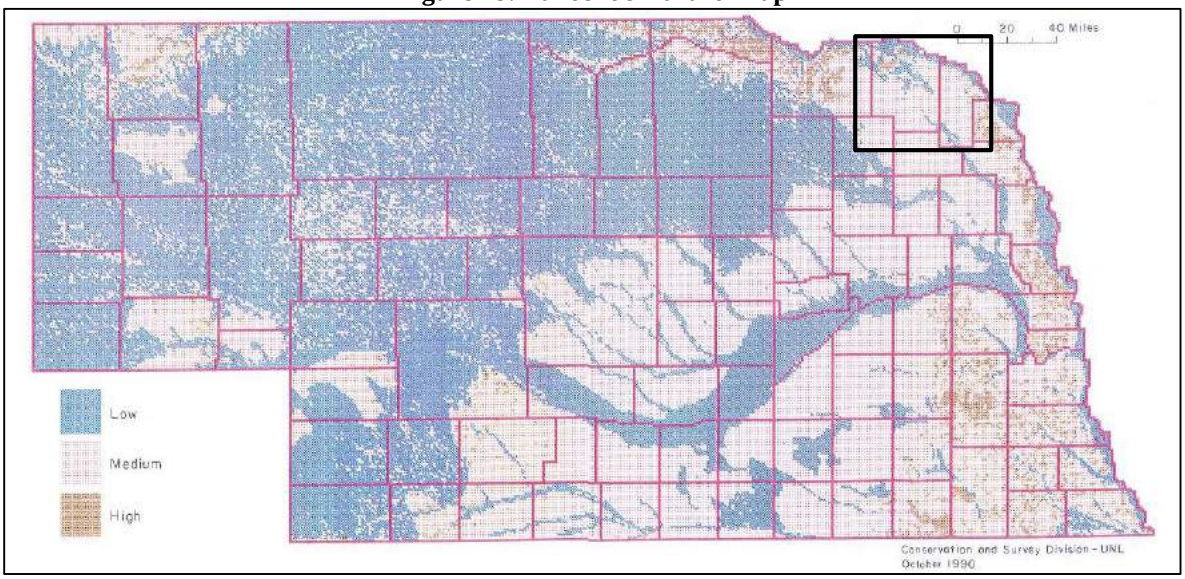
Landslides also occur when the ground becomes saturated after heavy rains or snow falls causing debris flow or mud flow. These flows can cause a wave of mud and debris that can knock down trees, damage houses, creating "dams" that cause localized flooding.

According to Professor Duane Eversoll from the University of Nebraska at Lincoln, "the three elements needed for a landslide to occur are geological formations susceptible to landslide, a slope and precipitation. According to the University of Nebraska, "Landslides have occurred throughout Nebraska; they are more common in the eastern and northeastern parts of the state." According to the book "Nebraska Landslides", glaciers covered the eastern portion of the state approximately 2 million years ago creating a terrain with slopes. Over time, these slopes have been covered with sediment deposits and other porous ground materials that are susceptible to saturation from precipitation which causes landslides.

LOCATION

Figure 28 displays the landslide hazard area map of Nebraska. There is generally a low to medium risk of landslides across most of the planning area with the greatest risk located in northwest Cedar County near the Missouri River valley.

Figure 28: Landslide Hazard Map



Source: Nebraska Geologic Survey Landslide Study

EXTENT

Landslides are classified based on the Varnes Classification of Slope Movements as indicated in Table 98. Based on the historic record, it is likely that any landslide that does occur will be minor and localized. All seven of the landslides in the Cedar County database were rotational slides. In Dixon County, six of the nine landslides were rotational slides, one complex, and two falls were recorded.

Table 98: Varnes Classification Scale

Type of Movement			Type of Material		
			Bed Rock	Engineering Soils	
				Predominately coarse	Predominately fine
Falls			Rock fall	Debris fall	Earth Fall
Topples			Rock topple	Debris topple	Earth topple
Slides	Rotational	few units	Rock slump	Debris slump	Earth slump
			Rock block slide	Debris block slide	Earth block slide
	Translational	many units	Rock slide	Debris slide	Earth slide
Lateral Spreads			Rock spread	Debris spread	Earth spread
Flows			Rock flow (deep creep)	Debris flow (slow creep)	Earth flow
Complex		Combination of two or more principal types			

Source: School of Natural Resources, University of Nebraska-Lincoln

HISTORICAL OCCURRENCE

The University of Nebraska-Lincoln School of Natural Resource's "Landslides in Nebraska" database reported 16 landslides across Cedar and Dixon counties. The database has not been updated or maintained in several years. However, one additional landslide was identified for Cedar County by the Emergency Manager in that county, which occurred in June 2014, bringing the total to 17 landslides across two counties. This one additional landslide occurred in northern Cedar County on 894 Road after a section of the road slid off due to heavy rains. It was reported that the total damages to repair the road were estimated at $65,000. The other reported landslides did not cause any damages in Cedar and Dixon counties. Table 99 documents the number of landslides in planning area, however, the timeframe for documentation is unclear.

Table 99: Known Number of Landslides in the Planning Area by County

County	Number of Landslides
Cedar	8*
Dixon	9

Source: UNL "Landslides in Nebraska"
**Includes one additional report of a landslide from the County EM*

Landslides are often highly localized events. While Table 99 identifies that both counties are vulnerable to landslide, communities participating in this plan were also asked to identify if landslides were a concern for their jurisdiction. Only Cedar County identified landslides as a concern due to the damages sustained along a road in 2014.

AVERAGE ANNUAL LOSSES

Since it is unknown when the database of landslides in Nebraska was started, the average annual losses as a result of landslides will not be calculated. In total, there have been 17 landslides across the two county planning area, and $65,000 in property loss occurred from one landslide in 2014, which damaged a road.

Table 100: Landslide Loss Estimation

Hazard Type	Number of Events	Total Property Loss	Average Annual Property Loss	Total Crop Loss	Annual Crop Loss
Landslide	17	$65,000	N/A	N/A	N/A

Source: UNL "Landslides in Nebraska" and the Cedar County EM

PROBABILITY

While 17 landslide events were documented to have occurred in the planning area, without a timeframe attached to this documentation, annual probability cannot be calculated. For the purpose of this plan, the annual probability for landslides will be stated as less than five percent.

FUTURE DEVELOPMENT

Although the physical cause of many landslides cannot be removed, geologic investigations, good engineering practices, and effective enforcement of land-use management regulations can reduce landslide hazards. The area in northwest Cedar County that is most vulnerable to landslides is rural in nature. Transportation routes and people that travel along them will be most vulnerable to a landslide event.

REGIONAL VULNERABILITIES

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

Table 101: Regional Landslide Vulnerabilities

Sector	Vulnerability
People	-People living along bluffs or potential landslide areas are at risk
Economic	-Localized impacts to businesses impacted by landslides
Built Environment	-Possible damage or loss of structures
Infrastructure	-Damaged roadways -Damaged power lines -Rural water infrastructure may be damaged
Critical Facilities	-The risk to critical facilities is low but rural water projects could be impacted

RISK ASSESSMENT SUMMARY

Table 102: Summary

Number of Past Events	17 landslides
Vulnerable Locations	Northwest Cedar County
Extent	Majority are localized rotational slides
Annual Probability	<5%
Averaged Annual Losses	N/A

PAST MITIGATION EFFORTS

There are some options available to mitigate the impacts of a landslide. However, due to the low chance of occurrence of landslides, none of the actions below are standard practice in the planning area.

- Monitor soils for signs of landslides
- Post signs along the roads near landslides, warning drivers of the potential
- Ensure that buildings and critical facilities are not located in areas prone to landslides through land use planning
- Education and outreach to the public about landslides and the potential impacts

LEVEE FAILURE

HAZARD PROFILE

According to FEMA on their website:

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

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

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

The USACE, who is responsible for federal levee oversight and inspection of levees, has three ratings for levee inspections.

Table 103: USACE Levee Rating Categories

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

Source: USACE

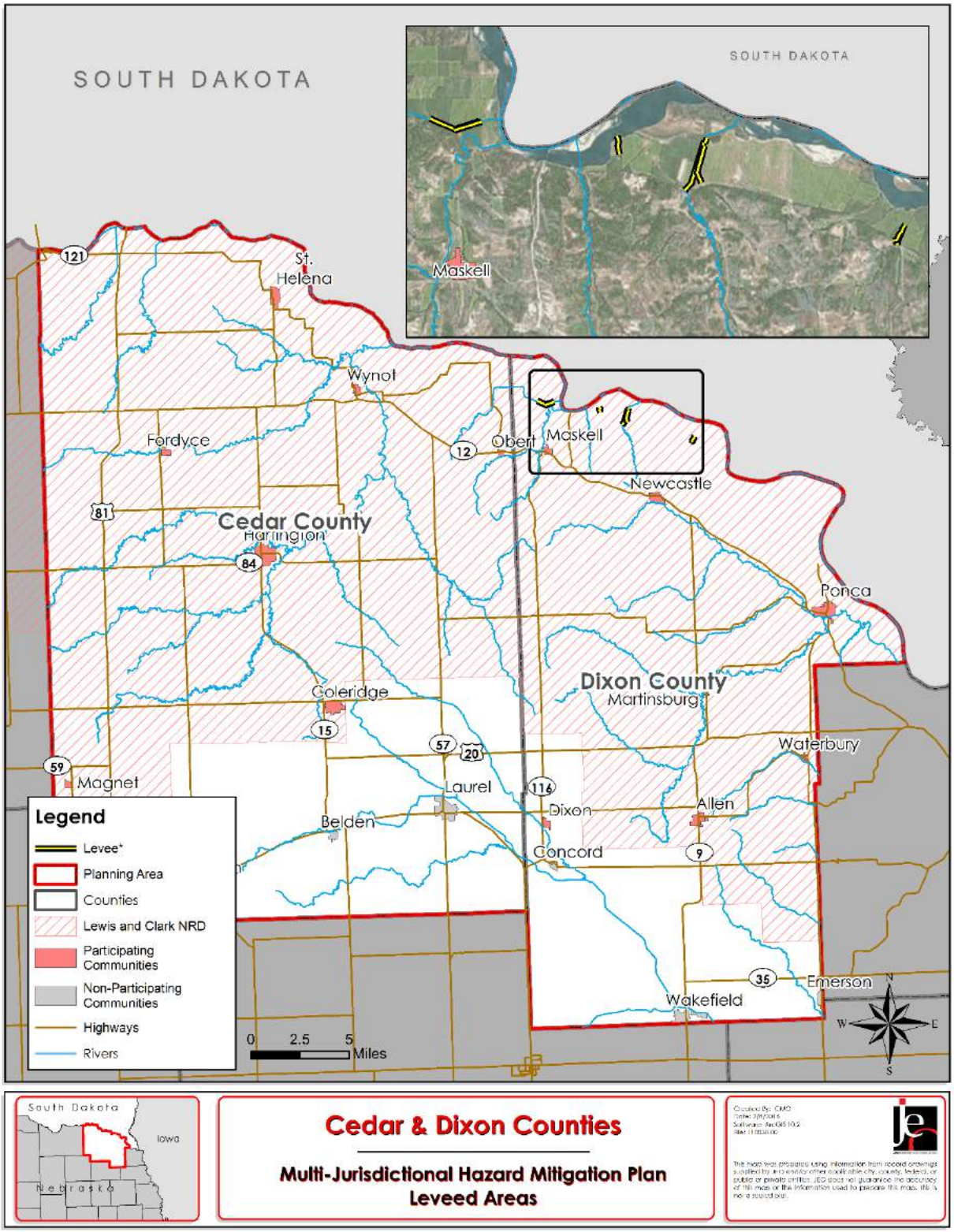
The USACE is also responsible for determining levee safety. The following are the five classifications for levee safety.

Table 104: Levee Safety Classes

Class	Urgency
I	Urgent and Compelling
II	Urgent
III	High Priority
IV	Priority
V	Normal

Source: USACE

Figure 29: Leveed Areas



LOCATION

Four agricultural levees are located in the Missouri River floodplain in northern Dixon County, but there are no federal levees located within the planning area as reported by the USACE National Levee Database. Unfortunately, there is no known source for all of the numerous municipal, agricultural, and other small levees in the state.

