# EXECUTIVE SUMMARY

## *INTRODUCTION*

In April 2015, Twin Platte Natural Resources District (NRD) hired JEO Consulting Group Inc. to update their Hazard Mitigation Plan in compliance with the 5-year update requirement established by the Disaster Mitigation Act of 2000 (DMA 2000). This updated plan was prepared in order to reduce the participating communities' vulnerability to natural hazards and maintain their eligibility for the Federal Emergency Management Agency (FEMA) pre-disaster grant opportunities. The Twin Platte NRD and its Hazard Mitigation Plan are multi-jurisdictional, and cover the following local jurisdictions.

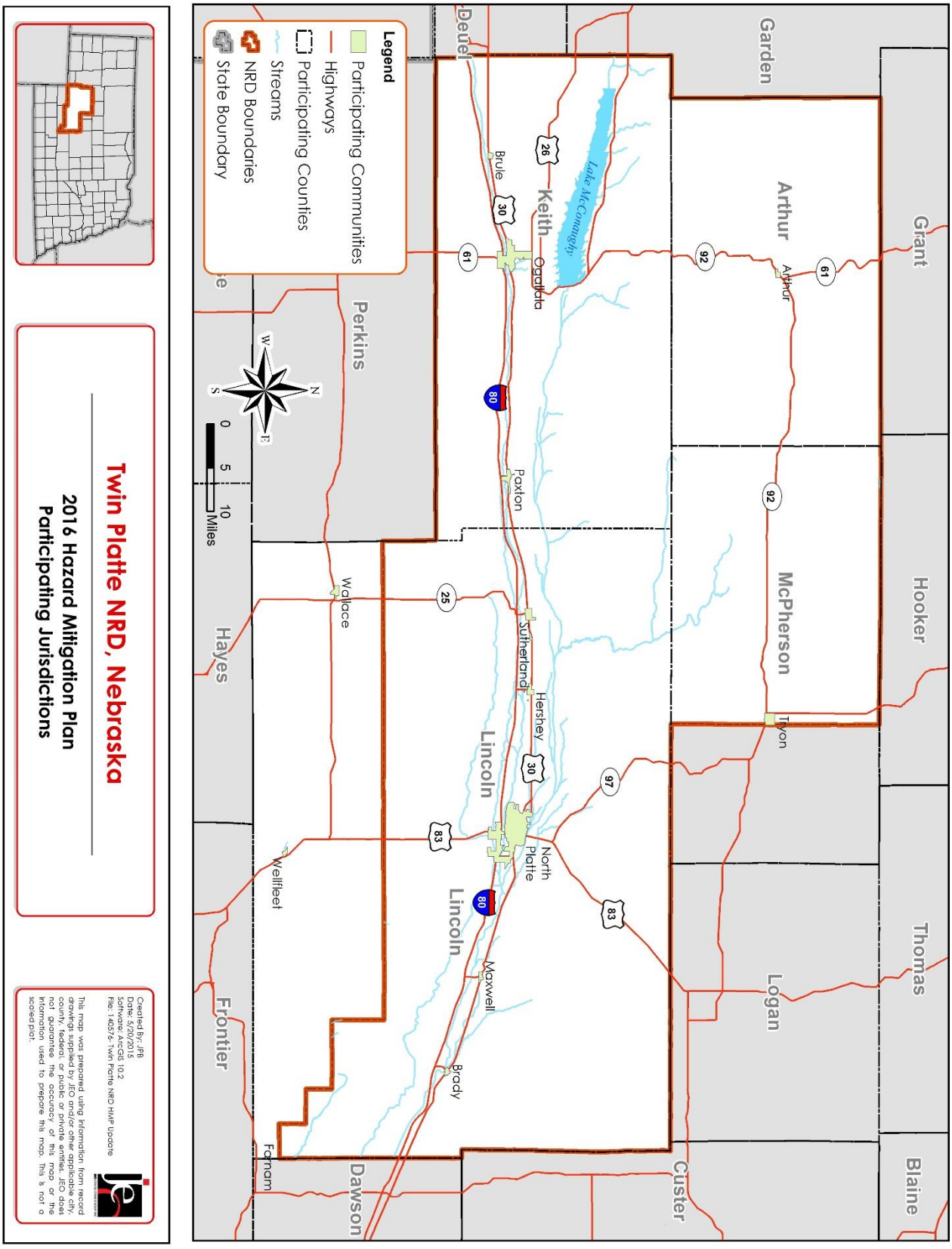
**Table 1: Participating Entities**

| Plan Participants | |
|---|---|
| **Arthur County** | North Platte, City of |
| Arthur, Village of | Sutherland, Village of |
| Arthur County Schools | Wallace, Village of |
| **Keith County** | **McPherson County** |
| Brule, Village of | McPherson County Schools |
| Ogallala, City of | **Twin Platte NRD** |
| Paxton, Village of | Keith-Lincoln Irrigation District |
| Paxton Consolidated Schools | Paxton-Hershey Irrigation District |
| **Lincoln County** | Platte Valley Irrigation District |
| Hershey, Village of | Suburban Irrigation District |
| Hershey Public Schools | Western Irrigation District |
| Maxwell, Village of | |

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 2014 Nebraska State Hazard Mitigation Plan were utilized as starting points for the local planning effort. The list of hazards addressed includes:

- Agricultural Disease (Animal and Plant)
- Chemical Release (Transportation and Fixed Site)
- Dam Failure
- Drought
- Earthquake
- Extreme Heat
- Flooding
- Grass/Wildfire
- Hail
- High Wind
- Landslide
- Levee Failure
- Severe Thunderstorm
- Severe Winter Storm
- Terrorism
- Tornado

**Figure 1: Planning Area**



The potential for disaster losses and the probability of occurrence of natural and man-made hazards present a significant concern for the communities participating in this plan update. The driving motivation behind the update of this Hazard Mitigation Plan is to reduce vulnerability and the likelihood of impacts to the health, safety, and welfare of all citizens in the planning area. To achieve this end, the planning team and participating jurisdictions reviewed, updated, and approved goals and objectives which will help guide the process of identifying both broad-based and community specific mitigation strategies and projects. These mitigation projects will, if implemented, reduce their vulnerability and help build stronger, more resilient communities.

This plan identified specific goals and objectives to help guide the planning process. These goals and objectives were updated from the 2011 Twin Platte NRD Multi-Jurisdictional Hazard Mitigation Plan. The goals and objectives for this plan update are as follows:

***Goal 1: Protect the Health and Safety of Residents***

*Objective 1.1: Reduce or prevent damage to property and 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, infrastructure, services, utilities, and trees to the extent possible.*

*Objective 2.2: Develop hazard specific plans, conduct studies or assessments, and retrofit buildings and facilities 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 Education Regarding Vulnerabilities to Hazards***

*Objective 3.1: Develop and provide information to residents and businesses about the types of hazards to which they are exposed, what the effects may be, where they occur, and what they can do to better prepare for them.*

***Goal 4: Improve Emergency Management Capabilities***

*Objective 4.1: Develop or update Emergency Response Plans, procedures and abilities; increase the capability to respond.*

*Objective 4.2: Develop or update Evacuation Plans 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 multiple goals.*

***Goal 6: Enhance Overall Resilience and Promote Sustainability***

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

## *SUMMARY OF CHANGES*

Several changes were made to the 2011 Hazard Mitigation Plan and planning process, including: the inclusion of man-made hazards based on the threats addressed in the 2014 State of Nebraska Hazard Mitigation Plan, greater efforts to reach out to and include stakeholder groups, an expanded risk assessment for both the entire planning area, as well as each participating jurisdiction, and the inclusion of additional mitigation strategies. This update also works to unify the various planning mechanisms in place throughout the participating communities (i.e. Comprehensive Plans, Local Emergency Operation Plans, Zoning Ordinances, Building Codes, etc.) to ensure that the goals and objectives identified in those planning mechanisms are consistent with the strategies and projects included in this plan.

## *PLAN IMPLEMENTATION*

Various communities across the planning area have implemented hazard mitigation projects following the 2011 Hazard Mitigation Plan. Many of these projects are related to hazard monitoring, warning systems and/or educating community members. Examples include: installing and upgrading sirens in Ogallala, and improving emergency communications in North Platte.

In order to build upon these prior successes and continue to implement mitigation projects, plan participants will need to continue relying upon multi-agency coordination as a means of leveraging resources. Communities across the planning area have worked with a range of entities to complete projects; potential partners for future project implementation include, but are not limited to: Twin Platte Natural Resources District, Silver Jackets, Lincoln County, Keith County, Arthur County, McPherson County, Department of Natural Resources, NEMA, local industry, 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 perception. 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 2: Risk Assessment Overview**

| Regional Risk Assessment | | | |
|---|---|---|---|
| **Hazard** | **Previous Occurrence Events/Years** | **Approximate Annual Probability** | **Likely Extent** |
| **Agricultural Animal Disease** | 2005/1.5 | 100% | Unavailable |
| **Agricultural Plant Disease** | 29/19 | 100% | Unavailable |
| **Chemical Fixed Sites** | 69/32 | 100% | 532 Gallons |
| **Chemical Transportation** | 329/36 | 100% | Limited (<1 mile from release site) |
| **Dam Failure** | 0 | ~1% | Total inundation in floodplain downstream from dam |
| **Drought**** | 175/780** | 22% | D2 |
| **Earthquakes** | 0/42 | ~2% | <4.0 |
| **Extreme Heat** | 37/1 | 100% | >90°F |

| Regional Risk Assessment | | | |
|---|---|---|---|
| **Hazard** | **Previous Occurrence Events/Years** | **Approximate Annual Probability** | **Likely Extent** |
| **Flooding** | 50/19 | 100% | Some inundation of structures* (<1% of structures) and roads near streams. Some evacuations of people may be necessary (<1% of population) |
| **Grass/Wildfires** | 1,041/15 | 100% | <100 acres |
| **Hail** | 1209/19 | 100% | H3 – H6 |
| **High Winds** | 444/19 | 100% | 9 BWF |
| **Levee Failure** | 0 | ~1% | 0 structures located in protected areas |
| **Severe Thunderstorms** | 364/19 | 100% | ≥1" rainfall |
| **Severe Winter Storms** | 163/19 | 100% | .25 - .5" ice<br>20 - 40°F below zero (wind chills)<br>4 – 8" snow<br>25 – 40 mph winds |
| **Terrorism** | 0 | ~1% | Undefined |
| **Tornados** | 78/19 | 100% | EF0 |

*Quantification of vulnerable structures provided in *Section Seven: Participant Sections*
**Drought occurrence is measured by months

**Table 3: 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 | N/A | N/A |
| Agricultural Plant Disease | N/A | N/A | $376,501 | $25,100 |
| Chemical Fixed Sites | Unknown | Unknown | $0 | $0 |
| Chemical Transportation | $436,289 | $14,543 | $0 | $0 |
| Dam Failure | $0 | $0 | $0 | $0 |
| Drought | $0 | $0 | $55,995,082 | $3,733,005 |
| Extreme Heat | $0 | $0 | $12,386,335 | $825,756 |
| Flooding | $3,688,000 | $194,105 | $444,445 | $29,630 |
| Grass/Wildfires[3] | $2,000,000 | $105,263 | $156,621[3] | $12,048[3] |
| Hail | $56,163,700 | $2,955,984 | $62,191,464 | $4,146,098 |
| High Winds | $4,836,200 | $254,537 | $6,435,481 | $429,032 |
| Severe Thunderstorms | $4,259,700 | $224,195 | $0 | $0 |
| Severe Winter Storms | $1,149,000 | $60,474 | $3,028,524 | $201,902 |
| Terrorism | $0 | $0 | $0 | $0 |

| Hazard Type | Total Property Loss[1] | Average Annual Property Loss[1] | Total Crop Loss[2] | Average Annual Crop Loss[2] |
|---|---|---|---|---|
| Tornados | $4,378,750 | $230,461 | $3,193 | $213 |

*1 Indicates data is from NCDC (January 1996 to April 2015)*
*2 Indicates data is from USDA (2000 to 2014)*
*3 Indicates data is from NFS (2000 to 2012)*

Many natural hazards, such as agricultural disease, extreme heat, flooding, grass and wildfires, hail, high winds, severe thunderstorms, severe winter storms and tornados 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, hail, high winds, severe thunderstorms, and tornados have resulted in the most significant property damage within the planning area. The following hazards are the hazards of most concern to the planning area. At least ten participants identified these hazards as a hazard of most concern.

**Chemical Spills - Transportation**
Hazardous materials can be transported by highway, rail, or pipeline, and can include many corrosive, toxic, unstable, or explosive chemicals and materials. Hazardous materials releases can occur from vehicle accidents, defective values or hoses on tankers, train derailments, pipeline ruptures or explosions, storage tank overtopping during delivery of products, etc.

The Twin Platte planning area has had 329 chemical spills during transportation from August 1, 1980 to March 21, 2015. During these events, there have been no fatalities, 12 minor injuries, and $436,289 in damages from the spills.

While transportation accidents can occur anywhere in the planning area, communities and households adjacent to major highways and rail corridors may be more vulnerable. If an incident were to occur where an evacuation was necessary, particular populations that may be especially vulnerable include households without access to a vehicle, the elderly, facilities with populations with low mobility (such as hospitals and nursing homes).

**Flooding**
Flood events are the most damaging and costly hazard in the United States, and account for 66 percent of all Presidential disaster declarations. The Twin Platte NRD planning area is bisected by the North Platte and South Platte Rivers until the two rivers converge into the Platte River just east of North Platte. The planning area is also home to Nebraska's largest lake, Lake McConaughy, which, at full storage, is 20 miles long, four miles wide and 142 feet deep at the dam. Lake Ogallala, Lake Maloney, and the Sutherland Reservoir are also significant water bodies within the planning area.

The planning area has experienced 50 flooding events since 1996. These events led to $3,688,000 in property losses and $444,445 in crop losses. Vulnerable populations include residents located in the floodplain, and the elderly.

**Grass/Wildfires**
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 ability 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).

Within the planning area, there have been 1,041 occurrences of wildfire in the last 15 years. These fires have caused $2,000,000 in property damages and $156,621 in crop damages. Typical wildfire occurrences in the planning area take place in agricultural fields rather than in heavy forests. For this reason, local fire departments are prepared and able to control these events. Fire departments across the counties have mutual aid agreements in place for when a single fire department is unable to control the situation.

Vulnerability related to wildfire is more geographic than demographic. Farmsteads and agricultural buildings located in rural areas are the most vulnerable groups in the planning area related to wildfire. Demographics can become a concern in major, during large scale fire events which require evacuation of residents.

**Hail**

Hail is usually associated with severe thunderstorms. This association makes hail just as unpredictable as severe thunderstorms. Hail events in thunderstorms differ from many other hazards because they travel large areas and through multiple jurisdictions within a single region. Additionally, hail events in thunderstorms often occur in series, with one area having the potential to be hit multiple times in one day.

Hail occurs frequently in the planning area, as there have been 1,209 hail events in the last 19 years. Hail is the most damaging hazard in the planning area. These hail events have caused over $56 million in property damages and over $62 million in crop damages. Vulnerable populations include residents of mobile homes, the elderly, and those caught outside during storm events.

**Severe Thunderstorms**

Thunderstorms differ from many other hazards because they are generally large in magnitude, have a long duration, and travel across large areas and through multiple jurisdictions within a single region. Severe thunderstorms are most likely to occur between the months of April and August 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; damages to homes and vehicles from hail; damage to mechanical systems located outdoors; downed power lines and poles from high winds; injuries from windborne debris; downed tree limbs and trees; and destruction of crops.

There have been 364 occurrences of severe thunderstorms in the planning area in the last 19 years. These storms have led to $4,259,700 in property damages.

Vulnerable populations related to severe thunderstorms include: residents of mobile homes, 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. Most participating jurisdictions have reported updates or improvements to risk communication and outdoor warning systems. In addition, the use of text notifications have helped decrease the human vulnerability to this hazard.

**Severe Winter Storms**

Severe winter storms are an annual occurrence for the planning area and the State of Nebraska. 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 dilapidated structures; death of livestock; and closure of critical facilities.

There have been 163 occurrences of severe winter storms in the last 19 years. These storms have led to $1,149,000 in property damages and $3,028,524 in crop damages. The most vulnerable citizens within the planning area are children, elderly, individuals and families below the poverty line, and those new to the area or state.

**Tornados**
Tornados occur in the planning area on an annual basis. These storms have the potential to be extremely violent and destructive. There have been 78 tornadic events in the planning area in the last 19 years. These tornadic events have led to $4,378,750 in property damages.

Vulnerable populations within the planning area include residents living in mobile homes, 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.

## *MITIGATION STRATEGIES*

There are a wide variety of strategies that can be used to reduce the impacts of hazards for the residents in the planning area as well as the built environment. The following table shows mitigation actions that were chosen by planning participants during this update.

**Table 4: Selected Mitigation Actions**

| Goal/ Objective | Action # | Action | Action Item | Hazards Addressed |
|---|---|---|---|---|
| Goal 1 Objective 1.1 | 1.1.1 | **Provide adequate fire protection** | 1. Identify and evaluate current fire hall<br>2. Improve and/or replace fire hall<br>3. Identify and evaluate current firefighting equipment locations<br>4. Improve and/or add firefighting at additional locations | Grass/Wildfires, Severe Thunderstorms, Severe Winter Storms |
| | 1.1.2 | **Lightning rods** | 1. Install lightning rods in strategic locations at high points | Severe Thunderstorms |
| | 1.1.3 | **Snowplow** | 1. Purchase additional snowplow | Severe Winter Storms |
| | 1.1.4 | **Reduce fire damage** | 1. Identify vulnerable areas and combustion sources<br>2. Evaluate fire resistant roofing<br>3. Develop plan to reduce wildfire impact and reduce combustion materials<br>4. Reduce combustible material by removal or other methods<br>5. Enact building codes/ordinances for fire resistant roofing | Grass/Wildfire |
| | 1.1.5 | **Promote first aid** | 1. Promote first aid training for all staff | All hazards |
| Goal 2 Objective 2.1 | 2.1.1 | **Improve/provide adequate backup and emergency generators** | 1. Identify and evaluate current backup and emergency generators<br>2. Obtain additional generators based on identifications and evaluation | Tornados, High Winds, Severe Winter Storms, Severe Thunderstorms |

| Goal/ Objective | Action # | Action | Action Item | Hazards Addressed |
|---|---|---|---|---|
| | **2.1.2** | **Reduce tree damage & damage from trees** | 1. Conduct tree inventory<br>2. Develop tree maintenance/trimming program<br>3. Implement tree maintenance/trimming program | Grass/Wildfire, Tornados, Severe Thunderstorms, Severe Winter Storms, Hail |
| | **2.1.3** | **Stormwater system and drainage improvements** | 1. Undersized systems can contribute to localized flooding. Improvements may include pipe upsizing and additional inlets. Retention and detention facilities may also be implemented to decrease runoff rates while also decreasing the need for other stormwater system improvements | Flooding |
| | **2.1.4** | **Provide adequate public safe rooms & post disaster storm shelter** | 1. Identify and evaluate existing safe rooms and/or storm shelters<br>2. Improve and/or construct safe rooms and/or storm shelters | Tornados, High Winds, Severe Thunderstorms |
| | **2.1.5** | **Surge protectors** | 1. Purchase and install surge protectors on sensitive equipment in critical facilities | Severe Thunderstorms |
| | **2.1.6** | **Bank stabilization** | 1. Stabilize banks along streams and rivers. This may include, but is not limited to: reducing bank slope, addition of riprap, installation of erosion control materials/fabrics | Flooding |
| | **2.1.7** | **Channel and bridge improvements** | 1. Implement channel and bridge improvements to increase channel conveyance and decrease the base flood elevations | Flooding |
| | **2.1.8** | **Drainage ditches** | 1. Deepen drainage ditches and clean out culverts | Flooding |
| | **2.1.9** | **Drainage study/stormwater master plan** | 1. Preliminary drainage studies and assessments can be conducted to identify and prioritize design improvements to address site specific localized flooding/drainage issues to reduce and/or alleviate flooding<br>2. Stormwater master plans can be developed to help identify stormwater problem areas and potential drainage improvements | Flooding |
| | **2.1.10** | **Stream/Bank/Grade structure improvements** | 1. Evaluate current stream bed and bank stabilization needs<br>2. Implement stream bed and bank improvements including grade control structures, rock rip rap, vegetative cover, etc. | Flooding |
| | **2.1.11** | **Canal maintenance** | 1. Implement necessary actions to maintain the canal | Chemical Spills, Flooding, Dam Failure, Severe Thunderstorm, Drought |
| | **2.1.12** | **Groundwater recharge** | 1. Divert excess flows from North Platte River to recharge groundwater within the aquifer | Drought |
| | **2.1.13** | **Flood proofing critical facilities** | 1. Conduct flood proofing feasibility study for structures<br>2. Implement flood proofing measures | Flooding |
| | **2.1.14** | **Improve electrical service** | 1. Evaluate hardening, retrofitting, looping and/or burying of power lines and related infrastructure and/or comparable protection measures | Tornados, High Winds, Severe Thunderstorms, Hail |

| Goal/ Objective | Action # | Action | Action Item | Hazards Addressed |
|---|---|---|---|---|
| | | | 2. Implement measures to improve electrical service | |
| | **2.1.15** | **Reduce road damage** | 1. Conduct assessment of past damages and causes<br>2. Evaluate road damage mitigation measures<br>3. Implement feasible road damage mitigation measures | Severe Thunderstorms, Flooding |
| | **2.1.16** | **Windbreak improvements** | 1. Conduct evaluation of current windbreaks<br>2. Implement improvements/repairs to windbreaks | High Winds, Severe Thunderstorms, Severe Winter Storms |
| | **2.1.17** | **Repair flood damage** | 1. Repair Platte River flood damage | Flooding |
| **Goal 2 Objective 2.2** | **2.2.1** | **Parcel level evaluation of flood prone properties** | 1. Conduct a study examining parcels located in flood prone areas and identify mitigation measures that can reduce future impacts | Flooding |
| | **2.2.2** | **Remove flow restrictions** | 1. Conduct a preliminary drainage assessment and/or design bridge improvements to reduce and/or alleviate flooding. Bridges typically serve as flow restrictions along streams and rivers<br>2. Cleanout and reshaping channel segments at bridge crossings can increase conveyance, reducing the potential for flooding<br>3. Replacing or modifying of bridges and other flow restrictions may be necessary to eliminate flooding threats and damages | Flooding |
| | **2.2.3** | **Improve and revise snow/ice removal program** | 1. As needed, continue to revise and improve the snow and ice program for streets<br>2. Revisions should address plowing snow, ice removal, parking during snow and ice removal, and removal of associated storm debris<br>3. Acquire equipment needed and pave roads | Severe Winter Weather |
| | **2.2.4** | **Update floodplain information/mapping** | 1. Conduct mapping/remapping of floodplain<br>2. Revise floodplain/insurance maps | Flooding |
| **Goal 2 Objective 2.3** | **2.3.1** | **Critical facility siting** | 1. Prohibit the construction of critical facilities within the immediate radius of chemical storage facilities through resolution or ordinance | Chemical Spills (Fixed Site) |
| | **2.3.2** | **Stormwater management committee** | 1. Establish a stormwater development committee to oversee improvements to the stormwater system and to respond to community concerns | Flooding |
| | **2.3.3** | **Maintain good standing in NFIP** | 1. Continue to regulate development in floodplain areas<br>2. Adopt future floodplain maps when available<br>3. Conduct additional floodplain mapping/remapping | Flooding |

| Goal/ Objective | Action # | Action | Action Item | Hazards Addressed |
|---|---|---|---|---|
| **Goal 3 Objective 3.1** | **3.1.1** | **Public awareness/education** | 1. Through activities such as outreach projects, distribution of maps and environmental education increase public awareness of natural hazards to both public and private property owners, renters, businesses, and local officials about hazards and ways to protect people and property from these hazards<br>2. Educate citizens on water conservation methods, evacuation plans, etc.<br>3. Purchase equipment such as overhead projectors and laptops | All hazards |
| **Goal 4 Objective 4.1** | **4.1.1** | **Emergency fuel supply plan** | 1. Plan to ensure adequate fuel supply is available during an emergency. Actions might include: prioritization and rationing plan for gasoline and diesel uses in extended loss of fuel supply or electric power supply; a plan to purchase local fuel supply, etc. | Tornados, High Winds, Severe Thunderstorms, Severe Winter Storms, Flooding, Dam Failure |
| | **4.1.2** | **Dam failure exercise** | 1. Conduct table top exercises to determine the response scenarios in the event of dam failure | Dam Failure |
| | **4.1.3** | **Mutual aid through WARN program** | 1. Establish mutual aid agreements through Water/Wastewater Agency Response Network (WARN) Program | All hazards |
| | **4.1.4** | **Emergency operations** | 1. Identify and establish an Emergency Operations Center | All hazards |
| | **4.1.5** | **Emergency management exercise** | 1. Develop and facilitate an emergency management exercise | All hazards |
| | **4.1.6** | **Map municipal infrastructure** | 1. Acquire Geographic Information System (GIS) to map municipal infrastructure | All hazards |
| **Goal 4 Objective 4.2** | **4.2.1** | **Evacuation Plan** | 1. Develop local evacuation plan | Dan Failure, Grass/Wildfire |
| **Goal 4 Objective 4.3** | **4.3.1** | **Improve warning systems** | 1. Evaluate current warning systems<br>2. Improve warning systems/develop new warning system<br>3. Obtain/upgrade warning system equipment and methods, including alert sirens<br>4. Identify locations of weather warning radios<br>5. Improve weather radio system<br>6. Obtain/upgrade weather radios | All hazards |
| | **4.3.2** | **Improve emergency communications** | 1. Develop/improve emergency communication action plan<br>2. Implement emergency communication action plan<br>3. Obtain/upgrade emergency communication equipment<br>4. Obtain/upgrade/distribute weather warning radios | All hazards |

| Goal/ Objective | Action # | Action | Action Item | Hazards Addressed |
|---|---|---|---|---|
| **Goal 5 Objective 5.2** | **5.2.1** | **Tree City USA** | 1. Work to become a Tree City USA through the National Arbor Day Foundation in order to receive direction, technical assistance, and public education materials on how to establish a hazardous tree identification and removal program | Hail, High Winds, Severe Thunderstorms, Severe Winter Storms |
| **Goal 6 Objective 6.1** | **6.1.1** | **Update Comprehensive Plan** | 1. Update comprehensive plan<br>2. Integrate plan with Hazard Mitigation Plan components | All hazards |

## *SUMMARY*

This document is an update to the 2011 Twin Platte NRD Multi-Jurisdictional Hazard Mitigation Plan. For this update, the hazards found to be of greatest concern for participating jurisdictions include: flooding, grass/wildfire, 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.

# SECTION ONE: INTRODUCTION

## HAZARD MITIGATION PLANNING

Hazard events are inevitable. The uncertainty of their effects resides in the intensity 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 hazards."*

*"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, 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 public and private property, cause environmental degradation, or disrupt the local economy and overall quality of life.

The Twin Platte NRD 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 the Twin Platte NRD 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

In an effort to reduce the nation's mounting natural disaster losses, the U.S. Congress passed the Disaster Mitigation Act of 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). They 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 the Final Rule published in the Federal Register on November 30, 2007 (44 CFR §201.6).

### *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.

> ***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*

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

- ***Hazard Mitigation Grant Program (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.
- ***Flood Mitigation Assistance Program (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. The local jurisdiction must also be a member of the NFIP. The goal of FMA is to reduce or eliminate claims under the NFIP.
- ***Pre-Disaster Mitigation Grant Program (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 natural hazard mitigation program.
- ***NFIP Community Rating System (CRS):*** The CRS offers recognition to local governments that exceed minimum requirements of the National Flood Insurance Program (refer to *Section Four: Risk Assessment – Flooding*). Recognition comes in the form of discounts on flood insurance policies purchased by citizens. The CRS offers credit for mitigation plans that are prepared according to a multi-step process.

## *PLAN FINANCING AND PREPARATION*

In regards to plan financing and preparation, the Twin Platte NRD was the "sub-applicant" which submitted a sub-application for FEMA assistance to the "Applicant". The "Applicant," in this case is the State of Nebraska. If HMA funding is awarded, the sub-applicant becomes the "sub-grantee" and is responsible for

managing the sub-grant and complying with program requirements and other applicable federal, state, territorial, tribal, and local laws and regulations.

The Twin Platte NRD applied for a HMGP planning grant and received federal-cost share to provide 75 percent assistance for the completion of a 'multi-jurisdictional' hazard mitigation plan update. A multi-jurisdictional plan includes any taxing authority such as cities, villages, counties, school districts, or other special districts.

# SECTION TWO: PLANNING PROCESS

## *INTRODUCTION*

The process utilized to develop a hazard mitigation plan is often as important as the final planning document. For this planning process, the Twin Platte NRD adapted the four step hazard mitigation planning process outlined by FEMA to fit the needs of the participating jurisdictions. The following pages will outline how the planning team was established; the function of the planning team; key project meetings and community representative; 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, any 'taxing authority' was also included.

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, NRD's, and regional emergency management districts. Twin Platte NRD 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 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 for ideas developed during the initial assessment of risks to be revised 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 an 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.

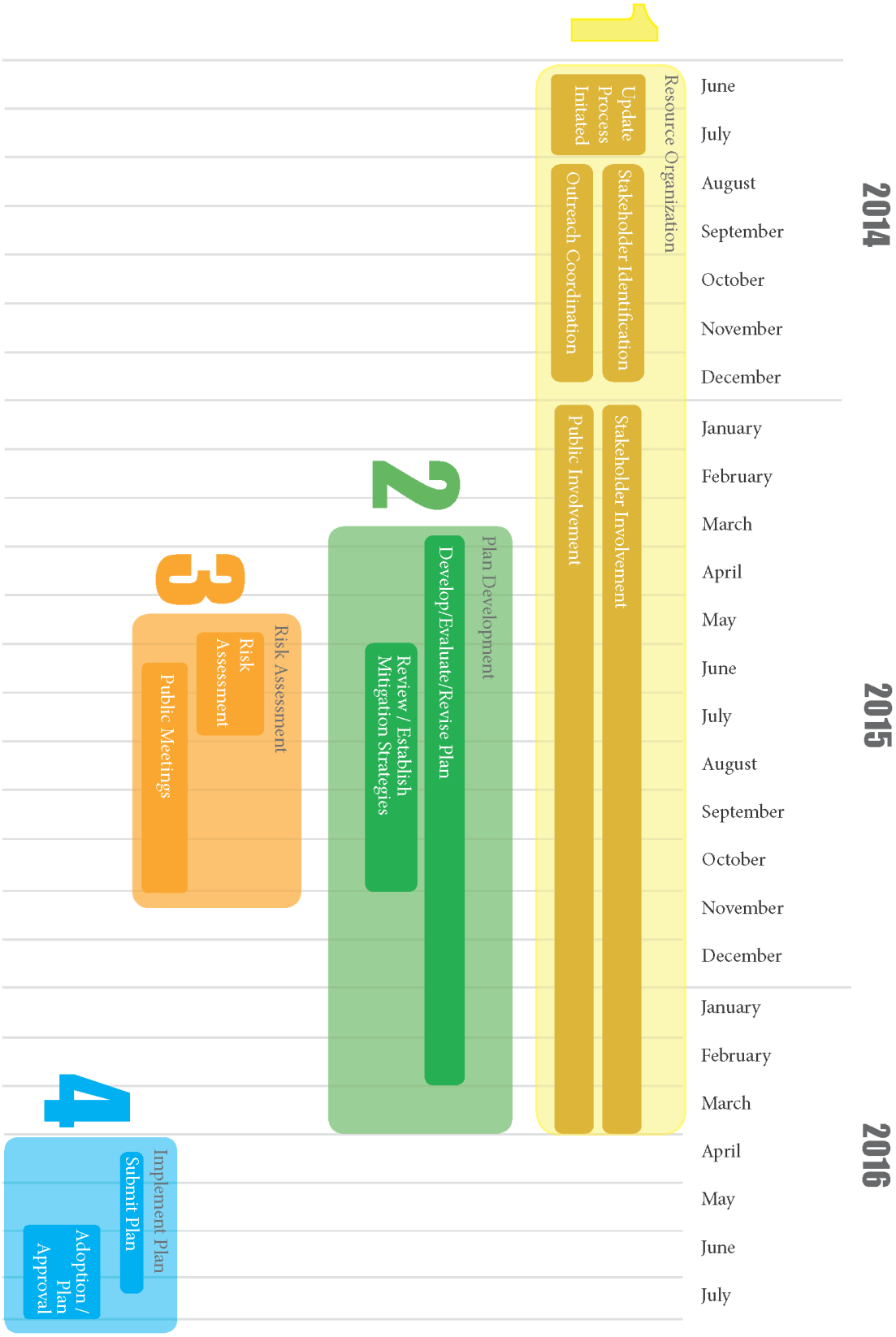
## *PLAN UPDATE PROCESS*

Twin Platte NRD began the process of securing funding for their Multi-Jurisdictional Hazard Mitigation plan on June 9, 2014. JEO was contracted soon after to guide and facilitate the planning process and assemble the Multi-Jurisdictional Hazard Mitigation Plan. For the planning area, Glen Bowers led the development of the plan and served as the primary point-of-contact throughout the project. The project kick-off meeting was attended by members from both NRDs, and Emergency Managers from each county in the plan. JEO staff provided an overview of the work to be completed over the following three months including: the identification of and coordination with the planning team; determination of number and location of future public meetings; assessment of the attendance requirements; and, discussion of what types of information would need to be developed and collected to successfully complete the plan.

The first activity in the development process for the Twin Platte NRD Multi-Jurisdictional Hazard Mitigation Plan Update was coordination of efforts with local, state, and federal agencies and organizations. NDNR and NEMA became involved in the planning process. Both NRDs, each county, 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 following figure.

**Figure 2: Planning Process**



## ORGANIZATION OF RESOURCES

### PLANNING TEAM

At the beginning of the planning process, the planning team, comprised of local participants, state government officials, and JEO, 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 planning team members can be found in the following table. Additional technical support was provided to the planning team through staff from NEMA and the NDNR.

**Table 5: Hazard Mitigation Planning Team**

| Name | Title | Jurisdiction |
|---|---|---|
| Glen Bowers | Water Programs Field Coordinator | Twin Platte NRD |
| Bill Simpson | Emergency Manager/Sheriff | Arthur County |
| Pete Peterson | Emergency Manager | Keith County |
| Brandon Myers | Emergency Manager | Lincoln County |
| Jim Hawks | City Administrator | North Platte |
| Tim McConnell | Emergency Manager | McPherson County |
| *Mitch Paine** | *Flood Mitigation Planning Coordinator* | *NDNR* |
| *Mary Baker** | *State Hazard Mitigation Officer* | *NEMA* |
| *Jeff Henson** | *Project Manager* | *JEO Consulting Group, Inc.* |
| *Phil Luebbert** | *Planner, Project Coordinator* | *JEO Consulting Group. Inc.* |

**External Contributors*

### PARTICIPANT INVOLVEMENT

Elected officials, key stakeholders, and residents within the Twin Platte NRD experience the area's hazards first hand, and play a key role in providing local information necessary to complete the plan. Participants played a key role in the identification of hazards; understanding the community's awareness of risk; providing a record of historical disaster occurrences and localized impacts; reviewing existing goals and objectives; approval of newly established goals and objectives; 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 required to have a minimum of one representative present at the "Hazard Identification" and "Mitigation Strategies" meetings. Many jurisdictions opted to have multiple community members present at both rounds of meetings. Sign-in sheets from all public meetings can be found in *Appendix B*. Jurisdictions were encouraged to invite stakeholder groups from within their communities to participate in the public meetings.

Jurisdictions that were unable to attend the scheduled public meetings were able to request a meeting with members of the 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. These meetings were held in the form of one-on-one meetings (either in person or one the phone).

In addition to the Hazard Identification and Mitigation Strategies meetings, a Hazard Mitigation Workshop was held at the start of the planning process. The intent of the workshop was to better inform plan participants about the hazard mitigation process. The workshop included the following topics:

- Tabletop exercise
- What is hazard mitigation?
- Components of a risk assessment
- Identifying mitigation projects
- Public outreach and involvement

**Table 6: Workshop Attendees**

| June 18, 2015 – Ogallala | | |
|---|---|---|
| **Name** | **Title** | **Jurisdiction** |
| Kathy Fischer | Hershey School Representative | Hershey Public Schools |
| Harold Arensdorf | County Commissioner | McPherson County |
| John Bryant | County Commissioner | McPherson County |
| Caleb Johnson | County Commissioner | Keith County |
| Samantha Boggs | Clerk | Village of Sutherland |
| Ken Gibbons | Superintendent | Village of Sutherland |
| Jane Skinner | City Clerk/Treasurer | City of Ogallala |
| Aaron Smith | City Manager | City of Ogallala |
| Ken Knoepfel | Planning and Zoning | City of Ogallala |
| Ronnie Stewart Jr. | Superintendent | Village of Hershey |
| LeAnn Ellis | Clerk | Village of Hershey |
| Kimberly Wenzel | Village Board Member | Village of Arthur |
| Stuart Simpson | North Platte Public Schools | City of North Platte |
| David Hahn | Building/Flood Manager | City of North Platte |
| Tim McConnell | Sheriff/Emergency Manager | McPherson County |
| Pete Peterson | Emergency Manager | Keith County |
| Glen Bowers | Water Programs Field Coordinator | Twin Platte NRD |

The Hazard Identification meetings were held on:

- July 7, 2015 at the Twin Platte NRD office, 111 South Dewey Street, North Platte, NE
- July 8, 2015 at the Ogallala City Hall, 411 East 2nd Street, Ogallala NE

**Table 7: Hazard Identification Meeting Attendees**

| July 7, 2015 – North Platte | | |
|---|---|---|
| **Name** | **Title** | **Jurisdiction** |
| Caleb Johnson | Commissioner | Keith County |
| Ken Gibbons | Utilities Superintendent | Village of Sutherland |
| Harold Arensdorf | County Commissioner | McPherson County |
| John Bryant | County Commissioner | McPherson County |
| Tim McConnell | Emergency Manager | McPherson County |
| Judy Clark | Planning Administrator | City of North Platte |
| Jim Hawks | City Administrator | City of North Platte |
| Kevin Dodson | Superintendent | North Platte Catholic Schools |
| Dave Hahn | Building/Flood Manager | City of North Platte |
| Brandon Myers | Emergency Manager | Lincoln County |
| Glen Bowers | Water Programs Field Coordinator | Twin Platte NRD |
| **July 8, 2015 – Ogallala** | | |
| **Name** | **Title** | **Jurisdiction** |
| Belinda Daly | Village Clerk | Village of Arthur |
| Kent Anderson | Highway Superintendent | Arthur County |
| Bill Simpson | County Sheriff | Arthur County |
| Barry Schaeffer | Superintendent | Arthur County schools |
| Doug Luedke | Board Member | Village of Paxton |
| Del Dack | Superintendent | Paxton Schools |
| Pete Peterson | Emergency Manager | Keith County |
| Jane Skinner | Clerk | City of Ogallala |
| Glen Bowers | Water Programs Field Coordinator | Twin Platte NRD |

The intent of the Hazard Identification meetings was to overview the planning process and discuss what information would need to be provided to complete the plan. Participants completed worksheets to identify specific hazard concerns and to provide more information on hazard vulnerability. Participants also reviewed and provided status updates for mitigation actions listed in the previous plan, as well commented on a draft of their jurisdiction's participant sections. For documentation of these meetings, along with sample meeting worksheets (refer to *Appendix C*).