Of the four levees, none are FEMA certified or are shown to provide protection from a 1 percent annual chance flood as indicated on the available FIRM maps. All four structures were locally constructed to limit localized flooding. These structures are displayed in the previous figure.

EXTENT

The failure of a levee would likely lead to the inundation of agricultural fields.

HISTORICAL OCCURRENCES

There have been no reports of levee failure within the planning area.

AVERAGE ANNUAL DAMAGES

Since there have been no reports of levee failure in the planning area, average annual damages are not calculated.

PROBABILITY

Levee failure has a low probability of occurring in the future. With zero reported incidents in the past, it is unlikely that levee failure will occur. For the purpose of this plan, the probability of levee failure will be stated as one percent annually. The plan recognizes that while there have not been occurrences in the past, that is not necessarily indicative of future occurrences.

FUTURE DEVELOPMENT

Development in the areas near the levees would increase the vulnerability of this hazard.

REGIONAL VULNERABILITIES

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

Table 105: Regional Levee Vulnerabilities

Sector	Vulnerability
People	-Residents or visitors in the inundation area are at risk -Agricultural workers
Economic	-Crop loss
Built Environment	-Any structures in the inundation area may be damaged
Infrastructure	-County roads may be closed or damaged
Critical Facilities	-None

RISK ASSESSMENT SUMMARY

Table 106: Summary

Number of Past Events	0
Vulnerable Locations	Northwestern Dixon County
Extent	Inundation of agricultural fields
Annual Probability	1%
Averaged Annual Losses	N/A

PAST MITIGATION EFFORTS

There are some options available that can be done to mitigate the impacts of levee failure. However, due to the nature of these privately owned and maintained levees, none of the actions below are standard practice in the planning area.

- Evacuation Plan
- Land-use regulations preventing development in area protected by existing levees
- Education on the potential impacts of a levee failure

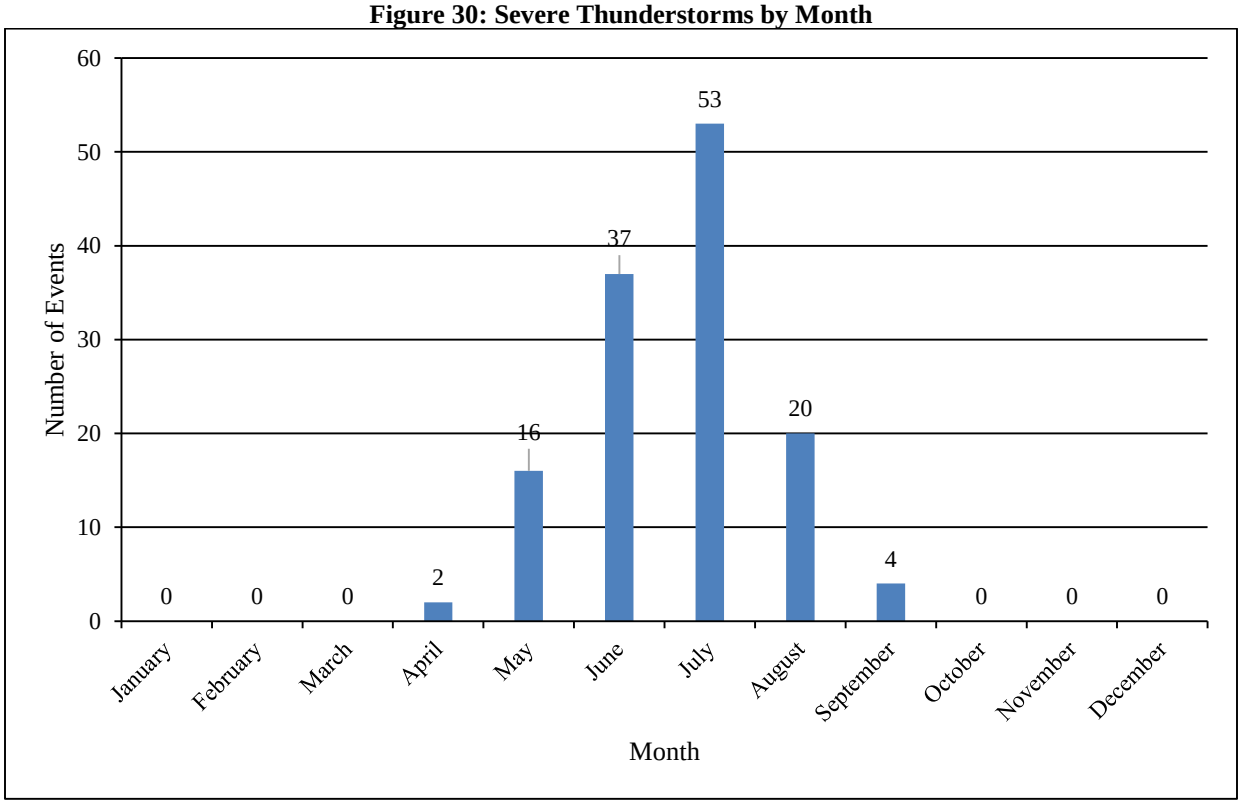
SEVERE THUNDERSTORMS

HAZARD PROFILE

Severe thunderstorms are common and unpredictable seasonal events throughout Nebraska, including the planning area. A thunderstorm is defined as a storm that contains lightning and thunder, which is caused by unstable atmospheric conditions. When cold upper air sinks and warm moist air rises, storm clouds or "thunderheads" develop, resulting in thunderstorms. This can occur singularly, in clusters, or in lines. The NWS defines a thunderstorm as severe if it contains hail that is one inch in diameter or capable of winds gusts of 58 mph or higher.

Severe thunderstorms in the planning area usually occur in the afternoon and evening during the spring and summer months (Figure 30). These often massive storms can include heavy rain, hail, lightning, high wind, and can produce tornados with little or no advanced warning. Furthermore, heavy rains can cause flooding, lightning can cause wildfires, and high winds can down trees, cause power outages, and destroy property with their shear force.

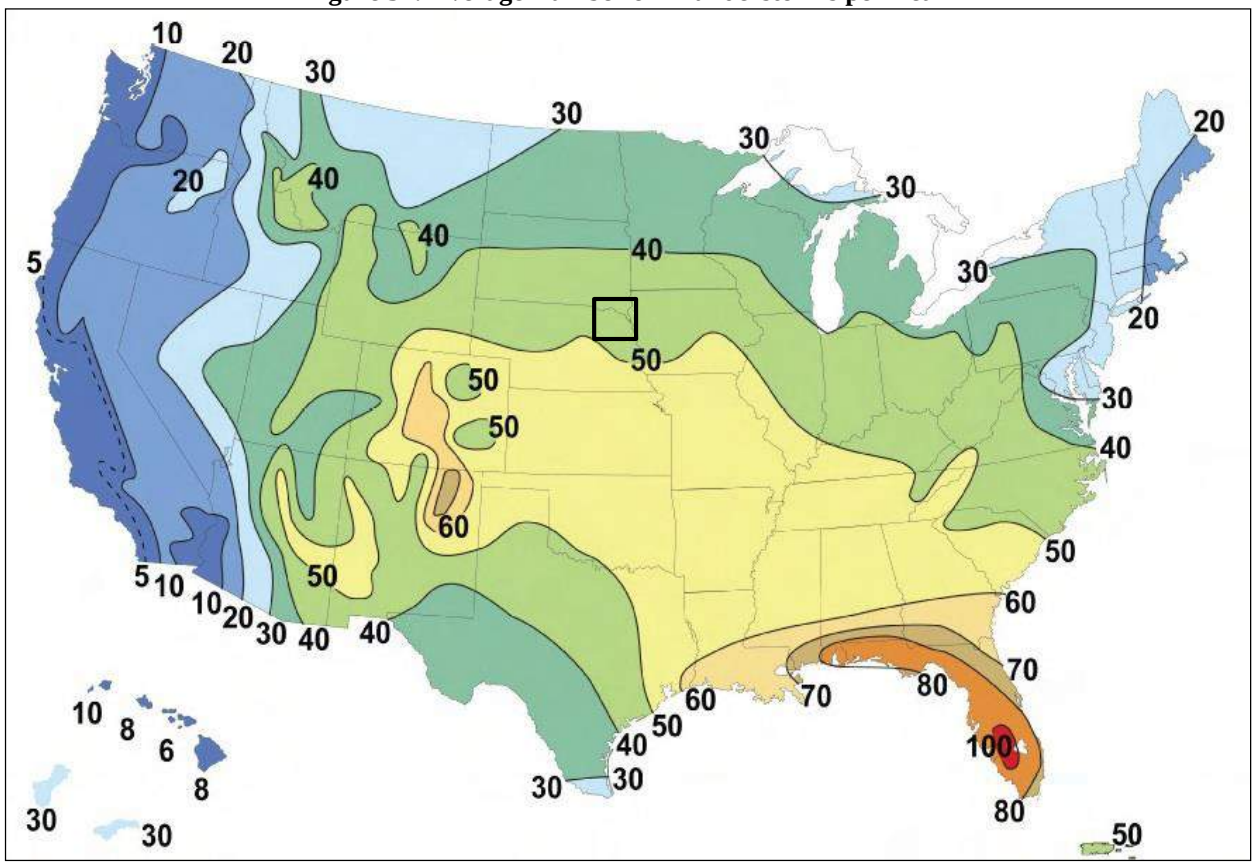
Figure 30: Severe Thunderstorms by Month



Source: NCDC, 1996-2015

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 the point of becoming severe, the potential for damages include crop losses from wind and hail, property losses due to building and automobile damages due to hail, wind, or flash flooding, and death or injury to humans and animals from lightning, drowning, or getting struck by falling or flying debris. Figure 31 displays the average number of days with thunderstorms across the country each year. The planning area experiences an average of over 40 thunderstorms over the course of one year.

Figure 31: Average Number of Thunderstorms per Year



Source: NWS

Thunderstorms can develop in less than 30 minutes, and can grow to an elevation of eight miles into the atmosphere. Lightning, by definition, is present in all thunderstorms and can be harmful to humans and animals, cause fires to buildings and agricultural lands, and cause 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, it is when lightning comes in contact with the ground that society is potentially impacted. Lightning generally occurs when warm air is mixed with colder air masses, resulting in atmospheric disturbances necessary for polarizing the atmosphere. Between 2006 and 2013, an average of 33 people were killed each year by lightning in the United States. In Nebraska, one fatality was attributed to lightning between 2004 and 2013.

LOCATION

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

EXTENT

The extent of a severe thunderstorm event may be large enough to impact the entire planning area (such as in the case of a squall line, derecho, or long-lived supercell) or just a few square miles, in the case of a single cell that marginally meets severe criteria. As noted earlier, the NWS defines a severe thunderstorm with having either: damaging winds at 58 mph or higher, and/or one inch hail or larger.

HISTORICAL OCCURRENCES

The NCDC reports events as they occur in each community. A single severe thunderstorm event can affect multiple communities and counties at a time; the NCDC 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 NCDC as several events. The NCDC reports a total of 132 thunderstorm (wind) and 4 lightning events in the planning area from January 1996 to June 2015. Severe thunderstorm events were responsible for $1,111,000 in property damages, and $3,545,120 in crop damages. The USDA RMA data does not specify severe thunderstorms as a cause of loss. However, excessive moisture or precipitation (rain) was used to indicate crop loss from heavy rain events which were likely associated with severe thunderstorms. Lightning events caused $110,000 in property damages and no crop damages. There were no deaths from these storms, but one injury occurred.

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon NCDC Storm Events Database since 1996 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, or injury. Severe thunderstorms and lightning cause an average of $62,615 per year in property damages.

Table 107: Severe Thunderstorms Loss Estimate

Hazard Type	Number of Events[1]	Events Per Year	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Severe Thunderstorms	132	6.8	$1,111,000	$56,974	$3,545,120	$236,341
Lightning	4	0.2	$110,000	$5,641	$0	$0
Total	**136**	**7.0**	**$1,221,000**	**$62,615**	**$3,545,120**	**$236,341**

1 Indicates the data is from NCDC (January 1996 to July 2015); 2 Indicates data is from USDA RMA (2000 to 2014)

PROBABILITY

Based on historical records and reported events, severe thunderstorms are likely to occur on an annual basis. The NCDC reported 132 severe thunderstorms between 1996 and 2015; this results in a 100 percent chance annually for thunderstorms.

FUTURE DEVELOPMENT

Future development projects should consider high wind hazards at the planning, engineering, and architectural design stage with the goal of reducing vulnerability. Additionally, hail-resistant roof materials should be considered to reduce the risk of hail damage in the future.

REGIONAL VULNERABILITIES

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

Table 108: Regional Severe Thunderstorm Vulnerabilities

Sector	Vulnerability
People	-The elderly are vulnerable as they are less mobile than other members of the community -Mobile home residents are at risk of injury and damage to their property if the mobile home is not anchored properly
Economic	-Closed businesses from damage or closed roads are likely to lose revenue and loss of income to workers

Sector	Vulnerability
Built Environment	-Buildings are at risk to hail damage -Downed trees and tree limbs
Infrastructure	-High winds and lightning can cause power outages and down power lines -Roads may wash out from heavy rains and become blocked from downed tree limbs
Critical Facilities	-Power outages are possible -Critical facilities may sustain damage from hail, lightning, and wind

RISK ASSESSMENT SUMMARY

Table 109: Summary

Number of Past Events	136 Severe Thunderstorm Wind and Lightning Events or 7 events/year
Vulnerable Locations	Entire planning area
Extent	Wind = 58 mph and/or Hail ≥ 1.00 inch
Annual Probability	100%
Averaged Annual Losses	Property = $62,615 and Crops = $236,341

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Bury overhead power lines
    - Many communities have started to bury power lines
- Continue to participate, or become a participant, in Tree City USA; establish a tree maintenance ordinance
    - Many communities participate or are interested in participating
- Establish a Tree Board to assist in the development of a tree management program
    - This is a requirement of Tree City USA
- Encourage the construction of safe rooms
    - Some jurisdictions would like to add safe rooms
- Establish community severe weather warning protocols
    - Most communities follow the National Weather Service protocols
- Incorporate text messaging into severe weather messaging programs
- Incorporate cable TV interruption warning systems
- Purchase and issue weather radios to critical facilities and vulnerable populations
    - Most communities have weather radios
- Establish mutual aid agreements with neighboring communities and privately owned businesses
    - Agreements exist between most communities
- Establish public education programs to increase awareness of the dangers posed by severe thunderstorms and ways the public can mitigate the potential impacts
    - Most county emergency managers have some education programs
- Establish data recovery program and backup program for municipal employees
- Install and maintain surge protection for critical facilities
- Use of hail resistant materials
    - Some jurisdictions have hail resistant roofing and hail guards on A/C units on critical facilities

SEVERE WINTER STORMS

HAZARD PROFILE

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

Extreme Cold

Along with snow and ice storm events, extreme cold can be dangerous to people and animals. What constitutes extreme cold varies from region to region but is generally accepted as being temperatures that are significantly lower than the average low temperature. For the planning area, the coldest months of the year are January, February, March, November and December. The average low temperatures for these months are all below freezing (average low for the five months 17.1°F). The average high temperatures for the months of January, February, and December are near 33.0°F. Record lows for the region range from -33°F in December, -38°F in January, -33°F in February, and -17°F in March.

Freezing Rain

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

Blizzards

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

LOCATION

The entire planning area is at risk of severe winter storms due to the regional nature of this type of storm.

EXTENT

The Sperry-Piltz Ice Accumulation Index (SPIA) was developed by the NWS to predict the accumulation of ice and resulting damages. The SPIA looks at total precipitation, wind, and temperatures to predict the intensity of ice storms. Figure 32 shows the SPIA index.

Figure 32: SPIA Index

The Sperry-Piltz Ice Accumulation Index, or "SPIA Index" – Copyright, February, 2009

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

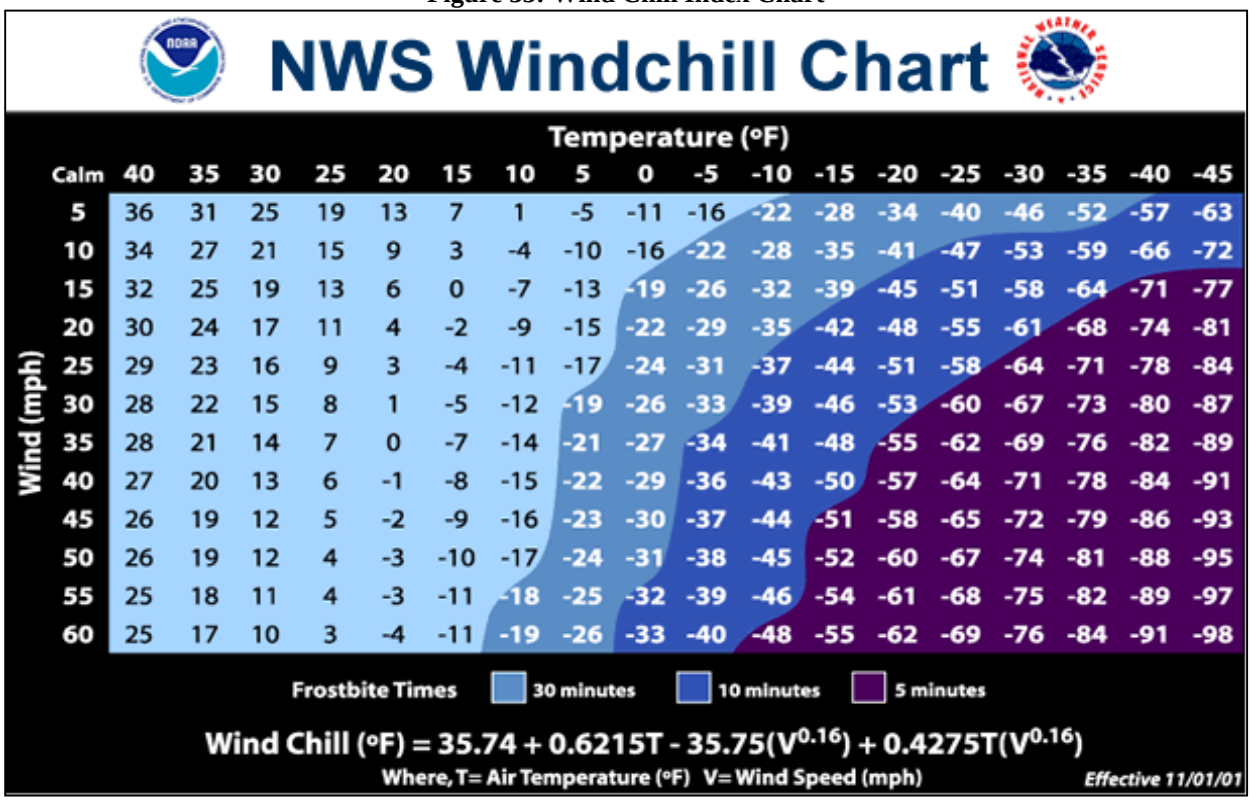
(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Source: http://www.spia-index.com/index.php

Reviews of historical severe winter storms across the planning area show that there are a range of events that can occur. Ice Storm Warnings are issued when accumulation of at least 0.25 inches is expected from a storm, which controlling for high winds, would tend to classify ice storms in Nebraska as SPIA Level 2 or higher. The January 2010 storm brought a quarter inch of ice, whereas the December 2007 storm had ice accumulations between a half inch and three quarters of an inch.

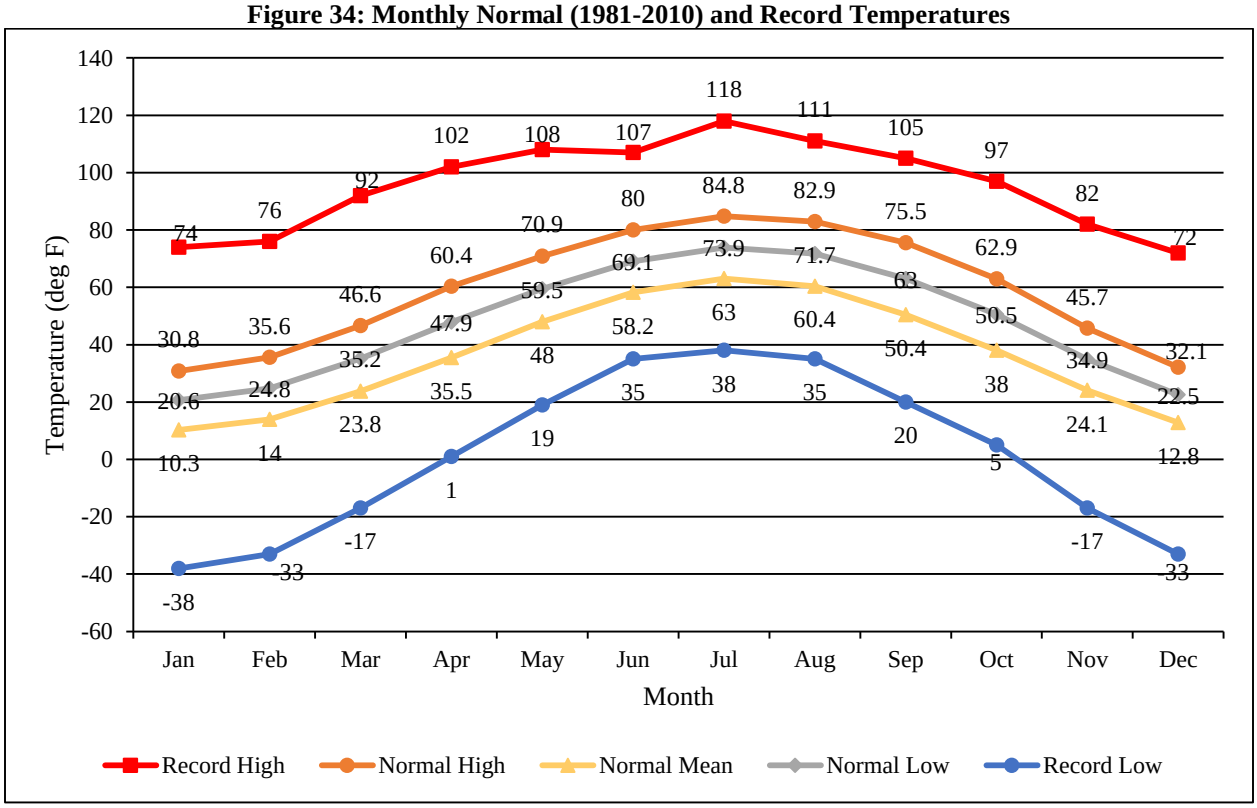
The Wind Chill Index was developed by the NWS to determine the decrease in air temperature felt by the body on exposed skin due to wind. The wind chill is always lower than the air temperature and can quicken the effects of hypothermia or frost bite as it gets lower. Figure 33 shows the wind chill index used by the NWS.