Participants were also required to attend mitigation strategies meetings.

The mitigation strategies meeting was held on:

- October 7, 2015 at the Twin Platte NRD office, 111 South Dewey Street, North Platte, NE

**Table 8: Mitigation Strategies Meeting Attendees**

| October 7, 2015 – North Platte | | |
|---|---|---|
| **Name** | **Title** | **Jurisdiction** |
| Del Dack | Superintendent | Paxton Schools |
| Glen Bowers | Water Programs Field Coordinator | Twin Platte NRD |
| Brandon Myers | Emergency Manager | Lincoln County |
| Judy Clark | Planning Administrator | City of North Platte |
| Ken Gibbons | Utilities Superintendent | Village of Sutherland |
| Samantha Boggs | Clerk | Village of Sutherland |
| Ken Knoepfel | Planning and Zoning | City of Ogallala |
| Aaron Smith | City Manager | City of Ogallala |
| Harold Arensdorf | County Commissioner | McPherson County |
| John Bryant | County Commissioner | McPherson County |

The intent of the Mitigation Strategies meeting was to provide the public and jurisdictional representatives with an overview of the work required to complete the mitigation planning process. Participants completed worksheets to identify new mitigation projects. Participants also commented on am updated draft of their jurisdiction's participant sections. For documentation of these meetings, along with sample meeting worksheets (refer to *Appendix C*).

**Table 9: Public Notification - For Meetings**

| **Action** | **Intent** |
|---|---|
| Project Kick-Off Letter | Sent to participants to announce the purpose of the plan |
| Planning Team Letter | Informed the planning team about their first meeting |
| Neighboring Jurisdictions Letter | Informed neighboring jurisdictions about the planning effort |
| Welcome Letter | Sent to all participants welcoming them to the planning process |
| Press Release | Sent to each local newspapers to describe the purpose of the plan |
| Follow-up Emails and Phone Calls | Participating jurisdictions were contacted frequently to assist in developing the plan |
| 30 Day and 15 Day Reminder Letters | Sent to participants to discuss the agenda/dates/times/locations of the two public meetings and workshop |
| Website | JEO created a website for the plan with meeting notification |
| Word-of-Mouth | Staff discussed the plan with jurisdictions throughout the planning process |

## *ASSESSMENT OF RISK*

### *HAZARD RISK AND VULNERABILITY ASSESSMENT*

The Twin Platte NRD Multi-Jurisdictional Hazard Mitigation Plan Update utilizes a hazard risk assessment methodology to assess the potential risk and vulnerability of the entire planning area and of each participating jurisdiction. The risk assessment methodology utilizes a combination of: public input and information provided by elected officials, key stakeholders, and residents throughout the planning area; publically available data on previous occurrences; and, other sources of information where available.

> ***Risk*** *is the potential loss associated with a hazard, defined in terms of probability, rate of recurrence, extent, severity, and end result.*
>
> ***Vulnerability*** *is the identification of what is capable of being affected as the result of a hazard.*

A more detailed hazard risk and vulnerability assessment information can be found in *Section Four: Risk Assessment*. This includes: the calculation of average annual damages; the discussion of significant previous occurrences; Special Flood Hazard Area (SFHA) data for flooding; and other hazard specific indicators of risk.

Information specific to each jurisdiction, including the results of their unique risk assessment can be found in their respective sections in *Section Seven: Participant Sections*.

### *CAPABILITY ASSESSMENT*

The purpose of conducting a capability assessment is to evaluate a jurisdiction's ability to implement mitigation actions. The process assists with the determination of which actions are feasible or are likely to be implemented over time given the jurisdiction's planning and regulatory; administrative and technical; fiscal; and educational capability. In addition, it provides the opportunity to assess existing planning mechanisms, to identify any gaps or weaknesses within existing government activities that might result in increased community vulnerability, and to highlight positive actions already in place that should be continually supported.

The capability assessment was conducted through a detailed survey *(see Appendix C)* that was sent out to the designated representative of each participating jurisdiction during the July meetings. The survey questionnaire requested information on capability indicators such as: existing planning endeavors and mechanisms; local policies, programs and ordinances, personnel resources, and budgetary considerations that would strengthen or weaken the localities' ability to implement identified hazard mitigation actions. This assessment provides an overview of the capability of a jurisdiction and also identifies room for future improvements.

## *PLAN UPDATE*

### *SET PLANNING GOALS AND OBJECTIVES*

The planning team reviewed the goals and objectives stated in the 2011 Twin Platte NRD Multi-Jurisdictional Hazard Mitigation Plan Update. These goals were updated to reflect current needs. Please refer to *Section Five: Mitigation Actions* for specific mitigation goals and objectives.

### *PUBLIC INVOLVEMENT AND OUTREACH*

Below is a summary of how information was locally distributed to the public to facilitate their involvement in this plan update.

At the beginning of the planning process the 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. Outreach included notification prior to all public meetings, as well as phone call and email reminders of upcoming meetings. In addition to directly distributing this information to a variety of government departments, the following stakeholder groups and school districts were also invited to the planning process.

**Table 10: Stakeholders Invited to Participate**

| Organization | Organization |
|---|---|
| **Private Schools** | **Assisted Living Facilities** |
| Our Redeemer Lutheran Schools | Welcov Assisted Living at Ogallala |
| Platte Valley Christian School | Centennial Park Retirement Village, LTD |
| St Paul's Lutheran Elementary School | Liberty House |
| St Luke Elementary Schools | Linden Estates |
| **Public Power Districts** | North Platte PE, LLC |
| McCook PPD | **Airports** |
| Dawson PPD | North Platte Regional Airport |
| Midwest Electric Coop. Corp | Searle Field (Ogallala) |
| Nebraska PPD | **Nursing Homes** |
| Panhandle Rural Electric Membership Association | Indian Hills Healthcare Community |
| Custer PPD | Centennial Park Retirement Village |
| **Hospitals** | Linden Court |
| Perkins County Health Services | North Platte Care Center, LLC |
| Great Plains Health | Sutherland Care Center |
| Ogallala Community Hospital | |

Stakeholder groups were encouraged to disperse information to their membership to gain a better, more well-rounded understanding of community concerns and needs. In addition to offering information and participating in the various planning meeting, stakeholder groups and school districts were also able to review a draft of the plan and offer comments prior to its finalization. Project updates were provided to stakeholder groups who participated in the planning process. Project updates were sent via email to everyone who attended either the Hazard Identification or Mitigation Strategies meetings. Neighboring jurisdictions were invited as well. The following table indicates which neighboring communities were notified of the planning process. Letters were sent to county clerks, unless otherwise noted, at their respective jurisdictions and disseminated appropriately.

**Table 11: List of Neighboring Jurisdictions Notified of the Planning Process**

| Community | |
|---|---|
| Garden County | Dawson County |
| Deuel County | Custer County |
| Perkins County | Logan County |
| Hayes County | Hooker County |
| Frontier County | Grant County |

### *GENERAL PLANS, DOCUMENTS, AND INFORMATION*

General plans, documents, and information used throughout the development and update of the plan are listed in the following table:

**Table 12: 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 |
| Local Mitigation Planning Handbook (2013) | http://www.fema.gov/media-library-data/20130726-1910-25045-9160/fema_local_mitigation_handbook.pdf |
| Hazard Mitigation Assistance Unified Guidance (2013) | http://www.fema.gov/hazard-mitigation-assistance |
| What is a Benefit: Guidance on Benefit-Cost Analysis on Hazard Mitigation Projects | http://www.fema.gov/benefit-cost-analysis |
| The Census of Agriculture (2012) | http://www.agcensus.usda.gov/ |
| National Flood Insurance Program Community Status Book (2014) | http://www.fema.gov/cis/NE.html |
| Local Mitigation Plan Review Guide (2013) | http://www.fema.gov |
| **Plans/Studies** | **Source** |
| Nebraska Drought Mitigation and Response Plan (2000) | http://carc.nebraska.gov/docs/NebraskaDrought.pdf |
| State of Nebraska Hazard Mitigation Plan (2014) | http://www.nema.ne.gov/pdf/hazmitplan.pdf |
| Nebraska Geological Survey Landslide Study (2006) | http://snr.unl.edu/csd/surveyareas/geology.asp |
| Community Comprehensive Plans/Zoning and Subdivision regulations | From respective communities |
| **Data Sources/Technical Resources** | **Source** |
| Federal Emergency Management Agency | http://www.fema.gov |
| United States Department of Commerce | http://www.commerce.gov/ |
| National Oceanic Atmospheric Administration | http://www.noaa.gov/ |
| National Environmental Satellite, Data, and Information Service | http://www.nesdis.noaa.gov/ |
| National Climatic Data Center | http://www.ncdc.noaa.gov |
| Storm Prediction Center Statistics | http://www.spc.noaa.gov |
| United States Geological Survey | http://www.usgs.gov/ |
| United States Department of Agriculture | http://www.usda.gov |
| United States Department of Agriculture – Risk Assessment Agency | http://www.rma.usda.gov |
| National Agricultural Statistics Service | http://www.nass.usda.gov/ |
| High Plains Regional Climate Center | http://www.hprcc.unl.edu |
| United States Census Bureau | http://www.census.gov |
| National Flood Insurance Program | http://www.fema.gov<br>http://dnrdata.dnr.ne.gov |
| National Flood Insurance Program Bureau and Statistical Agent | http://www.fema.gov/national-flood-insurance-program |
| FEMA Map Service Center | http://www.msc.fema.gov |
| National Drought Mitigation Center – Drought Monitor | http://drought.unl.edu/dm/monitor.html |
| National Drought Mitigation Center – Drought Impact Reporter | http://www.droughtreporter.unl.edu |

| Documents | Source |
|---|---|
| National Historic Registry | http://www.nps.gov/nr |
| United States Small Business Administration | http://www.sba.gov |
| Nebraska Emergency Management Agency | http://www.nema.ne.gov |
| Nebraska Climate Assessment Response Committee | http://carc.agr.ne.gov |
| Nebraska Department of Natural Resources | http://www.dnr.ne.gov |
| Nebraska Department of Natural Resources – GIS | http://dnrdata.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 |
| Natural Resources Conservation Service | www.ne.nrcs.usda.gov |
| Nebraska Forest Service | http://www.nfs.unl.edu/ |
| Nebraska Forest Service – Wildland Fire Protection Program | http://nfs.unl.edu/program-wildlandfireprotection.asp |
| Nebraska Association of Resources Districts | http://www.nrdnet.org |
| Nebraska Public Power District Service | http://sites.nppd.com |
| Nebraska Department of Revenue – Property Assessment Division | www.revenue.ne.gov/PAD |
| UNL – College of Agricultural Sciences and Natural Resources – Schools of Natural Resources | http://casnr.unl.edu |
| High Hazard Dam Inundation Area/Information | http://dnr.ne.gov/website |

### *PUBLIC REVIEW*

Once the draft of the Hazard Mitigation Plan 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 10, 2016 through April 10, 2016. Participating jurisdictions were emailed and mailed a letter notifying them of this public review period. The Hazard Mitigation Plan was also made available on the project website (http://jeo.com/tphmp/) to download the document. Comments and changes that were received were incorporated into the plan.

### *PLAN APPROVAL AND 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 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 6* describes the system that participating jurisdictions in the planning area 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: REGIONAL PROFILE AND ASSET INVENTORY

## *INTRODUCTION*

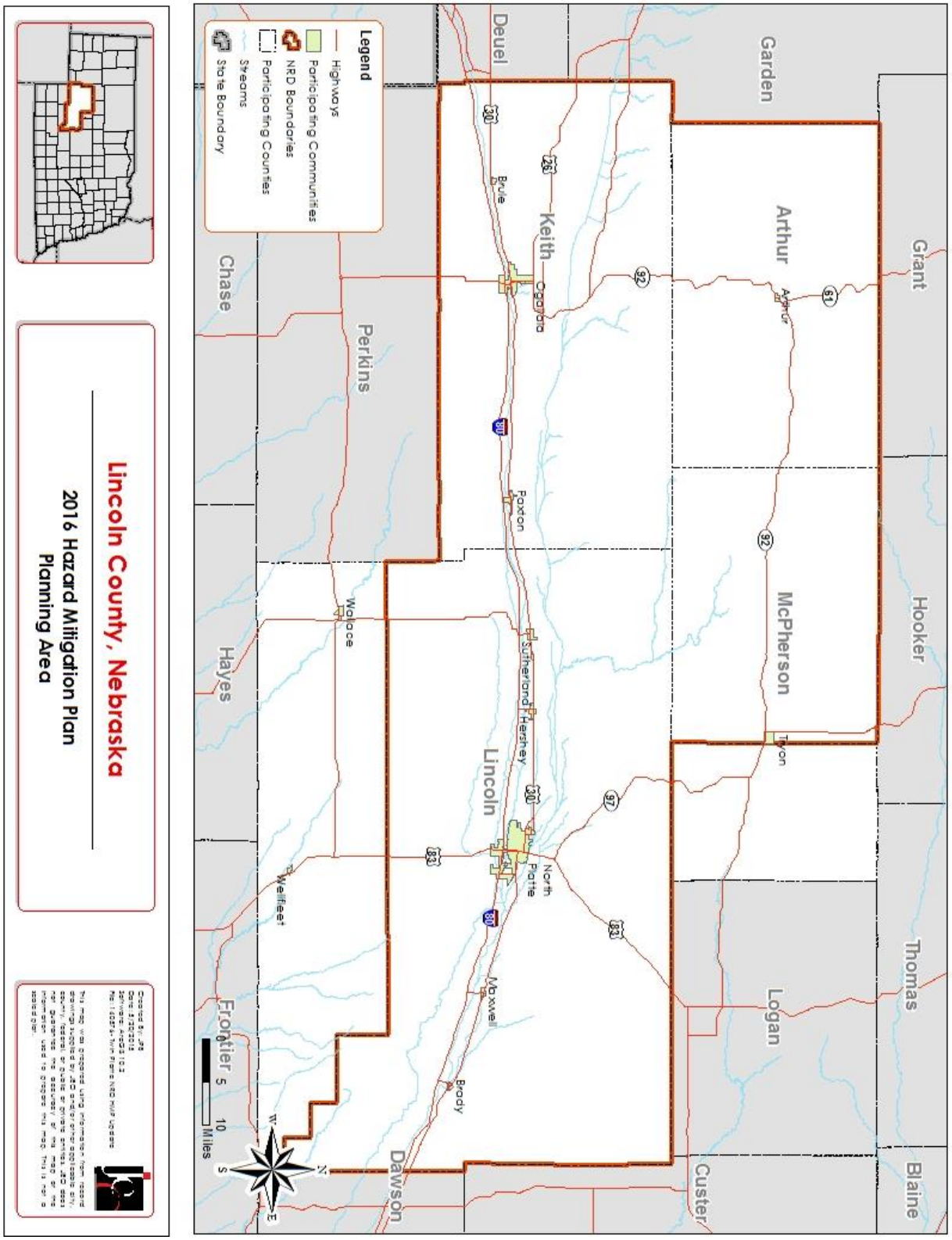
It is vitally important to understand the people and built environment within the planning area in order to identify vulnerabilities. The purpose of this section is to provide an overall profile of the planning area including: geography, demographics, structural inventory, and regional capabilities.

## *PLANNING AREA GEOGRAPHIC SUMMARY*

The Twin Platte NRD is located in western Nebraska and serves an estimated population of 43,000 in four counties: Arthur, Keith, Lincoln, and McPherson. The planning area will encompass the Twin Platte NRD as well as the entirety of Lincoln and McPherson Counties.

The planning area is comprised of three topographic regions: plains, dissected plains, and sand hills. The plains are represented by flat-lying land above the valley that are made from sandstone or stream-deposited silt, clay sand and gravel overlain by wind-deposited silt. Dissected plains are represented by hilly lands with moderate to steep slopes and sharp ridge crests. Sand hills are hilly lands comprised of low to high dunes of sand stabilized by a grass cover.

**Figure 3: Planning Area**



## *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.

As populations change, through growth or decline, 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 area; 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 urban areas. According to the US Census, the regional population for 2010 is 45,975 persons. This is an increase of 2.2 percent in ten years. The projected population was created using the birth and death rates from the Nebraska Department of Health and Human Services' Vital Records. This is a relatively simple method to predict population change, but it does not account for predominant age cohorts in the community or in and out migration, both of which will likely impact the rate of growth or decline. The 2020 population projections indicate a modest increase from 2010.

**Table 13: Population Trends 2000-2010**

| Jurisdiction | 2000 Population | 2010 Population | % Change (2000 – 2010) | 2020 Projected Population |
|---|---|---|---|---|
| Arthur County (Total) | 444 | 460 | 3.6% | 400 |
| Arthur | 145 | 117 | -19.3% | 102 |
| Keith County (Total) | 8,875 | 8,368 | -5.7% | 8,101 |
| Brule | 372 | 326 | -12.4% | 318 |
| Ogallala | 4,930 | 4,737 | -3.9% | 4,562 |
| Paxton | 614 | 523 | -14.8% | 509 |
| Lincoln County (Total) | 34,632 | 36,288 | 4.8% | 37,086 |
| Brady | 366 | 428 | 16.9% | 435 |
| Hershey | 572 | 665 | 16.3% | 676 |
| Maxwell | 315 | 312 | -0.9% | 317 |
| North Platte | 23,878 | 24,733 | 3.6% | 25,326 |
| Sutherland | 1,129 | 1,286 | 13.9% | 1,308 |
| Wallace | 329 | 366 | 11.2% | 372 |
| Wellfleet | 76 | 78 | 2.6% | 79 |
| McPherson County (Total) | 533 | 382 | -28.3% | 388 |
| **Total** | **44,484** | **45,498** | **2.2%** | **45,975** |

*Sources: United States Census Bureau - 2000, 2010; Nebraska Department of Health and Human Services*

The following table shows the population by age in each community of the planning area. The largest cohort of 35-54 represents 25.6 percent of the population, or 11,579 persons. The smallest cohort of 85 and older represents 2.4 percent of the population, or 1,098 persons. The Village of Brule (5.5 percent) has well above the planning area average for the population 85 and older.

The age cohorts that represent the highest levels of vulnerability those of people under the age of 19 and over the age of 55. For the planning area, over 26-percent of the population is under the age of 19. This group is vulnerable to a wide range of hazards including: severe winter storms, tornado, and extreme heat. Most individuals under the age of 19 are reliant on others for transportation. Events that require evacuation or relocation (such as moving to a tornado shelter) would require transportation that may or may not be immediately available, as they are dependent on others in the area. This demographic group is more likely to be clustered together, especially during daytime hours when they are in school. An event, like a tornado, that impacts a school building during school hours could result in a much higher injury and/or fatality count than if this group was dispersed throughout the community. According to the American Association of Pediatrics, children of all ages are much more vulnerable to the effects of extreme heat (such as when exercising outside during school hours) due to a decreased ability to regulate their body temperature.

Individuals over the age of 55 constitute over 31-percent of the planning area population with over half of those individuals (17-percent of the total population) being over the age of 65. This demographic group also experiences higher risks related to a number of natural hazards which include: severe winter storms, tornados, severe thunder storms, and extreme heat. A 2011 study conducted by the Center for Injury Research and Policy 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 symptoms of cardiac distress during snow removal. Community members over the over the age of 65 have a higher rate of decreased mobility, directly impacting their ability to seek shelter during extreme weather events. Power outages during severe thunderstorms and severe winter storms may also result in prolonged power outages resulting in negative outcomes for community members dependent on medical equipment.

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.

**Table 14: Planning Area's Population by Age**

| Jurisdiction | <9 | 10 - 19 | 20 - 34 | 35 - 54 | 55 - 64 | 65 - 84 | >85 | Median | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Arthur County** | 111 | 62 | 61 | 125 | 69 | 77 | 2 | 37.5 | 507 |
| | 21.9% | 12.2% | 12.0% | 24.7% | 13.6% | 15.2% | 0.4% | | 100% |
| **Arthur** | 47 | 28 | 16 | 48 | 33 | 18 | 1 | 39.6 | 191 |
| | 24.6% | 14.6% | 8.4% | 25.1% | 17.3% | 9.4% | 0.5% | | 100% |
| **Keith County** | 892 | 982 | 1061 | 2211 | 1265 | 1669 | 167 | 48.5 | 8,247 |
| | 10.8% | 11.9% | 12.9% | 26.8% | 15.3% | 20.2% | 2.0% | | 100% |
| **Brule** | 11 | 47 | 10 | 90 | 76 | 73 | 18 | 55.4 | 325 |
| | 3.3% | 14.4% | 3.1% | 27.7% | 23.3% | 22.4% | 5.5% | | 100% |
| **Ogallala** | 637 | 487 | 799 | 1211 | 553 | 843 | 141 | 45.4 | 4,671 |

| Jurisdiction | <9 | 10 - 19 | 20 - 34 | 35 - 54 | 55 - 64 | 65 - 84 | >85 | Median | Total |
|---|---|---|---|---|---|---|---|---|---|
| | 13.6% | 10.4% | 17.1% | 25.9% | 11.8% | 18.0% | 3.0% | | 100% |
| **Paxton** | 68 | 103 | 85 | 173 | 79 | 83 | 0 | 39.2 | 591 |
| | 11.5% | 17.4% | 14.4% | 29.3% | 13.4% | 14.0% | 0% | | 100% |
| **Lincoln County** | 4,996 | 4,837 | 6,425 | 9,142 | 4,928 | 4,888 | 912 | 39.1 | 36,128 |
| | 13.8% | 13.4% | 17.8% | 25.3% | 13.6% | 13.5% | 2.5% | | 100% |
| **Brady** | 87 | 81 | 69 | 105 | 53 | 53 | 11 | 33.6 | 459 |
| | 18.9% | 17.6% | 15.0% | 22.9% | 11.5% | 11.5% | 2.4% | | 100% |
| **Hershey** | 72 | 114 | 71 | 177 | 149 | 79 | 9 | 39.9 | 671 |
| | 10.7% | 16.9% | 10.6% | 26.4% | 22.2% | 11.8% | 1.3% | | 100% |
| **Maxwell** | 23 | 45 | 29 | 73 | 52 | 34 | 7 | 47.1 | 263 |
| | 8.7% | 17.1% | 11.0% | 10.9% | 19.8% | 12.9% | 2.7% | | 100% |
| **North Platte** | 3,557 | 3,278 | 2,853 | 5,857 | 3,128 | 3,166 | 686 | 36.4 | 24,609 |
| | 14.4% | 13.3% | 11.6% | 23.8% | 12.7% | 12.9% | 2.8% | | 100% |
| **Sutherland** | 242 | 215 | 176 | 430 | 211 | 235 | 59 | 42.7 | 1,568 |
| | 15.4% | 13.7% | 11.2% | 27.4% | 13.5% | 14.9% | 3.8% | | 100% |
| **Wallace** | 53 | 53 | 66 | 89 | 57 | 29 | 2 | 35.5 | 349 |
| | 15.2% | 15.2% | 18.9% | 25.5% | 16.3% | 8.3% | 0.6% | | 100% |
| **Wellfleet** | 0 | 19 | 0 | 26 | 19 | 13 | 0 | 48.7 | 77 |
| | 0% | 24.7% | 0% | 33.8% | 24.7% | 16.9% | 0% | | 100% |
| **McPherson County** | 49 | 40 | 73 | 101 | 48 | 56 | 17 | 43.7 | 382 |
| | 12.8% | 10.5% | 19.1% | 26.4% | 12.6% | 14.7% | 1.2% | | 100% |
| **Total** | 6,048 | 5,921 | 7,620 | 11,579 | 6,310 | 6,690 | 1,098 | - | 45,264 |
| | 13.4% | 13.1% | 16.8% | 25.6% | 13.9% | 14.8% | 2.4% | | 100% |

*Source: American Community Survey, 2009 - 2013*

## *BUILT ENVIRONMENT AND STRUCTURAL INVENTORY*

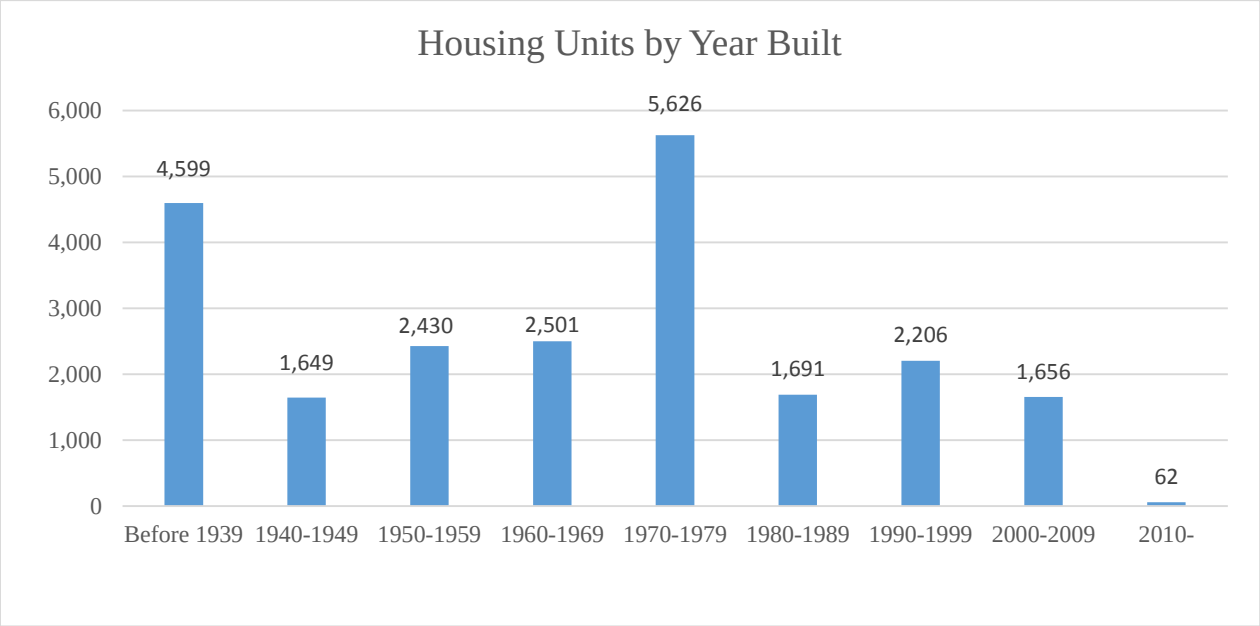
Data related to the built environment is an important component of a hazard mitigation plan. It is essential that during the planning process, communities and participating jurisdictions display an understanding of their built environment and work to identify needs that may exist within their planning area.

***HOUSING STATISTICS***

Figure 4 displays the age of housing units across the planning area. Most of the housing units within the planning area were constructed before 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. Over 80 percent of housing units were built prior to 1990 in the planning area.

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.

**Figure 4: Housing Units by Year Built**




*Source: American Community Survey, 2009 - 2013*

Approximately 1.7 percent (378 units) of occupied housing 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. Many counties in the planning area utilize the CodeRED phone service for severe weather alerts. This service will automatically call home or cell phones which are in the warning area determined by the National Weather Service. CodeRED also issues notices related to evacuations, bio-terrorism alerts, boil water notices, and missing child reports. CodeRED requires citizens to voluntarily register for this service. As such, emergency managers should work to promote the registration of house and cell phone numbers with these systems.

Approximately 11.3 percent of all 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.

Approximately 4.5 percent of all housing units do not have a vehicle available. Households without vehicles may have difficulty evacuating during hazardous events.

**Table 15: Selected Housing Characteristics for the Planning Area**

| Characteristic | Number of Units | Percent of Total |
|---|---|---|
| Occupied housing units | 19,199 | 85.6% |
| Lacking complete plumbing facilities | 38 | <1% |
| Lacking complete kitchen facilities | 177 | <1% |
| No telephone service available | 378 | 1.7% |
| Mobile homes | 2,531 | 11.3% |
| Housing unit with no vehicle available | 1,012 | 4.5% |
| House heating: bottled, tank, or LP gas | 2,175 | 9.7% |

*Sources: American Community Survey – 2009-2013, DP-4*

Occupied housing units may often be 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 what were once homes becoming projectiles and wind-borne debris. Wind-borne debris can injure people, damage vehicles and other structures, as well as create a post-impact environment where debris management is intensified.

**Table 16: Housing Occupancy and Tenure (Occupied, Vacant, Owner, Renter)**

| Jurisdiction | Total Housing Units | | | | Occupied Housing Units | | | |
|---|---|---|---|---|---|---|---|---|
| | Occupied | | Vacant | | Owner | | Renter | |
| | Number | Percent | Number | Percent | Number | Percent | Number | Percent |
| **Arthur County** | 177 | 74.7% | 60 | 25.3% | 109 | 61.6% | 68 | 38.4% |
| **Arthur** | 72 | 75.8% | 25 | 24.2% | 43 | 59.7% | 29 | 40.3% |
| **Keith County** | 3,786 | 70.2% | 1,610 | 29.8% | 2,649 | 70.0% | 1,137 | 30.0% |
| **Brule** | 169 | 81.3% | 39 | 18.8% | 144 | 85.2% | 25 | 14.8% |
| **Ogallala** | 2,117 | 91.3% | 201 | 8.7% | 1,422 | 67.2% | 695 | 32.8% |
| **Paxton** | 256 | 92.8% | 20 | 7.2% | 177 | 69.1% | 79 | 30.9% |
| **Lincoln County** | 15,067 | 90.9% | 1,500 | 9.1% | 10,338 | 68.6% | 4,729 | 31.4% |
| **Brady** | 167 | 86.5% | 26 | 13.5% | 128 | 76.6% | 39 | 23.4% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Hershey** | 260 | 84.7% | 47 | 15.3% | | 224 | 86.2% | 36 | 13.8% |
| **Maxwell** | 122 | 95.3% | 6 | 4.7% | | 91 | 74.6% | 31 | 25.4% |
| **North Platte** | 10,544 | 93.0% | 795 | 7.0% | | 6,684 | 63.5% | 3,850 | 36.5% |
| **Sutherland** | 559 | 96.2% | 22 | 3.8% | | 425 | 76.0% | 134 | 24.0% |
| **Wallace** | 143 | 84.6% | 26 | 15.4% | | 102 | 71.3% | 41 | 28.7% |
| **Wellfleet** | 38 | 88.4% | 5 | 11.6% | | 30 | 78.9% | 8 | 21.1% |
| **McPherson County** | 169 | 76.8% | 51 | 23.2% | | 117 | 69.2% | 52 | 30.8% |
| **Total** | 19,199 | 85.6% | 3,221 | 14.4% | | 13,213 | 68.8% | 5,986 | 31.2% |

*Source: American Community Survey, 2009 – 2013*

### *AT RISK POPULATIONS*

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."

In general, at risk populations may have difficulty with medical issues, poverty, lack of mobility, and communications due to language barriers. Several principals 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 can impact at risk populations in different ways
- This analysis does not factor in community or personal effort to reduce vulnerability

The following tables present a series of indicators which may suggest social vulnerability during hazard events. This list is not exhaustive and was influenced by the Social Vulnerability Index®. Additional tables in this section contain other social vulnerability indicators, such as the percentage of the population under the age of five or over the age of 65, the percentage of renter occupied units, age of housing, median household income, inventory of care facilities, and more.

**Table 17: Selected Social Vulnerability Indicators**

| County | % Ethnic Minority | % Female Headed Households; No Spouse Present | % Unemployed | % Living in Poverty | % With a Disability | % That Speak English Less Than Very Well |
|---|---|---|---|---|---|---|
| Arthur County | 0.4% | 8.0% | 4.0% | 6.9% | 3.7% | 0.8% |
| Keith County | 3.4% | 7.1% | 3.9% | 11.2% | 5.0% | 1.1% |
| Lincoln County | 5.4% | 8.9% | 5.6% | 11.4% | 7.6% | 1.6% |
| McPherson County | 0% | 3.8% | 1.3% | 13.6% | 10.9% | 0% |
| **Total** | **4.9%** | **8.5%** | **3.7%** | **11.0%** | **7.1%** | **1.4%** |

*Source: American Community Survey, 2009 – 2013*

Race and ethnicity contribute to social vulnerability through a lack of access to resources, cultural differences from a community's dominant culture, and the social, economic, and political marginalization that is often associated with these disparities. Language and cultural barriers can also affect access to post-disaster funding and residential locations in high hazard areas.

Women can have a more difficult time during recovery than men, often due to sector-specific employment, lower wages, and family care responsibilities.

The ability to absorb losses and enhance resilience against hazard impacts is influenced by the economic wellbeing of a community. Wealth enables communities to absorb and recover from losses more quickly due to insurance, social safety nets, and entitlement programs. Likewise, unemployed persons and/or persons living in poverty may be more vulnerable to the economic impacts of disasters. Expenses related to pre-disaster preparation, evacuation, and post-disaster recovery may be more burdensome for the unemployed. Further, residents with limited economic resources are more likely to live in older, more vulnerable structures. These structures could be: mobile homes; located in the floodplain; located near known hazard sites (i.e. chemical storage areas); or older poorly maintained structures. Residents below the poverty line are more vulnerable to all hazards within the planning area.

Residents who speak English as a second language may struggle with a range of issues before, during, and after hazard events. General vulnerabilities revolve around a potential inability to effectively communicate with others or difficulty comprehending materials aimed at notification and/or education. When presented with a hazardous situation, it is important that all community members be able to receive, decipher, and act on relevant information. An inability to understand warnings and notifications may prevent non-native English speakers from reacting in a timely manner.

**Table 18: Inventory of Care Facilities**

| Jurisdiction | Number of Hospitals | Number of Hospital Beds | Assisted Living Home | Assisted Living Beds | Nursing Homes | Nursing Home Beds | Child Care Facilities/ Preschools |
|---|---|---|---|---|---|---|---|
| Arthur County | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Keith County | 1 | 18 | 1 | 34 | 1 | 45 | 19 |
| Lincoln County | 1 | 116 | 4 | 233 | 3 | 324 | 59 |
| McPherson County | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*Sources: Department of Health and Human Services*

## *National Historic Registry*

According to the National Register of Historic Places, there are 22 historical places in the planning area. Below is a summary list of the historic sites located within the planning area. Detailed information of the historic sites is presented by participants in *Section Seven: Participant Section*.

The following table lists the sites within the planning area that are on the National Register of Historic Places.

**Table 19: Historic Sites**

| Site Name | Date Listed | County | In Floodplain? |
|---|---|---|---|
| Pilgrim Holiness Church | 6/18/1979 | Arthur | No |
| First Arthur County Courthouse and Jail | 1/10/1990 | Arthur | No |
| Diamond Springs Stage Station | 10/15/1970 | Keith | Yes |
| Beauvais' Ranche Archeological Site | 2/20/1975 | Keith | No |
| Big Blowout Site | 12/4/2001 | Keith | No |
| Meismer Bison Kill Site | 12/4/2001 | Keith | No |
| California Hill | 7/12/1974 | Keith | No |
| Roscoe State Aid Bridge | 6/29/1992 | Keith | Yes |
| Dr. Burdette L. Gainsforth House | 12/5/2002 | Keith | No |
| Keystone Community Church | 1/25/1979 | Keith | No |
| Leonidas A. Brandhoefer Mansion | 10/3/1973 | Keith | No |
| Standard Oil Red Crown Service Station | 8/20/2004 | Keith | No |
| Ogallala United States Post Office | 5/11/1992 | Keith | No |
| Fort McPherson | 3/7/2012 | Lincoln | No |
| Scout's Rest Ranch | 1/30/1978 | Lincoln | Yes |
| O'Fallon's Bluff | 7/12/1974 | Lincoln | No |
| Sutherland State Aid Bridge | 6/29/1992 | Lincoln | No |
| North Platte Post Office & Federal Building | 3/4/2009 | Lincoln | No |
| Fox Theater | 5/9/1985 | Lincoln | No |
| Hotel Yancey | 5/9/1985 | Lincoln | No |
| Lincoln County Courthouse | 1/10/1990 | Lincoln | No |
| Johnston Memorial Building | 3/20/1986 | Lincoln | No |

*Source: NPS National Register of Historic Places*

## *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.

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. To view jurisdiction specific critical facility maps refer to *Section 7: Participant Sections*.