Figure 33: Wind Chill Index Chart



Source: NWS

Figure 34: Monthly Normal (1981-2010) and Record Temperatures

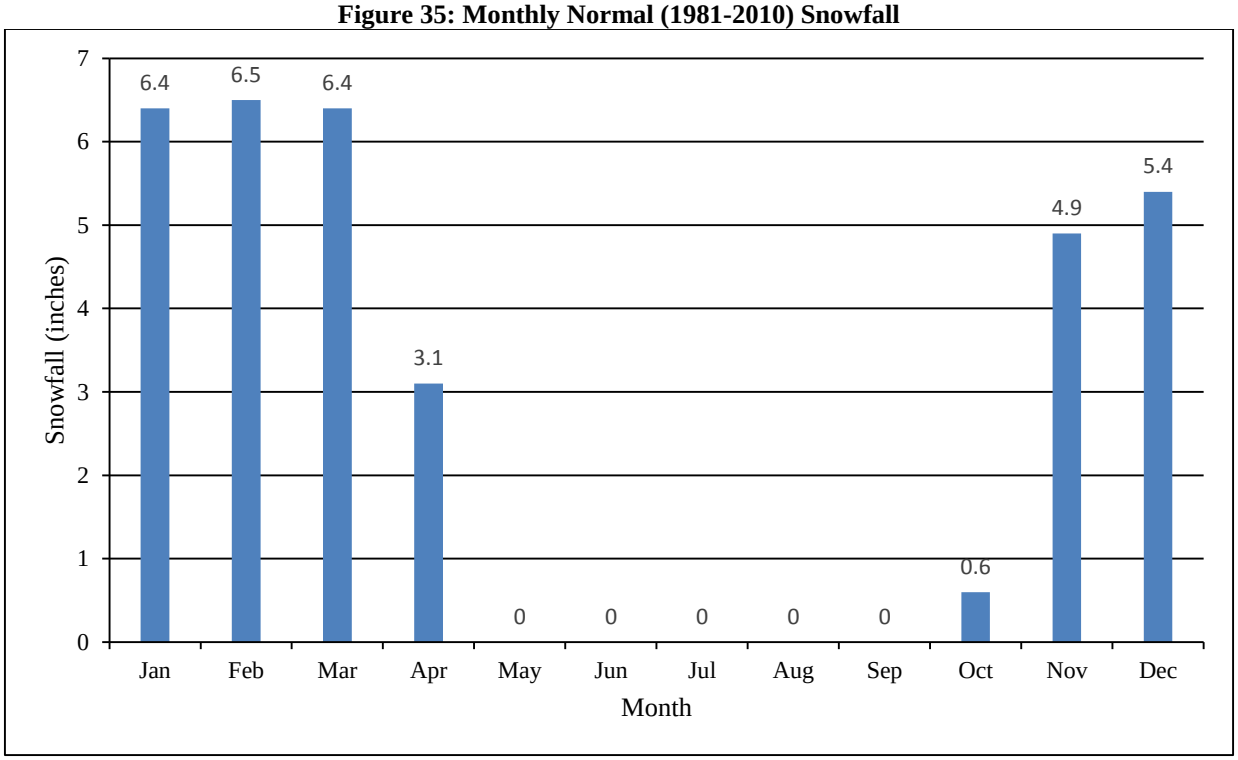


Source: Midwestern Regional Climate Center

The coldest months of the year are January, February, March, November, and December and normal lows for these months average around 17°F as shown in Figure 34.

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

Figure 35: Monthly Normal (1981-2010) Snowfall



Source: Midwestern Regional Climate Center

HISTORICAL OCCURRENCES

Due to the regional scale of severe winter storms, the NCDC reports events as they occur in each county. According to the NCDC, there were 131 severe winter storm events for the planning area from January 1996 to June 2015. These recorded events caused a total of $45,000 in property damages and zero deaths or injuries. USDA RMA data also reported $706,584 in crop damages between 2000 and 2014.

The NCDC recorded a total of 25 blizzard events, causing $45,000 in property damages; 14 heavy snow events with no reported property damages; 3 ice storm events with no reported property damages; 34 winter weather events with no reported property damages; and 55 winter storm events with no reported property damages.

Table 110: Severe Winter Storm Events by County

County	Number of Events
Cedar	62
Dixon	69

Source: NCDC Storm Events Database, 1996-2015

Additional details are provided in the following descriptions of some of the notable severe winter storm events in the planning area:

November 14-18, 1996 Ice Storm
An ice storm consisting of several periods of freezing rain caused tree damage and a few small power outages. Travel was disrupted and there were a few accidents.

November 10, 1998 Blizzard
Snow accumulating 3-6 inches combined with winds as strong as 60 mph to cause zero visibilities in snow. These conditions also caused blowing snow, drifting snow, and damage to trees and power lines with resultant power outages. Some roads were closed and people were stranded in vehicles. Businesses and schools were forced to close as the blizzard shut down the area. Damages were estimated at $25,000.

November 28, 2005 Blizzard
Snowfall of 3-5 inches combined with winds gusting over 50 mph created blizzard conditions. Visibilities were frequently reduced to near zero and travel was made difficult or impossible during the duration of the storm. Schools and businesses were forced to close. Minor damage was sustained to homes and vehicles by the strong winds. Damages were estimated at $10,000.

December 1, 2007 Ice Storm
Freezing rain accumulated between a half and three quarters of an inch of ice in much of the area. The icing downed tree limbs and caused scattered power outages.

December 24-27, 2009 Winter Storm/Blizzard
A prolonged winter storm/blizzard closed many roads and highways, and brought most traffic to a standstill for a few days. Snowfall from the storm began Christmas Eve morning and lasted well into the 26th, with substantial blowing and drifting snow and occasional periods of accumulating snow finally tapering off around midnight on the 27th. Northwest winds of 25-35 mph with gusts of 40 mph occurred for an extended period during the height of the storm, which reduced visibilities to below a quarter mile. Twenty stranded motorists had to be rescued by snowplows. Total snowfall from the storm was estimated at 13-18 inches with 17 inches measured near Hartington among the highest reported.

April 9-11, 2013 Winter Storm
An extended period of precipitation began with freezing rain and freezing drizzle producing light ice accumulations. It changed to sleet and then snow, with sleet and snow accumulations reaching over 7 inches in many areas. The winter precipitation made travel very difficult, resulting in schools and businesses being forced to close.

AVERAGE ANNUAL DAMAGES
The average damage per event estimate was determined based upon NCDC Storm Events Database since 1996 and includes aggregated calculations for each of the five types of winter weather provided in the database. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Severe winter storms have caused an average of $2,308 per year in property damage, and an average of $41,420 per year in crop damage for the planning area. It should be noted that the crop loss data from the USDA RMA only specifies cold wet weather, cold winter, freeze, and frost as the causes of loss during the winter events. These events were summed together into one group and placed with the winter weather row in the following table.

Table 111: Severe Winter Storm Loss Estimate

Hazard Type	Number of Events[1]	Average Number of Events Per Year[1]	Total Property Loss[1]	Average Annual Property Loss [1]	Total Crop Loss[2]	Average Annual Crop Loss [2]
Blizzard	25	1.3	$45,000	$2,308	N/A	N/A
Heavy Snow	14	0.7	$0	$0	N/A	N/A
Ice storm	3	0.2	$0	$0	N/A	N/A
Winter Weather	34	1.7	$0	$0	$621,302	$41,420
Winter Storm	55	2.8	$0	$0	N/A	N/A
Severe Winter Storms	**131**	**6.7**	**$45,000**	**$2,308**	**$621,302**	**$41,420**

1 Indicates the data is from NCDC (January 1996 to July 2015); 2 Indicates data is from USDA RMA (2000 to 2014)

PROBABILITY

Based on historical records, it is likely that severe winter storms will occur annually within the planning area.

FUTURE DEVELOPMENT

Future development would likely increase vulnerability to this hazard by increasing demand on utilities and increasing the exposure of more roadways and infrastructure.

REGIONAL VULNERABILITIES

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

Table 112: Regional Severe Winter Storm Vulnerabilities

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

RISK ASSESSMENT SUMMARY

Table 113: Summary

Number of Past Events	131 or about 7/year
Vulnerable Locations	Entire planning area
Extent	Ice < 0.50 inches; Snow = 4 to 8 inches; Winds = 40mph; Wind chill 20-40°F below zero
Annual Probability	100%
Averaged Annual Losses	Property = $2,308 and Crops = $41,420

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Incorporate text messaging into severe weather messaging programs
- Incorporate cable TV interruption warning systems
- Establish road closure policies and procedures necessary to protect the public
- Continue to participate, or become a participant, in Tree City USA; establish a tree maintenance ordinance
    - Many communities participated or would like to participate
- Establish a Tree Board to assist in the development of a tree management program
    - This is a requirement of Tree City USA
- Develop a database of "vulnerable populations"
- Establish public education programs to increase awareness of the dangers posed by severe winter storms and ways the public can mitigation the potential impacts
    - Most county emergency managers have some education programs
- Work with community groups serving "vulnerable populations" such as Meals on Wheels programs to help monitor vulnerable groups
- Retrofit buildings and infrastructure to withstand snow loads

TERRORISM

HAZARD PROFILE

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

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

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

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

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

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

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

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

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

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

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.

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

The Office of Infrastructure Protection leads the coordinated national program to reduce and mitigate risk within 18 national critical infrastructure and key resources (CIKR) sectors from acts of terrorism and natural disasters and to strengthen sectors' ability to respond and quickly recover from an attack or other emergency. This is done through the National Infrastructure Protection Plan (NIPP).

Under the NIPP, a Sector-Specific Agency (SSA) is the federal agency assigned to lead a collaborative process for infrastructure protection for each of the 18 sectors. The NIPP's comprehensive framework allows the Office of Infrastructure Protection to provide the cross-sector coordination and collaboration needed to set national priorities, goals, and requirements for effective allocation of resources. More importantly, the NIPP framework integrates a broad range of public and private CIKR protection activities into a single national program.

The SSAs provide guidance about the NIPP framework to state, tribal, territorial and local homeland security agencies and personnel. They coordinate NIPP implementation within the sector, which involves developing and sustaining partnerships and information-sharing processes, as well as assisting with contingency planning and incident management.

The Office of Infrastructure Protection has SSA responsibility for six of the 18 CIKR sectors. Those six are:

- Chemical
- Commercial Facilities
- Critical Manufacturing
- Dams
- Emergency Services
- Nuclear Reactors, Materials and Waste

SSA responsibility for the other 12 CIKR sectors is held by other Department of Homeland Security components and other federal agencies. Those 12 are:

- Agriculture and Food – Department of Agriculture; Food and Drug Administration
- Banking and Finance – Department of the Treasury
- Communications – Department of Homeland Security
- Defense Industrial Base – Department of Defense
- Energy – Department of Energy
- Government Facilities – Department of Homeland Security
- Information Technology – Department of Homeland Security
- National Monuments and Icons – Department of the Interior
- Postal and Shipping – Transportation Security Administration
- Healthcare and Public Health – Department of Health and Human Services
- Transportation Systems – Transportation Security Administration; U.S. Coast Guard

- Water – Environmental Protection Agency

The NIPP requires that each SSA prepare a Sector-Specific Plan, review it annually, and update it as appropriate.

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). NTAS replaced the Homeland Security Advisory System (HSAS) in 2011. The HSAS was the color coded system put in place after the September 11th attacks by Presidential Directive 5 and 8 in March of 2002.

NTAS is based on a system of analyzing threat levels and providing either an imminent threat alert or an elevated threat alert.

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 whether a threat alert of one kind or the other 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 are 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 then 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 that there is 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.

LOCATION

Terrorist activities could occur throughout the entire planning area. In rural areas, concerns are primarily related to agro-terrorism and tampering with water supplies. However, this hazard is of very minor concern for the planning area.

EXTENT

The extent of this hazard is unknown. Terrorist attacks can vary greatly in scale and magnitude. Although, the most likely extent for terrorism would be isolated to a single building.

HISTORICAL OCCURRENCES

The Global Terrorism Database, maintained by the University of Maryland and the National Consortium for the Study of Terrorism and Responses to Terrorism (START), was searched for previous terrorist incidents. This database contains information for over 140,000 terrorist attacks. According to this database, there have been no terrorist attacks in the planning area since 1970.

AVERAGE ANNUAL DAMAGES

Due to the lack of data and the very wide range of potential impacts, potential losses are not being calculated for this threat.

PROBABILITY

Given no historical record, the probability of this event occurring during any given year is less than one percent.

FUTURE DEVELOPMENT

Future development would likely increase the risk and vulnerability from terrorist incidents. Additional critical facilities, businesses, and residential areas would potentially be exposed. Communities should consider vehicular barriers around schools and critical facilities for added protection.

REGIONAL VULNERABILITIES

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

Table 114: Regional Terrorism Vulnerabilities

Sector	Vulnerability
People	-Police officers and first responders at risk of injury or death -People working in governmental buildings
Economic	-Damaged businesses can cause loss of revenue and loss of income for workers -Agricultural attacks could cause significant economic losses for the region
Built Environment	-Targeted buildings may sustain heavy damage
Infrastructure	-Water supply, power plants, utilities
Critical Facilities	-Police stations and government offices are at a higher risk

RISK ASSESSMENT SUMMARY

Table 115: Summary

Number of Past Events	None
Vulnerable Locations	Entire planning area
Extent	Isolated to a single building
Annual Probability	<1%
Averaged Annual Losses	N/A

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Training and exercises
- Education and outreach
- Vehicular barrier and other building protection measures
- General awareness raising programs such as "See Something, Say Something."