## *Structural Inventory and Valuation*

The planning team requested GIS parcel data from the Assessor for each county. This data allowed the planning team to analyze the location, number, and value of property improvements at the parcel level. The data did not contain the number of structures on each parcel. Parcel level data was unavailable for the Village of Arthur and McPherson County. A summary of the results of this analysis is provided in the table below.

**Table 20: Structural Inventory and Valuation Summary**

| Community | Number of Improvements | Total Improvement Value | Mean Value of Improvements Per Parcel | Number of Improvements in Floodplain | Value of Improvements in Floodplain |
|---|---|---|---|---|---|
| Arthur County * | 134 | $5,946,750 | $44,378 | 58 | $662,520 |
| Arthur | N/A | N/A | N/A | N/A | N/A |
| Keith County | 1,166 | $47,618,930 | $40,839 | 242 | $17,886,425 |
| Brule | 19 | $4,014,340 | $211,281 | 6 | $3,862,930 |
| Ogallala | 191 | $8,488,010 | $44,439 | 21 | $4,279,675 |
| Paxton | 34 | $466,590 | $13,723 | 5 | $115,130 |
| Lincoln County | 14,482 | $1,691,993,077 | $116,834 | 1,685 | $258,002,220 |
| Brady | 210 | $11,078,750 | $52,756 | 4 | $144,650 |
| Hershey | 332 | $26,242,415 | $79,043 | 143 | $8,359,505 |
| Maxwell | 152 | $5,920,435 | $38,950 | 152 | $5,920,435 |
| North Platte | 9,021 | $1,078,685,760 | $119,574 | 319 | $107,884,385 |
| Sutherland | 514 | $47,079,630 | $91,595 | 61 | $4,266,770 |
| Wallace | 199 | $8,818,225 | $44,312 | 1 | $11,855 |
| Wellfleet | 47 | $1,057,235 | $22,494 | 0 | $0 |
| McPherson County | N/A | N/A | N/A | N/A | N/A |
| **Total** | **26,501** | **$2,937,410,147** | **$920,218** | **2,697** | **$411,396,500** |

**Floodplain generated using HAZUS 2.2*

## *CAPABILITY ASSESSMENT*

The capability assessment for the Twin Platte NRD plays a significant role in the overall planning process, and lays part of the foundation for developing effective and implementable hazard mitigation strategies. This process also assists with the determination of goals, objectives, and actions, which are likely to be implemented given the jurisdiction's planning and regulatory capacity, levels of administrative and technical support, available fiscal resources, and current political climate.

This section examines the capabilities at the regional, state, and federal level that significantly contribute to mitigating the impacts of natural and man-made hazards. Specific information for each jurisdiction is later demonstrated in *Section Seven: Participant Sections.*

*Regional Capability (Twin Platte NRD)*

Nebraska's system of local natural resources management is unique in the United States. Unlike the county-wide districts found in most states, NRDs are based on river basin boundaries, enabling them to approach natural resources on a watershed basis. Like the other 22 NRDs in Nebraska, Twin Platte NRD is autonomous, governed by a locally-elected Board of Directors. While NRDs share a common set of responsibilities, each district sets its own priorities and develops its own programs to serve local needs. In general, NRDs are charged under state law with 12 areas of responsibility:

- Erosion prevention and control
- Prevention of damages from flood water and sediment
- Flood prevention and control
- Soil conservation

- Water supply for any beneficial uses
- Development, management, utilization, and conservation of groundwater and surface water
- Pollution control
- Solid waste disposal and drainage
- Drainage improvement and channel rectification
- Development and management of fish and wildlife habitat
- Development and management of recreational and park facilities
- Forestry and range management

Twin Platte NRD has a number of projects and programs that fulfill the responsibilities required by state law. There are a wide variety of projects and programs that include the following:

- Water programs
- Grasslands and wildfire programs
- Chemigation program
- Integrated Management Plan (IMP)
- Trees and conservation programs
- Cost-share programs
- NE Rain Program
- Education programs
- Annual nitrogen and water management report

### *State Capability*

**Nebraska Emergency Management Agency**

NEMA is a small agency with less than 40 full and part-time employees, and is a part of the Military Department in the State of Nebraska. NEMA is responsible for emergency management, which is usually divided into four phases: preparedness, response, recovery, and mitigation.

NEMA's role related to mitigation includes, but is not limited to developing the state Hazard Mitigation Plan. This plan serves as a comprehensive set of guidelines for hazard response across the state. The state Hazard Mitigation Plan frames the discussion that will be conducted at the local level related to relevant hazards and needs across the state. The State Hazard Mitigation Officer and other mitigation staff members play active roles in assisting the development of local hazard mitigation plans. Representatives from the state hazard mitigation program serve as technical guides to local planning teams and regularly participate in local mitigation planning meetings. The state hazard mitigation program also oversees the HMGP and works with the Governor's taskforce to prioritize projects requesting funding assistance through the HMGP.

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

NEMA's role during a response is to assist communities in responding to hazard events when the need for assistance exceeds the local capabilities and resources. This includes facilitating and tracking grants, coordinating local needs, providing state and federal level assistance through activation of Emergency Operation Centers (EOC) , Mass Critical Shelters, Emergency Alert Systems (EAS) and providing technical, logistical, and administrative resources and expertise before, during, and after incidents. The

main purpose of the recovery phase is to perform actions that allow the return of normal living, or better conditions, which may include vital life saving measures. The secondary role of the recovery phase is grant administration and tracking, project monitoring, damage assessment, collaborating with communities on effective recovery options and opportunities, serving as liaison between federal level entities and local representatives, and serving as a technical resource throughout the recovery process.

For more information regarding the plans and NEMA's responsibilities as well as their ongoing projects, please go to http://www.nema.ne.gov.

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

NDNR plays a significant role in protecting and conserving water resources through the oversight of surface and groundwater status, and integrated water management. The NDNR is also responsible for a non-structural program of floodplain management, coordination and assistance with the National Flood Insurance Program as well as the Flood Mitigation Assistance Program, reviewing and approving engineering plans for new dams, rehabilitating old dams, and high hazard dam emergency preparedness plans. NDNR was very active throughout the hazard planning process and provided extensive resources and technical support for hazard risk and vulnerability analysis, such as flood and dam failure. NDNR also works with communities in many capacities including assisting in the completion of Benefit Cost Analysis (BCA).

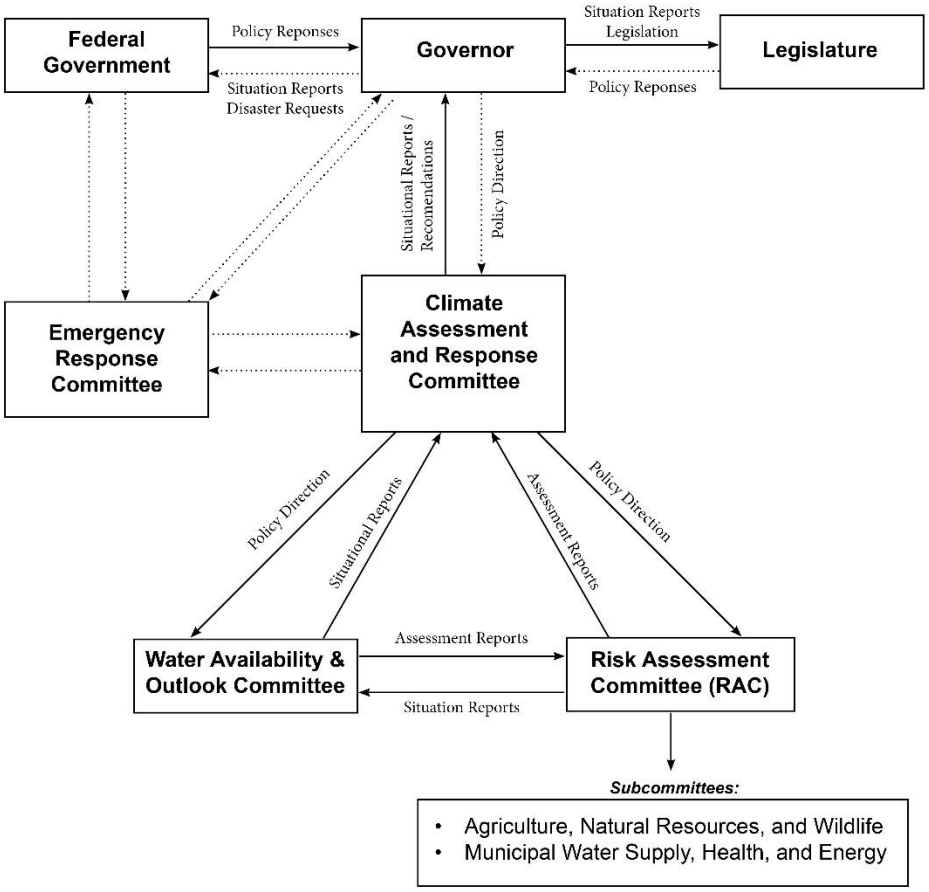
For more information regarding NDNR's responsibilities as well as their ongoing projects, please go to http://dnr.ne.gov/.

**Nebraska's Climate Assessment and Response Committee (CARC)**
Nebraska's CARC was established by the Nebraska Legislature in 1991 and serves as the major drought planning and response committee in state. The committee's duties are:

- To provide timely and systematic data collection, analysis, and dissemination of information about drought and other severe climate occurrences to the Governor and to other interested persons.
- To provide the Governor and other interested persons with information and advice relevant to requests for federal disaster declarations and to the use of funds and other types of assistance available to the state because of such declarations.
- To establish criteria for startup and shutdown of various assessment and response activities by state and federal agencies during drought and other climate-related emergencies.
- To provide an organizational structure that assures information flow and defines the duties and responsibilities of all agencies during times of drought and climate-related emergencies.
- To maintain a current inventory of state and federal agency responsibilities in assessing and responding to drought and other climate-related emergencies.
- To provide a mechanism for the improvement of methods of assessing impacts of drought on agriculture and industry.
- To provide such other coordination and communication among federal and state agencies as is deemed appropriate by such committee.
- To perform such other climate-related assessment and response functions as are desired by the Governor.

CARC also coordinated with other state and federal agencies to develop a State Drought Mitigation and Response Plan. The committee serves as a steering role for the state's drought plan and other climate-related activities. As shown in Figure 5, the other principal committees associated with CARC are the Water Availability and Outlook Committee (WAOC) and the Risk Assessment Committee (RAC). To avoid any overlap of duties, originally considered as a formal arm of CARC, Emergency Response Committee (ERC) was revised in June 2000 and its role was folded into the NEMA organization and separated from the official CARC structure.

**Figure 5: Organizational Components of Nebraska's CARC**




**Nebraska Forest Service**

The NFS is responsible for the care of existing forests within the state. The state agency is responsible for ensuring the health of state forests, ensuring that the forests are managed so they can provide logs for lumber, and protection of wildland from fire.

The NFS achieves these goals through a variety of programs. The Rural Forestry Assistance program provides assistance to landowners in need of forest management help. Some of these services include assistance and advice on forest and woodlot management, windbreak establishment, reforestation and other forestry related issues. The forest health program is responsible for maintaining a list of the most prominent pest problems in Nebraska, along with the trees affected, control recommendations, and timing. The wildland fire protection program is responsible for protecting wildlands from fire. The state does not have a fire suppression force within the forest service like other states. They rely on local firefighters to handle

the suppression of these fires. The agency does provide air support and equipment to the local firefighters if assistance is needed. The agency also focuses on prevention of fire.
For more information regarding the NFS's responsibilities as well as their ongoing projects, please go to http://nfs.unl.edu/

**Silver Jackets**
The Silver Jackets program is also worth mentioning for their extensive role in providing a formal and consistent strategy for an interagency approach to planning and implementing measures to reduce the risks associated with flooding and other natural hazards. It brings together multiple state, federal, and sometimes tribal and local agencies to learn from one another and apply their knowledge to reduce risk.

**Other Key Agencies**
Other agencies that play an active role in hazard mitigation planning at the state level are shown in the Table 21. Members from these agencies were designated as the Governor's Task Force for Disaster Recover (GTFDR) and served as the Planning Team responsible for coordinating the development of the 2014 State Hazard Mitigation Plan.

**Table 21: Other Key Agencies in the State of Nebraska**

| Agency | Official Website Link |
|---|---|
| Nebraska Department of Agriculture | http://www.nda.nebraska.gov/ |
| Nebraska State Patrol | https://statepatrol.nebraska.gov/ |
| Nebraska Department of Economic Development | http://www.neded.org/ |
| Nebraska Department of Environmental Quality | http://www.deq.state.ne.us/ |
| Nebraska Game and Parks Commission | http://outdoornebraska.ne.gov/ |
| Nebraska Historical Society | http://www.nebraskahistory.org/ |
| Nebraska Department of Administrative Services | http://das.nebraska.gov/ |
| Nebraska Department of Revenue | http://www.revenue.ne.gov/ |
| Nebraska Department of Health and Human Services | http://dhhs.ne.gov |
| Nebraska Forest Service | http://nfs.unl.edu/ |
| Nebraska Public Health Laboratory – UNMC | http://www.unmc.edu/pathology/ |
| University of Nebraska – School of Natural Resources | http://snr.unl.edu/ |

***FEDERAL ASSISTANCE***
The federal government and its sub-agencies have provided a variety of assistance for state and local governments in hazard mitigation planning and emergency response. The table below lists the major federal agencies and summarizes their major types of assistance. For more information regarding funding opportunities, please refer to Table 22. For more information regarding funding opportunities, please refer to *Appendix E*.

**Table 22: Major Federal Assistant Agencies**

| Agency | Type of Assistance | Official Website Link |
|---|---|---|
| Department of Homeland Security/Federal Emergency Management Agency | Administrative, Political, Funding, Educational, and Technical | http://www.fema.gov/ |
| National Oceanic and Atmospheric Administration | Educational and Technical | http://www.noaa.gov |
| U.S. Department of Agriculture | Funding, Educational, and Technical | http://www.usda.gov |
| U.S. Geological Survey | Educational and Technical | http://www.usgs.gov |

| Agency | Type of Assistance | Official Website Link |
|---|---|---|
| U.S. Environmental Protection Agency | Educational and Technical | http://www.epa.gov |
| U.S. Department of Housing and Urban Development | Administrative, Educational, and Technical | http://portal.hud.gov |
| U.S. Small Business Administration | Funding | http://www.sba.gov |
| U.S. Department of Transportation | Funding, Educational, and Technical | http://www.dot.gov/ |
| U.S. Department of Health and Human Services | Funding, Educational, and Technical | http://www.hhs.gov |

# SECTION FOUR: RISK ASSESSMENT

## INTRODUCTION

The ultimate purpose of this Hazard Mitigation Plan is to minimize the loss of life and property across the planning area. 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 23: Defined Terms**

| 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 | The 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 consist(s)(ed) 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* will include discussion of community specific assets at risk for relevant hazards.

***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.*

Analysis for regional risk will examine historic impacts and losses and what is possible, should the hazard occur in the future. Risk analysis will include both qualitative (i.e. description of historic or potential impacts) and quantitative data (i.e. assigning values and measurements for potential loss of assets). Finally, 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 24: Risk Assessment Data Sources**

| Type of Data | Data Source |
|---|---|
| Property Damage* | NCDC Storm Events Database |
| Crop Damage | USDA RMA |
| Sperry-Piltz Ice Accumulation Index (SPIA) | National Weather Service |
| Temperature, Precipitation, Snowfall | Weather Stations |
| TORRO Hailstone Scale | The Tornado and Storm Research Organization |
| Monthly Tornado Averages | NOAA |
| Tornado Time of Occurrence | NOAA |
| Tornado Activity in the United States | NOAA |
| Wind Zones in the United States | FEMA |
| Beaufort Wind Force Rankings | NWS |
| Historical Drought Intensity | National Drought Mitigation Center, University of Nebraska-Lincoln |
| Palmer Drought Severity Index | National Oceanic Atmospheric Administration, High Plains Regional Climate Center |
| USDA Secretarial Disaster Designations | US Department of Agriculture |
| Heat Index | NOAA |
| Number of Wildfires by Cause in Nebraska 2004-2010 | Nebraska Forest Service |
| Acres Burned by Cause in Nebraska 2004-2010 | Nebraska Forest Service |
| Wildfire Risk Potential Map | USDA Forest Service 2013 |
| NFIP Status | Nebraska Department of Natural Resources, National Flood Insurance Program |
| NFIP Policies - December 2012 | Nebraska Department of Natural Resources, National Flood Insurance Program |
| 2013 Recorded Animal Diseases | Nebraska Department of Agriculture |
| High Hazard Dams in the Planning Area | Nebraska Department of Natural Resources |
| Fault Lines in Nebraska | Nebraska Department of Natural Resources |
| Richter Scale | Federal Emergency Management Agency |
| Modified Mercalli Intensity Scale | Federal Emergency Management Agency |
| Nebraska Seismic Hazard Map | United States Geological Survey |
| Urban Fires by Type and Community | Nebraska State Fire Marshall |
| Fire Death Rates for the State of Nebraska | US Fire Administration |
| Chemical Spills from 1980 to 2014 (Transportation) | Pipeline and Hazardous Materials Safety Administration |
| Chemical Spills from 1982 to 2014 (Fixed Site) | National Response Center |

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

## *COMMUNITY BASED RISK ASSESSMENT*

Participating jurisdictions completed a risk assessment for their community/jurisdiction. The local planning teams were asked to prioritize hazards based on previous occurrences, impacts, and vulnerabilities. Participants were encouraged to consider: historic events; probability of future events; specific vulnerable populations; properties that may be at higher levels of risk related to hazards; potential impacts to critical facilities and critical services; and potential economic losses. The information developed during the community based risk assessment is presented in *Section Seven: Participant Sections.*

## *FUTURE DEVELOPMENT*

Future development in relation to vulnerability to hazards will be addressed in *Section Seven: Participant Sections.*

## *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 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 1996 to 2014. Although some data is available back to 1950, this plan update utilizes only the more current and more accurate data available.
- **Number of Hazard Events:** This shows how often an event occurs. The frequency of a hazard event will affect how the city responses. A thunderstorm may not cause much damage each time, but multiple storms can have an incremental effort 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:

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

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

## *HAZARD IDENTIFICATION*

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

- Agricultural Disease (Animal and Plant)
- Chemical Spills (Fixed Site)
- Chemical Spills (Transportation)
- Dam Failure
- Drought
- Earthquake
- Extreme Heat
- Flooding
- Grass/Wildfire
- Hail
- High Wind
- Levee Failure
- Severe Thunderstorm
- Severe Winter Storm
- Terrorism
- Tornado

## *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 mechanism 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 State Hazard Mitigation Plan 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 manifest as localized flooding and will be reported as such. This approach is consistent with the 2014 Nebraska State Hazard Mitigation Plan.

**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 or even in Nebraska. This approach is consistent with the 2014 Nebraska State Hazard Mitigation Plan.

**Landslide**: While there is data available related to landslide which have occurred across the state, the database has not been maintained in recent years. Further, landslides that have occurred across the state have resulted in no reported damages. There have been no recorded landslide events in the planning area. This is consistent with the 2014 Nebraska State Hazard Mitigation Plan.

**Radiological Fixed Site**: 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 exercise 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 State Hazard Mitigation Plan.

**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.

**Urban Fire**: The following table provides the data available from the Nebraska State Fire Marshal relevant for the planning area. The provided data suggests that the planning area has, and will continue experience fires in urban areas. Fire departments within the planning area have mutual aid agreements in place to address this threat, typically this hazard is addressed through existing plans and resources. Urban fire will not be fully profiled for this plan. Discussion relative to fire will be focused on wildfire and the potential impacts they could have on the built environment. This approach is consistent with the 2014 Nebraska State Hazard Mitigation Plan.

**Table 25: Urban Fire Incidents**

| Fire Department | Number of Urban Fire Incidents | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | Total |
| **Arthur County** | | | | | | | |
| Arthur Co Rural Fire Prot District | 5 | 8 | 3 | 6 | 6 | 13 | 41 |
| **Keith County** | | | | | | | |
| Brule Vol Fire Dept | - | - | - | - | - | 13 | 13 |
| Keystone-Lemoyne Fire & Rescue | 8 | 19 | - | - | - | - | 27 |
| Ogallala Vol Fire Dept | 1 | | - | 4 | 26 | 46 | 77 |
| Paxton Fire & Rescue | 8 | 14 | - | - | - | - | 22 |
| **Lincoln County** | | | | | | | |
| Brady Rural Fire Dept | - | - | - | - | - | - | - |
| Hershey Vol Fire Dept | 21 | 19 | 25 | 22 | 20 | 27 | 134 |
| North Platte Airport Authority | - | - | - | - | - | - | - |
| North Platte Fire Dept | 29 | 114 | 79 | 15 | - | 1 | 238 |
| Sutherland Vol Fire Dept | - | - | - | - | - | - | - |
| Wallace Rural Fire Dist | - | - | - | - | - | - | - |
| **McPherson County** | | | | | | | |
| McPherson County Fire Dept | 5 | 3 | 5 | 7 | 6 | - | 26 |

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

## *RISK 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, nor are full discussion of individual hazards included in this section.

**Table 26: Regional Risk Assessment**

| Regional Risk Assessment | | | |
|---|---|---|---|
| **Hazard** | **Previous Occurrence Events/Years** | **Approximate Annual Probability** | **Likely Extent** |
| **Agricultural Animal Disease** | 2,005/1.5 | 100% | Unavailable |
| **Agricultural Plant Disease** | 29/19 | 100% | Unavailable |
| **Chemical Spill (Fixed Sites)** | 69/32 | 100% | 532 Gallons |
| **Chemical Spill (Transportation)** | 329/36 | 100% | Limited (<1 mile from release site) |
| **Dam Failure** | 0 | ~1% | Total inundation in floodplain downstream from dam |
| **Drought**** | 175/780** | 22% | D2 |
| **Earthquakes** | 0/42 | ~1% | <4.0 |
| **Extreme Heat** | 37/1 | 100% | >90°F |
| **Flooding** | 50/19 | 100% | Some inundation of structures* (<1% of structures) and roads near streams. Some evacuations of people may be necessary (<1% of population) |
| **Grass/Wildfires** | 1,041/15 | 100% | <100 acres |
| **Hail** | 1209/19 | 100% | H3 – H6 |
| **High Winds** | 444/19 | 100% | 9 BWF |
| **Levee Failure** | 0 | ~1% | 0 structures located in protected areas |
| **Severe Thunderstorms** | 364/19 | 100% | ≥1" rainfall |
| **Severe Winter Storms** | 163/19 | 100% | .25 - .5" ice<br>20 - 40°F below zero (wind chills)<br>4 – 8" snow<br>25 – 40 mph winds |
| **Terrorism** | 0 | ~1% | Undefined |
| **Tornados** | 78/19 | 100% | EF0 |

*Quantification of vulnerable structures provided in *Section Seven: Participant Sections*
**Drought occurrence is measured by months

**Table 27: 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 | Unknown | Unknown | N/A | N/A |
| Agricultural Plant Disease | N/A | N/A | $376,501 | $25,100 |
| Chemical Fixed Sites | Unknown | Unknown | $0 | $0 |
| Chemical Transportation | $436,289 | $14,543 | $0 | $0 |
| Dam Failure | $0 | $0 | $0 | $0 |

| Hazard Type | Total Property Loss[1] | Average Annual Property Loss[1] | Total Crop Loss[2] | Average Annual Crop Loss[2] |
|---|---|---|---|---|
| Drought | $0 | $0 | $55,995,082 | $3,733,005 |
| Extreme Heat | $0 | $0 | $12,386,335 | $825,756 |
| Flooding | $3,688,000 | $194,105 | $444,445 | $29,630 |
| Grass/Wildfires | $2,000,000 | $105,263 | $156,621[3] | $12,048[3] |
| Hail Events | $56,163,700 | $2,955,984 | $62,191,464 | $4,146,098 |
| High Winds | $4,836,200 | $254,537 | $6,435,481 | $429,032 |
| Severe Thunderstorms | $4,259,700 | $224,195 | N/A | N/A |
| Severe Winter Storms | $1,149,000 | $60,474 | $3,028,524 | $201,902 |
| Terrorism | $0 | $0 | $0 | $0 |
| Tornados | $4,378,750 | $230,461 | $3,193 | $213 |

*1 Indicates data is from NCDC (January 1996 to April 2015)*
*2 Indicates data is from USDA (2000 to 2014)*
*3 Indicates data is from NFS (2000 to 2012)*

## *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 US 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 28: SBA Declarations**

| Declared | Disaster Number | Incident | Primary Counties | Contiguous Counties |
|---|---|---|---|---|
| 6/25/2015 | NE-00065 | Severe Storms, Straight-line Winds, and Flooding | Lincoln | - |
| 1/18/2015 | NE-00059 | Drought | Arthur, McPherson | Keith, Lincoln |
| 12/9/2014 | NE-00056 | Drought | Keith, Lincoln | Arthur, McPherson |
| 12/10/2013 | NE-00053 | Drought | Arthur, Keith, Lincoln, McPherson | - |
| 4/1/2013 | NE-00049 | Drought | Arthur, Keith, Lincoln, McPherson | - |
| 11/9/2011 | NE-00046 | Severe Storms with Excessive Rain, Flash | Arthur | Keith, Lincoln, McPherson |

| Declared | Disaster Number | Incident | Primary Counties | Contiguous Counties |
|---|---|---|---|---|
| | | Flooding, Hail, and High Winds | | |
| 10/5/2011 | NE-00045 | Severe Storms with Excessive Rain, Hail, and High Winds | Keith | Arthur, Lincoln, McPherson |
| 8/12/2011 | NE-00043 | Flooding | Lincoln | - |
| 7/18/2011 | NE-00042 | Flooding | Lincoln | Keith, McPherson |
| 9/7/2011 | NE-00041 | Flooding | Lincoln | Keith, McPherson |
| 7/15/2010 | NE-00038 | Severe Storms, Flooding, and Tornados | Arthur, Lincoln, McPherson | - |
| 4/21/2010 | NE-00035 | Severe Storms, Ice Jams, and Flooding | Arthur | - |
| 7/31/2009 | NE-00027 | Severe Storms, Tornados, and Flooding | Arthur, Lincoln | - |
| 6/20/2008 | NE-00021 | Severe Storms, Flooding, and Tornados | Lincoln, McPherson | - |
| 8/29/2007 | NE-00017 | Severe Storms and Flooding | Arthur, Keith, McPherson | - |
| 7/24/2007 | NE-00014 | Severe Storms, and Flooding | Lincoln | - |
| 1/7/2007 | NE-00011 | Severe Winter Storms | Keith, Lincoln | - |
| 1/26/2006 | NE-00005 | Severe Winter Storm | Lincoln, McPherson | - |

***Source: United States Small Business Administration***

### *PRESIDENTIAL DISASTER DECLARATIONS*

The presidential disaster declarations involving the planning area through July 2015 are summarized in the following table. Declarations prior to 1962 are available on the FEMA website, but do not list designated counties.

**Table 29: Presidential Disaster Declarations**

| Disaster Declaration Number | Declaration Date | Disaster Type | Declared County/Area |
|---|---|---|---|
| 4013 | 8/12/2011 | Flooding | Lincoln |
| 3323 | 6/18/2011 | Flooding | Lincoln |
| 1924 | 7/15/2010 | Severe Storms and Flooding | Arthur, Lincoln, McPherson |
| 1902 | 4/21/2010 | Severe Storms, Ice Jams, and Flooding | Arthur County |
| 1853 | 7/31/2009 | Severe Storms, Flooding, and Tornados | Arthur, Lincoln |
| 1770 | 6/20/2008 | Severe Storms, Tornados, and Flooding | Lincoln, McPherson |
| 1721 | 8/29/2007 | Severe Storms and Flooding | Arthur, Keith, McPherson |
| 1714 | 7/24/2007 | Severe Storms and Flooding | Lincoln |
| 1674 | 1/7/2007 | Severe Winter Storms | Keith, Lincoln |
| 1627 | 1/26/2006 | Severe Winter Storm | Lincoln, McPherson |
| 3245 | 9/13/2005 | Hurricane Katrina Evacuees | Arthur, Keith, Lincoln, McPherson |
| 1480 | 7/21/2003 | Severe Storms and Tornados | McPherson |

| Disaster Declaration Number | Declaration Date | Disaster Type | Declared County/Area |
|---|---|---|---|
| 1373 | 5/16/2001 | Severe Winter Storms, Flooding, and Tornados | Keith, Lincoln, McPherson |
| 1190 | 11/1/1997 | Severe Winter Storms, Rain, and Strong Winds | Lincoln |
| 1027 | 5/9/1994 | Severe Snow and Ice Storm | Lincoln |
| 228 | 7/18/1967 | Severe Storms and Flooding | Arthur |

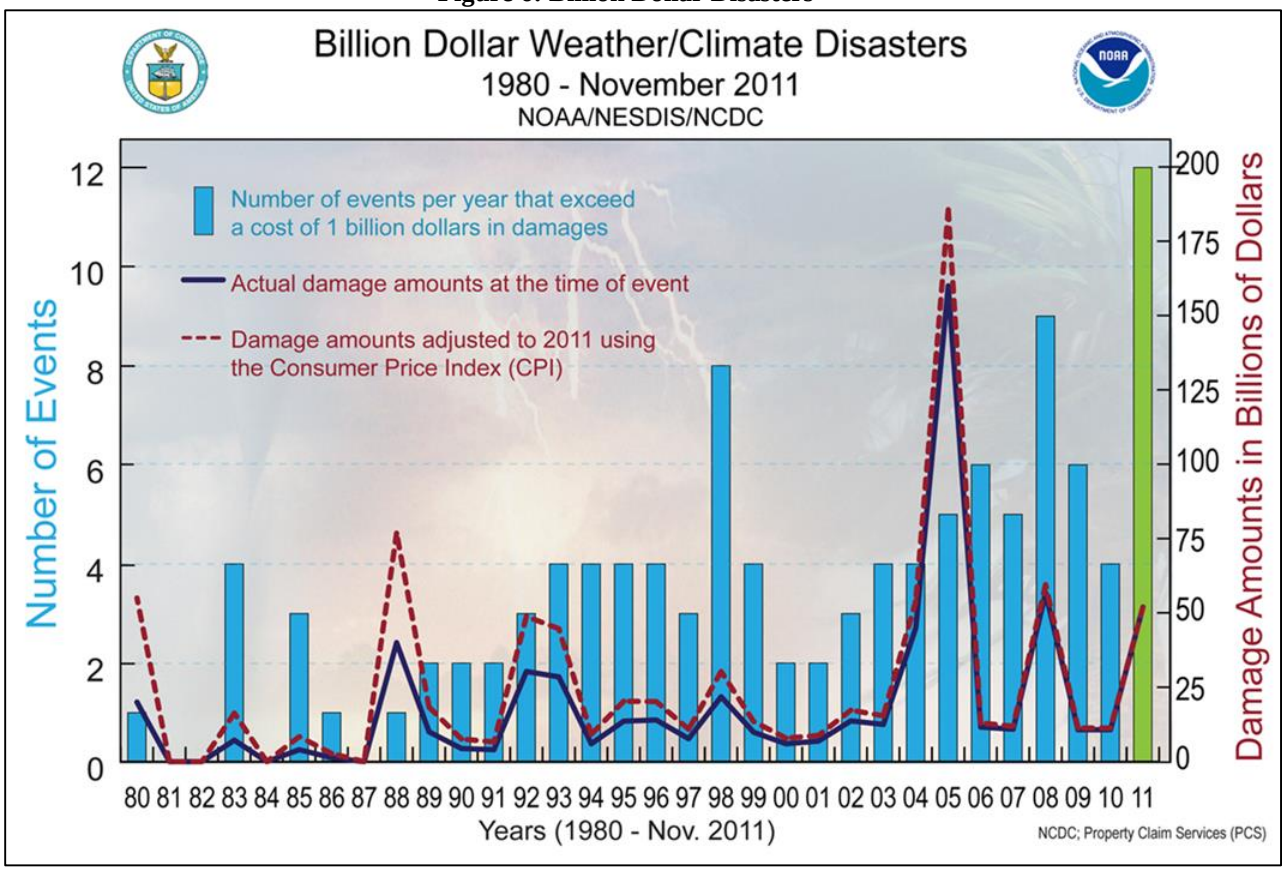
***Source: Federal Emergency Management Agency***

## CLIMATE ADAPTATION

Long term climate trends have and will continue to increase the risk to hazards within the planning area. The planet is warming due to a number of natural and anthropogenic forcings. This trend will have a number of significant economic, social, and environmental impacts on humans globally. This trend will also lead to an increase in the frequency and intensity of hazard events.

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, 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 Platte River from reduced snowpack in Rocky Mountains
- Additional 30-40 days in the frost-free season

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. This Hazard Mitigation Plan includes strategies for the planning area to address these changes, increase resilience and adapt to the future climate.

## HAZARD PROFILES

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

## *AGRICULTURAL DISEASE (ANIMAL AND PLANT DISEASE)*

### *HAZARD PROFILE*

Animal and plant diseases are 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 agriculture, and looks at the planning area's economy.

### *LOCATION*

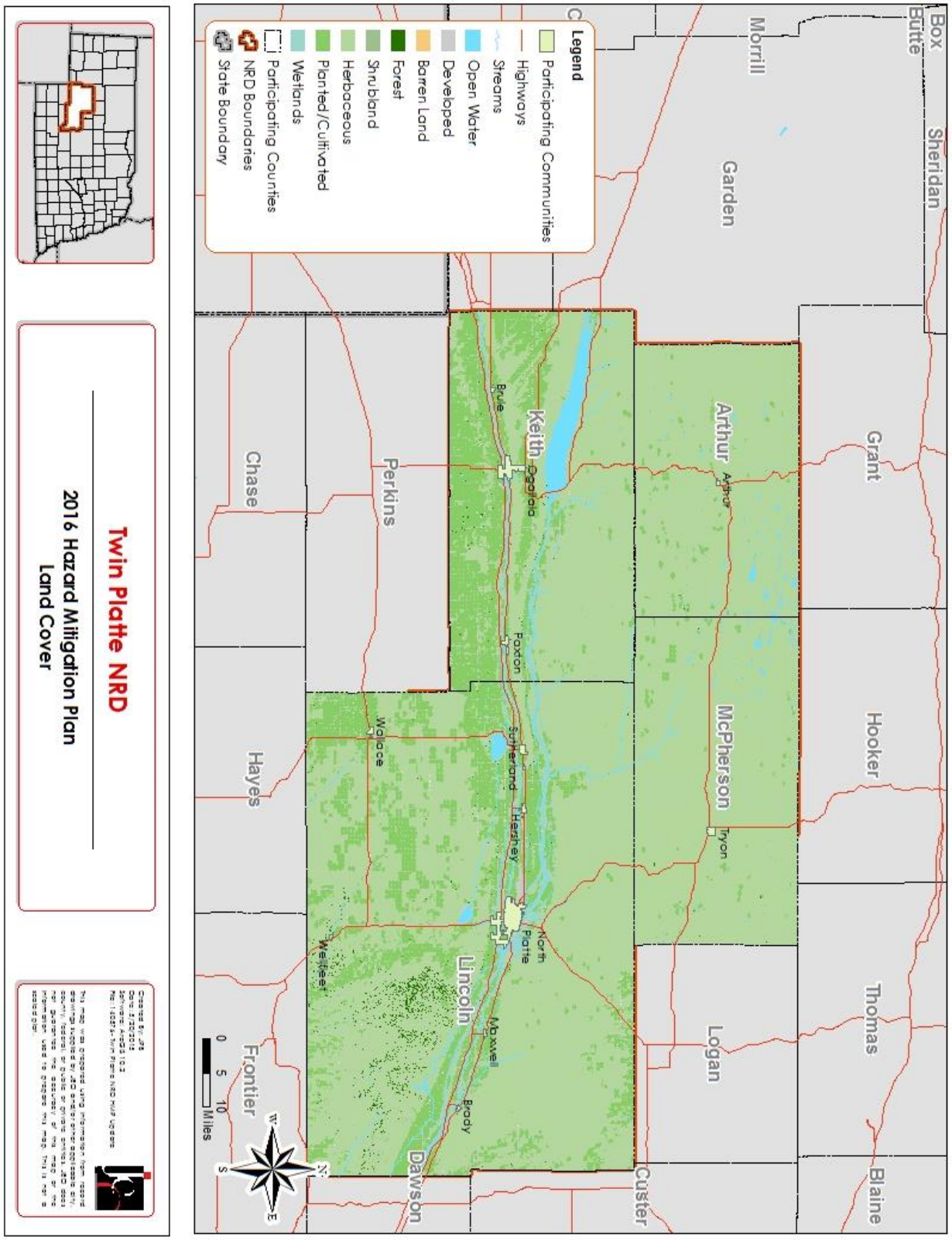
Mostly rural and agricultural areas are at risk to agricultural diseases. It is possible that developed/incorporated areas could be impacted more seriously if roadways were closed to limit the transportation of potentially tainted livestock. Figure 7 shows a map of land use with data provided by the University of Nebraska-Lincoln. The data is from a 2005 dataset, and while some of the uses may have changed since 2005, it is the most recent data available.

Given the planning area's agricultural economy, the majority of the planning area would be drastically impacted by any disease affecting crops or livestock.

### *EXTENT*

The likely extent of crop or livestock disease would be minor. Based on reports from participating jurisdictions most occurrences are limited in scope and geographic area. It is possible that large scale events could occur. Future updates could develop more statistics to provide a better quantification of extent related to agricultural diseases.