TORNADOS

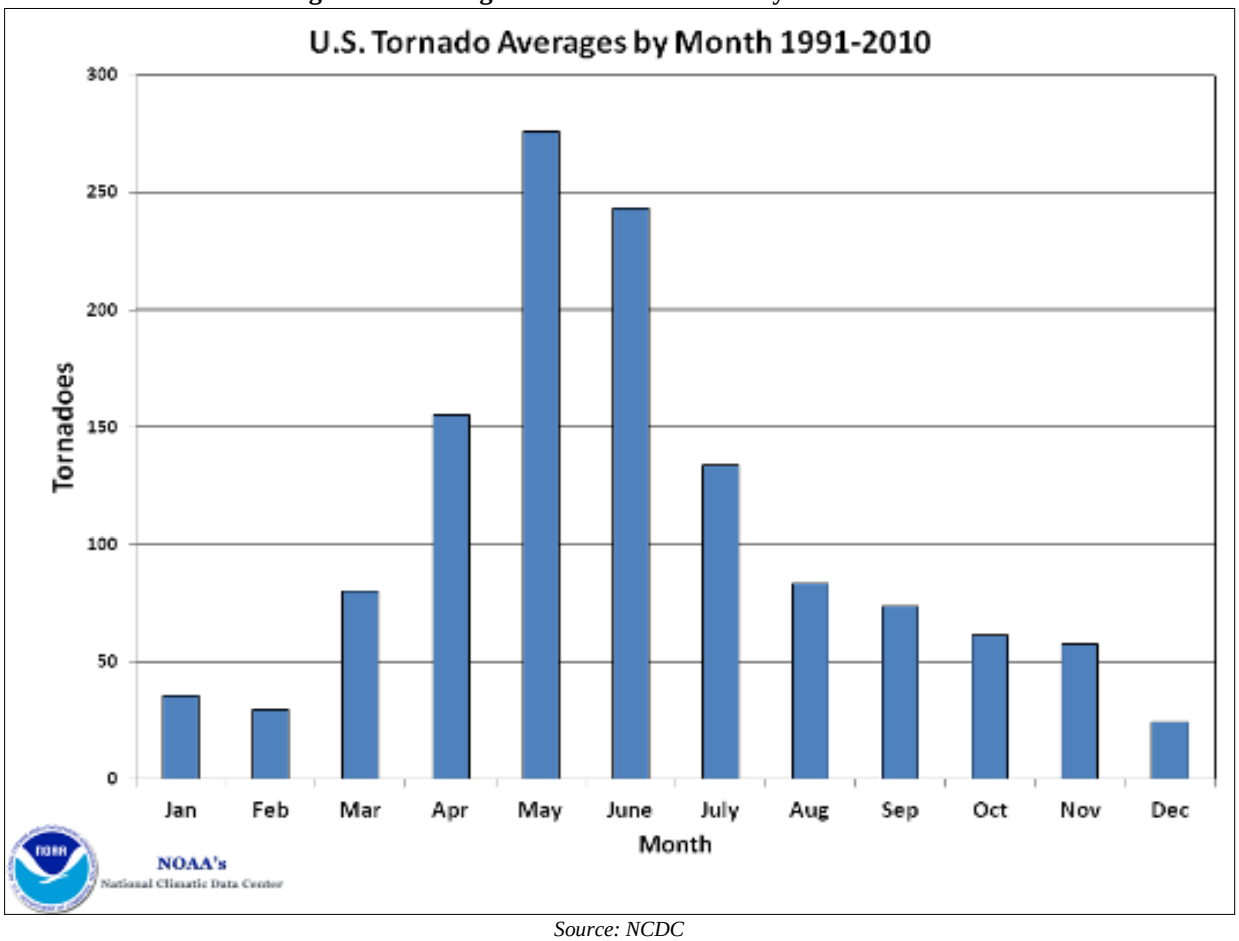
HAZARD PROFILE

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

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

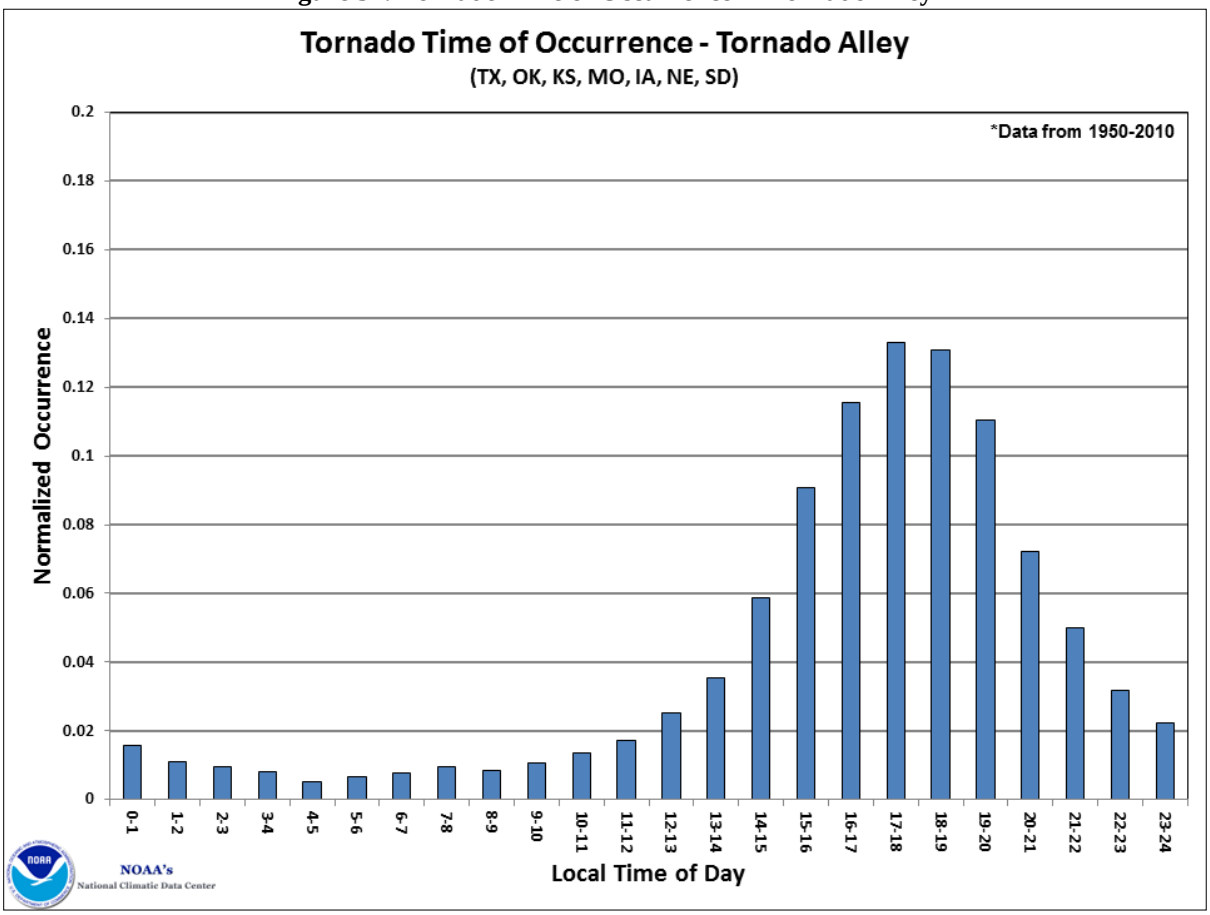
Once tornados are formed, they can be extremely violent and destructive. They have been recorded all over the world, but are most prevalent in the American Midwest and South, in an area known as "Tornado Alley." Approximately 1,000 tornados are reported annually in the contiguous United States (NOAA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

Figure 36: Average Number of Tornados by Month in U.S.



Source: NCDC

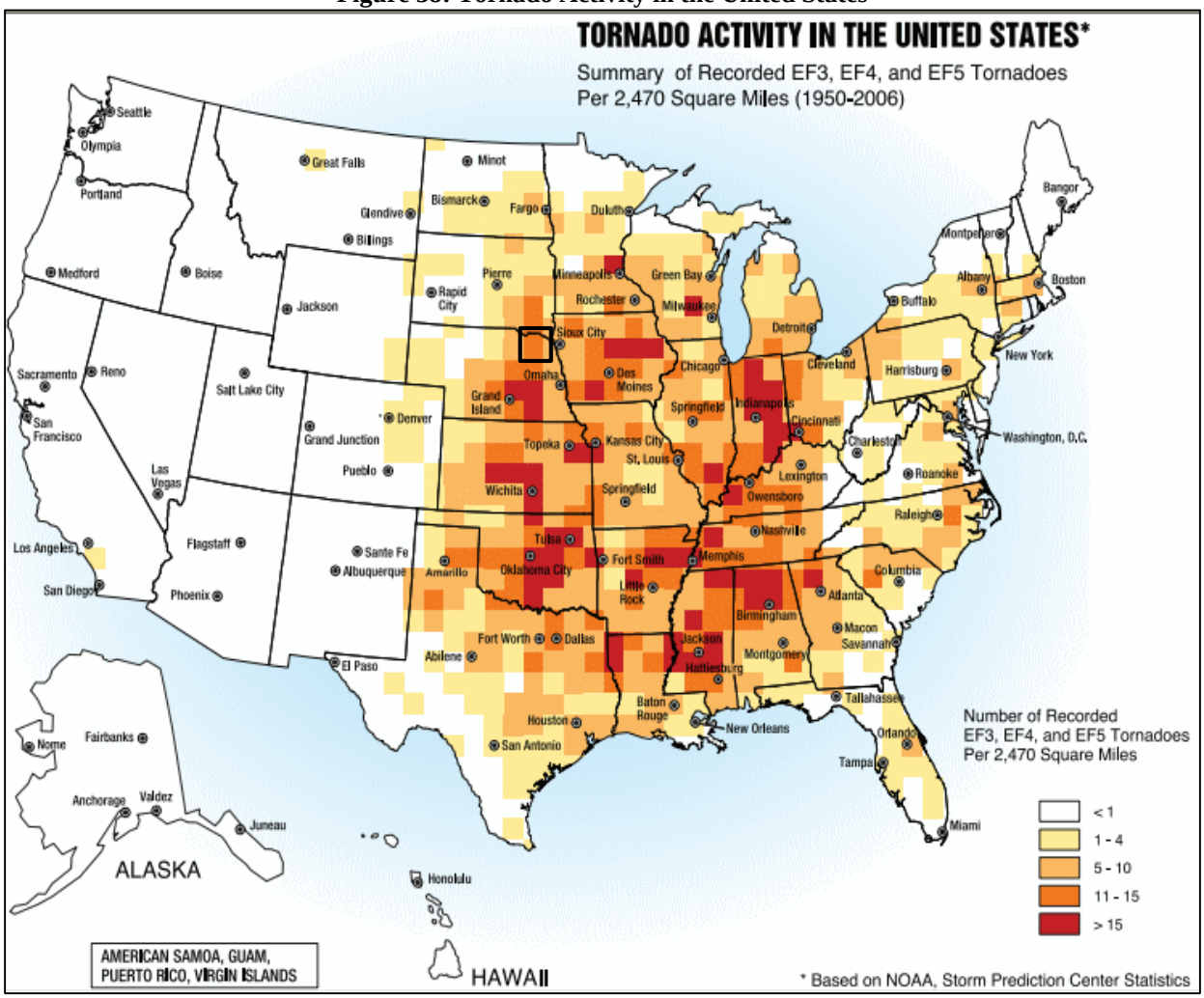
Figure 37: Tornado Time of Occurrence in Tornado Alley



Source: NCDC

Nebraska is ranked fifth in the nation for tornado frequency with an annual average of 45 tornados between 1953 and 2004 (NOAA 2011). The annual average number of tornados for Nebraska from 1991 to 2011 has increased slightly to 57 (NOAA 2013). The following figure shows the tornado activity in the United States as a summary of recorded F3, F4, and F5 tornados per 3,700 square miles form 1950-1998.

Figure 38: Tornado Activity in the United States

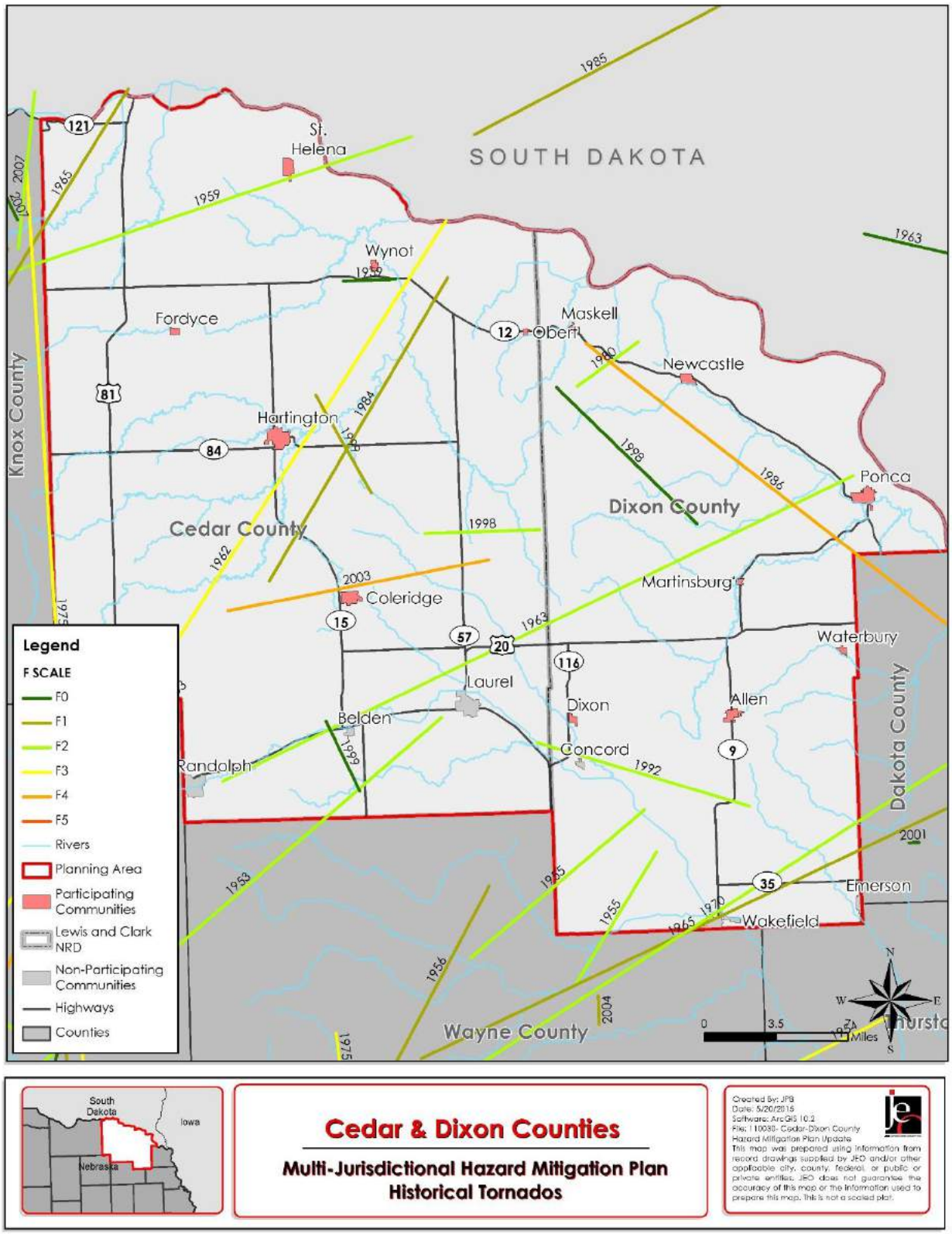


Source: NOAA Storm Prediction Center

LOCATION

Tornados can occur anywhere in the planning area. The following map shows the historical track locations across the region since 1950.

Figure 39: Historic Tornado Tracks (1950-2011)



Source: NOAA Storm Prediction Center (http://www.spc.noaa.gov/gis/svrgis/)

EXTENT

After a tornado passes through an area, an official rating category is determined. This official rating provides a common benchmark that allows comparisons to be made between different tornados. The magnitude of tornados is measured by the Enhanced Fujita Scale. The Enhanced Fujita Scale does not measure tornados by their size or width, but rather the amount of damage caused to human-built structures and trees. The Enhanced Fujita Scale replaced the Fujita Scale in 2007. The enhanced scale classifies EF0-EF5 damage as determined by engineers and meteorologists across 28 different types of damage indicators, including different types of building and tree damage. In order to establish a rating, engineers and meteorologists examine the damage, analyze the ground-swirl patterns, review damage imagery, collect media reports, and sometimes utilize photogrammetry and videogrammetry. Based on the most severe damage to any well-built frame house, or any comparable damage as determined by an engineer, an EF-Scale number is assigned to the tornado. Tables 116 and 117 summarize the Enhanced Fujita Scale and damage indicators. According to a recent report from the National Institute of Science and Technology on the Joplin Tornado, tornados rated EF3 or lower account for around 96 percent of all tornado damages.

Table 116: Enhanced Fujita Scale

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

Source: NOAA; FEMA

Table 117: Enhanced Fujita Scale Damage Indicator

Number	Damage Indicator
1	Small barns, farm outbuildings
2	One- or two-family residences
3	Single-wide mobile home (MHSW)
4	Double-wide mobile home
5	Apartment, condo, townhouse (3 stories or less)
6	Motel
7	Masonry apartment or motel
8	Small retail bldg. (fast food)
9	Small professional (doctor office, branch bank)
10	Strip mall
11	Large shopping mall

Number	Damage Indicator
12	Large, isolated ("big box") retail bldg.
13	Automobile showroom
14	Automotive service building
15	School - 1-story elementary (interior or exterior halls)
16	School - Junior or Senior high school
17	Low-rise (1-4 story) bldg.
18	Mid-rise (5-20 story) bldg.
19	High-rise (over 20 stories)
20	Institutional bldg. (hospital, govt. or university)
21	Metal building system
22	Service station canopy
23	Warehouse (tilt-up walls or heavy timber)
24	Transmission line tower
25	Free-standing tower
26	Free standing pole (light, flag, luminary)
27	Tree - hardwood
28	Tree - softwood

Source: NOAA; FEMA

Based on the historic record, it is most likely that tornados within the planning area will be of EF0 or EF1 strength. Of the 27 reported events, 15 were F/EF0, five were F/EF1 tornados, four were F/EF2, one was an EF3, and one was an EF4 tornado. (One tornado was not rated.)

HISTORICAL OCCURRENCES

NCDC cites 27 tornado events ranging from a magnitude of EF0 to EF3 (there was one F4) between 1996 and June 2015. These events were responsible for $6,670,000 in property damages. There was one death that occurred from the F4 on June 23, 2003 in Coleridge, and one injury also in Coleridge on May 28, 1998. The USDA RMA reported $987,904 in crop damages during a 15 year time period. Narratives of three notable events are provided below.

May 28, 1998 – 1 injury

Three farms were damaged by the F2 tornado. Eight to ten power poles were downed about 10 miles east-southeast of Hartington. The injury occurred about 9 miles east of Hartington southeast of the Highway 84/57 interchange.

June 23, 2003 – 1 death and $3.7 million in property damages

An eventual F4 tornado began its destructive path about six miles southwest of Coleridge. The tornado moved northeast and crossed the northern sections of the city, uprooting trees, downing power lines and destroying a couple of grain bins. A construction business in a garage was also destroyed. The tornado then continued northeast of town hitting a large hog farm. At this farm a 70 year old man was killed while in a storage shed when a tractor that was flipped by the winds crushed him. Many livestock were also killed by debris or flung through the air by the deadly winds. In one case, cattle were carried over a mile then left dead in a pile. The tornado then widened to around ¾ of a mile, reaching its maximum intensity. Numerous vehicles were tossed at this location and a complete farmstead was flattened. Trees were also stripped and debarked. The tornado remained around ¾ of a mile wide for a few more miles before turning slightly to the southeast and diminishing, but not before hitting two more farmsteads and moving one house off its

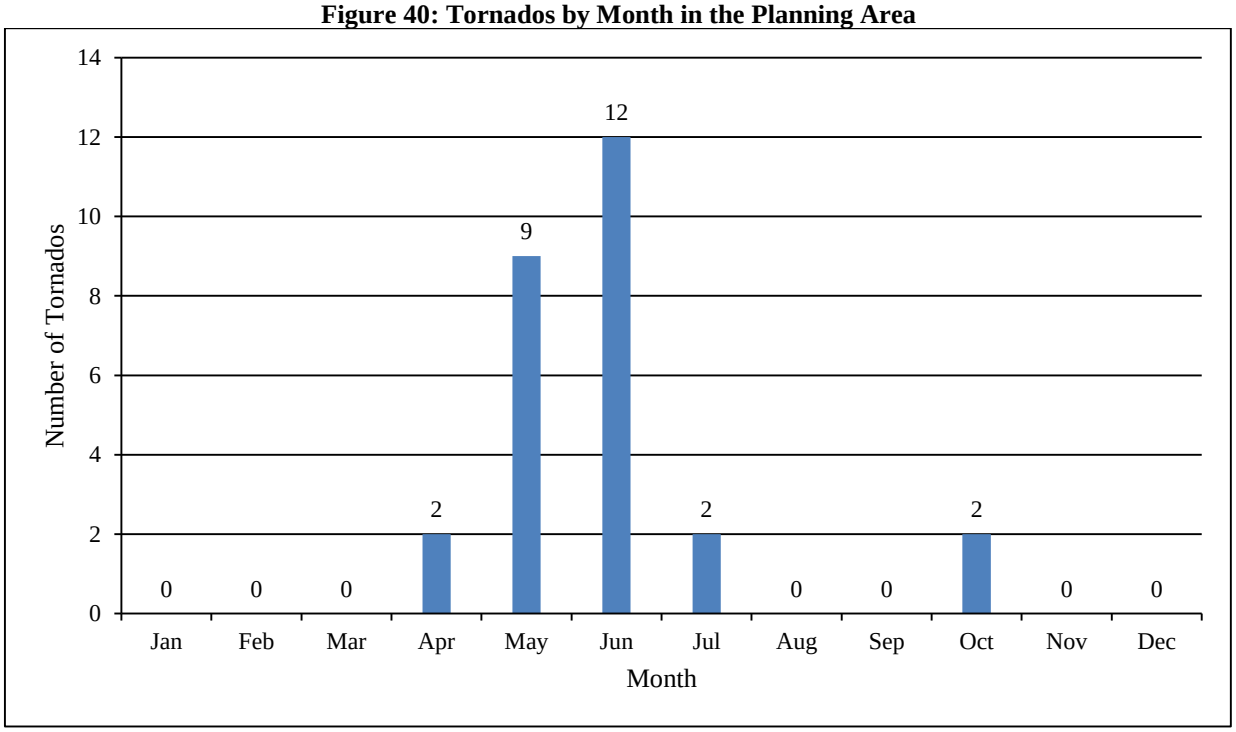
foundation. In total, 11 homes received substantial damage and between 100 and 200 utility poles were downed.

June 17, 2014 - $2 million in property damages

This tornado developed to the northwest of Coleridge and moved slowly east-southeast just to the north of the City of Coleridge. As the tornado neared 567th Avenue, it turned to the south along the eastern edge of the city producing some significant structural damage along the eastern side of Coleridge. The tornado continued south until nearing 875th Road where the forward speed further slowed, and the tornado changed to an eastern movement while becoming rain-wrapped. The eastern direction occurred for a half mile before the tornado moved almost due north along 568th Avenue while significantly weakening. The most significant damage, which was a strong EF3, occurred to the north of Coleridge along the 876Th Road. Here, two farm houses were destroyed down to the foundation and trees were snapped and debarked. The total path of the tornado, including all the turns, was 8.24 miles.

The following figure shows that the month of June has the highest number of tornados in the planning area.

Figure 40: Tornados by Month in the Planning Area



Source: NCDC, 1996-2015

AVERAGE ANNUAL DAMAGES

The average damage per event estimate was determined based upon NCDC Storm Events Database since 1996 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Tornados cause an average of $342,051 per year in property damage, and $65,860 in crop damages.