**Figure 7: Land Cover in the Planning Area**



***HISTORICAL OCCURRENCES***

According to the 2014 Nebraska Hazard Mitigation Plan Update and the Department of Agriculture Disease, the following four diseases were reported as having occurred throughout the 93 counties in Nebraska impacting livestock:

- **Chronic Wasting Disease (CWD)** – This disease was first reported in mule deer, white-tailed deer, black-tailed deer, and elk populations in the state's panhandle region beginning in 1998. Symptoms of the disease include weight loss, as well as incessant drinking and urination. An infected animal often stands listlessly, head down and ears drooping, with saliva dripping from its mouth. Between the years of 1997 and 2006 the Nebraska Game and Parks Commission confirmed 117 positive tests of CWD statewide. The livestock within the state have had no confirmed cases of the disease.

- **Vesicular Stomatitis (VS)** – In 2005, Nebraska had three horses test positive for VS. VS primarily affects cattle, horses, and swine, causing blisters on lips, tongues, and coronary bands. The blisters enlarge and break, leaving raw tissue that is so painful the animals refuse to eat or drink, and they become lame. Severe weight loss usually follows. In a herd affected by VS, nearly 90% of the animals may show clinical signs and nearly all develop antibodies. The disease is spread through direct contact between animals as well as through biting insects. If not properly handled, VS can be spread to humans and cause acute influenza like symptoms for four to seven days. There have been no new confirmed reports of VS in Nebraska since 2005.

- **Epizootic Hemorrhagic Disease (EHD)** – Commonly known as "blue tongue," is an acute, infectious, often fatal viral disease of some wild ruminants. It is characterized by extensive hemorrhaging, has been responsible for significant epizootics in deer in the northern United States and southern Canada. There have been ongoing confirmed reports of periodic outbreaks over the last fifty years in the state's deer population since the disease was first identified in 1955. All documented outbreaks of EHD have occurred during the late summer or early fall. Deer in the state's panhandle appear to be the most at risk when compared to other areas of the state. There have been no reports of EHD among the state's livestock; only wild game has been affected. The economic impact from such outbreaks could negatively impact businesses and communities that are reliant upon hunting for the majority of their sales or income.

- **Bovine Tuberculosis** – In the later stages of the disease, it is easier to see the clinical symptoms of Bovine Tuberculosis. According to the USDA, symptoms include: emaciation, lethargy, weakness, anorexia, low-grade fever, and pneumonia with a chronic, moist cough. Enlarged lymph nodes may also be present. Bovine Tuberculosis can be spread through the respiration of bacteria aerosols, contaminated feed or watering sites, or by drinking milk that is unpasteurized from infected animals. There is a high risk of contamination in enclosed areas such as barns that have poor ventilation. Bovine Tuberculosis primarily affects cattle but can be passed easily to any warm-blooded animal. In certain, but rare, conditions the disease can effect humans. In June of 2009, two beef cows in Rock County tested positive for the disease. In response to the findings, Nebraska Department of Agriculture (NDA) staff coordinated with federal animal disease officials to properly respond. The NDA with the help of federal officials tested 21,764 head of cattle in association with the investigation. As the NDA traced cattle movement into and out of the affected herd, 61 herds of cattle were quarantined in 20 of Nebraska's 93 counties. By April 7, 2010 all but three of those herds were released from quarantine. The herd that was initially affected was also released from quarantine and endured tests that are part of the USDA federal test and remove strategy.

- **Avian Influenza –** In the spring of 2015, the Nebraska Department of Agriculture confirmed the presence of highly pathogenic H5N2 avian influenza in commercial flocks in northeast Nebraska. This resulted in the Governor to issue a state of emergency declaration on May 12, 2015. As of the summer of 2015, the impacted farms led to the disposal of approximately 4.9 million chickens.

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

**Table 30: Livestock Inventory**

| County | Market Value of 2012 Agricultural Sales | Cattle | Hogs and Pigs | Chickens | Sheep |
|---|---|---|---|---|---|
| Arthur | $31,485,000 | 25,620 | - | - | - |
| Keith | $228,335,000 | 55,201 | - | - | 107 |
| Lincoln | $782,661,000 | 267,865 | 174 | 177 | 1,060 |
| McPherson | $30,107,000 | 36,247 | - | - | - |

*Source: 2012 U.S. Census of Agriculture*
*- Data not available*

In regard to diseases involving animals, the NDA provides reports on diseases occurring in the planning area. Table 31 includes those diseases and the number of occurrences, within the planning area between January 1, 2014, and June 30, 2015.

**Table 31: Animal Disease Reported to the Nebraska Department of Agriculture**

| Disease | Species Impacted | Number Of Occurrences |
|---|---|---|
| Bovine Viral Diarrhea | Bovine | 2,004 |
| Paratuberculosis | Bovine | 1 |

*Source: Nebraska Department of Agriculture*

The diseases listed above are only a sampling of the possible diseases that could impact animals. Data related to diseases and rates of disease among "free range game" is limited due to lack of laboratory testing, reporting, and field study.

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

**Table 32: Land and Value of Farms in the Planning Area**

| County | Number of Farms | Land in Farms | Market Value of 2012 Crop Sales |
|---|---|---|---|
| Arthur | 85 | 452,774 | $9,208,000 |
| Keith | 388 | 541,266 | $138,487,000 |
| Lincoln | 1,168 | 1,423,398 | $264,672,000 |
| McPherson | 118 | 470,820 | $5,873,000 |

*Source: 2012 U.S. Census of Agriculture*

**Table 33: Crop Values**

| Crop | Arthur County | | Keith County | | Lincoln County | | McPherson County | |
|---|---|---|---|---|---|---|---|---|
| | Acres Planted | Value (2012) | Acres Planted | Value (2012) | Acres Planted | Value (2012) | Acres Planted | Value (2012) |
| Corn | 5,480 | - | 107,699 | $86,545,000 | 201,473 | $191,808,00 | 2,117 | $2,399,000 |
| Sorghum | - | - | - | - | 450 | $245,000 | - | - |
| Soybeans | - | - | 17,511 | $15,447,000 | 42,392 | $30,896,000 | 386 | - |
| Wheat | - | - | 39,848 | - | 13,453 | $4,031,00 | - | - |

*Source: 2012 U.S. Census of Agriculture*
*- Data not available*

The above list does not account for all crops in the region as there are others such as sugar beets, dry beans, sunflowers, and chickpeas. However, the crops in Table 33 make up the bulk of the crop portion of the planning area's agricultural product. There are many diseases that can impact crops that vary from year to year, the most common of which are listed in Table 34.

**Table 34: Common Crop Diseases in Nebraska by Crop Types**

| Crop | Diseases | |
|---|---|---|
| Corn | • Anthracnose<br>• Bacterial Stalk Rot<br>• Common Rust<br>• Fusarium Stalk Rot<br>• Fusarium Root Rot<br>• Gray Leaf Spot<br>• Maize Chlorotic Mottle Virus | • Southern Rust<br>• Stewart's Wilt<br>• Common Smut<br>• Goss's Wilt<br>• Head Smut<br>• Physoderma |
| Soybeans | • Anthracnose<br>• Bacterial Blight<br>• Bean Pod Mottle<br>• Brown Spot<br>• Brown Stem Rot<br>• Charcoal Rot<br>• Frogeye Leaf Spot<br>• Phytophthora Root and Stem Rot<br>• Pod and Stem Blight | • Purple Seed Stain<br>• Rhizoctonia Root Rot<br>• Sclerotinia Stem Rot<br>• Soybean Mosaic Virus<br>• Soybean Rust<br>• Stem Canker<br>• Sudden Death Syndrome |
| Wheat | • Barley Yellow Dwarf<br>• Black Chaff<br>• Crown and Root Rot<br>• Fusarium Head Blight | • Leaf Rust<br>• Tan Spot<br>• Wheat Soil-borne Mosaic<br>• Wheat Streak Mosaic |
| Sorghum | • Ergot<br>• Sooty Stripe<br>• Zonate Leaf Spot | |

*Source: Nebraska Department of Agriculture*

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

- Grasshoppers,
- Western Bean Cutworm,
- European Corn Borer,
- Corn Rootworm,
- Corn Nematodes,
- Bean Weevil,

- Mexican Bean Beatle,
- Soybean Aphids, and
- Rootworm Beatles

***AVERAGE ANNUAL DAMAGES***

Using data from the USDA RMA, annual crop losses can be estimated for plant disease. However, the RMA does not track losses for livestock, so it is not possible to estimate losses due to animal disease.

**Table 35: Agricultural Disease Losses**

| Hazard Type | Number of Events | Total Crop Loss | Average Annual Crop Loss |
|---|---|---|---|
| Plant Disease | 29 | $376,501 | $25,100 |
| Insects | 30 | $546,264 | $36,418 |

*Source: USDA RMA, 2000-2015*

***PROBABILITY***

Based on the record provided by the NDA, it is likely that agricultural diseases (both plant and animal) will occur annually (100 percent probability).

***VULNERABILITY ASSESSMENT***

The historical occurrence of animal disease is low overall. Usually, animal disease impacts a relatively small number of livestock. However, it should be noted that during the most recent period of record, there was a significant outbreak which demonstrates the vulnerability for animal disease, though in a more inflated manner than prior reporting periods. As for plant disease, it is difficult to track the historical occurrence of plant disease for the planning area. In most growing seasons, there are some occurrences of plant disease but few result in significant impacts, economic or otherwise.

***MITIGATION ALTERNATIVES***

Hazard mitigation options for agricultural diseases focus primarily on education and outreach. Some of the options for the outreach include talking with the local extension agents about the types of plant and animal disease most common in the planning area. The NDA developed the Livestock Emergency Disease Reporting System which has a Veterinary Corps, and it offers training on managing livestock disease. The following are mitigation alternatives that jurisdictions could use to reduce their risk of agricultural disease.

- Education of local farmers regarding common diseases and any potential for new diseases
- Encourage farmers/ranchers to purchase crop insurance
- Develop early warning and response protocols for the agricultural sector
- Conduct an emergency management exercise related to agricultural disease outbreaks
- Quarantine farms that have an outbreak of certain diseases until all animals test negative for the disease

## *CHEMICAL SPILL (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.

Chemical manufacturers are one source of hazardous materials, but there are many others, including service stations, hospitals, and hazardous materials waste sites.

Varying quantities of hazardous materials are manufactured, used, or stored at an estimated 4.5 million facilities in the United States—from major industrial plants to local dry cleaning establishments 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. The Table 36 demonstrates the nine classes of hazardous material according to the 2012 Emergency Response Guidebook.

**Table 36: Hazardous Material Classes**

| Class | Type of Material | Divisions |
|---|---|---|
| 1 | Explosives | Division 1.1 – Explosives with a mass explosion hazard<br>Division 1.2 – Explosives with a projection hazard<br>Division 1.3 – Explosives predominantly a fire hazard<br>Division 1.4 – Explosives with no significant blast hazard<br>Division 1.5 – Very insensitive explosives with a mass explosion hazard<br>Division 1.6 – Extremely insensitive articles |
| 2 | Gases | Division 2.1 – Flammable gases<br>Division 2.2 – Non-flammable, non-toxic gases<br>Division 2.3 – Toxic gases |
| 3 | Flammable liquids (and Combustible liquids) | |
| 4 | Flammable solids; Spontaneously combustible materials | Division 4.1 – Flammable solids<br>Division 4.2 – Spontaneously combustible materials<br>Division 4.3 – Water-reactive substances/Dangerous when wet materials |
| 5 | Oxidizing substances and Organic peroxides | Division 5.1 – Oxidizing substances<br>Division 5.2 – Organic peroxides |
| 6 | Toxic substances and infections substances | Division 6.1 – Toxic substances<br>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 Nebraska Department of Environmental Quality (NDEQ) in 2013. A listing of chemical storage sites in each jurisdiction can be found in *Section Seven: Participant Sections*.

***EXTENT***

According to the historical record, the average chemical spill from a fixed site in the planning area is 532 gallons. Any spills that occur would likely be localized to the facilities and adjacent surroundings.

***HISTORICAL OCCURRENCES***

According to the U.S. Coast Guard's National Response Center database (NRC), there have been 69 fixed site chemical spills from 1982 – 2014 in the planning area. No property damages were recorded as a result of these chemical spills. The following table shows ten of the largest spills recorded in the planning area.

**Table 37: Fixed Site Chemical Spills**

| Date of Event | Location of Release | Quantity Spilled | Material Involved |
|---|---|---|---|
| 6/22/1990 | North Platte | 3,000 pounds | Anhydrous Ammonia |
| 12/19/1995 | North Platte | 10,000 Gallons | Oil, Diesel |
| 1/31/1997 | North Platte | 2,000 Gallons | Oil, Fuel |
| 7/26/1997 | North Platte | 1,000 Gallons | Oil, Diesel |
| 4/20/1999 | Sutherland | 2,247 Gallons | Sodium Hydroxide |

| Date of Event | Location of Release | Quantity Spilled | Material Involved |
|---|---|---|---|
| 3/7/2007 | Sutherland | 1,800 Gallons | Ethylene Glycol |
| 1/24/2008 | North Platte | 1,000 Gallons | Diesel Fuel/Water Mixture |
| 3/22/2009 | North Platte | 1,000 Gallons | Oil, Lubricating liquid |
| 6/12/2009 | North Platte | 2,000 Gallons | Oily Water |

### *AVERAGE ANNUAL DAMAGES*
Given a lack of recorded damages in the planning area, average annual damages and frequency were not calculated for this hazard.

### *PROBABILITY*
The historical record indicates that chemical releases at fixed site storage areas have a 100 percent chance of occurring annually. There were 69 reported events from 1980 to 2015 within the planning area.

### *VULNERABILITY ASSESSMENT*
Individuals in close proximity to an incident could see moderate to deadly health impacts depending upon the extent of the incident and the materials involved. Vulnerable populations may include the elderly and facilities with populations with low mobility such as hospitals, nursing homes, and housing units. The most common injury that might occur would be chemical burns from coming into contact with the substance that spilled. Breathing in the chemicals may lead to injuries or deaths if the spilled chemical is toxic. Fires or explosions are also possible with these spills and could cause injuries.

### *MITIGATION ALTERNATIVES*
Mitigation alternatives for this hazard include training, outreach and education, and planning to ensure that critical facilities are placed in lower risk areas when possible.

- Maintain a database of vulnerable populations
- Conduct training exercises on how to respond to an event
- Have all hazard weather radios in critical facilities
- Ensure emergency alert sirens are in working order
- Purchase a current copy of the Emergency Response Guidebook to be able to identify spilled substance

## *CHEMICAL SPILLS (TRANSPORTATION)*

### *HAZARD PROFILE*

Hazardous materials are defined by the US Pipeline and Hazardous Materials Safety Administration (PHMSA) as a substance that has been determine 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, or pipeline. They can include anhydrous ammonia, chlorine gas, hydrochloric acid, natural gas liquids, derivatives of petroleum, white phosphorous, pesticides, solvents, and many other corrosive, toxic, unstable, or explosive chemicals and materials. Hazardous materials releases can occur from vehicle accidents, defective values or hoses on tankers, train derailments, pipeline ruptures or explosions, storage tank overtopping during delivery of products, and many other scenarios.

According to the US Pipeline and Hazardous Materials Safety Administration (PHMSA), hazardous materials traffic in the US now exceeds 800,000 shipments per day, transporting 3.1 billion tons of hazardous materials annually.

Nationally, according to the US Pipeline and Hazard Materials Safety Administration (PHMSA), the US averages 28 deaths per year due to accidents resulting from the transportation of hazardous materials, or an average of about one death per every 12 million American. While such fatalities are a low probability risk, even one event can harm many people. Even if no fatalities result, events such as pipeline ruptures and tanker car derailments can cause many thousands of dollars in damage, and harm the built and natural environment.

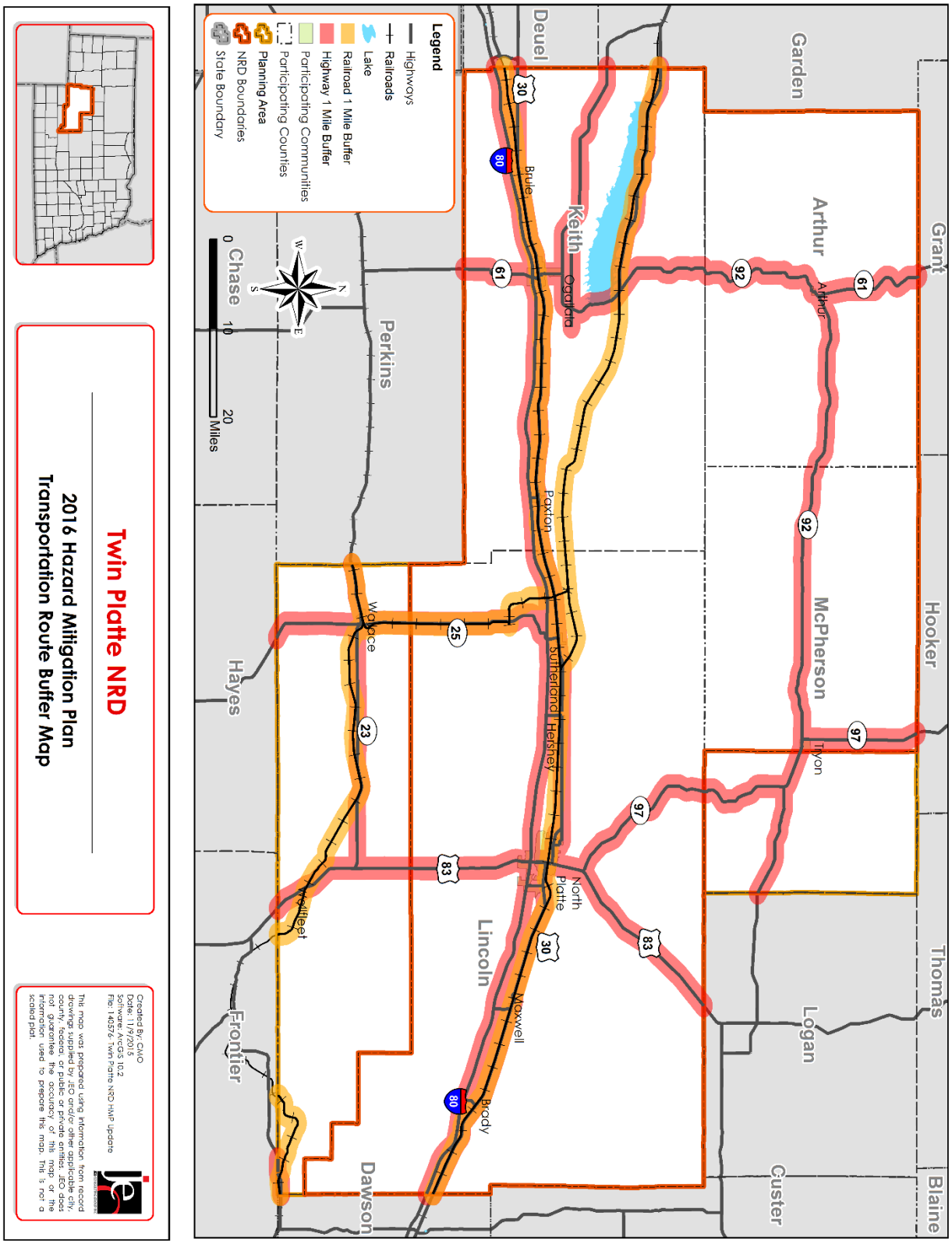
The US Department of Transportation, through PHMSA, has broad jurisdiction to regulate the transportation of hazardous materials, including the discretion to decide which materials shall be classified as hazardous. These materials are placed into one of nine hazard classes based on their chemical and physical properties. The hazard schedules may be further subdivided into divisions based on their characteristics.

Additionally, some hazardous materials may be re-classified as combustible materials or "other regulated materials" (ORM-D), because they pose a somewhat lesser but still extant hazard during transport. Because properties and characteristics are crucial in understanding the dynamics of a spill during a traffic incident, it is important for response personnel to understand the hazard classes and their divisions, and re-classified materials.

### *LOCATION*

Chemical releases are more likely to occur during transportation along major transportation routes as identified in Figure 8. Participating communities specifically reported transportation along railroads as having the potential to impact communities. It was also reported, however, that railroads providing service through the planning area have already developed plans to respond to chemical releases along rail routes.

**Figure 8: Major Transportation Routes with One Mile Buffer**



***EXTENT***

Probable extent related to chemical release is difficult to anticipate. Releases that have occurred in the planning area range from less than 1 Liquid Gallon (LGA) to 22,000 LGAs. Based on historic records, it is likely that any spill involving hazardous materials that occur will not affect any area larger than one mile around the spill that occurs.

***HISTORICAL OCCURRENCES***

In the state of Nebraska, according to the PHMSA, there have been 2,525 incidents involving hazardous materials being transported by air, highway, railway and water. These incidents involved at least 276 various forms of toxic materials across the classifications described by the 2016 Emergency Response Guidebook.

Of these 2,525 incidents, 329 of those occurred within in the planning area. The first was reported on August 1, 1980 and the most recent occurred on March 21, 2015. During these events, there have been no fatalities, 12 minor injuries, and $436,289 in damages from the spills.

The following table provides a list of the largest spills due to transportation incidents involving hazardous materials.

**Table 38: Historical Chemical Spills 1980-2015**

| Date of Event | Location of Release | Failure Description | Material Involved | Method of Transportation | Total Damage |
|---|---|---|---|---|---|
| 9/11/1989 | North Platte, NE | Basic material | 150 LGA Corrosive Material | Highway | $0 |
| 8/21/1999 | North Platte, NE | Punctured, Improper preparation for transportation | 160 LGA Poisonous Materials | Highway | $900 |
| 10/20/2009 | Hershey, NE | None | 168 LGA Flammable-Combustible Liquid | Highway | $0 |
| 11/11/1991 | North Platte, NE | Loose closure component or device | 200 LGA Flammable-Combustible Liquid | Rail | $1,900 |
| 7/13/2012 | North Platte, NE | Punctured, vehicular crash or accident damage | 349.125 LGA Miscellaneous Hazardous Material | Highway | $0 |
| 4/22/1993 | North Platte, NE | Basic material | 1,746 LGA Combustible Liquid | Highway | $115,000 |
| 4/28/1987 | North Platte, NE | Basic material | 2,100 LGA Flammable-Combustible Liquid | Highway | $0 |
| 6/27/1996 | North Platte, NE | Burst or ruptured hose | 2,800 LGA Flammable-Combustible Liquid | Highway | $39,300 |
| 4/3/1981 | Paxton, NE | None | 3,379 LGA Combustible Liquid | Highway | $0 |
| 10/23/2011 | North Platte, NE | Structural, Improper preparation for transportation | 8,000 SLB Miscellaneous Hazardous Material | Rail | $4,500 |
| 1/6/1995 | North Platte, NE | Basic material, Derailment | 22,000 LGA Miscellaneous Hazardous Material | Rail | $14,400 |

| Date of Event | Location of Release | Failure Description | Material Involved | Method of Transportation | Total Damage |
|---|---|---|---|---|---|
| 1/11/2004 | North Platte, NE | Derailment, Vehicular crash or accident damage | 72,000 SLB Oxidizer | Rail | $10 |

*Source: PHMSA*

### *AVERAGE ANNUAL DAMAGES*

The average damage per event estimate was determined based upon PHMSA's Incidents Reports since 1980 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. This hazard causes an average of $12,119 per year in property damages.

**Table 39: Chemical Transportation Losses**

| Hazard Type | Number of Events | Total Property Loss | Average Annual Property Loss |
|---|---|---|---|
| Transportation: Chemical Release | 329 | $436,289 | $12,119 |

*Source: PHMSA January 1980 – August 2015*

### *PROBABILITY*

The historical record indicates that chemical releases during transport have a 100 percent chance of occurring annually. There were 329 reported events from 1980 to 2015 within the planning area.

The planning area is home to Bailey Yard, the largest rail yard in the world. The location of Bailey Yard in the planning area increases the probability of a chemical transportation incident.

**Figure 9: Bailey Yard in North Platte**

***VULNERABILITY ASSESSMENT***

While transportation accidents can occur anywhere in the planning area, communities and households adjacent to major highway and rail corridors may be more vulnerable. If an incident were to occur where an evacuation was necessary, particular populations that may be especially vulnerable include households without access to a vehicle, the elderly, and facilities with populations with low mobility such as hospitals, nursing homes, and housing units.

***MITIGATION ALTERNATIVES***

Mitigation actions related to this threat include:

- Drills and exercises within potential impact zones
- Studies to identify the primary hazardous materials transported along specific routes;
- Restrict transportation of hazardous materials at high traffic times or in high traffic areas; and
- Provide shelter-in-place kits and training for vulnerable populations such as child care and nursing homes
- Obtain a current copy of the Emergency Response Guidebook to be able to identify the spilled substance

## *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:

- 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."

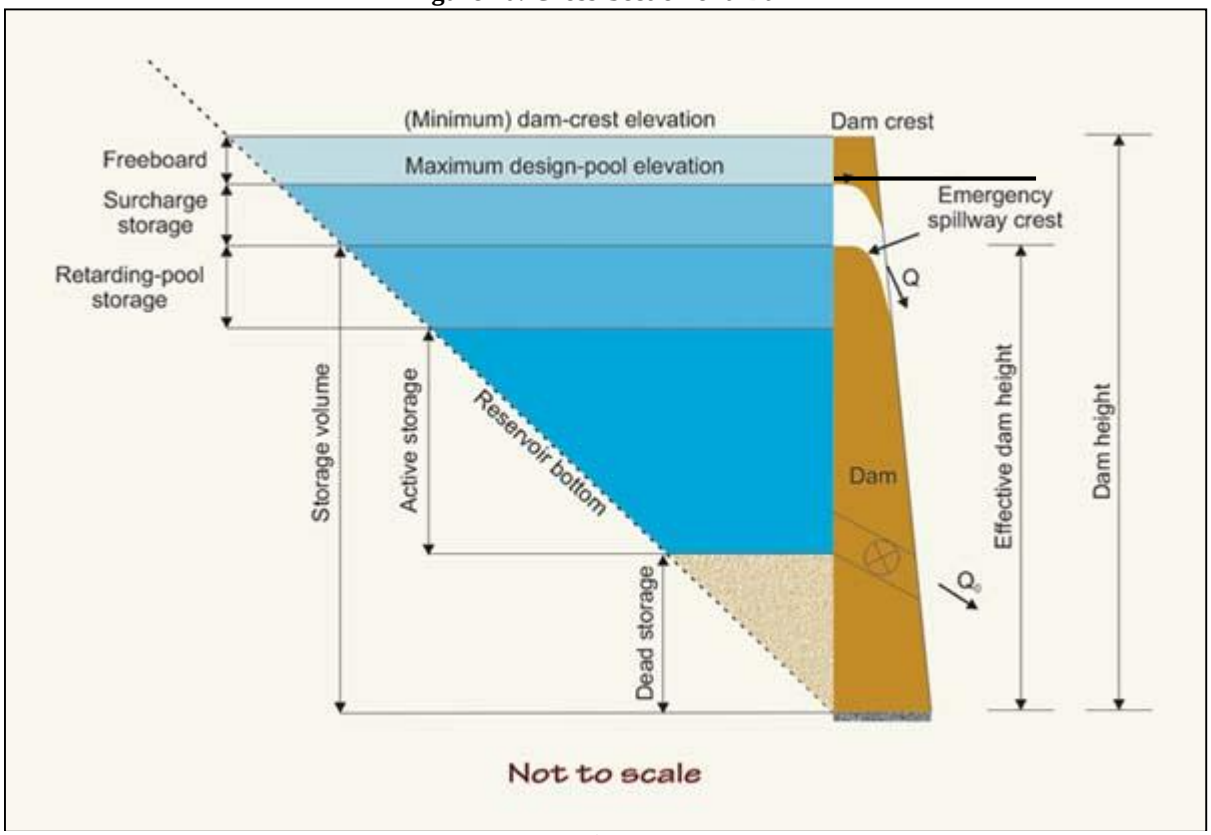
The Department of Natural Resources uses a classification system for dams throughout the state including those areas participating in this plan. The classification system includes three classes Small, Intermediate, and Large, which are defined as:

**Table 40: Dam Size Classification**

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

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. Figure 44 shows a cross section of a dam. The effective height of the dam is shown as being from the base of the dam to the top of the emergency 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.

**Figure 10: Cross-Section of a Dam**




*Source: http://ponce.sdsu.edu/first_project_report_080229.html*

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

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

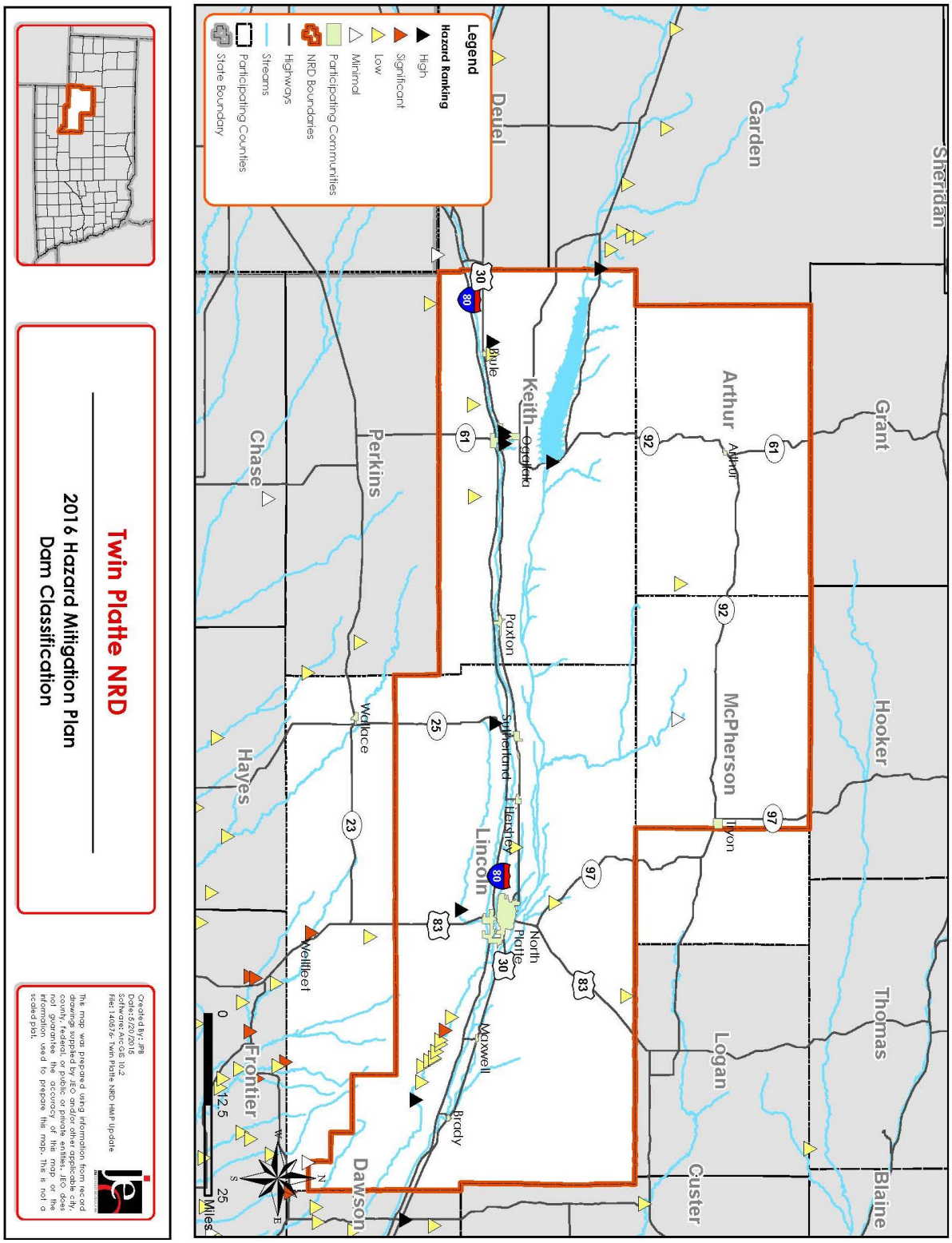
**Table 41: Dams in the Planning Area**

| Jurisdiction | Total Number of Dams | Classification - Downstream Hazard Potential | | | |
|---|---|---|---|---|---|
| | | High | Significant | Low | Minimal |
| **Arthur County** | **1** | **0** | **0** | **1** | **0** |
| **Keith County** | **8** | **5** | **0** | **3** | **0** |
| **Lincoln County** | **21** | **3** | **2** | **14** | **2** |
| **McPherson County** | **1** | **0** | **0** | **0** | **1** |
| **Planning Area** | **31** | **8** | **2** | **18** | **3** |

*Source: NDNR*

According to the state of Nebraska's Hazard Mitigation Plan, the planning area has two of the top 30 ranked high hazard dams in the state based on population at risk. Kingsley Dam in Keith County is the highest ranked dam in the state with 139,673 persons at risk downstream in the event of failure. Maloney Dam in Lincoln County is the 30th ranked dam in the state with 1,361 persons at risk.

**Figure 11: Dam Locations**



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 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 NWS. Table 42 lists those dams classified as "High Hazard Potential."

In total, there are 31 dams located within the planning area with classifications ranging from minimal hazard to high hazard. Most of the dams (21) are rated low or minimal, two are significant, and eight are rated a high hazard dam. The high hazard dams are listed in Table 42. Wes Clark Dam located in Garden County is an upstream dam that may affect the planning area if it were to fail.

**Table 42: High Hazard Dams**

| Owner | Name | NIDID | Purpose | Dam Height (ft.) | Maximum Storage (acre-feet) | Last Inspection Date |
|---|---|---|---|---|---|---|
| Ogallala | Cure Creek 1-A | NE00210 | C | 35 | 326 | 6/2/2015 |
| Twin Platte NRD | Brule Creek 1-A | NE00211 | C | 53 | 2,731 | 6/2/2015 |
| Central Nebraska Public Power & Irrigation District | Kingsley Dam | NE01048 | H | 163 | 2,200,000 | 6/11/2015 |
| Ogallala | Ogallala 6 (West Dam) | NE02331 | C | 32 | 170 | 6/2/2015 |
| Ogallala | Ogallala 7 (East Dam) | NE02334 | C | 38 | 515 | 6/2/2015 |

| Owner | Name | NIDID | Purpose | Dam Height (ft.) | Maximum Storage (acre-feet) | Last Inspection Date |
|---|---|---|---|---|---|---|
| Central Nebraska Public Power & Irrigation District | Jeffrey Dam Canal | NE01036 | H | 70 | 21,115 | 9/2/2014 |
| Nebraska Public Power District | Sutherland Dam | NE01051 | H | 66 | 18,500 | 4/16/2015 |
| Nebraska Public Power District | Maloney Dam | NE01052 | H | 44 | 21,000 | 4/14/2015 |
| North Platte NRD | Wes Clark Cat Dam* | NE01204 | C | 30 | 328 | Unknown |

*Source: NDNR*
**Upstream Dam*

***LOCATION***
For the purposes of this plan, inundation areas for each of the dams identified in this plan are called breach routings. Breach routings are used to help delineate the area downstream of a dam potentially impacted by inundation should that dam fail. These inundation areas can be used in determining the dam's hazard potential. Used in conjunction with survey and topographic data, breach routings can be used to determine the anticipated depth of flooding at specific structures or facilities. Due to the sensitive nature of this threat, breach mapping will not be included in this document. If members of the public wish to view EAP and breach maps for dams in the planning area, a request can be made to the county emergency managers, Twin Platte NRD or NDNR.

***EXTENT***
Dam failure in the planning area would result in the inundation of an area slightly greater than the 100-year floodplain. A breach of a high hazard dam would likely lead to loss of life and significant property damage.

***HISTORICAL OCCURRENCES***
No instances of dam failure have been recorded within the planning area.

***AVERAGE ANNUAL DAMAGES***
Due to lack of data and the sensitive nature of this hazard, potential losses are not being calculated for this threat. Community members in the planning area that wish to quantify the threat of dam failure should contact the county emergency management, Twin Platte NRD, or the NDNR.

***PROBABILITY***
Dam failure has a low probability of occurring in the future. As mentioned in the 2014 Nebraska HMP, a study by an independent contractor showed that the failure of Kingsley Dam is highly unlikely. 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.

***VULNERABILITY ASSESSMENT***
The definition of dam failure for the purposes of this plan was considered 'sunny day failure,' of a full dam. This is a total dam failure in which the impounded water all flows downstream.

This was done because inundation maps are generated using this assumption. Throughout the planning area, if a high hazard dam failure occurred, many people and structures downstream of the failure would be inundated.

According to the NDNR dam database, there are eight high hazard dams in the planning area, and one high hazard upstream dam. The vulnerability assessment for dam failure is discussed more specifically regarding dam failures in each jurisdiction's respective participant section. It shall be noted that the inundation maps for the high hazard dams in Nebraska are not available for public viewing because it is sensitive information. More detailed information can be sought through the county emergency management agencies in which the dams are located. In addition, there are existing plans in place for the monitoring and inspection of dams.

All dams are inspected on a regular basis and after extreme conditions have occurred. 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.

The unique characteristics of different jurisdictions allow dam failure to impact them differently. Villages, cities and SIDs are vulnerable in that structures could be inundated or destroyed and the loss of life or injury could occur. Residents in the rural areas of the counties can be affected by dam failure in the same way that incorporated communities are affected.