Table 118: Tornado Loss Estimate

Hazard Type	Number of Events[1]	Average Number of Events Per Year	Total Property Loss[1]	Average Annual Property Loss [1]	Total Crop Loss[2]	Average Annual Crop Loss [2]
Tornados	27	1.4	$6,670,000	$342,051	$987,904	$65,860

1 Indicates the data is from NCDC (January 1996 to July 2015); 2 Indicates data is from USDA RMA (2000 to 2014)

PROBABILITY

Given the 27 events over the course of 19.5 years, there is a 100 percent probability that a tornado event will occur in the planning area in any given year.

FUTURE DEVELOPMENT

Communities have options to partially mitigate the impacts resulting from tornados. Building codes for new structures can be strengthened, requiring increased rebar in foundations, enhanced nailing patterns for wall sheathing, and the use of Simpson Strong Ties and Straps. Building codes can also be strengthened to require the use of anchors and tie-downs of mobile homes. Additionally, individuals can choose to build to an optional Code Plus Standard, such as Fortified for Safer Living. Safe rooms can be installed in new structures as well as made to adapt to existing structures. In-ground safe rooms can be installed in existing structures for as little as $4,000. The installation of public safe rooms in areas around vulnerable populations, such as mobile home parks, can increase safety of residents in those areas.

Considerations for future development should include developing tornado safe rooms in or near mobile home parks. The 2003 Tornado Shelters Act authorizes communities to use Community Development Block Grant (CDBG) funds for construction of tornado-safe shelters in manufactured home parks with 20 or more housing units consisting predominately of low- and moderate-income residents.

REGIONAL VULNERABILITIES

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

Table 119: Regional Tornado Vulnerabilities

Sector	Vulnerability
People	-Citizens living in mobile homes are at risk to death or injury -Citizens without access to shelter below ground or in safe room -Elderly with decreased mobility or poor hearing may be higher risk -Lack of multiple ways of receiving weather warnings, especially at night
Economic	-Significant economic losses possible, especially with EF3 tornados or greater
Built Environment	-All building stock are at risk of significant damages
Infrastructure	-All above ground infrastructure at risk to damages -Impassable roads due to debris blocking roadways
Critical Facilities	-All critical facilities at risk to significant damages and power outages

RISK ASSESSMENT SUMMARY

Table 120: Summary

Number of Past Events	27 tornados or 1.4/year
Vulnerable Locations	Entire planning area
Extent	EF0-EF1
Annual Probability	100%
Averaged Annual Losses	Property = $342,051 and Crops = $65,860

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- Bury power and service lines
    - Many have started to bury power lines
- Continue to participate, or become a participant, in Tree City USA; establish a tree maintenance ordinance
    - Many communities participate or would like to participate
- Establish a Tree Board to assist in the development of a tree management program
    - This is a requirement of Tree City USA
- Encourage the construction of safe rooms
    - Some jurisdictions would like to build a safe room
- Ensure outdoor warning sirens are functional and located adequately to warn the public of potential tornadic events
    - All communities have warning sirens
- Incorporate text messaging into severe weather messaging programs
- Incorporate cable TV interruption warning systems
- Establish mutual aid agreements with neighboring communities and privately owned businesses
    - All communities have mutual aid agreements
- Establish public education programs to increase awareness of the dangers posed by severe tornados and strong winds, and ways the public can mitigate potential impacts.
    - Most county emergency managers have some education programs
- Enhance building codes to incorporate wind –resistant building techniques
    - State requires home to be built to withstand winds of 130 mph, which is what most jurisdictions require
- Establish data recovery program and backup program for municipal employees

URBAN FIRE

HAZARD PROFILE

Urban fires are classified as "uncontrolled burning in a residence or building from natural, human or technical causes". These fires have a potential to spread to adjoining structures. Local city and county fire departments are tasked with the response and control of urban fires.

According to the United States Fire Administration, fire risk "varies from region to region in the United States". This often is a result of climate, poverty, education, demographics, and other causal factors. Often times, all that is needed to cause an uncontrolled urban fire is a heat source to spark a fire, flammable materials that act as a fuel source, and oxygen. Within the State of Nebraska, and the planning area specifically, urban fires can occur throughout the region, to any fire prone structure.

LOCATION

Urban fires are most likely to occur in developed, incorporated areas. The probability of fire occurrence has a direct correlation to the density and age of the structure. Older wood-built structures are at a greater risk of fire.

EXTENT

Urban fire has a history of occurring throughout the planning area. While urban fires are often localized events typically contained to an individual structure, it is possible for widespread outbreaks, which could involve multiple structures in close proximity to one another.

HISTORICAL OCCURRENCES

Table 121 shows the number of fires that occurred between 2007 and 2012 in the planning area. The information for the table comes from the Nebraska State Fire Marshal's Office. The database being used is a voluntary reporting system so not all incidents will be reported. This is the best data available for urban fires for the planning area.

Table 121: Urban Fires by Fire Department

Fire Department	Number of Urban Fire Incidents						
	2007	2008	2009	2010	2011	2012	Total
Cedar County							
Belden Rural Fire Dept.	4	5	7	6	0	1	23
Coleridge Vol Fire Dept.	12	4	12	10	0	0	38
Fordyce Vol Fire Dept.	-	-	0	-	0	0	0
Hartington City & Rural Fire Dept.	24	22	22	28	23	25	144
Laurel Vol Fire Dept.	9	19	2	-	11	0	41
Magnet Vol Fire Dept.	-	-	0	-	0	0	0
Randolph Vol Fire Dept.	17	13	13	31	20	22	116
Wynot Vol Fire Dept.	12	-	0	-	0	0	12
Dixon County							
Allen & Waterbury Rural Dist.	3	8	0	-	0	0	11
Concord Vol Fire Dept.	8	3	1	3	5	5	25
Dixon Vol Fire Dept.	20	-	19	-	0	0	39
Martinsburg Vol Fire Dept.	1	1	0	-	0	0	2
Newcastle Vol Fire Dept.	12	15	0	-	0	0	27
Ponca Vol Fire Dept.	30	17	23	17	10	33	130
Wakefield Vol Fire Dept.	4	17	8	1	1	3	34
Total	**156**	**124**	**107**	**96**	**70**	**89**	**642**

Source: Nebraska State Fire Marshal's Office, 2007-2012

AVERAGE ANNUAL DAMAGES

Based on the data from the Nebraska State Fire Marshal, there are approximately 107 fires annually across the planning area. Due to lack of data, average annual damages are not being calculated for this threat.

PROBABILITY

There is a 100 percent probability that urban fires will occur within the planning area in the future, particularly in more urban areas.

FUTURE DEVELOPMENT

There are many strategies that can be undertaken to protect both existing and future assets. Any future development that occurs in the region with respect to residential and non-residential structures has the potential for fire damage or destruction. The use of building codes and Fire Wise building practices will reduce some of the damages that could occur, and reduce the risk that neighboring structures could catch fire as easily.

REGIONAL VULNERABILITIES

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

Table 122: Regional Urban Fire Vulnerabilities

Sector	Vulnerability
People	-Vulnerable populations include adults older than 65 and children under 4 are at a higher risk of fire death
Economic	-If several businesses are damaged in a fire, economic losses could occur
Built Environment	-All building stock are at risk, but particularly those without smoke alarms or fire sprinkler system
Infrastructure	-Minimal impacts
Critical Facilities	-All critical facilities at risk

RISK ASSESSMENT SUMMARY

Table 123: Summary

Number of Past Events	642 during 2007-2012
Vulnerable Locations	Entire planning area, especially developed areas
Extent	Single structure to multiple structures
Annual Probability	100%
Average Annual Losses	N/A

PAST MITIGATION EFFORTS

The following list provides an account of efforts taken to reduce regional vulnerabilities.

- New municipal wells
- Civil service improvements (New fire trucks)
- Firefighter training
    - All fire departments have training that they must complete

INTRODUCTION

The primary focus of the mitigation strategy is to establish goals and objectives, and identify action items to reduce the effects of hazards on existing infrastructure and property in a cost effective and technically feasible manner. The development of goals and objectives took place during the Regional Planning Team meetings.

Meeting participants reviewed the goals from the 2010 HMP, and discussed recommended additions and modifications. The intent of each goal and set of objectives is to develop strategies to account for risks associated with hazards, and identify ways to reduce or eliminate those risks. Each goal and set of objectives is followed by 'mitigation alternatives,' or actions.

A preliminary list of goals and objectives was provided to the Regional Planning Team and participants at the Round 1 public meetings. Each participant was asked to review all of the goals and objectives, and comment on possible improvements or suggest how to make them meet the needs of their jurisdiction. Each participating jurisdiction decided to utilize the same goals and objectives.

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

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

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

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

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

SUMMARY OF CHANGES

The development of the mitigation strategy for this plan update includes the addition of several mitigation actions, revisions to the mitigation alternative selectin process, and the incorporation of mitigation actions for the additional hazards addressed in the update.

GOALS AND OBJECTIVES

Below is the final list of goals and objectives as determined by the participants and Regional Planning Team. These goals and objectives provide specific direction to guide participants in reducing future hazard related losses. The goals and objectives were numbered to assist in the development and organization of mitigation alternatives or 'action items', as discussed in *Section Seven: Participant Sections*.

Goal 1: Protect the Health and Safety of Residents

***Objective 1.1:** Reduce or prevent damage to property or prevent loss of life or serious injury (overall intent of the plan).*

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 community to mitigate for 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 most likely to affect them, potential impacts of the hazards, where they occur, and what they can do to be better prepared.*

Goal 4: Improve Emergency Management Capabilities

Objective 4.1: *Develop or improve community and/or County Emergency Response Plan(s) 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.*

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.*

Goal 6: Enhance Overall Resilience and Promote Sustainability

Objective 6.1: *Incorporate hazard mitigation and adaptation into updating other local planning endeavors (e.g. comprehensive plans, zoning ordinance, subdivision regulation, etc.)*

MITIGATION ALTERNATIVES (ACTION ITEMS)

After the establishment of the goals and objectives, mitigation alternatives were prioritized. The alternatives considered included: the mitigation actions in the previous plan, additional mitigation actions discussed during the planning process, and recommendations from JEO for additional mitigation actions. In addition, JEO provided each participant a preliminary list of mitigation alternatives to be used as a starting point. The prioritized list of alternatives helped participants determine which actions will best assist their respective jurisdiction in alleviating damages in the event of a disaster. The listed priority does not indicate which actions will be implemented first, but will serve as a guide in determining the order at which each action should be implemented.

These projects are the core of a hazard mitigation plan. The group was instructed that each alternative must be directly related to the goals and objectives. Alternatives must be specific activities that are concise and can be implemented individually.

Mitigation alternatives were evaluated based on referencing the community's risk assessment and capability assessment. Communities were encouraged to choose mitigation actions that were realistic and relevant to the concerns identified.

A final list of alternatives was established including: information on the associated hazard mitigated, 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 JEO.

It is important to note that not all of the mitigation actions identified by a community may ultimately be included or 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.

PARTICIPANT MITIGATION ALTERNATIVES

In *Section Seven: Participant Sections,* mitigation alternatives that are identified by each jurisdiction are listed and include the following information:

- Description – general summary of the action item
- Analysis – brief summary of what the action item will accomplish
- Goal/Objective – which goal and objective the action item falls under
- Hazard(s) Addressed – which hazard the mitigation action aims to address
- Potential funding – a list of any potential funding mechanism used 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 smaller communities. Establishment of a cost-benefit analysis is out of 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, ongoing and new mitigation alternatives for each participating jurisdiction can be found in *Section Seven: Participant Sections.*

MITIGATION ALTERNATIVE PROJECT MATRIX

During public meetings, each participant was asked to review mitigation projects listed in the 2010 HMP and also review a list of potential mitigation alternatives which would lead to action items to reduce the effects of hazards. Projects selected varied from community to community depending upon the significance of each hazard present. The information listed in Tables 124 and 125 is a compilation of the mitigation alternatives identified by jurisdiction and organized by the goal and objective to be met.

Table 124: Mitigation Alternatives Selected by Each Jurisdiction Part I

Mitigation Alternatives		Cedar County	Coleridge	Fordyce	Hartington	Magnet	Obert	St. Helena	Wynot	Hartington-Newcastle Schools	LCC Schools	Randolph Schools	Wynot Schools
Goal 1													
Objective 1.1	**Backup Generators**	X	X	X	X	X	X	X	X	X	X	X	X
	Safe Rooms/Storm Shelters	X	X		X			X		X	X	X	X
	Stabilize/Anchor Fertilizer, Fuel, and Propane Tanks	X					X	X					
	Storm Shelter Identification	X	X										
	New Municipal Well				X								
	Power, Service, Electrical, and Water Distribution Lines							X					X
	Short Term Residency Shelters												
Goal 2													
Objective 2.1	**Stormwater System and Drainage Improvements**	X	X					X	X				
	Stream Bank Stabilization/ Grade Control Structures/ Channel Improvements	X											
	Transportation Drainage Improvements	X											
	Surge Protectors	X											
	Channel and Bridge Improvements	X											
	Drainage Ditches	X											
	Grade Control Structures	X											
	Improve Drainage	X											
	Remove Flow Restrictions	X											
	Tree City USA		X		X			X					
	Water System Improvements						X						

Mitigation Alternatives		Cedar County	Coleridge	Fordyce	Hartington	Magnet	Obert	St. Helena	Wynot	Hartington-Newcastle Schools	LCC Schools	Randolph Schools	Wynot Schools
	Impact Resistant Roof Coverings						X						X
	Electrical System Looped Distribution/Redundancies						X						
	Bury Power Lines						X						
	Security Camera Updates										X		
	Building Safety Renovations										X		
	Hazardous Tree Removal Program												X
	Facilities for Vulnerable Populations												
	Improve and Revise Snow/Ice Removal Program												
	Groundwater/Irrigation/Water Conservation Management Plan and Practices												
	Protect Rooftop Utilities												
Objective 2.2	**Infrastructure Assessment Study**	X											
	Designated Snow Routes	X											
	Drainage Study/Stormwater Master Plan	X											
	Develop a Drought Management Plan		X										
Objective 2.3	**Continuity Planning**	X											X
	Land Use Regulations	X											
	Floodplain Management	X											
	Participate in the NFIP			X									
	Maintain Good Standing in the NFIP				X								
	Floodplain Regulation Enforcements and Updates				X								

Mitigation Alternatives		Cedar County	Coleridge	Fordyce	Hartington	Magnet	Obert	St. Helena	Wynot	Hartington-Newcastle Schools	LCC Schools	Randolph Schools	Wynot Schools
Goal 3													
Objective 3.1	**Public Awareness/Education**	X	X				X		X	X		X	X
	Shelter in Place	X											
	FIRM Mapping	X											
	Risk Communication	X											
	Promote First Aid												X
Goal 4													
Objective 4.1	**Obtain Missing Data**	X						X					
	Civil Service Improvements	X	X			X							
	Backup Municipal/County Records	X											
	Database of Vulnerable Populations	X											
	Emergency Operations	X											
	Emergency Fuel Supply Plan	X											
	Rescue/Snow Removal	X	X										
	Develop Flood Assistance Strategies	X											
	Snow Plow					X							
Objective 4.2	**Evacuation Plan**	X											
	Comprehensive Disaster/Emergency Response Plan	X											
	Emergency Exercise	X											
Objective 4.3	**Alert/Warning Sirens**	X	X						X				
	Emergency Communications	X											
	Warning Systems	X	X										
	Weather Radios	X			X	X	X	X	X				

Mitigation Alternatives		Cedar County	Coleridge	Fordyce	Hartington	Magnet	Obert	St. Helena	Wynot	Hartington-Newcastle Schools	LCC Schools	Randolph Schools	Wynot Schools
	Static Detectors	X											
	Alarm System Notification										X		
Goal 5													
Objective 5.1	**Intergovernmental Support**	X											
Objective 5.2	**Implement Projects that Achieve Several Goals**												
Goal 6													
Objective 6.1	**Update Comprehensive Plan**												

Table 125: Mitigation Alternatives Selected by Each Jurisdiction Part II

Mitigation Alternatives		Dixon County	Allen	Dixon	Martinsburg	Maskell	Newcastle	Ponca	Waterbury	Ponca Schools	Lewis and Clark NRD	Northeast Nebraska Public Health
Goal 1												
Objective 1.1	**Backup Generators**		X	X		X	X	X	X		X	
	Safe Rooms/Storm Shelters		X	X	X	X	X	X	X		X	X
	Stabilize/Anchor Fertilizer, Fuel, and Propane Tanks				X							
	Storm Shelter Identification		X									
	New Municipal Well											
	Power, Service, Electrical, and Water Distribution Lines											

Mitigation Alternatives		Dixon County	Allen	Dixon	Martinsburg	Maskell	Newcastle	Ponca	Waterbury	Ponca Schools	Lewis and Clark NRD	Northeast Nebraska Public Health
	Short Term Residency Shelters		X		X							X
	Expand Water Storage Capacity/ Emergency Water Supplies										X	
	Hazardous Fuel Reduction										X	
	Flood-Prone Property Acquisition										X	
	Construct Cooling Stations											X
Goal 2												
Objective 2.1	**Stormwater System and Drainage Improvements**					X	X	X				
	Stream Bank Stabilization/ Grade Control Structures/ Channel Improvements				X	X	X	X	X		X	
	Transportation Drainage Improvements	X										
	Surge Protectors		X		X							
	Channel and Bridge Improvements											
	Drainage Ditches											
	Grade Control Structures											
	Improve Drainage											
	Remove Flow Restrictions											
	Tree City USA		X				X	X				
	Water System Improvements			X								
	Impact Resistant Roof Coverings								X			X
	Electrical System Looped Distribution/Redundancies		X									X
	Bury Power Lines											
	Security Camera Updates									X		

Mitigation Alternatives		Dixon County	Allen	Dixon	Martinsburg	Maskell	Newcastle	Ponca	Waterbury	Ponca Schools	Lewis and Clark NRD	Northeast Nebraska Public Health
	Building Safety Renovations											
	Hazardous Tree Removal Program								X			
	Facilities for Vulnerable Populations		X		X							
	Improve and Revise Snow/Ice Removal Program			X								
	Groundwater/Irrigation/Water Conservation Management Plan and Practices				X						X	
	Protect Rooftop Utilities								X			
	Slope Stabilization										X	
	Windbreaks/Living Snow Fence										X	
	Infrastructure Hardening											X
Objective 2.2	**Infrastructure Assessment Study**											
	Designated Snow Routes											
	Drainage Study/Stormwater Master Plan						X					
	Develop a Drought Management Plan										X	
Objective 2.3	**Continuity Planning**											X
	Land Use Regulations											
	Floodplain Management						X					
	Participate in the NFIP	X			X	X						
	Maintain Good Standing in the NFIP		X				X	X				
	Floodplain Regulation Enforcements and Updates						X					
	Fire Prevention Program										X	
	Mobile Home Anchoring											X

Mitigation Alternatives		Dixon County	Allen	Dixon	Martinsburg	Maskell	Newcastle	Ponca	Waterbury	Ponca Schools	Lewis and Clark NRD	Northeast Nebraska Public Health
Goal 3												
Objective 3.1	**Public Awareness/Education**	X	X	X	X	X	X	X	X			X
	Shelter in Place											
	FIRM Mapping											
	Risk Communication											
	Promote First Aid		X						X			
Goal 4												
Objective 4.1	**Obtain Missing Data**		X			X	X				X	
	Civil Service Improvements		X	X	X							
	Backup Municipal/County Records		X					X	X			
	Database of Vulnerable Populations			X								X
	Emergency Operations											
	Emergency Fuel Supply Plan		X	X							X	
	Rescue/Snow Removal											
	Develop Flood Assistance Strategies											
	Snow Plow			X								
	GIS Lidar Map	X										
	Complete/Update Wildfire Protection Plan										X	
	Cooling Station Database											X
Objective 4.2	**Evacuation Plan**											
	Comprehensive Disaster/Emergency Response Plan		X	X	X							
	Emergency Exercise							X				X

Mitigation Alternatives		Dixon County	Allen	Dixon	Martinsburg	Maskell	Newcastle	Ponca	Waterbury	Ponca Schools	Lewis and Clark NRD	Northeast Nebraska Public Health
Objective 4.3	Alert/Warning Sirens		X					X	X			
	Emergency Communications		X								X	
	Warning Systems											
	Weather Radios	X	X	X	X	X						
	Static Detectors											
	Alarm System Notification											
	Install Intercom System									X		
Goal 5												
Objective 5.1	Intergovernmental Support		X									
Objective 5.2	Implement Projects that Achieve Several Goals											
Goal 6												
Objective 6.1	Update Comprehensive Plan		X									

COMPLETED MITIGATION EFFORTS

Previously completed mitigation actions identified by the communities can be found in their specific participant section in *Section Seven: Participant Sections.*

MONITORING, EVALUATING, AND UPDATING THE PLAN

Participants of the CDC HMP will be responsible for annually monitoring, evaluating, and updating of 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 responsible party 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.

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

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

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

To assist with monitoring of 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 should 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 may 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 shall start meeting to discuss mitigation updates at least six months prior to the deadline for completing the plan review. The persons overseeing the evaluation process will review the goals and objectives of the previous plan and evaluate them to determine whether they are still pertinent and current. Among other questions, they may want to consider the following:

- 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 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 D* may also be used to assist with plan updates.

In addition, the governing body will be responsible for ensuring that the Hazard Mitigation Plan goals and objectives are incorporated into applicable revisions of each participant's comprehensive plan and any new planning projects undertaken by the participant. The HMP should also take into account any changes in the comprehensive plans, and incorporate the information accordingly in its next update.

CONTINUED PUBLIC INVOLVEMENT

To ensure continued plan support and input from the public and business owners, public involvement should remain a top priority for each participant. Notices for public meetings involving discussion of, or action on mitigation updates should be published and posted in the following locations a minimum of two weeks in advance:

- Public spaces around the jurisdiction
- City/Village Hall
- Websites
- Local newspapers
- Regionally-distributed newspaper

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. Cedar and Dixon Counties should compile a list of proposed amendments received annually and prepare a report providing applicable information for each proposal, and recommend action on the proposed amendments.

INCORPORATION INTO EXISTING PLANNING MECHANISMS

The Regional Planning Team utilized a variety of plan integration tools to help communities determine how their existing planning mechanisms were related to the Hazard Mitigation Plan. Utilizing FEMA's *Integrating the Local Natural Hazard Mitigation Plan into a Community's Comprehensive Plan* Guidance, as well as FEMA's *2014 Plan Integration Guide*, each community engaged in a plan integration discussion. Each community referenced all relevant existing planning mechanisms and provided information on how these did or did not address hazards and vulnerability. Recommendations for improving this integration were discussed at the public meetings, but several communities did not have other relevant planning mechanisms. For these communities that lack existing planning mechanisms, especially smaller villages, the Hazard Mitigation Plan should be used as a guide for future activity and development in the community. Each community that has a comprehensive plan was encouraged to incorporate elements of the HMP within it. This ensures that the mitigation component of the comprehensive plan would be consistently revisited and reviewed. In order to determine which pieces of the comprehensive plan overlap with the HMP, communities can use the American Planning Association's Safe Growth Audit. However, care must be taken so that this mitigation portion is reviewed and updated every five years, as the evaluation and updating of the comprehensive plan is typically performed on a 10-year basis.

SECTION SEVEN: PARTICIPANT SECTIONS

PURPOSE OF PARTICIPANT SECTIONS

Participant sections contain information specific to jurisdictions which have participated in the CDC planning effort. Information from individual communities was collected at public and one-on-one meetings and used to establish the plan. Participant sections include: location and geography, climate, transportation, demographics, future development trends, critical facilities, risk assessment, capability assessment, plan integration, and mitigation actions. In addition, maps specific only to each jurisdiction are included such as: critical facilities as identified by the jurisdiction, 1 percent annual chance floodplain boundaries, and land use map.

The risk assessment information, as provided by individual participants, in *Section Four: Risk Assessment* and *Section Seven: Participant Sections* 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 participant section 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 referred to in *Section Four: Risk Assessment.*