***MITIGATION ALTERNATIVES***

Actions to mitigate the hazard of dam failure include:

- 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

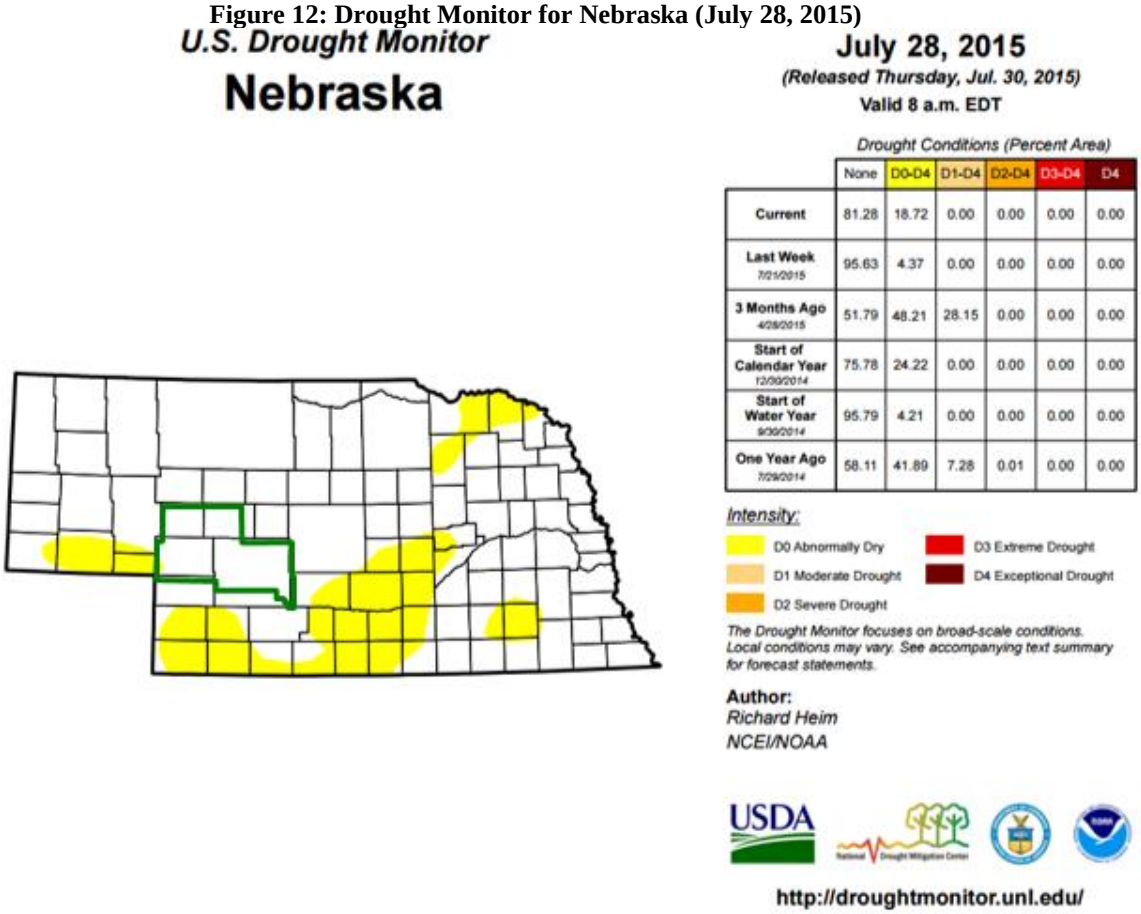
## *DROUGHT*

### *HAZARD PROFILE*

> *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 generally defined as a natural hazard that results from a prolonged 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.

**Figure 12: Drought Monitor for Nebraska (July 28, 2015)**




*Source: National Drought Mitigation Center*

Drought is a slow-onset, creeping phenomenon and its impacts are largely non-structural. 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 is more difficult to identify than that of quick-onset natural hazards (e.g., flood and storm) that result in more visible impacts. In addition, drought has more than 150 definitions and this lack of a universal definition makes it even harder to indicate the onset and ending. 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.

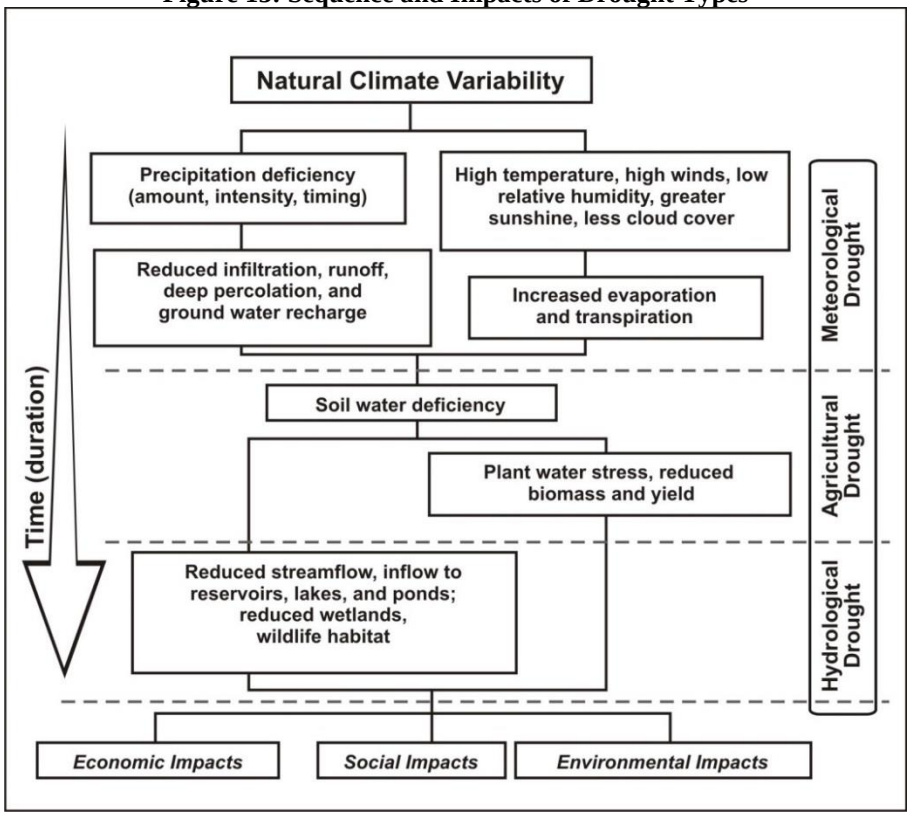
- **Agricultural Drought** – occurs when there is deficient moisture that hinders planting germination, leading to low plant population per hectare and a reduction of final yield. Agricultural drought is closely linked with meteorological and hydrological drought, as agricultural water supplies are contingent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

- **Hydrological 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 13: Sequence and Impacts of Drought Types**




*Source: National Drought Mitigation Center*

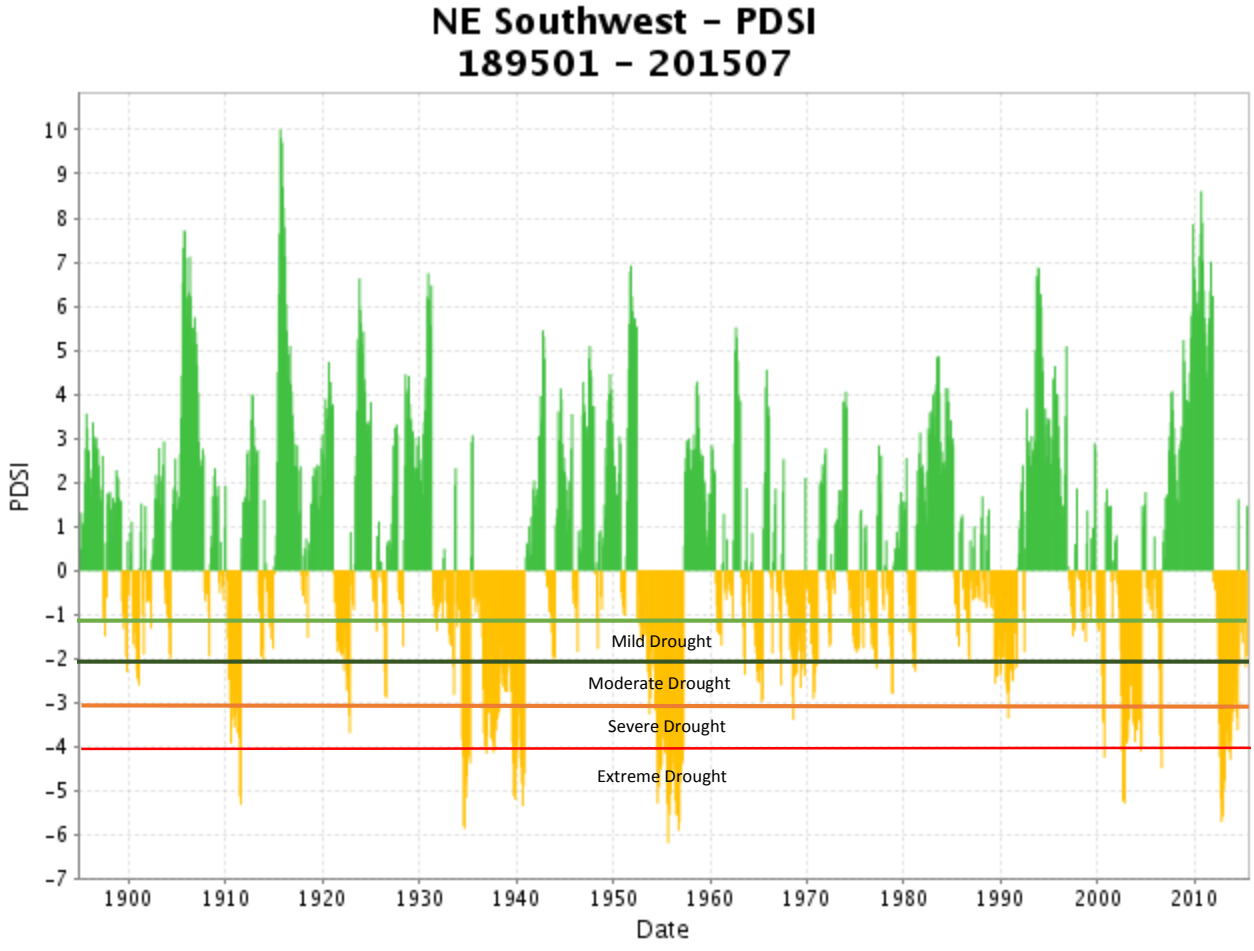
***LOCATION***

The entire planning area is susceptible to the impacts of drought. Agricultural areas and producers may experience greater impacts than incorporated areas.

***EXTENT***

Due to drought's unique nature and characteristics, there is not one best way to predict and monitor drought. Among the various indices, the Palmer Drought Severity Index (PDSI) has been widely used by state and local governments in the U.S. The USDA uses the U.S. Drought Monitor in determining when to grant emergency drought assistant. Figure 14 illustrates historical PDSI for Southwest Nebraska, which includes the planning area, between the years of 1895 and 2014. The negative Y axis represents a drought, for which '-2' indicates a moderate drought, '-3' a severe drought, and '-4' an extreme drought. Table 43 shows the details of the Palmer classifications. According to this dataset, extreme droughts were recorded in 11 years dating back to 1895 and major events include the Dust Bowl in the 1930s, 1950s, and the recent 2012 drought. Table 44 shows the classification for the Drought Monitor. According to the historical record, the planning area is likely to experience: D1 drought 38% of the time, D2 drought 22% of the time, D3 drought 11% of the time, and D4 drought 8% of the time.

**Figure 14: Palmer Drought Severity Index**




*Source: NDMC*

**Table 43: 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*

**Table 44: United States Drought Monitor Classification**

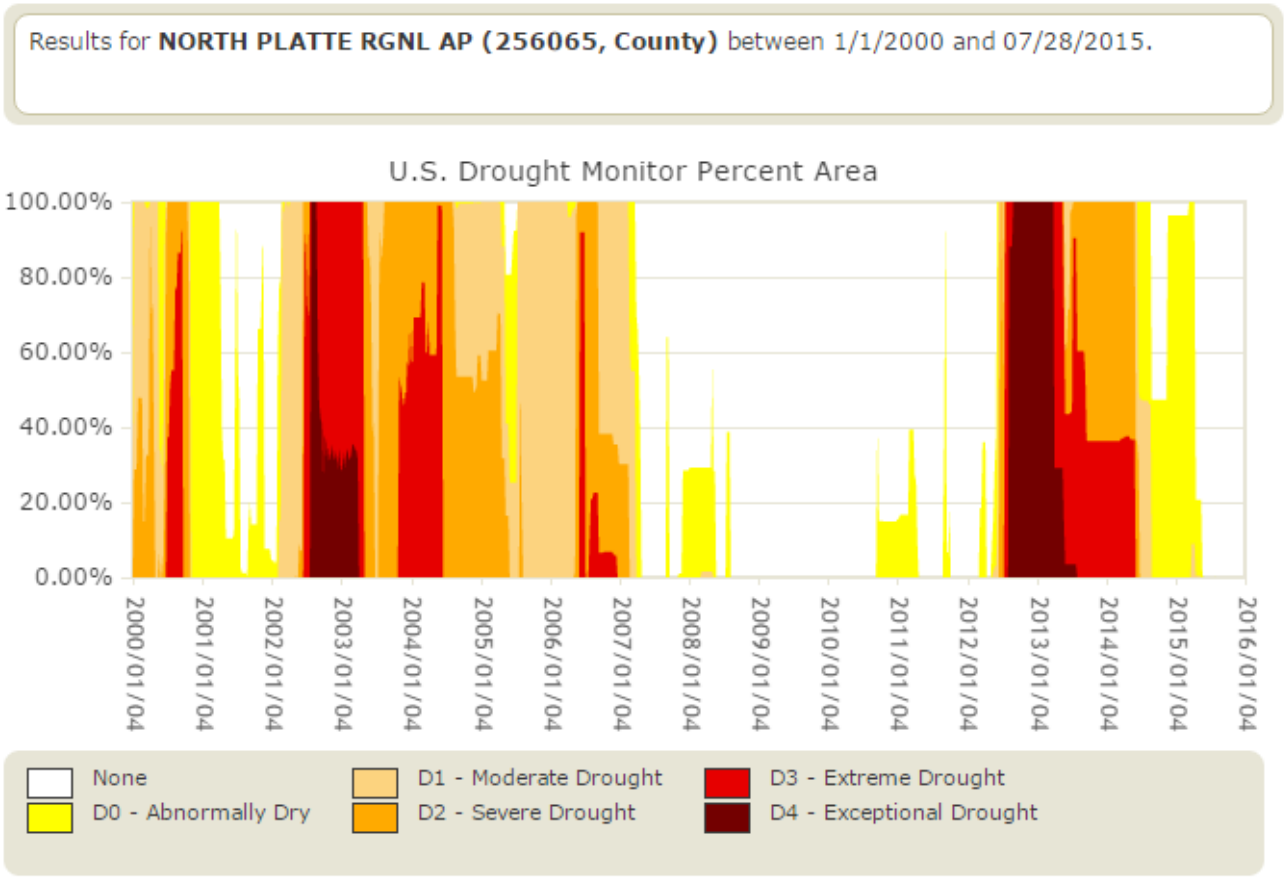
| Category | Description | PDSI Ranges | Possible Impacts |
|---|---|---|---|
| D0 | Abnormally Dry | -1.0 to -1.9 | Going into drought: short-term dryness slowing planting, growth of crops or pastures.<br>Coming out of drought: some lingering water deficits; pastures or crops not fully recovered. |
| D1 | Moderate Drought | -2.0 to -2.9 | Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent;<br>voluntary water-use restrictions requested |
| D2 | Severe Drought | -3.0 to -3.9 | Crop or pasture losses likely, water shortages common; water restrictions imposed |
| D3 | Extreme Drought | -4.0 to -4.9 | Major crop/pasture losses; widespread water shortages or restrictions |
| D4 | Exceptional Drought | -5.0 or less | Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams and wells creating water emergencies. |

*Source: NDMC*

***HISTORICAL OCCURRENCE***

The extreme heat and drought event that started in the summer of 2012 was substantial, but did not warrant a Presidential disaster declaration within Nebraska. Figure 15 summarizes the historical drought conditions for the Planning Area by intensity and percent area since 2000. These conditions are similar to those throughout the planning area. According to the data acquired from NDMC, the planning area experienced two periods of extreme drought since 2000, the first beginning in the summer of 2002 and moderating to extreme and serve drought conditions in the following summer. A decade later, beginning in July of 2012 the second exceptional drought occurred. It finally fell to the moderate drought category in the summer of 2014. Some communities encouraged voluntary water conservation during the period of drought.

**Figure 15: Historic Drought Conditions**




*Source: NDMC*

***AVERAGE ANNUAL DAMAGES***

The annual property loss estimate was determined based upon NCDC Storm Events Database since 1996 and number of historical occurrences. 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. Historically, drought causes an average of $1,157,895 per year in property damages. Crop damages would average around $3,733,005 per year due to drought events for the planning area.

**Table 45: Loss Estimate for Drought**

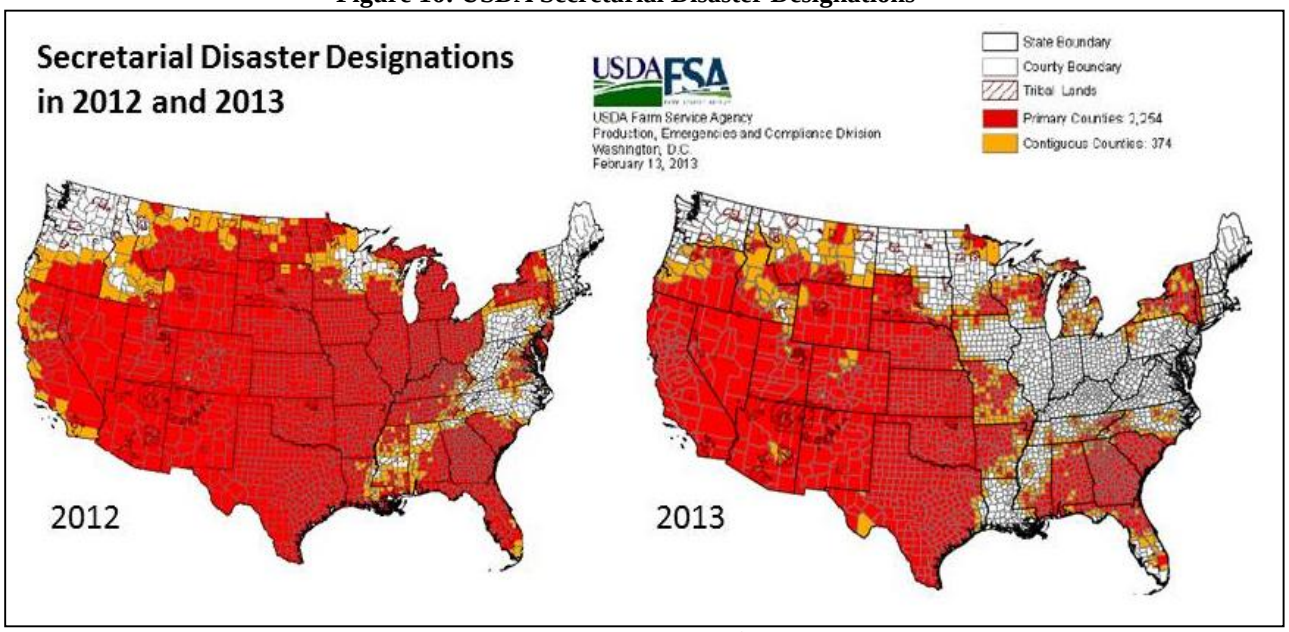
| Hazard Type | Number of Months of Drought/Total Months of Record[3] | Total Property Loss[1] | Average Annual Property Loss [1] | Total Crop Loss[2] | Average Annual Crop Loss [2] |
|---|---|---|---|---|---|
| Drought | 175/780 | $2,200,000 | $1,157,895 | $55,995,082 | $3,733,005 |

*1 Indicates the data is from NCDC (January 1996 to April 2015); 2 Indicates data is from USDA RMA (2000 to 2014); 3 Indicates the data is from NDMC (January 1948 to December 2012)*

The severe drought in 2012 significantly affected the agricultural sector of the state. Although the full impacts have 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 Farm-Raised Fish Program (ELAP), Livestock Indemnity Program (LIP), and Tree Assistance Program

(TAP). Figure 16 shows the drought disaster designations by USDA in 2012 and 2013. All of Nebraska is in the red zone, indicating that Nebraska, including our planning area, has a high probability of a drought disaster in the time period shown.

**Figure 16: USDA Secretarial Disaster Designations**




*Source: U.S. Department of Agriculture*

### ***PROBABILITY***

Probability for drought is calculated by the number of months in drought divided by the total months on record. The planning area experienced D2 drought in 175 out of 780 months on record; resulting in a 22% chance of a drought each year.

### ***VULNERABILITY ASSESSMENT***

As identified in Nebraska's Drought Mitigation and Response Plan, drought is a common feature of the Nebraska landscape, and often causes significant economic, environmental, and social impacts. Although agriculture is the major sector affected, impacts on rural and municipal water supplies, fish and wildlife, tourism, recreation, water quality, soil erosion, the incidence of wildfires, electricity demand, and other sectors are also significant. Also, the indirect impacts of drought on personal and business incomes, tax revenues, unemployment, and other areas are important to note. In general, drought produces a complex web of impacts that ripple through many sectors of the economy. This is largely due to the dependence of so many sectors on water to produce goods and provide services. It is impossible to predict all the potential impacts, but the common impacts of drought have been compiled by the NDMC and are illustrated in Table 46.

**Table 46: Classification of Drought-Related Impacts**

| Problem Sectors | Impacts |
|---|---|
| **Economic** | • Loss from crop production<br>▪ Annual and perennial crop losses; damage to crop quality<br>▪ Reduced productivity of cropland (wind erosion, etc.)<br>▪ Insect infestation<br>▪ Plant disease<br>▪ Wildlife damage to crops<br>• Loss from dairy and livestock production<br>▪ Reduced productivity of range land |

| Problem Sectors | Impacts |
|---|---|
| | ▪ Forced reduction of foundation stock<br>▪ Closure/limitation of public lands to grazing<br>▪ High cost/unavailability of water for livestock<br>▪ High cost/unavailability of feed for livestock<br>▪ High livestock mortality rates<br>▪ Increased predation<br>▪ Range fires<br>• Loss from timber production<br>▪ Forest fires<br>▪ Tree disease<br>▪ Insect infestation<br>▪ Impaired productivity of forest land<br>• Loss from fishery production<br>▪ Damage to fish habitat<br>▪ Loss of young fish due to decreased flows<br>• Loss of national economic growth, hindrance of economic development<br>• Income loss for farmers and others directly affected<br>• Loss of farmers through bankruptcy<br>• Loss to recreational and tourism industry<br>• Loss to manufacturers and sellers of recreational equipment<br>• Increased energy demand and reduced supply because of drought-related power curtailments<br>• Costs to energy industry and consumers associated with substituting more expensive fuels (oil) for Hydroelectric power<br>• Loss to industries directly dependent on agricultural production (e.g., machinery)<br>• Decline in food production/disrupted food supply<br>▪ Increase in food prices<br>▪ Increased importation of food (higher costs)<br>• Disruption of water supplies<br>• Unemployment from drought-related production declines<br>• Strain on financial institutions (foreclosures, greater credit risk s, capital shortfalls, etc.)<br>• Revenue losses to federal, state, and local governments (from reduced tax base)<br>• Deterred capital investment, expansion<br>• Dislocation of businesses<br>• Revenues to water supply firms<br>• Loss from impaired navigability of streams, rivers, and canals<br>• Cost of water transport or transfer<br>• Cost of new or supplemental water resource development |
| **Environmental** | • Damage to animal species<br>▪ Reduction and degradation of fish and wildlife habitat<br>▪ Lack of feed and drinking water<br>▪ Disease<br>▪ Increased vulnerability to predation (e.g., from species concentration near water)<br>• Loss of biodiversity<br>• Wind and water erosion of soils<br>• Reservoir and lake drawdown<br>• Damage to plant species<br>• Water quality effects (e.g., salt concentration, increased water temperatures, pH, dissolved oxygen)<br>• Air quality effects (dust, pollutants)<br>• Visual landscape quality (dust, vegetative cover, etc.)<br>• Increased fire hazard<br>• Estuarine impacts; changes in salinity levels, reduced flushing<br>• Insect infestation |
| **Social** | • Increased groundwater depletion (mining), land subsidence<br>• Loss of wetlands |

| Problem Sectors | Impacts |
|---|---|
| | • Loss of cultural sites<br>• Food shortages (decreased nutritional level, malnutrition, famine)<br>• Loss of human life (e.g., food shortages, heat)<br>• Public safety from forest and range fires<br>• Conflicts between water users, public policy conflicts<br>• Increased anxiety<br>• Loss of aesthetic values<br>• Health-related low flow problems (e.g., diminished sewage flows, increased pollutant concentrations, etc.)<br>• Recognition of institutional constraints on water use<br>• Inequity in the distribution of drought impacts/relief<br>• Decreased quality of life in rural areas<br>• Increased poverty<br>• Reduced quality of life, changes in lifestyle<br>• Social unrest, civil strife<br>• Population migration (rural to urban areas)<br>• Reevaluation of social values<br>• Increased data/information needs, coordination of dissemination activities<br>• Loss of confidence in government officials<br>• Recreational impacts |

***MITIGATION ALTERNATIVES***

The following bullet points identify some general mitigation strategies that can be used to reduce a community's vulnerability to the threat of drought. Some of these strategies are already in place in the planning area. The following mitigation actions were identified during the update process as options to mitigate the impacts of drought:

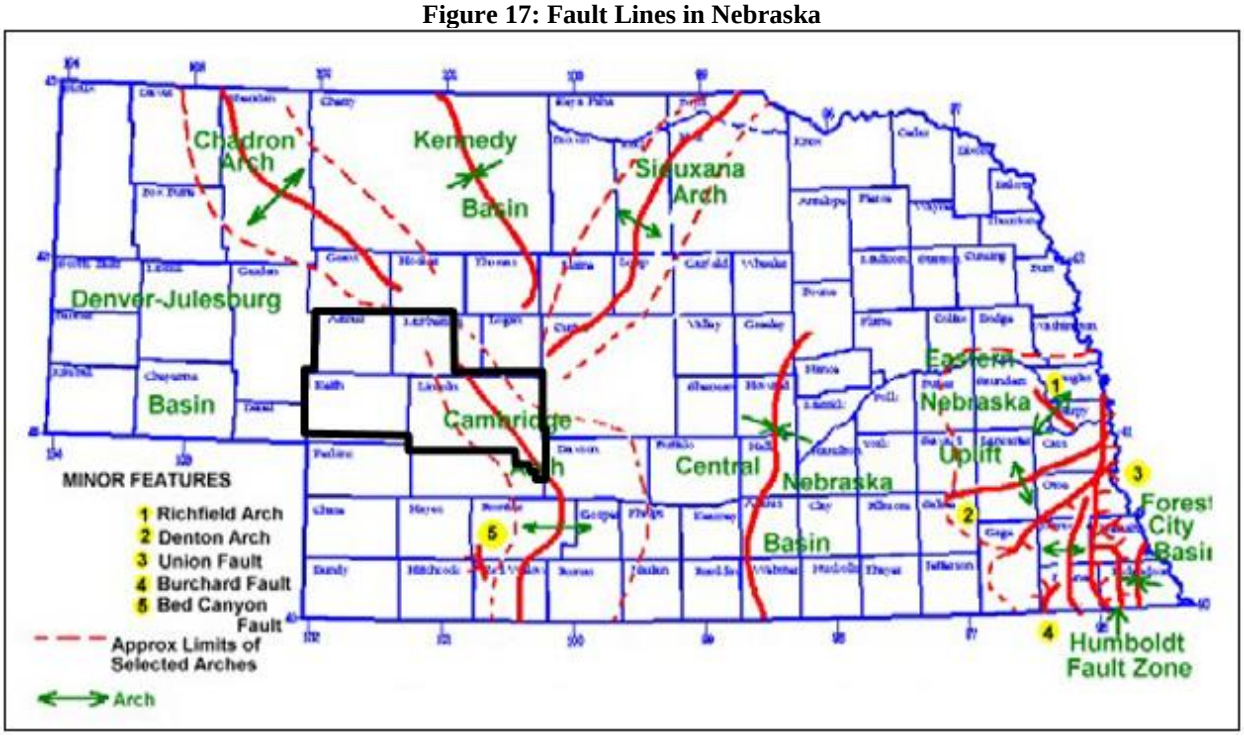
- Participate in the Tree City USA program
- Expand water storage capacity
- Identify locations and drill new municipal wells
- Establish a source water contingency plan
- Establish an irrigation/groundwater management plan
- Encourage agricultural businesses to purchase crop insurance as appropriate
- Drought education programs (residential and agricultural)
- Assess Drought Vulnerability (identify factors that affect drought severity for local jurisdictions)
- Establish a Drought Monitoring Board and drought reporting procedures
- Establish monitoring procedures for municipal water supply and distribution systems
- Develop drought specific plans (this may include water conservation plans, drought preparedness plans, and wellhead protection plans)
- Establish municipal water conservation programs
- Establish agricultural policies (agricultural irrigation standards, grazing policies, etc.)
- Enhanced residential landscape standards (xeriscaping, irrigation systems requirements, etc.)
- Enhanced building codes to require low-flow fixtures in new construction
- Incentives to retrofit structures with low-flow fixtures
- Incorporate permeable surfaces into municipal designs
- Investigate alternative water supply options

## *EARTHQUAKES*

### *HAZARD PROFILE*

An earthquake is the result of a sudden release of energy in the Earth's tectonic plates, which 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. Figure 17 shows the fault lines in Nebraska, and the planning area is outlined in black.

**Figure 17: Fault Lines in Nebraska**




*Source: Nebraska DNR*

### *LOCATION*

The main fault line that crosses into the planning area is the Cambridge Arch. The Cambridge Arch runs across much of Lincoln County and into the south central portion of McPherson County. The rest of the planning area does not have an identified feature.

### *EXTENT*

Earthquakes are measured by magnitude and intensity. Magnitude is measured by the Richter scale, a base-10 logarithmic scale, which uses seismographs around the world to measure the amount of energy released by an earthquake. Intensity is measured by the Modified Mercalli Intensity Scale, which determines the intensity of an earthquake by comparing actual damage against damage patterns of earthquakes with known intensities.

Table **47** and Table 48 summarize the Richter scale and Modified Mercalli scale. Any earthquake that does occur within the planning area will likely be less than 4.0 on the Richter scale.

**Table 47: 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 48: Modified Mercalli Scale**

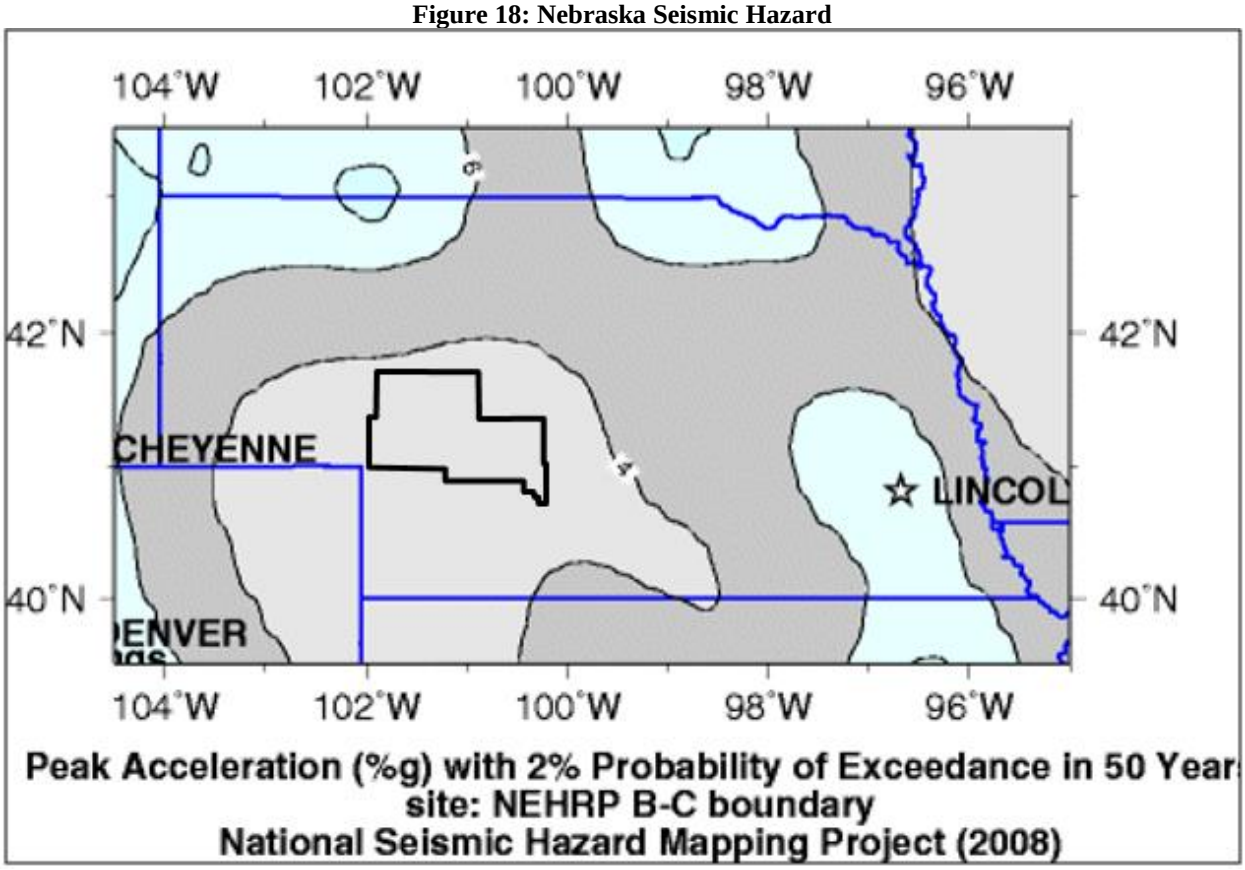
| Scale | Intensity | Description of Effects | Corresponding Richter Scale Magnitude |
|---|---|---|---|
| I | Instrumental | Detected only on seismographs | |
| II | Feeble | Some people feel it | < 4.2 |
| III | Slight | Felt by people resting, like a truck rumbling by | |
| IV | Moderate | Felt by 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*

### ***HISTORICAL OCCURRENCES***

The strongest earthquake in Nebraska history occurred on November 15, 1877, and the planning area was affected. In North Platte, the shock was reported to have lasted 40 seconds and intensity VII effects were noted. The NEIC Earthquake Search database provided by the United States Geological Survey (USGS) Earthquake Hazards Program did not report any earthquakes in the planning area between 1973 and 2014. However, there was one earthquake in 2007 that occurred just south of the planning area in Frontier County. The earthquake was recorded as a 3.0 on the Richter scale. There was also an earthquake that occurred northeast of the planning area in 2015 in Thomas County.

**Figure 18: Nebraska Seismic Hazard**




*Source: United States Geological Survey*

Figure 18 displays the seismic hazard map for the State of Nebraska. The planning area is outlined in black.

***AVERAGE ANNUAL DAMAGES***

Due to the lack of sufficient earthquake data, limited resources, low earthquake risk for the area, and limited 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***

There have been no earthquakes in the period of record (1973-2014). An earthquake is unlikely to occur in the planning area. For the purposes of this plan, there is approximately a one percent chance of an earthquake occurring within the planning area annually.

***VULNERABILITY ASSESSMENT***

Low income individuals are particularly vulnerable to the threat of earthquakes. Often, low income individuals and families live in lower cost homes (older homes, mobile homes) that are less able to withstand disaster. Older homes and mobile homes may not have been constructed using the most advanced building codes or have received updates and retrofits that would have increased their stability and ability to withstand seismic events. For example, damages resulting from the 1994 Northridge earthquake in California were disproportionately focused on low and moderate income rental housing units that were older, and thus more vulnerable to seismic damages.

***MITIGATION ALTERNATIVES***

The following bullet points identify some general mitigation strategies that can be used to reduce a community's vulnerability to the threat of earthquakes. Some of these strategies, such as the use of warning systems, are already in place in the planning area. Many of these strategies are identified and discussed in greater detail in the FEMA document *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards.* Due to the low earthquake risk most of the alternatives are not standard practice in the planning area.

- Increase Earthquake Risk Awareness (i.e. outreach to businesses, schools, and individuals)
- Adopt and enforce seismic building codes
- Incorporate Seismic Safety into all Local Plans (i.e., create a Seismic Safety Committee)
- Conduct inspections of building safety (i.e., identify seismic risk)
- Protect critical facilities and infrastructure (i.e., installing shut off valves; bracing equipment; and reviewing all bridge construction plans)
- Implement structural mitigation techniques (i.e. membranes on windows to prevent glass shattering, steel bracing on chimneys; etc.)
- Conduct outreach to building inspectors, engineers and architects

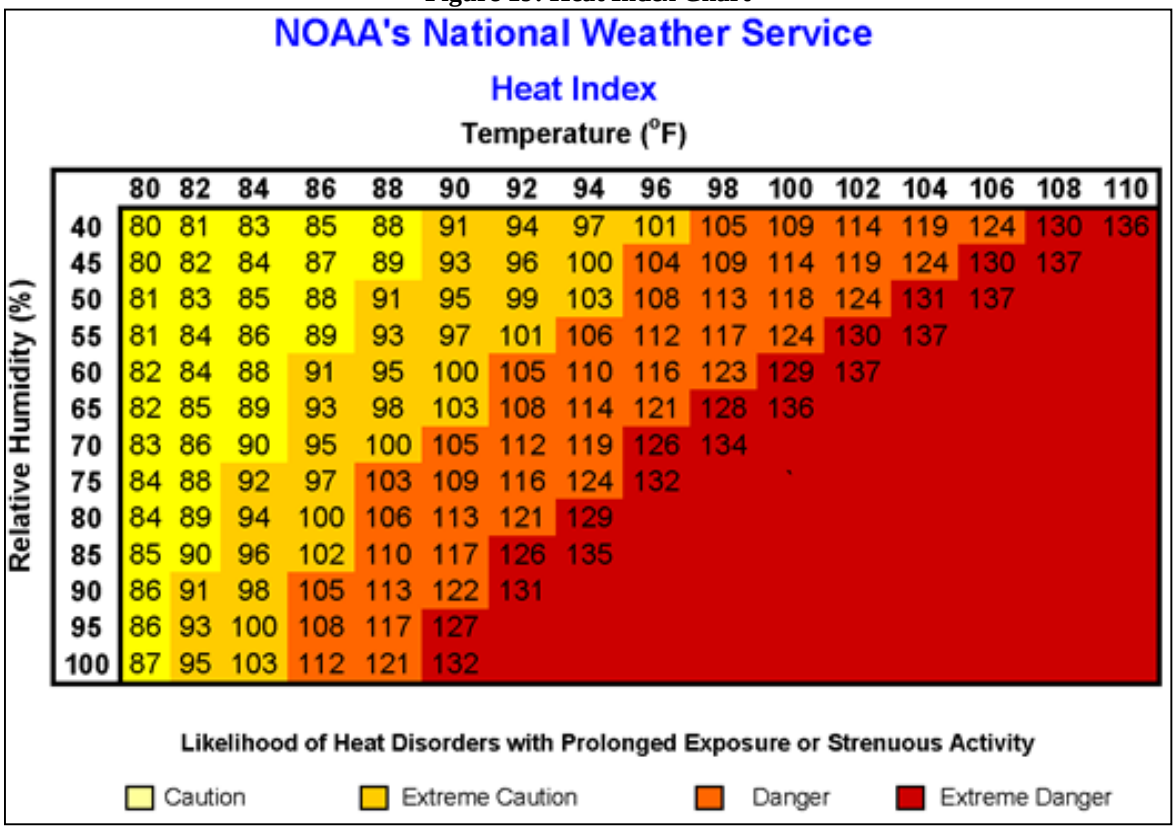
## EXTREME HEAT

### HAZARD PROFILE

Extreme heat is often associated with 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. For the planning area, the months with the highest temperatures are May, June, July, August, and September. The NWS is responsible for issuing excessive heat outlooks, excessive heat watches, and excessive heat warnings. Excessive heat outlooks are issued when 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. An excessive heat watch should provide local officials and residents in the area enough time to take appropriate actions to mitigate the effects of extreme heat. 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.

An important factor in extreme heat situations is the humidity level relative to the temperature. As is indicated in Figure 19, as the Relative Humidity increases, the temperature needed to cause a dangerous situation decreases. For example, for 100% Relative Humidity dangerous levels of heat begin at 86°F where as a Relative Humidity of 50%, requires 94°F. The combination of Relative Humidity and Temperature result in a Heat Index: 100% Relative Humidity + 86°F = 112° Heat Index.

**Figure 19: Heat Index Chart**




*Source: NOAA*

***LOCATION***

The entire planning area is likely to experience extreme heat events due to the regional nature of this hazard.

***EXTENT***

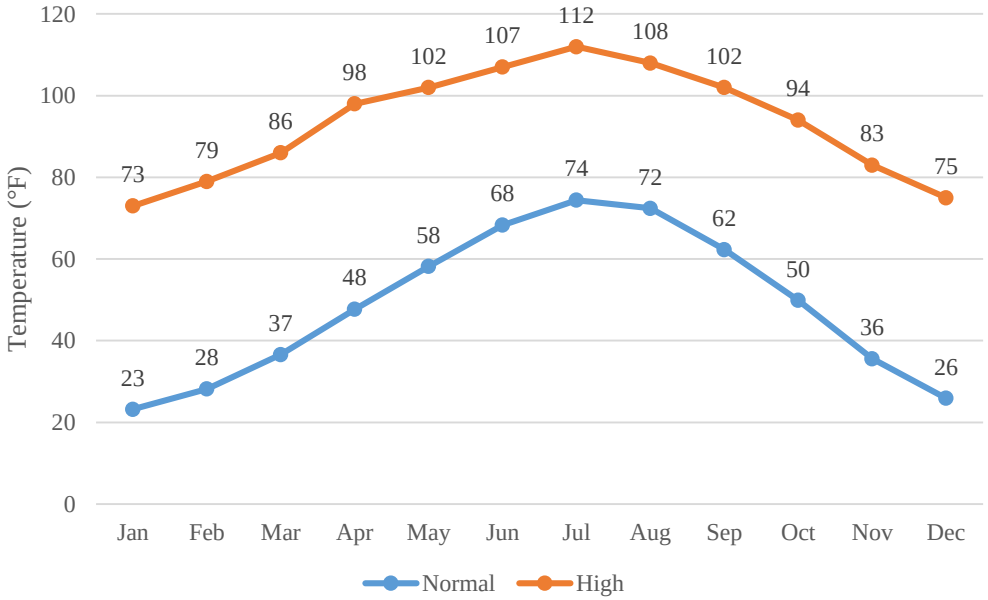
For this planning process and the planning area, extreme heat is defined as temperatures greater than 90°F. It is reasonable to estimate that for the month of May, the planning area will experience about one day with temperatures greater than 90°F; for the month of June, the planning area will experience six days of temperatures greater than 90°F; for the month of July, the planning area will experience 13 days of temperatures greater than 90°F; for August, the planning area will experience 11 days of temperatures greater than 90°F; and in September, the planning area will experience four days of temperatures greater than 90°F.

**Table 49: Record Highs and Average Days over 90˚F for North Platte WSO Airport Station (1948-2012)**

| Month | Record High | Days with Temperatures Greater than 90°F |
|---|---|---|
| January | 73°F | 0 |
| February | 79°F | 0 |
| March | 86°F | 0 |
| April | 98°F | 0.2 |
| May | 102°F | 1.0 |
| June | 107°F | 5.9 |
| July | 112°F | 13.5 |
| August | 108°F | 11.3 |
| September | 102°F | 4.3 |
| October | 94°F | 0.3 |
| November | 83°F | 0 |
| December | 75°F | 0 |

*Source: High Plains Regional Climate Center*

**Figure 20: Record and Normal High Temperatures (1948-2012)**




*Source: High Plains Regional Climate Center*

### *HISTORICAL OCCURRENCE*

While there are no events with death, injuries, or losses reported by the NCDC, the High Plains Regional Climate Center (HPRCC) reports that on average there are 37 days annually where temperatures are greater than 90°F occur in the planning area.

### *AVERAGE ANNUAL DAMAGES*

The direct and indirect effects of extreme heat are difficult to quantify. There is no way to place a value on the loss of human life. Potential losses such as power outages could affect businesses, homes, and critical facilities. High demand and intense use of air conditioning can overload the electrical systems and cause damages to infrastructure. Extreme heat is also responsible for $825,756 annually in crop damages.

**Table 50: Extreme Heat Loss Estimate**

| Hazard Type | Average Number of Days Per Year >90°F[1] | Total Crop Loss[2] | Average Annual Crop Loss [2] |
|---|---|---|---|
| Extreme Heat | 37 days | $12,386,335 | $825,756 |

*1 Indicates the data is from HPRCC; 2 Indicates data is from USDA RMA (2000 to 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.

### *VULNERABILITY ASSESSMENT*

The months of June, July, and August are when most extreme heat events occur. These months also have lower amounts of precipitation, thus increasing the possibility for a drought event. Periods of high temperatures can make people vulnerable to heatstroke, heat cramps, heat exhaustion, and pose a threat to human life. The populations that are at most risk are young children, elderly, and those working and living in non-air-conditioned environments. Building stock, such as critical facilities, are not at risk; however periods of extreme heat place a significant demand on utilities, such as water and electricity, which can

cause a failure in the system. Power loss could occur with the high demand on energy, making an extreme heat event even more dangerous.

The agricultural economy, especially livestock, is highly vulnerable and at great risk during periods of extreme heat. Heat stress in feedlot cattle can cause reduced performance, and in the most severe cases, death of the animals, resulting in millions of dollars in losses to the cattle industry.

All segments of the population are vulnerable to the effects of extreme heat. However, there are population groups with higher levels of vulnerability to extreme heat, which include: the elderly, residents of nursing homes or care facilities, children, those isolated from social interactions, and low-income groups. Elderly residents have a lower tolerance for extreme temperatures and can feel the effects more rapidly. Low-income elderly in urban areas are especially at risk to extreme temperatures. Young children under the age of 5 are highly susceptible to the effects of extreme heat as well. They have a smaller body mass to surface ratio making them more vulnerable to heat-related morbidity and mortality. Children also become dehydrated more quickly than adults, making for greater concern. Low-income residents and families may lack resources that mitigate the impacts of extreme heat such as air conditioning.

### ***MITIGATION ALTERNATIVES***

The following bullet points identify some general mitigation strategies that can be used to reduce a community's vulnerability to the threat of extreme heat. Some of these strategies, such as the use of warning systems, are already in place in the planning area. Many of these strategies are identified and discussed in greater detail in the FEMA document, *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*.

- Identify Existing Community Shelters/Centers
- Assist Vulnerable Populations (i.e., creating a database to track those individuals at high risk such as the elderly)
- Reduce Urban Heat Island Effect (i.e., using cool roofing products that reflect sunlight and heat away from buildings)
- 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)

## *FLOODING (RIVERINE AND FLASH)*

### *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 district, affecting whole drainage basins and impacting property in multiple states. The principal type of flood most common to Nebraska, due to geographic location and topography, is riverine floods.

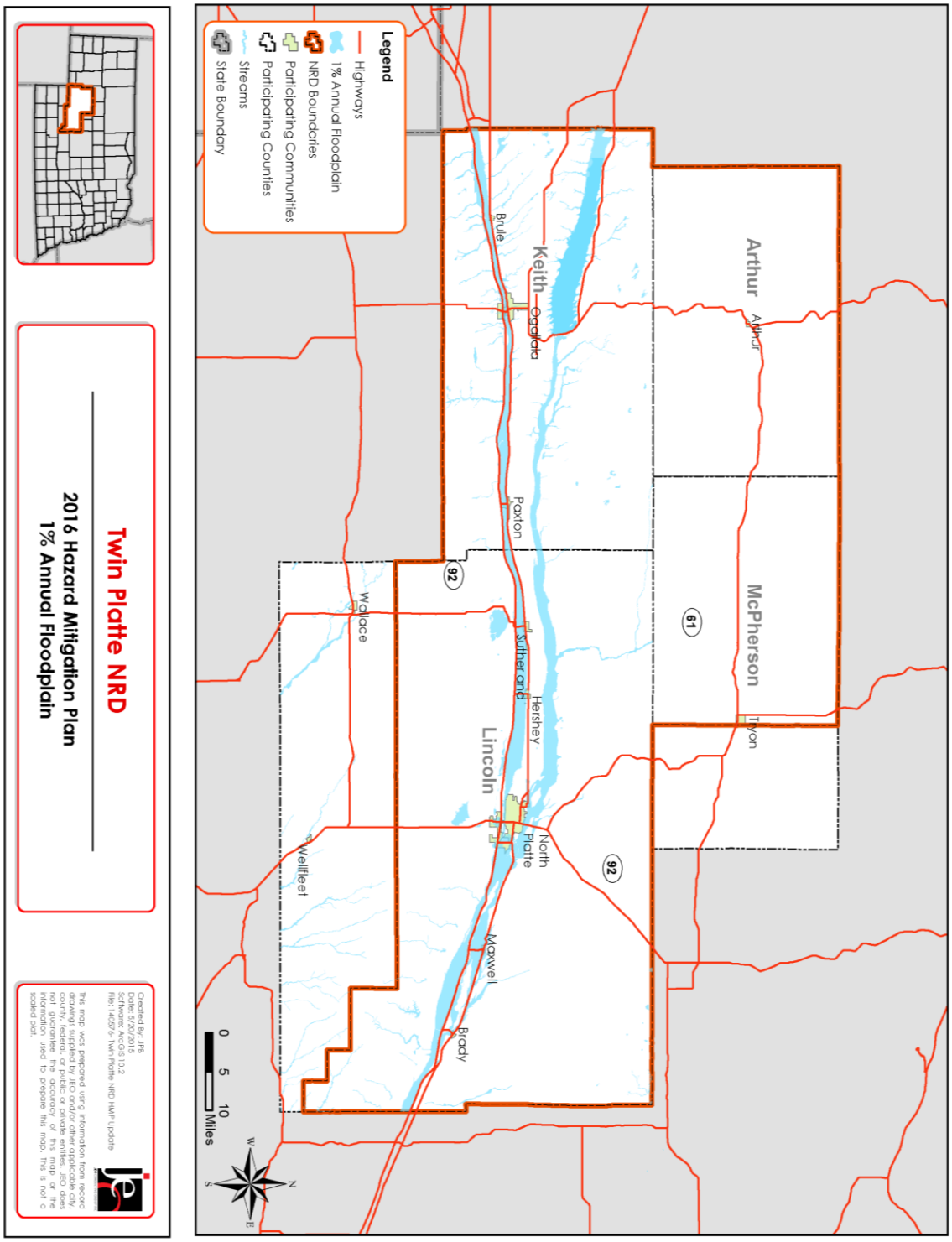
Riverine floods, slower in nature, occur when water from sustained rainfall or rapid snow melt overflows a waterway. Flash floods, faster in nature, result from convective precipitation usually due to intense thunderstorms or sudden releases from an upstream impoundment created behind a dam, landslide, or levee. Flash floods are distinguished from regular floods by a timescale of fewer than six hours. Flooding from excessive rainfall in Nebraska usually occurs between late spring and early fall.

Flooding is most commonly caused by excessive rainfall or snowmelt, but unexpected drainage obstructions such as landslides, ice, or debris can cause slow flooding upstream of the obstruction. Ice jams can cause flooding when a warm snap breaks up river ice, which flows downstream, and piles up against bridges or other waterway obstructions, causing a temporary dam in the waterway with water backing up behind it. When an ice jam breaks, all of the backed-up water is suddenly released, causing a rush of water downstream which can rapidly exceed the capacity of waterways and cause severe flash flooding. Ice jams are common throughout Nebraska during the transition between winter and spring.

Flash floods are rapid flooding of geomorphic low-lying areas, when the ground becomes saturated with water that has fallen too quickly to be absorbed. They are usually caused by heavy rains associated with severe thunderstorms. Flash floods can also occur after the collapse of an ice jam, or a man-made structure, such as a dam or levee. Flash floods most often occur in normally dry areas that have recently received precipitation. This type of flooding is extremely dangerous because of its sudden nature.

The Twin Platte NRD planning area is bisected by the North Platte and South Platte Rivers until the two rivers converge into the Platte River just east of North Platte. The planning area also is home to Nebraska's largest lake, Lake McConaughy, which at full storage is 20 miles long, four miles wide and 142 feet deep at the dam. Lake Ogallala, Lake Maloney, and the Sutherland Reservoir are other significant water bodies within the planning area.

**Figure 21: 1% Annual Chance Floodplain for the Planning Area**



***LOCATION***

According to the FEMA Map Service Center website (www.msc.fema.gov), most communities in the planning area that currently have a Flood Insurance Rate Map (FIRM) panels, which are listed in Table 51. In *Section Seven: Participant Sections*, the 1 percent annual chance floodplain map is included for each participating jurisdiction, where available, as well as an inventory of structures located in the 1 percent annual chance floodplain.

**Table 51: Flood Insurance Rate Map Panels**

| Location | FIRM Panel | Effective Date |
|---|---|---|
| **Arthur County** | N/A | N/A |
| **Arthur** | 310006 | 01/10/1975 |
| **Keith County** | 31101C0450C | 9/30/2005 |
| **Brule** | 31101C0575C | 9/30/2005 |
| **Ogallala** | 31101C0450C | 9/30/2005 |
| **Paxton** | 31101C0700C | 9/30/2005 |
| **Lincoln County** | N/A | N/A |
| **Brady** | 31111C0965C | 1/2/2009 |
| **Hershey** | 31111C0570C | 1/2/2009 |
| **Maxwell** | 31111C0910C | 1/2/2009 |
| **North Platte** | 31111C0860C | 1/2/2009 |
| **Sutherland** | 31111C0545C | 1/2/2009 |
| **Wallace** | 31111C1235C | 1/2/2009 |
| **Wellfleet** | 31111C1340C | 1/2/2009 |
| **McPherson County** | N/A | N/A |

*Source: FEMA*

***EXTENT***

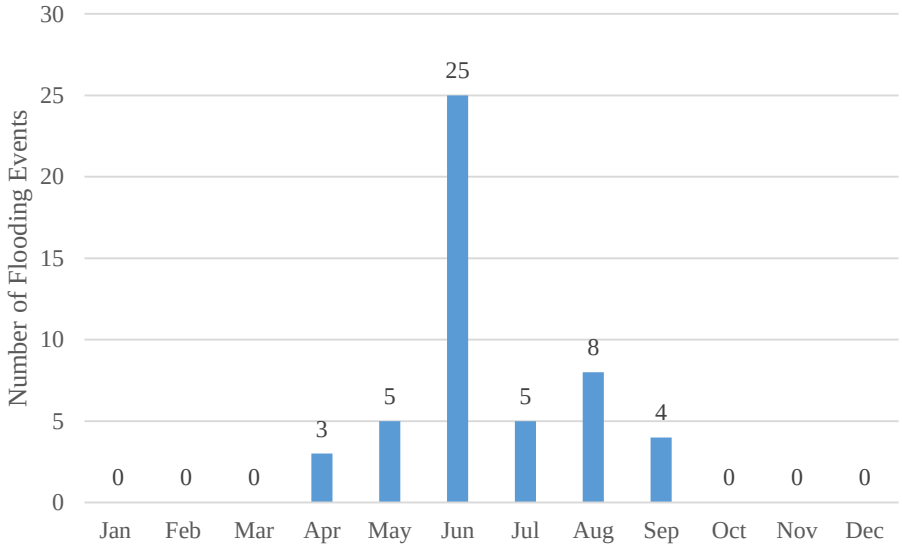
The NWS has three categories to define the severity of a flood (once a river reaches flood stage) as indicated in Table 52. As indicated in Figure 22, the most common month for flooding within the planning area is June. While it is possible that major flood events will occur, the likely extent of flood events planning area will be classified as minor or moderate (Table 52).

**Table 52: 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 22: Flooding Events (Flash and Riverine)**




*Source: NCDC*

***NATIONAL FLOOD INSURANCE PROGRAM (NFIP)***

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

In return for availability of federally backed flood insurance, jurisdictions applying to join the NFIP must agree to adopt and enforce minimum flood loss reduction standards to regulate proposed development in special flood hazard areas as defined by the Federal Emergency Management Agency'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.

Currently, Nebraska has 11,640 policies in force representing $2 billion worth of coverage. The following tables summarize NFIP participation and active policies within the planning area.

**Table 53: NFIP Participants**

| Jurisdiction | Eligible-Regular Program | Date Current Map | Sanction | Suspension | Rescinded | Participation in NFIP |
|---|---|---|---|---|---|---|
| **Arthur County** | - | - | - | - | - | No |
| **Arthur** | - | 01/10/1975 | - | - | - | No |
| **Keith County** | 9/27/1985 | 9/30/2005 | - | - | - | Yes |
| **Brule** | 9/27/1985 | 9/30/2005 | - | - | - | Yes |
| **Ogallala** | 9/30/1987 | 9/30/2005 | - | - | - | Yes |
| **Paxton** | 9/27/1985 | 9/30/2005 | - | - | - | Yes |
| **Lincoln County** | 8/1/1987 | 1/2/2009 | - | - | - | Yes |
| **Brady** | 6/3/1986 | 1/2/2009 | - | - | - | Yes |

| Jurisdiction | Eligible-Regular Program | Date Current Map | Sanction | Suspension | Rescinded | Participation in NFIP |
|---|---|---|---|---|---|---|
| **Hershey** | 8/19/1987 | 1/2/2009 | - | - | - | Yes |
| **Maxwell** | 9/27/1985 | 1/2/2009 | - | - | - | Yes |
| **North Platte** | 11/1/1979 | 1/2/2009 | - | - | - | Yes |
| **Sutherland** | 9/27/1985 | 1/2/2009 | - | - | - | Yes |
| **Wallace** | - | 1/2/2009 | - | - | 3/31/1977 | No |
| **Wellfleet** | - | 1/2/2009 | - | - | - | No |
| **McPherson County** | - | - | - | - | - | No |

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

**Table 54: NFIP Policies in Force**

| Jurisdiction | Policies In-force | Total Premium (Dollars) | Total Coverage (Dollars) |
|---|---|---|---|
| **Arthur County** | N/P | N/A | N/A |
| **Arthur** | N/P | N/A | N/A |
| **Keith County** | 6 | $553,100 | $4,919 |
| **Brule** | N/P | N/A | N/A |
| **Ogallala** | 30 | $9,419,900 | $60,547 |
| **Paxton** | 1 | $350,000 | $460 |
| **Lincoln County** | 123 | $11,363,600 | $93,734 |
| **Brady** | 1 | $25,500 | $340 |
| **Hershey** | 49 | $4,938,700 | $49,733 |
| **Maxwell** | 42 | $3,203,400 | $35,347 |
| **North Platte** | 250 | $51,428,200 | $166,630 |
| **Sutherland** | 10 | $638,800 | $7,469 |
| **Wallace** | N/P | N/A | N/A |
| **Wellfleet** | N/P | N/A | N/A |
| **McPherson County** | N/P | N/A | N/A |
| **Planning Area Total** | 512 | $81,921,200 | $419,179 |

N/A: Not Applicable; N/P: Not Participate.
*Source: Nebraska Department of Natural Resources, National Flood Insurance Program*

### *NFIP REPETITIVE LOSS STRUCTURES*

NDNR was contacted to determine if any existing buildings, infrastructure, or critical facilities are classified as NFIP Repetitive Loss Structures. According to the NDNR, there are no repetitive loss structures in the planning area.

### *HISTORICAL OCCURRENCES*

The NCDC reports 50 flooding events from 1996 to 2015. Of these events, 39 were flash flooding and 11 were riverine flooding. According to the NCDC, flash flooding resulted in $2,923,000 in property damages while riverine flooding caused $765,000 in property damages. Moreover, there were two flash flood events that resulted in injury or death.

In 1999, two people were injured in a flash flooding event in southwest Lincoln County in which roads and culverts were washed out. A couple hit a washed out road one mile west of Wallace, and their car was swept away. Both individuals escaped the car and survived. However, one of them had to be rescued after clinging to a tree for more than two hours.

A flash flood event took the life of an individual in Keith County in 2002. The individual was killed as a bridge approach collapsed on Interstate 80. A large thunderstorm hit the area dropping 8 to 11 inches of rain. One bridge and numerous roads were damaged or washed out. Many homes were damaged in the area as well.

### *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 $194,105 in property damages and $29,630 in crop losses per year in the planning area.

**Table 55: Flood Loss Estimate**

| Hazard Type | Number of Events[1] | Total Property Loss[1] | Average Annual Property Loss [1] | Total Crop Loss[2] | Average Annual Crop Loss [2] |
|---|---|---|---|---|---|
| Flooding | 50 | $3,688,000 | $194,105 | $444,445 | $29,630 |

*1 Indicates data from NCDC (January 1996 to April 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.

### *VULNERABILITY ASSESSMENT*

A 2008 national study examining social vulnerability as it relates to flood events, found that low-income and minority populations are disproportionately vulnerable to flood events. These groups may lack needed resources to mitigate potential flood events as well as resources that are necessary for evacuation and response. In addition, low income residents are more likely to live in areas vulnerable to the threat of flooding, but lack the resources necessary to purchase flood insurance. The study did find that flash floods are more often responsible for injuries and fatalities than prolonged flood events. Other groups that may be more vulnerable to floods, specifically flash floods, include the elderly, those outdoors during rain events, and those in low-lying areas. Elderly residents may suffer from a decrease or complete lack of mobility and as a result, be caught in flood-prone areas. Residents in campgrounds or public parks may be more vulnerable to flooding events. Many of these areas exist in natural floodplains and can experience rapid rise in water levels resulting in injury or death.

### *MITIGATION ALTERNATIVES*

The following list identifies general mitigation strategies that can be used to reduce a community's vulnerability to the threat of flooding. Some of these strategies, such as the use of warning systems, are already in place in the planning area. Many of these strategies are identified and discussed in greater detail in the FEMA document *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards.*

- 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)

- Participate in the NFIP
- 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 storm water systems
- Establish education programs to educate the public about the risks of flooding and ways to protect their families and property
- Preserve natural open spaces in floodplains
- Incorporate permeable surfaces and other "green infrastructure" components into municipal designs
- Establish a "green infrastructure" program
- Elevate or retrofit structures and utilities
- Incorporate flood mitigation programs into comprehensive plans
- Enhance building codes (i.e. require tie-downs for propane tanks and other gas and chemical storage containers; require water detention swales and retention ponds for new construction)
- Participate in the NFIP's Community Rating System
- Incorporate ice jam prevention techniques into mitigation strategies and projects
- Develop incentives for structural flood proofing
- Develop flood response plans for the community (incorporating information about pet and agricultural animal considerations)
- Consider erosion control and bank stabilization programs for critical facilities
- Retain natural vegetative beds in stormwater channels

## *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 property located in the wildland-urban interface. The wildland-urban interface (WUI) is defined as the zone of transition between developed areas and undeveloped wilderness, where structures and other human development meet wildland.

Wildfires are a growing hazard in most regions of the United States. They pose 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.

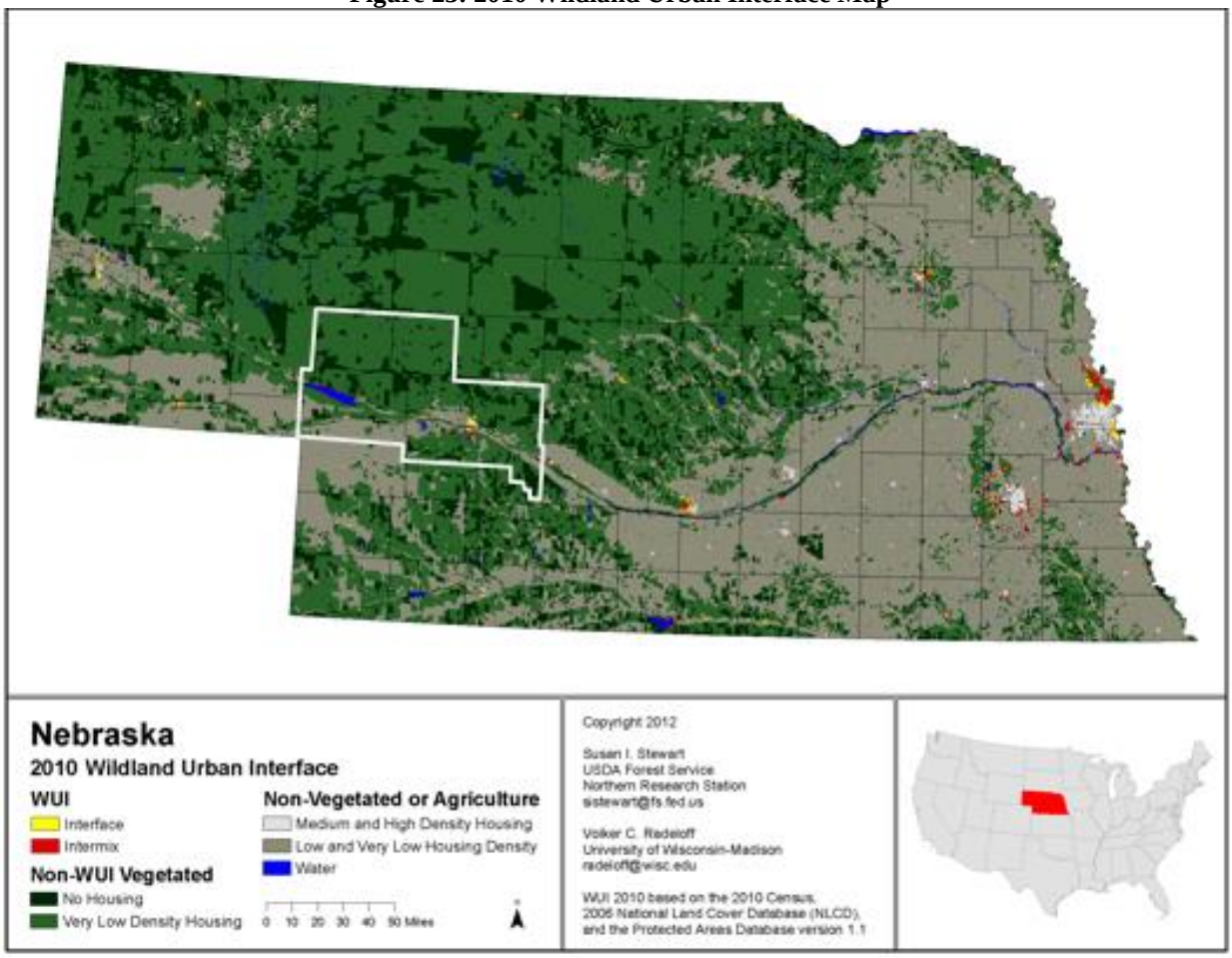
*Lightning starts approximately 10,000* ***forest fires*** *each year, yet ninety percent of forest fires are started by humans.*

*-National Park Service*

Wildfires are characterized in terms of their physical properties including topography, weather, and fuel. Wildfire behavior is often complex and variably dependent on factors such as fuel type, moisture content in the fuel, humidity, wind speed, topography, geographic location, ambient temperature, the effect of weather on the fire, and the cause of ignition. Fuel is the only physical property humans can control and is the target of most mitigation efforts. The NWS monitors the risk factors including high temperature, high wind speed, fuel moisture (greenness of vegetation), low humidity, and cloud cover in the state on a daily basis.

In recent decades, the population of the United States has decentralized, and residents have moved farther away from the center of villages and cities. As a result, the area known as the WUI has developed significantly, in terms of both population and building stock. 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 white outline. Most of the planning area is located in a Non-WUI designated area (Figure 23), with no or low density housing with a mix of vegetated, non-vegetated, and agricultural land.

**Figure 23: 2010 Wildland Urban Interface Map**




*Source: http://silvis.forest.wisc.edu//maps/wui/2010/downloadSource: USDA Forest Service*

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

***LOCATION***

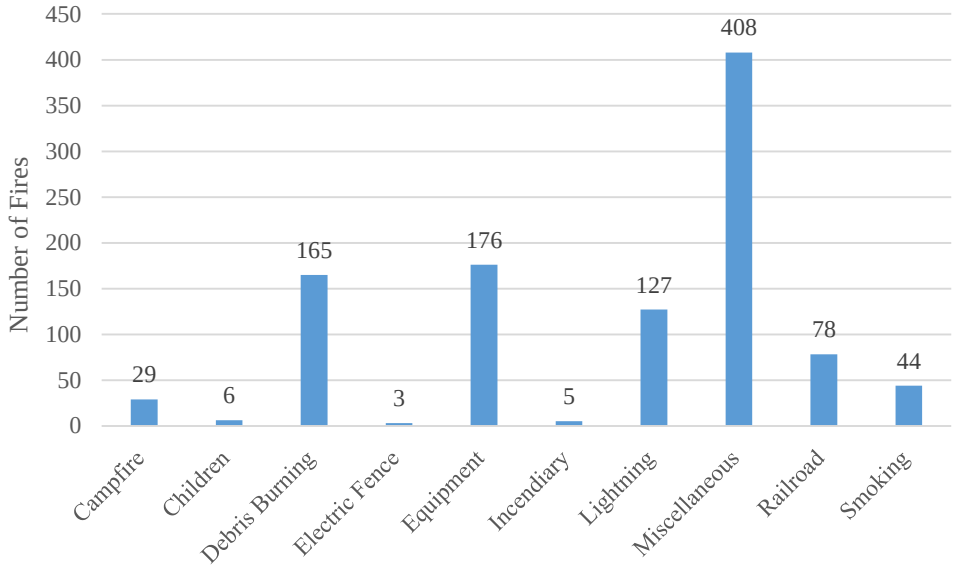
The entire planning area is at risk of wildfire. However, some areas are more vulnerable than others including areas within the WUI, and agricultural buildings.

***EXTENT***

Figure 24 illustrates the number of wildfires by cause in the planning area from 2000 to 2014, which burned nearly 140,000 acres in total. There were 1,041 reported wildfires in the planning area between 2000 and 2014. Fifty-four of the fires burned 100 acres or more, with the largest wildfire burning more than 60,000 acres in the Paxton area in 2012.

Wildfires are most likely to be started by miscellaneous causes (39%). Equipment (17%) and debris burning (16%) 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 24: Wildfires by Cause for the Planning Area 2000-2014**



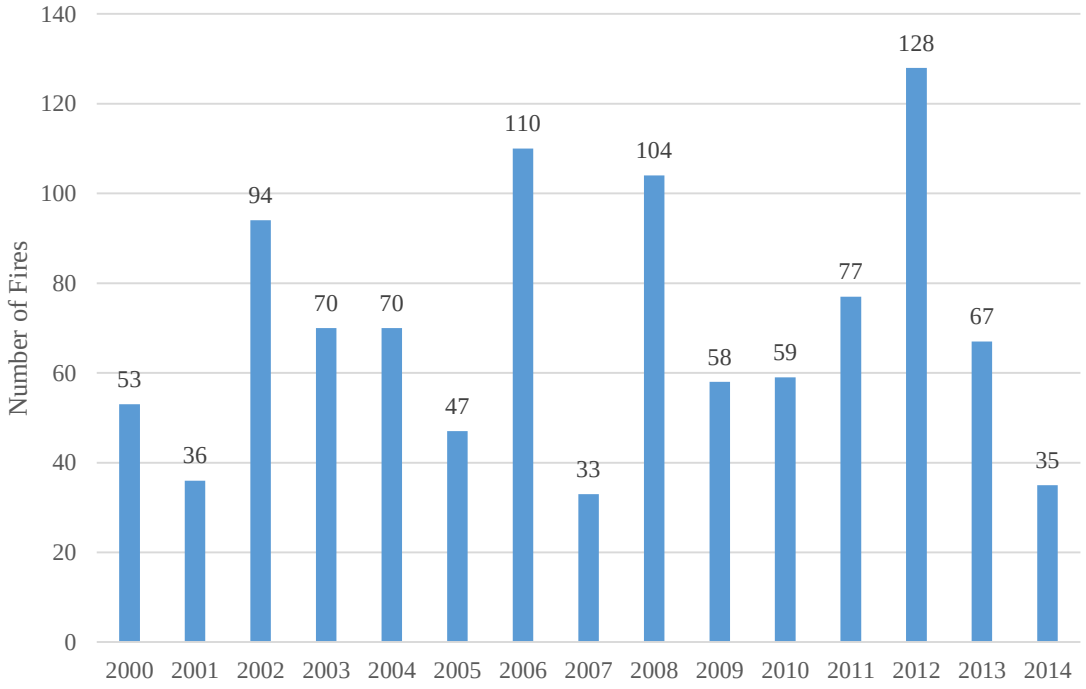

*Source: Nebraska Forest Service*

***HISTORICAL OCCURRENCES***

The entire state of Nebraska is vulnerable to wildfires, but the western portion of the state is more susceptible to this hazard. In 2012, three homes and various out-buildings and equipment were destroyed in the "Korty Check Fire" which burned 10,000 acres in Keith and Perkins counties. Though the 2012 fire did not warrant a Presidential declaration of disaster for wildfire, there have been five such declarations in the state since 2006.

For the planning area, there were 939 reported wildfires by 13 different fire departments according to the Nebraska Forest Service from 2000 to 2012. The reported events burned 137,329 acres of range land, 254 acres of forest land, and 1,739 acres of crop land. The reported fire events caused $156,621 in crop damages according to the Nebraska Forest Service. The NCDC reported an additional $2,000,000 in property losses. It should be noted that 2013 and 2014 incidents were excluded from these counts, as damage costs were not available.

**Figure 25: Number of Wildfires by Year for the Planning Area**




*Source: Nebraska Forest Service*

***AVERAGE ANNUAL DAMAGES***

The average damage per event estimate was determined based upon Nebraska Forest Service wildfires database from 2000 to 2012 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. During the 13 year period, wildfires caused about $105,263 per year in property damage, and $12,048 per year in crop damage in the planning area.

**Table 56: Wildfire Loss Estimation**

| Hazard Type | Number of Events[2] | Total Property Loss[1] | Average Annual Property Loss[1] | Total Crop Loss[2] | Average Annual Crop Loss[2] |
|---|---|---|---|---|---|
| Grass/Wildfires | 939 | $2,000,000 | $105,263 | $156,621 | $12,048 |

*1 Indicates data is from NCDC (1996-2015); 2 Indicates data is from NFS (2000 to 2012)*

***PROBABILITY***

Probability of grass/wildfire occurrence is based on the historic record provided by the Nebraska Forest Service and reported potential by participating jurisdictions. Based on the historic record, both small (less and 100 acres) and large (greater than 100 acres) grass/wildfires are likely to occur annually.

***VULNERABILITY ASSESSMENT***

According to FEMA, periods of drought and dry conditions throughout the year greatly increase the potential for wildland fires and contribute to extreme wildfires. During a severe drought, large wildfires are common with windy days and steep slopes, which can cause wildfires to spread rapidly and become out of control in a very short time period.

Wildfires can cause extensive damage, both to property and human life. The damages caused by wildfires include, and extend past, the loss of building stock, recreation areas, timber, forage, wildlife habitat, and

scenic views. The secondary effects of wildfires include erosion, landslides, introduction of invasive species, and changes in water quality. These secondary effects are exacerbated due to the exposure of bare ground and loss of vegetative cover following a wildfire.

Wildfire poses a threat to a range of demographic groups. Wildfire and urban wildfire could result in major evacuations of residents in impacted and threatened areas. Groups and individuals lacking reliable transportation could be trapped in dangerous locations. Lack of transportation is common among the elderly, low income individuals, and families especially in urban areas. Homes and residents located in the Wildland Urban Interface are also very vulnerable to wildfire and urban fires.

***MITIGATION ALTERNATIVES***

The following bullet points identify some general mitigation strategies that can be used to reduce a community's vulnerability to the threat of wildfire. Some of these strategies, such as the use of warning systems, are already in place in the planning area. The following mitigation actions were identified as options to help mitigate the impacts of wildfire:

- New municipal wells
- Expand water storage capacity
- Civil service improvements (new fire trucks)
- Map and assess vulnerability to wildfire
- Incorporate wildfire mitigation in comprehensive planning (i.e., identify areas of risk per assessment of vulnerability)
- Reduce risk through land use planning (i.e., implement landscaping ordinances)
- Develop a Wildland-Urban Interface code
- Require or encourage fire-resistant construction (i.e., encourage the use of non-combustible materials)
- Retrofit at-risk structures with ignition-resistant materials (i.e., installing wall components that conform to ignition-resistant construction standards)
- Create defensible space around structures and infrastructure
- Conduct maintenance to reduce risk (i.e., perform arson prevention cleanup activities)
- Implement a fuels management program (i.e., Nebraska Forest Service – Forest Fuels Reduction Program)
- Participate in the Firewise program
- Increase wildfire risk awareness (i.e., informing the public about proper evacuation procedures)
- Educate property owners about wildfire mitigation techniques
- Wildland fire fighting training for fire departments

# HAIL

## HAZARD PROFILE

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

The moisture from combined thunderstorms and hail events can be beneficial. However, when thunderstorms do produce hail, there is potential for crop losses, property losses due to building and automobile damages, and personal injury due to people not seeking shelter during these events. The potential for damage increases as the size of the hail increases, as some hail stones call fall at 100 mph.

## 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 57 outlines the TORRO Hailstone Scale.

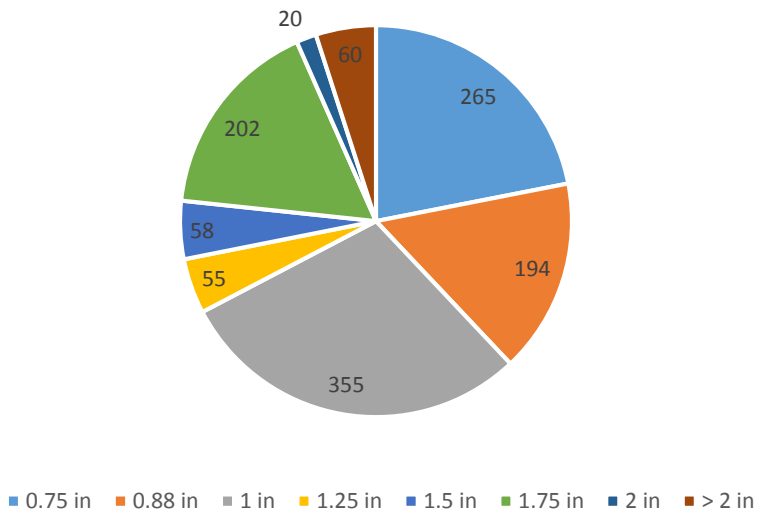
**Table 57: TORRO Hail Scale**

| 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 1,209 hail events reported for the planning area, the average hailstone size is 1.19 inches. Events of this magnitude correlate to an H3 classification. It is reasonable to expect H3 classified events to occur more than one time per year in the planning area. In addition, it is reasonable based on the number of occurrence to expect larger hailstones in the planning area annually. The planning area has endured four H10 hail events during the period of record. For this area, it is realistic to expect an H6 event to occur approximately every year in the planning area. Figure 26 shows hail events based on the size of the hail.

**Figure 26: Hail Events by Size**




*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 reported a total of 1,209 hail events in the planning area between 1996 and 2015. These events were responsible for $56,163,700 in property damages and $62,191,464 in crop damages. These events resulted in one injury and no fatalities.

### *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 58: Hail Loss Estimate**

| Hazard Type | Number of Events[1] | Total Property Loss[1] | Average Annual Property Loss[1] | Total Crop Loss[2] | Average Annual Crop Loss [2] |
|---|---|---|---|---|---|
| Hail Events | 1209 | $56,163,700 | $2,955,984 | $62,191,464 | $4,146,098 |

*1 Indicates the data is from NCDC (January 1996 to April 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 1,209 hail events between 1996 and 2015, or on average 64 hail occurrences per year.

### *VULNERABILITY ASSESSMENT*

Hail occurs on an irregular basis, and can equally affect the entire planning area. Severe thunderstorms can produce heavy rain, flooding, damaging hail, lightning, and high winds during and after the event. All building stock and infrastructure including critical facilities, vehicles, power lines, trees, and utilities are at risk of being damaged or affected by severe thunderstorms. According to climate data, May and June have

the greatest amounts of rainfall. This coincides with severe thunderstorms and increased tornado activity during these months.

Hail is another component of severe thunderstorms that can seriously impact residents of mobile homes. Hail can damage vehicles, roofs, and landscaping, as well as cause injury and occasionally death.

Vulnerable populations related to hail events include the elderly, those living in mobile homes, and those caught outside during storm events. During hail events, it is not uncommon for residents/towns to lose power for a temporary or prolonged period of time. These power outages may prove deadly for elderly citizens that are reliant upon machines to remain alive. The elderly are generally less mobile than many other members or the community, making them more vulnerable to a wide range of threats.

***MITIGATION ALTERNATIVES***

The following bullet points identify some general mitigation strategies that can be used to reduce a community's vulnerability to the threat of hail. Many of these strategies are identified and discussed in greater detail in the FEMA document, *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*.

- 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
- Establish redundancies for necessary municipal services (i.e. water, gas, electric, transportation)
- Bury power and service lines
- Establish community severe weather warning 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
- Establish mutual aid agreements with neighboring communities and privately owned businesses
- Establish public education programs to increase awareness of the dangers posed by hail events and ways the public can mitigate the potential impacts
- Create incentive programs to encourage the use of hail resistant roofing materials for new and existing structures
- Develop business continuity plans for critical community services (public and private)
- Establish a data recovery program and a backup program for municipal employees

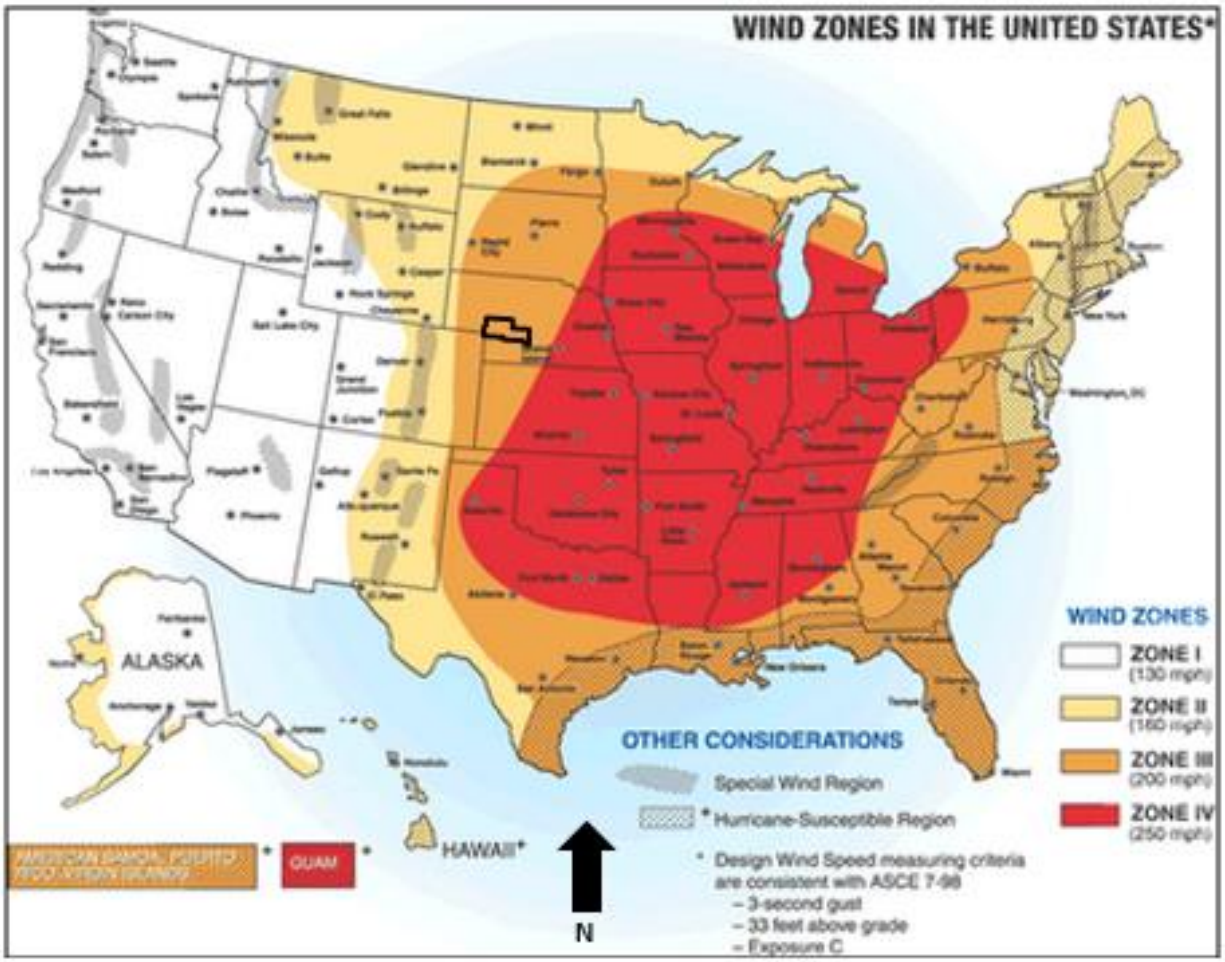
## *HIGH WINDS*

### *HAZARD PROFILE*

High winds typically accompany severe thunderstorms and severe winter storms, and 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 27 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 outlined in black, and is located in Zone III which has maximum winds of 200 mph equivalent to an EF4 tornado.

**Figure 27: Wind Zones in the U.S.**




*Source: FEMA*

### *LOCATION*

High winds commonly occur throughout the planning area. Developed areas are at a greater risk of damages than the rural, less densely populated portions of the planning area.

***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 59 outlines the scale, providing wind speed ranking, range of wind speeds per ranking, and a brief description of conditions for each ranking.

**Table 59: 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: Storm Prediction Center*

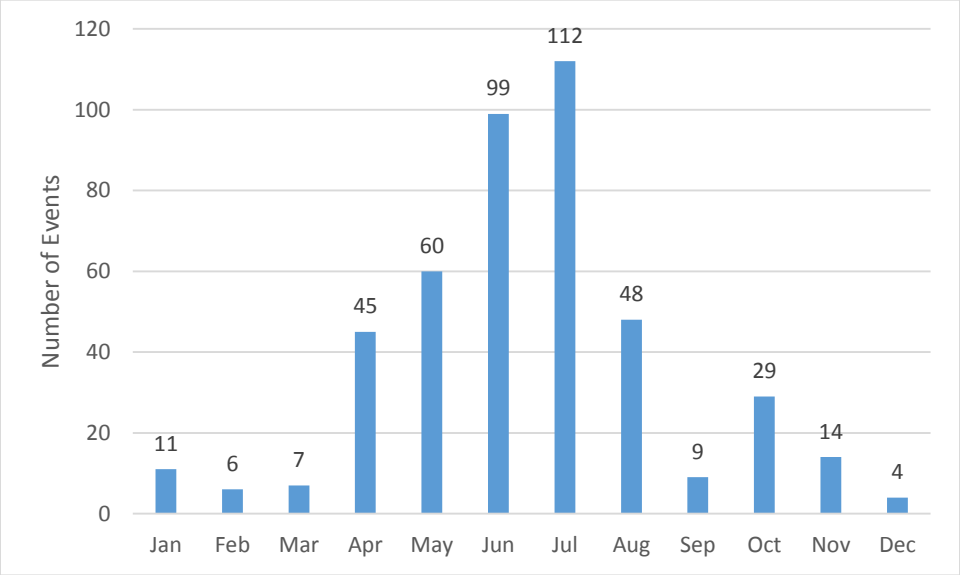
Using the NCDC reported events, the most common high wind event is a level 9/10. The reported high wind events had an average of 52 mph winds. It is likely that this level of event will occur several times annually.

***HISTORICAL OCCURRENCES***

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

There were 444 high wind events that occurred between January 1996 and April 2015. As seen in Figure 28, most high wind events occur in the spring and summer months. No injuries or deaths were reported. However, these recorded events caused a total of $4,836,200 in property damages. Crop damages total $6,435,481 as a result of a high wind events in the planning area. These events from NCDC and reported by each community are listed in each participant section in *Section Seven: Participant Sections*.

**Figure 28: High Wind Events by Month**




*Source: NCDC*

***AVERAGE ANNUAL DAMAGES***

The average damage per event estimate was determined based upon NCDC's Storm Events Database since 1996 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. It is estimated that high wind events can cause an average of $254,537 per year in property damage, and an average of $429,032 per year in crop damage for the planning area.

**Table 60: High Wind Loss Estimate**

| Hazard Type | Number of Events[1] | Total Property Loss[1] | Average Annual Property Loss [1] | Total Crop Loss[2] | Average Annual Crop Loss [2] |
|---|---|---|---|---|---|
| High Winds | 444 | $4,836,200 | $254,537 | $6,435,481 | $429,032 |

*1 Indicates the data is from NCDC (January 1996 to April 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 several times annually. For the 19 years examined, there were 444 reported high wind events reported.

***VULNERABILITY ASSESSMENT***

High winds occur with irregularity, and can affect the entire planning area equally. All building stock and above ground infrastructure, including critical facilities, are at risk of being damaged or affected by high winds. High winds can cause structure loss, downed power lines, loss of electricity, obstruction to traffic flow, and significant damage to trees and center-pivot irrigation systems. A catastrophic event could lead to major economic loss for the jurisdiction. High wind speeds and flying debris can pose a significant threat to human life.

High winds can impact a wide range of people and properties. People living in mobile homes are particularly susceptible to the effects of high winds. Mobile homes that are not anchored or are not anchored properly can be blown over by winds as fast as 60 to 70 mph. Other factors that may increase vulnerability to the threat posed by high winds include age, poverty levels, and home rentals.

***MITIGATION ALTERNATIVES***

The following bullet points identify some general mitigation strategies that can be used to reduce a community's vulnerability to the threat of tornados and high winds. Some of these strategies may already be in progress within the participating jurisdictions, please see *Section 7: Participant Section* to find details on the status of these items for a specific jurisdiction. Many of these strategies are identified and discussed in greater detail in the FEMA document, *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards.*

- Bury overhead power lines
- Establish redundancies for necessary municipal services (i.e. water, gas, electric, transportation)
    - 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
- Encourage the construction of safe rooms
- Enhance building codes to incorporate wind-resistant building techniques
- Establish a data recovery program and a backup program for municipal employees
- Require tornado safe rooms in newly constructed municipal buildings
- Work with trailer and mobile home parks to develop tornado safe rooms
- Ensure schools are equipped with sufficient safe space for their maximum student capacity

## *LEVEE FAILURE*

### *HAZARD PROFILE*

According to FEMA's 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 in 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.

Levee failure can also occur when the levee water levels 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 61: 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 62: Levee Safey Classes**

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

*Source: USACE*

***LOCATION***
There are no federal levees that are located within the planning area as reported by the U.S. Army Corps of Engineers (USACE) National Levee Database. However, there is no known source for all of the numerous municipal, agricultural, and other small levees in the state. The local planning team indicated that most levees are along the canal systems running off of the South Platte and North Platte Rivers.

***EXTENT***
The failure of a levee would likely lead to the inundation of agricultural fields. Some residential areas may experience minor flooding as well.

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

***AVERAGE ANNUAL DAMAGES***
Due to the lack of historical occurrences of levee failure and the lack of known levee locations, average annual damages will not be calculated for this hazard.

***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.

***VULNERABILITY ASSESSMENT***
Levee failure would result in the inundation of the surrounding areas. Populations located along the canal system are most vulnerable to this hazard. In the event of levee failure, all building stock and infrastructure located in the surrounding area are at risk of being damaged.

***MITIGATION ALTERNATIVES***
There are many options that can be done to mitigate the impacts of a levee failure.

- Evacuation Plan
- Land-use regulations preventing development in area protected by existing levees
- Encourage structures protected by levees to purchase flood insurance
- Education on the potential impacts of a levee failure
- Develop Emergency Preparedness Plan
- Develop Risk Awareness Communication Plan
- Conduct emergency preparedness exercises

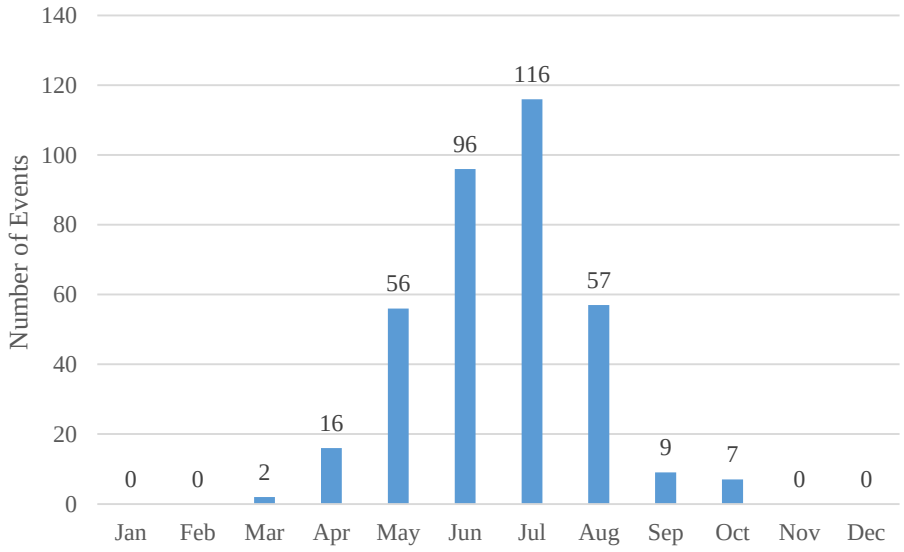
## *SEVERE THUNDERSTORMS (THUNDERSTORM WIND, HEAVY RAIN, AND LIGHTNING)*

### *HAZARD PROFILE*

Severe thunderstorms are common and unpredictable annual events throughout the central and southern United States. 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 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 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 sheer force.

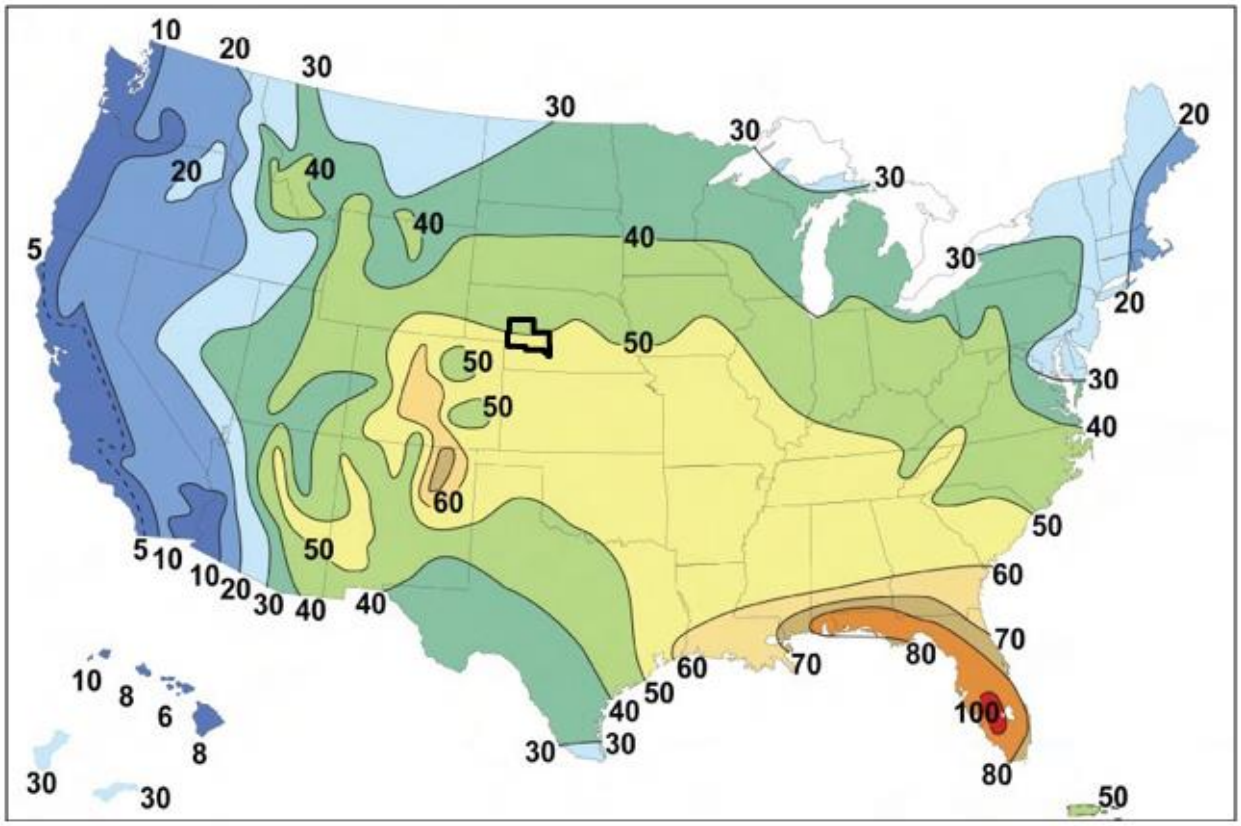
**Figure 29: Severe Thunderstorms by Month**




*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 damage includes 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 30 displays the average number of days with thunderstorms across the country each year, with Nebraska experiencing between 50 to 60 days from north to south across the state. The planning area experiences an average of 50 to 60 thunderstorms over the course of one year.

**Figure 30: Average Number of Thunderstorms**




*Source: NWS*

Thunderstorms can develop in fewer than 30 minutes, and can grow to an elevation of eight miles into the atmosphere. Lightning, by definition, is present in all thunderstorms and can be harmful to humans and animals, can cause fires to buildings and agricultural lands, and can 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, when lightning comes in contact with the ground, society can be 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 2015, an average of 31 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***

A major component of severe thunderstorms is rainfall accumulations. For the planning area, it is reasonable to expect spring (March, April and May) and summer (June, July and August) to have the highest rainfall totals. Using data provided by the HPRCC, Table 63 shows the average number of days with precipitation for the spring and summer months.

**Table 63: Average Number of Days with Precipitation**

| Amount of precipitation | Spring | Summer |
|---|---|---|
| Trace | 26 days | 29 days |
| 0.1 in. | 14 days | 16 days |
| 0.5 in. | 4 days | 6 days |
| 1 in. | 1 days | 2 days |

*Source: High Plains Regional Climate Center*

### *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; however, 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 364 thunderstorm (wind) and lightning events in the planning area from January 1996 to April 2015. These events were responsible for $4,259,700 in total property damages, and $590,000 in crop damages. There were no deaths from these storms, but a total of six injuries.

### *AVERAGE ANNUAL DAMAGES*

The average damage per event estimate was determined based upon NCDC's Storm Events Database since 1996 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Severe thunderstorms cause an average of $224,195 per year in property damages.

**Table 64: Severe Thunderstorm Loss Estimate**

| Hazard Type | Number of Events[1] | Total Property Loss[1] | Average Annual Property Loss[1] | Total Crop Loss[2] | Average Annual Crop Loss[2] |
|---|---|---|---|---|---|
| Severe Thunderstorms | 364 | $4,259,700 | $224,195 | N/A | N/A |

*1 Indicates the data is from NCDC (January 1996 to April 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 364 severe thunderstorms between 1996 and 2015; this results in 100 percent chance annually for thunderstorms.

### *VULNERABILITY ASSESSMENT*

Severe thunderstorms can produce heavy rain, flooding, damaging hail, lightning, and high winds during and after an event. All building stock and infrastructure including critical facilities, vehicles, power lines, trees, and utilities are at risk of being damaged or affected by severe thunderstorms. According to climate data, May and June have the greatest amounts of rainfall. This coincides with severe thunderstorms and increased tornado activity during these months.

Severe thunderstorms can cause property damage or loss, downed power lines, loss of electricity, obstruction to traffic flow, significant damage to trees, and pose a threat to human life. The electrical infrastructure is highly vulnerable to damages from lightning strikes and downed tree branches, roadways are vulnerable to wash outs and surface damages from flash floods, and building stock and personal property are vulnerable to damages from large hail stones. Severe thunderstorms can also cause significant damage to crops, levees, and dams throughout the rural areas of the planning area.

Vulnerable populations related to severe thunderstorms include the elderly, those living in mobile homes, and those caught outside during storm events. During severe thunderstorms, it is not uncommon for residents and towns to lose power for a temporary or prolonged period of time. These power outages may prove deadly for elderly citizens that are reliant upon machines to remain alive. The elderly are generally less mobile than many other members of the community, making them more vulnerable to a wide range of threats. Unanchored or improperly anchored mobile homes are at high risk during thunderstorms because they can be turned over by winds of 60 to 70 mph. Severe thunderstorms are defined by winds in excess of 58 mph.

Lightning is commonly considered the most dangerous and most frequently encountered weather hazard. Annually, there are an average of 31 fatalities from lightning in the United States. The most vulnerable groups related to lightning strikes are people located outside during storm events. From 2006-2016, men were 3.7 times more likely to be hit by lightning. Vulnerable areas to consider include public parks, campgrounds, swimming pools, and schools with playgrounds.

***MITIGATION ALTERNATIVES***

The following bullet points identify some general mitigation strategies that can be used to reduce community vulnerability to the threat of severe thunderstorms. Some of these strategies, such as the use of warning systems, are already in place in the planning area. Many of these strategies are identified and discussed in greater detail in the FEMA document *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*. As communities vary in their risk and vulnerability to the hazard, community-related mitigation strategies can be found in *Section Seven: Participant Sections*.

- Bury overhead power lines
- Establish redundancies for necessary municipal services (i.e. water, gas, electric, transportation)
    - 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
- Encourage the construction of safe rooms
- Establish community severe weather warning 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
- Establish mutual aid agreements with neighboring communities and privately owned businesses
- Establish public education programs to increase awareness of the dangers posed by severe thunderstorms, and ways the public can mitigate potential impacts
- Establish a data recovery program and a backup program for municipal employees
- Install and maintain surge protection for critical facilities
- Incentive programs to encourage the use of hail resistant roofing materials for new and existing structures
- Develop business continuity plans for critical community services (public and private)

## *SEVERE WINTER STORMS*

### *HAZARD PROFILE*

Severe winter storms are an annual occurrence in Nebraska. Winter storms can bring extreme cold, freezing rain, and heavy or drifting snow, creating 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 temperature for these months are all below freezing (average low for the five months 16.2°F). The average high temperatures for the months of January, February, and December are near 37.1°F. Record lows for the region range from -30°F in December, -35°F in January and February, and -21°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. Large snow events can cripple an entire jurisdiction by hindering transportation, knocking down tree limbs and utility lines, and causing structural damage to buildings.

Generally, winter storms occur between the months of November and March, but may occur as early as October and as late as April.

### *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 31 shows the SPIA index.

**Figure 31: 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 | |

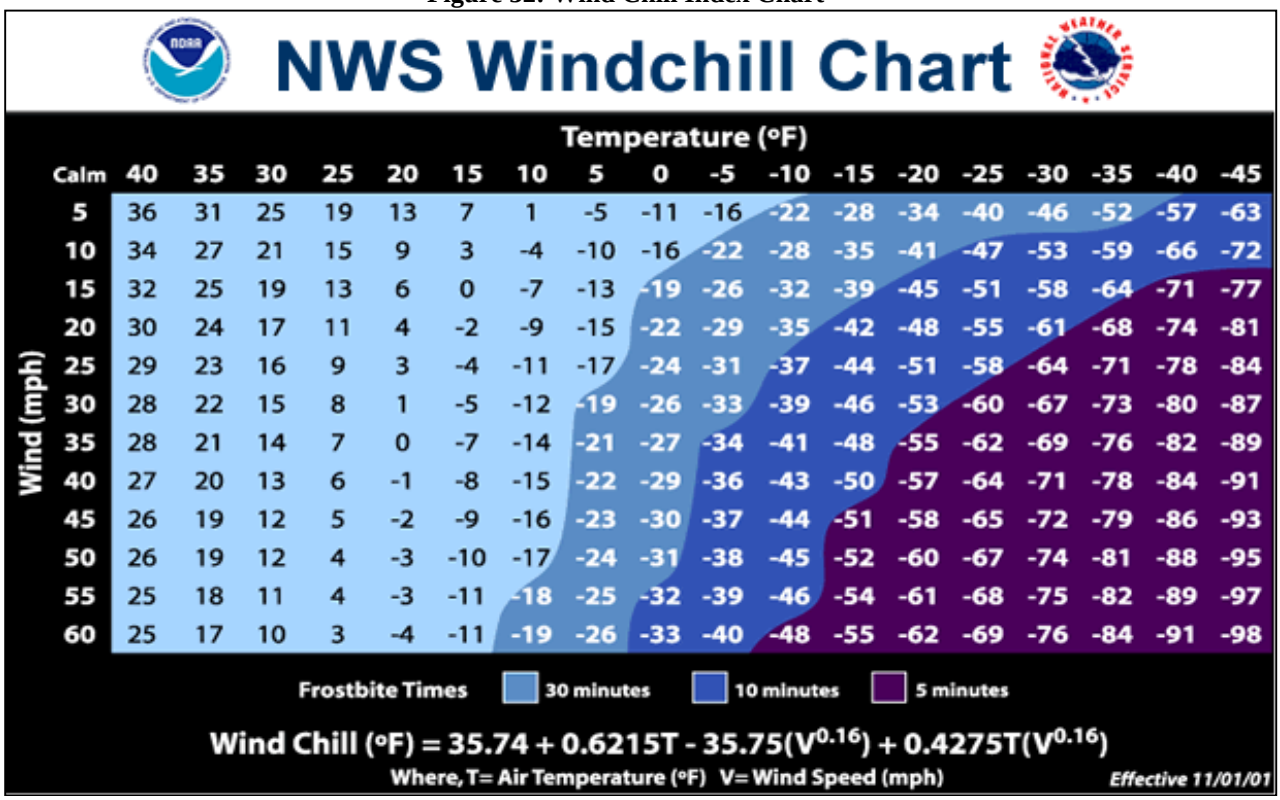
**(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)**

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

Reviews of historical severe winter storms across the planning area show that there is a range of events that can occur. Common component of winter storms in the planning area include extreme cold, ice, snow and high winds. Typical ice events correlate with Level 2 occurrences according to the SPIA Index. Ice accumulations range from a quarter of an inch to three quarters of an inch. The most common accumulation was one quarter of an inch to half an inch occurring in both ice events.

The Wind Chill Index was developed by the NWS to determine the decrease in air temperature felt by exposed skin on the body 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 32 shows the wind chill index used by the NWS.

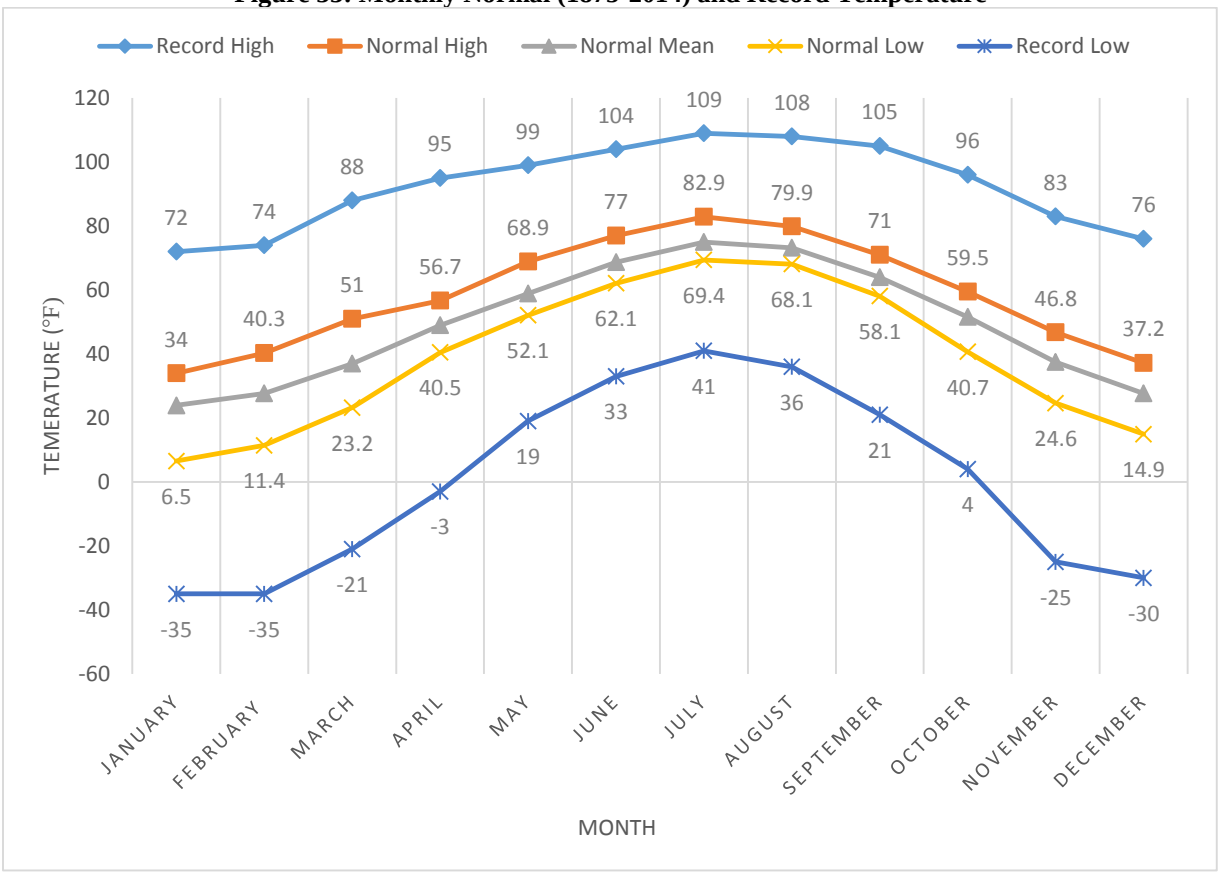
**Figure 32: Wind Chill Index Chart**




*Source: NWS*

The coldest months of the year are January, February, March, November, and December. Normal lows for these months average around 16 degrees as shown in Figure 33.

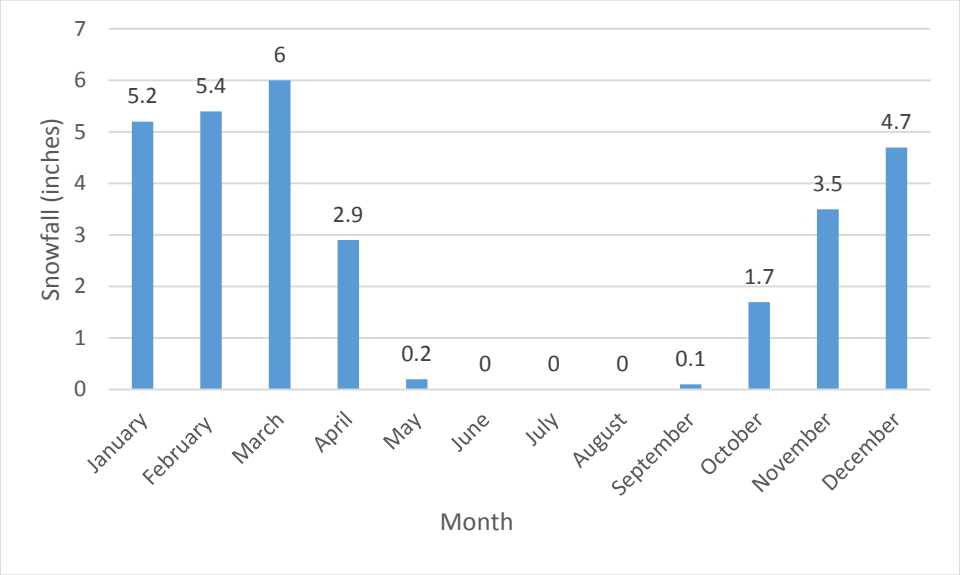
**Figure 33: Monthly Normal (1875-2014) and Record Temperature**




*Source: High Plains Regional Climate Center*

Average monthly snowfall for the planning area is shown in Figure 34, which shows the snowiest months are between December 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 40 mph with gusts reaching 60 mph or higher. Strong winds and low temperatures can combine to produce extreme wind chills of 20°F to 40°F below zero.

**Figure 34: Average Snowfall by Month**




*Source: High Plains 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 163 winter storm events for the planning area from January 1996 to April 2015. These recorded events caused a total of $1,149,000 in property damages. RMA reported $3,028,524 in crop damages from 2000 to 2014.

## *AVERAGE ANNUAL DAMAGES*

The average damage per event estimate was determined based upon NCDC's Storm Events Database since 1996 and number of historical occurrences. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Severe winter storms have caused an average of $60,474 per year in property damage, and an average of $201,902 per year in crop damage for the planning area.

**Table 65: Severe Winter Storm Loss Estimate**

| Hazard Type | Number of Events[1] | Total Property Loss[1] | Average Annual Property Loss [1] | Total Crop Loss[2] | Average Annual Crop Loss [2] |
|---|---|---|---|---|---|
| Severe Winter Storms | 163 | $1,149,000 | $60,474 | $3,028,524 | $201,902 |

*1 Indicates the data is from NCDC (January 1996 to April 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.

## *VULNERABILITY ASSESSMENT*

Power outages, which occur almost on an annual basis with severe winter storms in Nebraska, in combination with cold temperatures and below zero wind-chill, can pose a significant threat to human life. Highly vulnerable populations include residents of nursing homes, young children, the elderly, and those living in less than adequate environments. Critical facilities and infrastructure including emergency response and recovery operations, warning and communication systems, wells and water treatment, and many other services vital for returning the jurisdiction's functions to normal, are at risk during severe winter storm events due to potential power outages and other damages.

Severe winter storms occur on a regional scale, and can affect the entire planning area equally. All building stock and infrastructure, including critical facilities, are at risk of being damaged or affected by a severe winter storm.

The collection of snow and ice on power lines and electrical equipment can cause equipment damage, downed power lines, and a loss of electricity. Snow and ice accumulations on transportation routes can lead to obstruction of traffic flow and hinder emergency response. Severe winter storms can also cause significant damage to trees, with branches downing electrical lines, blocking roadways, or causing building and property damage.

Severe winter storms regularly result in damages to power lines and telephone lines, as well as other infrastructure related to threat communication (i.e. radio and television antennas). This potential for decreased message dissemination combined with potential power outages results in higher levels of vulnerability for a number of groups within the community including: the elderly, individuals and families living below the poverty line, those isolated from social interactions, groups with limited mobility, and residents that are new to the area/region. Elderly citizens are at higher risk of being isolated during severe winter storms as a result of decreased mobility, as well as a diminished ability to remove accumulations of snow and ice from vehicles and driveways. A 2011 study conducted by the Center for Injury Research and Policy found that, on average, there are 11,500 injuries and 100 deaths in the United States annually related to snow removal. People, especially males over the age of 55, are 4.25 times more likely to experience symptoms of cardiac distress during snow removal.

Individuals and families below the poverty line and those isolated from social interactions may lack resources or access to resources that could mitigate the impacts of severe winter storms. Needed resources include sufficient food supplies when snowed in, and alternative heating sources during prolonged power outages. Severe winter storms often result in closed or impassable roadways. This increases the vulnerability among segments of the population that already have decreased mobility, making it important that they have a social network that can check on them and ensure they have access to heat and food. Finally, people who are new to the area may not know what to expect from a severe winter storm and what actions are appropriate in preparing for the event. Threat communication is imperative for informing and educating this portion of the population.

***MITIGATION ALTERNATIVES***

The following bullet points identify some general mitigation strategies that can be used to reduce community vulnerability to the threat of severe winter storms. Some of these strategies may already be in progress within the participating jurisdictions, refer to *Section 7: Participant Section* to find details on the status of these items for a specific jurisdiction. Many of these strategies are identified and discussed in greater detail in the FEMA document, *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*.

- 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
- Establish a Tree Board to assist in the development of a tree management program
- Establish redundancies for necessary municipal services (i.e. water, gas, electric, transportation)
- 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 mitigate the potential impacts

- Work with community groups serving "vulnerable populations", such as Meals on Wheels programs to help monitor vulnerable groups
- Develop continuity plans for critical community services (public and private)
- Improve building codes to eliminate flat roofs in areas that expect heavy snow loads
- Retrofit buildings and infrastructure to withstand snow loads
- Increase weather monitoring procedures

## *TERRORISM*

According to the 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, this plan will use the following FBI definitions:

- 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

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 mainly 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.

The Sector-Specific Agencies 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 Sector-Specific Agency responsibility for six of the 18 CIKR sectors. Those six are:

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

Sector-Specific Agency 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 Sector-Specific Agency 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. 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 activity within the planning area is possible throughout the region.

***EXTENT***
Impacts from terrorism can range from very isolated occurrences of property damage with limited injuries, to large scale events with catastrophic impacts to lives and property.

***HISTORICAL OCCURRENCES***
There is no record of terrorist events within the planning area.

***AVERAGE ANNUAL DAMAGES***
Due to lack of data and historic impacts, average losses will not be calculated for this hazard.

***PROBABILITY***
There were no reports of terrorism reported within the planning area. This plan recognizes that while there have not been incidents of terrorism reported in the past, that does not prevent future occurrences. Probability of future occurrence related to this threat is stated at one percent annually.

***VULNERABILITY ASSESSMENT***

The unpredictable nature of terrorism is such that impacts can range from very isolated occurrences of property damage with limited injuries to large scale events with catastrophic impacts to lives and property. Infrastructure that are vulnerable include: tampering with water supply, agricultural attacks (plant and animal diseases), and cyber security attacks.

***MITIGATION ALTERNATIVES***

Mitigation alternatives for terrorism include:

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

## *TORNADOS*

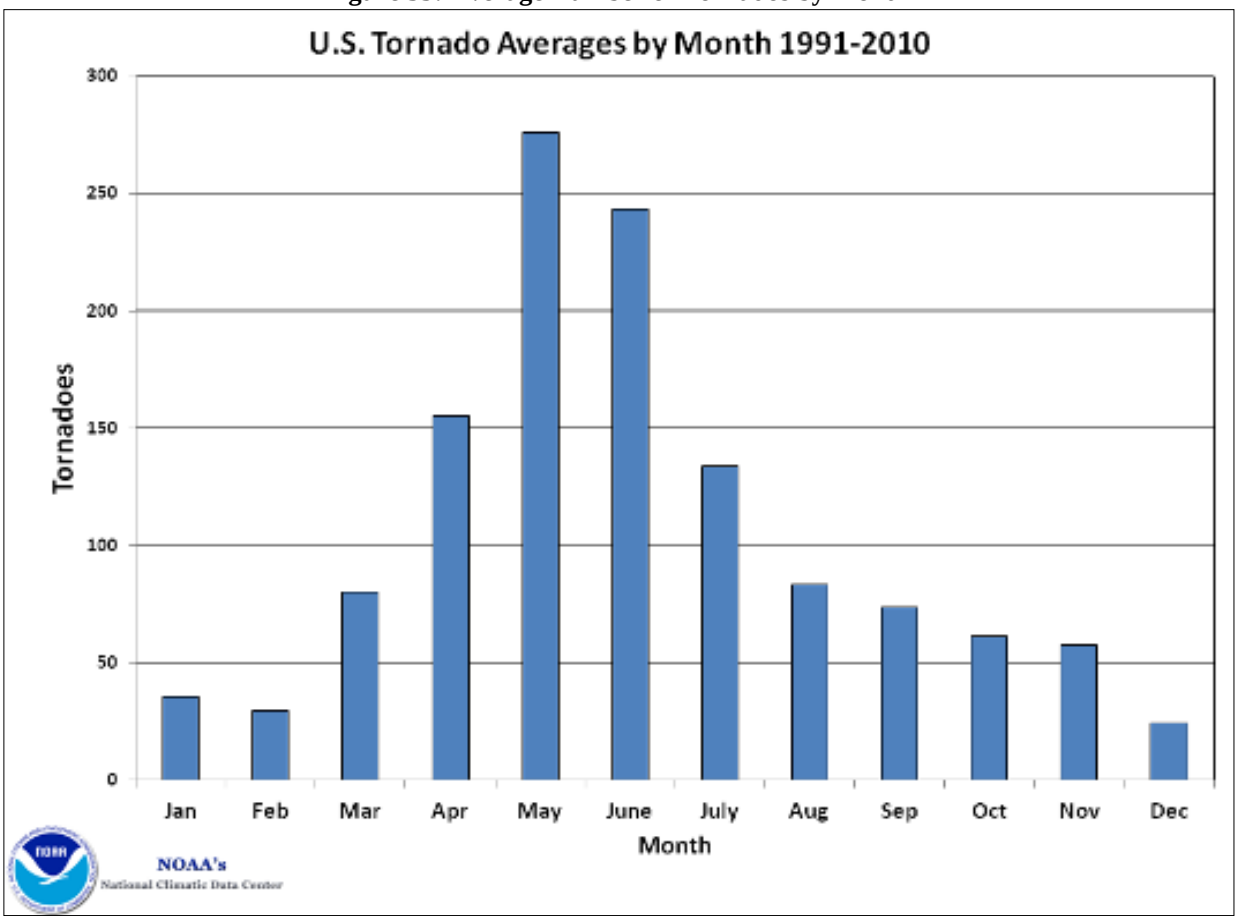
### *HAZARD PROFILE*

A tornado is typically associated with a supercell thunderstorm. In order for rotations to be classified as tornados, 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.

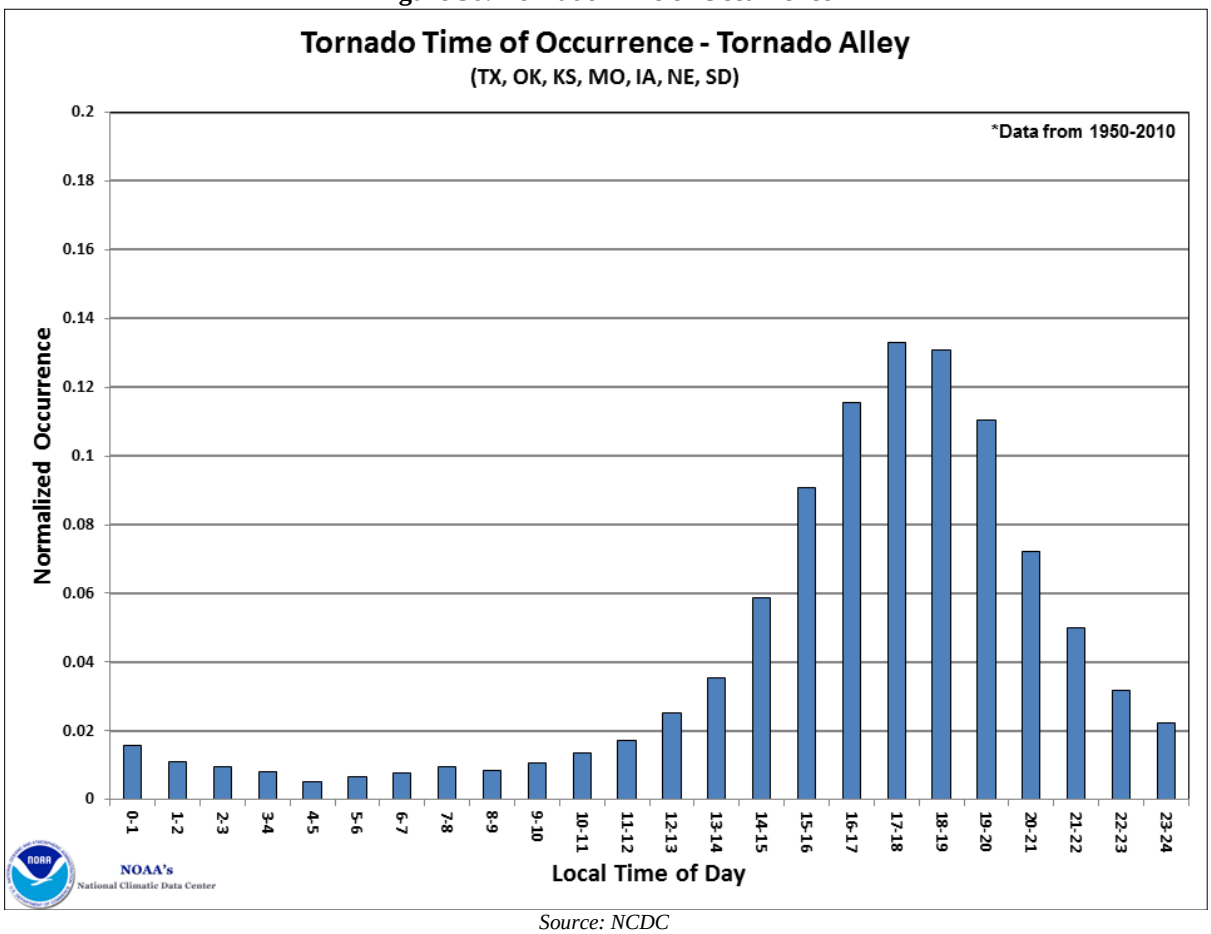
Once tornados are formed, they can be extremely violent and destructive. They have been recorded all over the world, but are most prevalent in the American Midwest and South, in an area known as "Tornado Alley." Approximately 1,000 tornados are reported annually in the contiguous United States (NOAA 2012). Tornados can travel distances over 100 miles and reach over 11 miles above ground. Tornados usually stay on the ground no longer than 20 minutes. Nationally, the tornado season typically occurs between March and April. 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 35: Average Number of Tornados by Month**




*Source: NCDC*

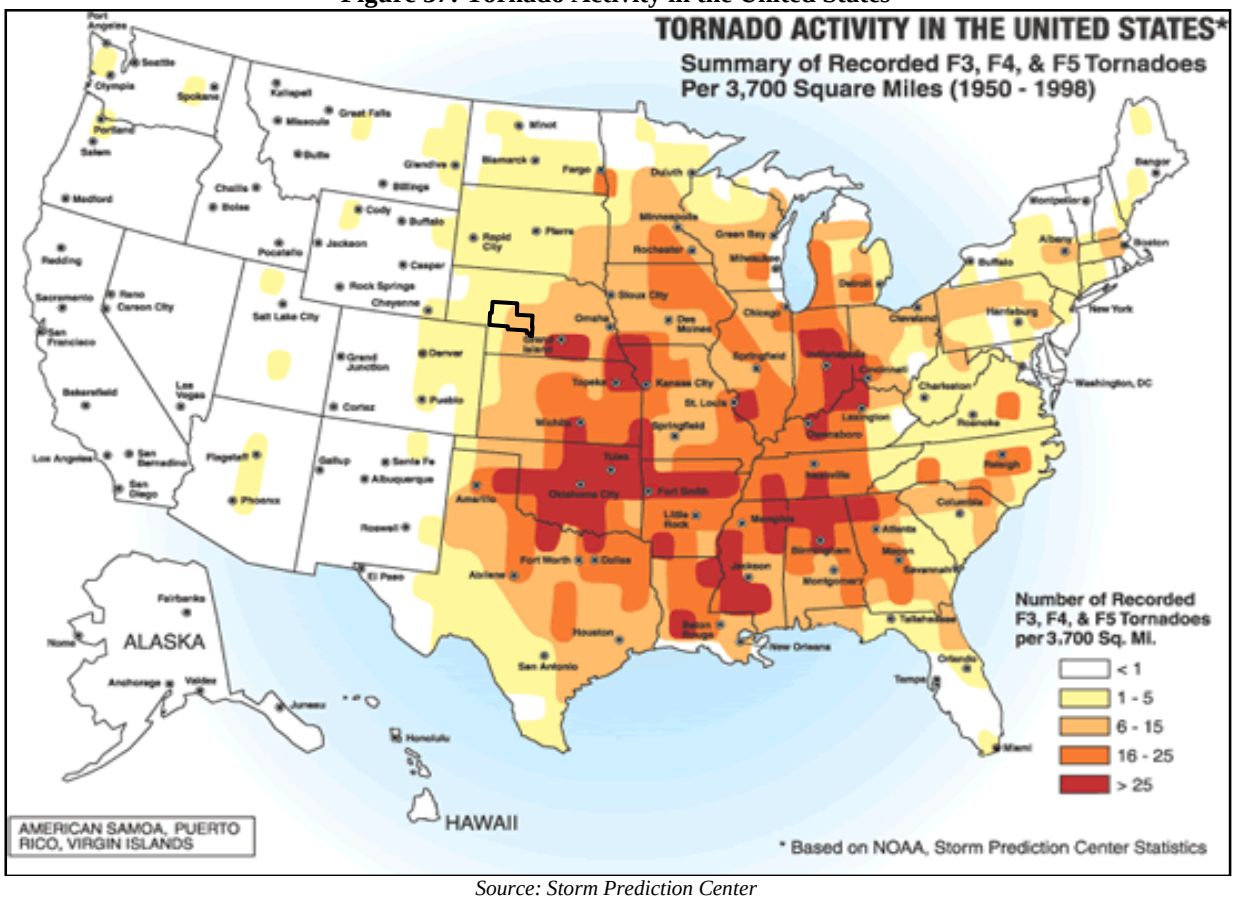
**Figure 36: Tornado Time of Occurrence**




*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). Figure 36 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 37: Tornado Activity in the United States**




*Source: Storm Prediction Center*

***LOCATION***

Tornados have occurred in all of the counties participating in this plan. Lincoln County has the greatest number of recorded tornados.

***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 a tornado 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 occasionally 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. Table 66 and Table 67 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 damage.

**Table 66: 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 67: 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 | Apt, condo, townhouse (3 stories or less) |
| 6 | Motel |
| 7 | Masonry apt. or motel |
| 8 | Small retail bldg. (fast food) |
| 9 | Small professional (doctor office, branch bank) |
| 10 | Strip mall |
| 11 | Large shopping mall |
| 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 - jr. or sr. 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 |

| Number | Damage Indicator |
|---|---|
| 25 | Free-standing tower |
| 26 | Free standing pole (light, flag, luminary) |
| 27 | Tree - hardwood |
| 28 | Tree - softwood |

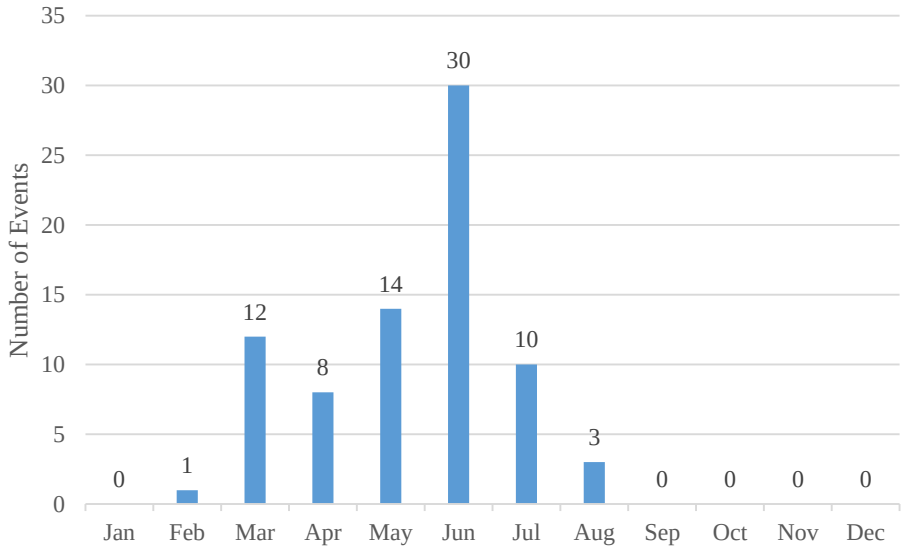
*Source: NOAA; FEMA*

Based on the historic record it is most likely that tornados within the planning area will be of EF0 strength. Of the 78 reported events 10 were F/EF1 tornados, one event was an F/EF2 tornados, four events were of F/EF3 magnitude, but the majority (63) were F/EF 0.

### ***HISTORICAL OCCURRENCES***

NCDC cites 78 tornado events ranging from a magnitude of EF0 to EF3. These events were responsible for $4,378,750 in property damages and $3,193 in crop damages. No deaths were reported, however nine injuries were cited. The jurisdiction specific events from NCDC and reported by each community were listed in each participant section in *Section Seven: Participant Sections*.

**Figure 38: Tornados by Month in the Planning Area**




*Source: NCDC*

### ***AVERAGE ANNUAL DAMAGES***

The average damage per event estimate was determined based upon NCDC's 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 $230,461 per year in property damage, and annual crop damage coming in at $213.

**Table 68: Tornado Loss Estimate**

| Hazard Type | Number of Events[1] | Total Property Loss[1] | Average Annual Property Loss [1] | Total Crop Loss[2] | Average Annual Crop Loss [2] |
|---|---|---|---|---|---|
| Tornados | 78 | $4,378,750 | $230,461 | $3,193 | $213 |

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

### ***PROBABILITY***

Based on historical records, it is likely that tornados will occur within the planning area annually with the most probable magnitude being an EF0. For the 19 years examined, there were 78 reported tornados, and a majority of these tornados were rated an EF0 or EF1.

### ***VULNERABILITY ASSESSMENT***

Tornados can impact a wide range of people and properties. People living in mobile homes are specifically susceptible to the effects of tornados. Other factors that may increase vulnerability to the threat posed by tornados include age, poverty levels, and home rentals.

The most common injuries from tornados are from flying or falling debris. The second most common injuries come from being picked up or blown by the tornado. Other injuries that occur include being hit by objects, building collapsing, or broken glass. The most common injuries are soft tissue injuries and fractures.

Lower income populations often live in housing that is the most vulnerable. The homes that are available to this group are not always up to code, and it is hard for the residents to make improvements because of financial limitations of their income bracket.

Mobile homes that are not anchored or are anchored improperly can be blown over by winds at speeds of 60 to 70 mph. A 2007 study conducted by Dr. W. Ashley at Northern Illinois University found that between 1985 and 2005, 44 percent of all tornado related fatalities occurred in mobile homes. Tornado related deaths in mobile homes have increased over the timeframe investigated from 37 percent of all fatalities from 1986 to 1990 to nearly 57 percent of all fatalities from 2001 to 2005.

The timing of tornados also impacts the vulnerability of people living in mobile homes. The 2007 study found that while only 25.8 percent of tornados occur between sunset and sunrise they account for 42.5 percent of tornado fatalities. This is a result of a number of factors including: decreased ability to identify tornados in the dark, decreased ability to communicate tornado threats due to a high rate of people sleeping during the night, and a higher number of people in the housing units (i.e. mobile home) during the nighttime.

The 2007 study found that middle aged people (those over 40 years of age) and the elderly are more vulnerable to tornados. This may be a result of decreased mobility, higher rate of auditory complications, or lack of resources needed to mitigate potential tornado related impacts.

Tornados occur with irregularity, and can affect the entire planning area equally. All building stock and above ground infrastructure, including critical facilities, are at risk of being damaged or affected by tornados. Tornados can cause structure loss, downed power lines, loss of electricity, obstruction to traffic flow, and significant damage to trees and center-pivot irrigation systems.

### ***MITIGATION ALTERNATIVES***

The following bullet points identify some general mitigation strategies that can be used to reduce community vulnerability to the threat of tornados. Some of these strategies may already be in progress within the participating jurisdictions. Please see *Section 7: Participant Section* to find details on the status of these items for a specific jurisdiction. Many of these strategies are identified and discussed in greater detail in the FEMA document, *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards.*

- Bury power and service lines
- Establish redundancies for necessary municipal services (i.e. water, gas, electric, transportation)

- 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
- Encourage the construction of safe rooms
- Ensure outdoor warning sirens are functional and located adequately to warn the public of potential tornadic events
- 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
- 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.
- Enhance building codes to incorporate wind –resistant building techniques
- Establish a data recovery program and a backup program for municipal employees
- Require tornado safe rooms in newly constructed municipal buildings
- Work with trailer and mobile home parks to develop tornado safe rooms
- Ensure schools are equipped with sufficient safe space for their maximum student capacity
- Develop business continuity plans for critical community services (public and private)
- Develop maps of vulnerable populations and safe rooms located near those groups

# Section Five: Mitigation Strategy

## *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 was completed through the Round 1 public meetings.

After each hazard was identified, goals and objectives were established. The intent of each goal and set of objectives was to develop strategies to account for the risks associated with the hazards, and identify ways to reduce or eliminate those risks. Each goal and set of objectives is preceded by 'mitigation alternatives' or actions items.

A preliminary list of goals and objectives was provided to the 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 how to improve or change them to meet the needs of their jurisdiction. Information from this review was used to finalize the 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*

This section has been updated to reflect changes in prioritization and needs within the participating jurisdictions. This section contains: completed mitigation projects, an update of previously identified projects, and the addition of new projects and strategies that have been identified.

## *GOALS AND OBJECTIVES*

Below is the final list of goals and objectives, as determined by the participants and 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 '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 greatest extent possible.*

***Objective 2.2:*** *Develop hazard specific plans, conduct studies or assessments, and retrofit jurisdiction 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 they are exposed to, what the effects may be, where they occur, and what they can do to be better prepared.*

***Goal 4: Improve Emergency Management Capabilities***

***Objective 4.1****: Develop or improve Emergency Response Plan and procedures and abilities.*

***Objective 4.2:*** *Develop or improve Evacuation Plan and procedures.*

***Objective 4.3:*** *Improve warning systems and ability to communicate to residents and businesses during and following a disaster or emergency.*

***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 ordinances, subdivisions regulations, etc.)*

## *MITIGATION ALTERNATIVES (ACTION ITEMS)*

After the establishment of each participant's 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; actions identified in FEMA's *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*, 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 heart 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 the consultant.

It is important to note that not all of the mitigation actions identified may ultimately be included in the community's plan 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 by the Twin Platte NRD.

***PARTICIPANT MITIGATION ALTERNATIVES***

The following are specific actions listed by participants of the Twin Platte NRD Hazard Mitigation Plan Update intended to be utilized in the implementation of mitigation alternatives. Each action is described by the following:

- Action – general name of the action.
- Action Item – brief summary of what the action will accomplish.
- Goal/Objective – which goal and objective the action item falls under.
- Hazard(s) Addressed – which hazard the mitigation action aims to address.
- Estimated Cost – a general cost estimate for the project.
- Potential funding – a list of any potential funding mechanism used to fund the action.
- Timeline – a general timeline as established by planning participants and the Planning Team.
- 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 which may lead the implementation of the action.
- Status – current status of the action.

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. The information listed below is a compilation of the mitigation alternatives organized by the goal and objective to be met. 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 5-year update. Ongoing and highly ranked mitigation alternatives for each participating jurisdiction can be found in *Section Seven: Participant Section.*

***MITIGATION ALTERNATIVE PROJECT MATRIX***

During public meetings, each participant was asked to update mitigation projects from the previous Hazard Mitigation Plan. The participants were also asked to list new projects based on FEMA's best practices manual which would lead to action items to reduce the effects of natural hazards. Communities were also strongly encouraged to develop highly specific projects based on completed risk assessments that were relevant to their communities. Participants also indicated if there were projects they did not want. Actions selected varied from community to community dependent upon the significance of each hazard present. The following table is a summary of the selected mitigation actions throughout the planning area.

**Table 69: Selected Mitigation Actions**

| Goal/ Objective | Action # | Action | Action Item | Hazards Addressed |
|---|---|---|---|---|
| Goal 1 Objective 1.1 | 1.1.1 | Provide adequate fire protection | 1. Identify and evaluate current fire hall<br>2. Improve and/or replace fire hall<br>3. Identify and evaluate current firefighting equipment locations<br>4. Improve and/or add firefighting at additional locations | Grass/Wildfires, Severe Thunderstorms, Severe Winter Storms |
| | 1.1.2 | Lightning rods | 1. Install lightning rods in strategic locations at high points | Severe Thunderstorms |
| | 1.1.3 | Snowplow | 1. Purchase additional snowplow | Severe Winter Storms |
| | 1.1.4 | Reduce fire damage | 1. Identify vulnerable areas and combustion sources<br>2. Evaluate fire resistant roofing<br>3. Develop plan to reduce wildfire impact and reduce combustion materials<br>4. Reduce combustible material by removal or other methods<br>5. Enact building codes/ordinances for fire resistant roofing | Grass/Wildfire |
| | 1.1.5 | Promote first aid | 1. Promote first aid training for all staff | All hazards |
| Goal 2 Objective 2.1 | 2.1.1 | Improve/provide adequate backup and emergency generators | 1. Identify and evaluate current backup and emergency generators<br>2. Obtain additional generators based on identifications and evaluation | Tornados, High Winds, Severe Winter Storms, Severe Thunderstorms |
| | 2.1.2 | Reduce tree damage & damage from trees | 1. Conduct tree inventory<br>2. Develop tree maintenance/trimming program<br>3. Implement tree maintenance/trimming program | Grass/Wildfire, Tornados, Severe Thunderstorms, Severe Winter Storms, Hail |
| | 2.1.3 | Stormwater system and drainage improvements | 1. Undersized systems can contribute to localized flooding. Improvements may include pipe upsizing and additional inlets. Retention and detention facilities may also be implemented to decrease runoff rates while also decreasing the need for other stormwater system improvements | Flooding |
| | 2.1.4 | Provide adequate public safe rooms & post disaster storm shelter | 1. Identify and evaluate existing safe rooms and/or storm shelters<br>2. Improve and/or construct safe rooms and/or storm shelters | Tornados, High Winds, Severe Thunderstorms |
| | 2.1.5 | Surge protectors | 1. Purchase and install surge protectors on sensitive equipment in critical facilities | Severe Thunderstorms |

| Goal/ Objective | Action # | Action | Action Item | Hazards Addressed |
|---|---|---|---|---|
| | **2.1.6** | **Bank stabilization** | 2. Stabilize banks along streams and rivers. This may include, but is not limited to: reducing bank slope, addition of riprap, installation of erosion control materials/fabrics | Flooding |
| | **2.1.7** | **Channel and bridge improvements** | 1. Implement channel and bridge improvements to increase channel conveyance and decrease the base flood elevations | Flooding |
| | **2.1.8** | **Drainage ditches** | 1. Deepen drainage ditches and clean out culverts | Flooding |
| | **2.1.9** | **Drainage study/stormwater master plan** | 1. Preliminary drainage studies and assessments can be conducted to identify and prioritize design improvements to address site specific localized flooding/drainage issues to reduce and/or alleviate flooding<br>2. Stormwater master plans can be developed to help identify stormwater problem areas and potential drainage improvements | Flooding |
| | **2.1.10** | **Stream/Bank/Grade structure improvements** | 1. Evaluate current stream bed and bank stabilization needs<br>2. Implement stream bed and bank improvements including grade control structures, rock rip rap, vegetative cover, etc. | Flooding |
| | **2.1.11** | **Canal maintenance** | 1. Implement necessary actions to maintain the canal | Chemical Spills, Flooding, Dam Failure, Severe Thunderstorm, Drought |
| | **2.1.12** | **Groundwater recharge** | 1. Divert excess flows from North Platte River to recharge groundwater within the aquifer | Drought |
| | **2.1.13** | **Flood proofing critical facilities** | 1. Conduct flood proofing feasibility study for structures<br>2. Implement flood proofing measures | Flooding |
| | **2.1.14** | **Improve electrical service** | 1. Evaluate hardening, retrofitting, looping and/or burying of power lines and related infrastructure and/or comparable protection measures<br>2. Implement measures to improve electrical service | Tornados, High Winds, Severe Thunderstorms, Hail |
| | **2.1.15** | **Reduce road damage** | 1. Conduct assessment of past damages and causes<br>2. Evaluate road damage mitigation measures<br>3. Implement feasible road damage mitigation measures | Severe Thunderstorms, Flooding |
| | **2.1.16** | **Windbreak improvements** | 1. Conduct evaluation of current windbreaks<br>2. Implement improvements/repairs to windbreaks | High Winds, Severe Thunderstorms, Severe Winter Storms |
| | **2.1.17** | **Repair flood damage** | 1. Repair Platte River flood damage | Flooding |
| **Goal 2 Objective 2.2** | **2.2.1** | **Parcel level evaluation of flood prone properties** | 1. Conduct a study examining parcels located in flood prone areas and identify mitigation measures that can reduce future impacts | Flooding |

| Goal/ Objective | Action # | Action | Action Item | Hazards Addressed |
|---|---|---|---|---|
| | **2.2.2** | **Remove flow restrictions** | 1. Conduct a preliminary drainage assessment and/or design bridge improvements to reduce and/or alleviate flooding. Bridges typically serve as flow restrictions along streams and rivers<br>2. Cleanout and reshaping channel segments at bridge crossings can increase conveyance, reducing the potential for flooding<br>3. Replacing or modifying of bridges and other flow restrictions may be necessary to eliminate flooding threats and damages | Flooding |
| | **2.2.3** | **Improve and revise snow/ice removal program** | 1. As needed, continue to revise and improve the snow and ice program for streets<br>2. Revisions should address plowing snow, ice removal, parking during snow and ice removal, and removal of associated storm debris<br>3. Acquire equipment needed and pave roads | Severe Winter Weather |
| | **2.2.4** | **Update floodplain information/mapping** | 1. Conduct mapping/remapping of floodplain<br>2. Revise floodplain/insurance maps | Flooding |
| **Goal 2 Objective 2.3** | **2.3.1** | **Critical facility siting** | 1. Prohibit the construction of critical facilities within the immediate radius of chemical storage facilities through resolution or ordinance | Chemical Spills (Fixed Site) |
| | **2.3.2** | **Stormwater management committee** | 1. Establish a stormwater development committee to oversee improvements to the stormwater system and to respond to community concerns | Flooding |
| | **2.3.3** | **Maintain good standing in NFIP** | 1. Continue to regulate development in floodplain areas<br>2. Adopt future floodplain maps when available<br>3. Conduct additional floodplain mapping/remapping | Flooding |
| **Goal 3 Objective 3.1** | **3.1.1** | **Public awareness/education** | 1. Through activities such as outreach projects, distribution of maps and environmental education increase public awareness of natural hazards to both public and private property owners, renters, businesses, and local officials about hazards and ways to protect people and property from these hazards<br>2. Educate citizens on water conservation methods, evacuation plans, etc.<br>3. Purchase equipment such as overhead projectors and laptops | All hazards |
| **Goal 4 Objective 4.1** | **4.1.1** | **Emergency fuel supply plan** | 1. Plan to ensure adequate fuel supply is available during an emergency. Actions might include: prioritization and rationing plan for gasoline and diesel uses in extended loss of fuel supply or electric power supply; a plan to purchase local fuel supply, etc. | Tornados, High Winds, Severe Thunderstorms, Severe Winter Storms, Flooding, Dam Failure |
| | **4.1.2** | **Dam failure exercise** | 1. Conduct table top exercises to determine the response scenarios in the event of dam failure | Dam Failure |
| | **4.1.3** | **Mutual aid through WARN program** | 1. Establish mutual aid agreements through Water/Wastewater Agency Response Network (WARN) Program | All hazards |

| Goal/ Objective | Action # | Action | Action Item | Hazards Addressed |
|---|---|---|---|---|
| | **4.1.4** | **Emergency operations** | 1. Identify and establish an Emergency Operations Center | All hazards |
| | **4.1.5** | **Emergency management exercise** | 1. Develop and facilitate an emergency management exercise | All hazards |
| | **4.1.6** | **Map municipal infrastructure** | 1. Acquire Geographic Information System (GIS) to map municipal infrastructure | All hazards |
| **Goal 4 Objective 4.2** | **4.2.1** | **Evacuation Plan** | 1. Develop local evacuation plan | Dan Failure, Grass/Wildfire |
| **Goal 4 Objective 4.3** | **4.3.1** | **Improve warning systems** | 1. Evaluate current warning systems<br>2. Improve warning systems/develop new warning system<br>3. Obtain/upgrade warning system equipment and methods, including alert sirens<br>4. Identify locations of weather warning radios<br>5. Improve weather radio system<br>6. Obtain/upgrade weather radios | All hazards |
| | **4.3.2** | **Improve emergency communications** | 1. Develop/improve emergency communication action plan<br>2. Implement emergency communication action plan<br>3. Obtain/upgrade emergency communication equipment<br>4. Obtain/Upgrade/distribute weather warning radios | All hazards |
| **Goal 5 Objective 5.2** | **5.2.1** | **Tree City USA** | 1. Work to become a Tree City USA through the National Arbor Day Foundation in order to receive direction, technical assistance, and public education materials on how to establish a hazardous tree identification and removal program | Hail, High Winds, Severe Thunderstorms, Severe Winter Storms |
| **Goal 6 Objective 6.1** | **6.1.1** | **Update Comprehensive Plan** | 1. Update comprehensive plan<br>2. Integrate plan with Hazard Mitigation Plan components | All hazards |

## *COMPLETED MITIGATION EFFORTS*

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

# Section Six: Plan Implementation and Maintenance

## *MONITORING, EVALUATING, AND UPDATING THE PLAN*

Participants of the Twin Platte Natural Resources District Plan will be responsible for annual 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, as well as property 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 they 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.

### ***CONTINUED PUBLIC INVOLVEMENT***

To ensure continued plan support and input from the public as well as property and business owners, public involvement will 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
- Web sites
- Local newspapers
- Regionally-distributed newspaper

### ***UNFORESEEN OPPORTUNITIES***

If any major new, innovative mitigation strategies arise which are determined to be of importance, and could impact the planning area or elements of this plan, a plan amendment may be proposed and considered separate from the annual review and other proposed plan amendments. Counties in the planning area should compile a list of proposed amendments received annually and prepare a report providing applicable information for each proposal, and recommend action based on the proposed amendments.

## *INCORPORATION INTO EXISTING PLANNING MECHANISMS*

The Planning Team utilized a variety of plan integration tools to help communities determine how their existing planning mechanisms were related to the Hazard Mitigation Plan. 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. Opportunities to further integrate current planning mechanisms were discussed at the public meetings. Most jurisdictions have not incorporated hazard mitigation into other relevant planning mechanisms, nor have they established formal strategies for plan integration at this time. All jurisdictions will work to integrate the goals and objectives of the hazard mitigation plan within future planning mechanisms (as appropriate).

# Section Seven: Participant Sections

## *PURPOSE OF PARTICIPANT SECTIONS*

Participant sections contain information specific to jurisdictions which have participated in the Twin Platte NRD planning effort. Information from individual communities was collected at public and one-on-one meetings and used to establish the plan. Participant sections include: history and development, location and geography, transportation, demographics, critical facilities, future development trends, risk assessment, capability assessment, 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 and the jurisdictions 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. Only certain hazards are examined in depth for each participant section. 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.*