AUGUST 2025

IOWA TRIBE OF KANSAS AND NEBRASKA 2025 HAZARD MITIGATION PLAN

3345 B Thrasher Road
White Cloud, KS 66094

A Federally Recognized Indian Nation since 1937

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Acronyms and Abbreviations

2019 Kansas Region K	2019 Kansas Homeland Security Region K
BRIC	Building Resilient Infrastructure and Communities
CFR	Code of Federal Regulations
DTA	Direct Technical Assistance
EPA	U.S. Environmental Protection Agency
EF Scale	Enhanced Fujita Scale
FEMA	Federal Emergency Management Agency
ft	foot
HMP	Hazard Mitigation Plan
Iowa Tribe	Iowa Tribe of Kansas and Nebraska
mph	miles per hour
NCEI	National Centers for Environmental Information
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
°F	degrees Fahrenheit
%	percent

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Executive Summary

The purpose of the Iowa Tribe of Kansas and Nebraska (Iowa Tribe) Hazard Mitigation Plan (HMP) is to guide current and future efforts to mitigate natural hazards effectively and efficiently on the Iowa Tribe's reservation and other tribally owned lands. The overall goal is to reduce or eliminate long-term risk to life, property, and natural and cultural resources from various hazards. The Iowa Tribe will be referred to as the "Tribe" for the purposes of this document. Within this document, the Tribe refers to tribal members living both on and off the reservation.

Natural hazards, such as erosion, extreme heat, and high winds, pose a significant threat to the natural resources, political integrity, economic stability, and health and well-being of community tribal members. A lack of planning and preparation for those hazards could potentially increase the frequency and severity of those hazards if left unmitigated. To effectively plan for these hazards, the Tribal Grants and Contracts Administrator and tribal department members worked together to develop this HMP beginning in August 2024. The Tribal Grants and Contracts Administrator applied for and was selected to receive Federal Emergency Management Agency Building Resilient Infrastructure and Communities Direct Technical Assistance from 2022 through 2025. The original request for technical assistance was for the planning and execution of a renewable energy microgrid initiative for the reservation; however, the purpose shifted to support for developing the 2025 HMP. The Tribal Grants and Contracts Administrator and groups of tribal department members and tribal enterprises met bimonthly in 2024 and 2025 to identify hazards, capabilities, and assets, and to develop mitigation goals and actions in alignment with the Tribe's priorities for hazard mitigation.

Recent hazards have stretched the abilities of tribal resources to respond to, mitigate, and recover from these incidents. In the past decade, four 100-year flood events have impacted casino access, cut off a major highway for 6 months, and inundated low-lying farmland. In 2019, a severe storm resulted in the failure of a dam that caused flooding in the reservation even though the dam was outside its boundaries. With continuing updates to this plan and long-term infrastructure development, the Tribe will continue to systematically identify policies, actions, and resources to mitigate and prepare for multiple types of emergencies or disasters.

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1.0 Introduction

1.1 Planning Area

The current Iowa Tribe of Kansas and Nebraska (Iowa Tribe) reservation boundaries were established in the Treaty of March 6, 1861. The reservation covers approximately 12,038 acres across portions of Brown County and Doniphan County in Northeast Kansas and Richardson County in Southeast Nebraska. The reservation shares its western border with the Sac and Fox Nation of Missouri in Kansas and Nebraska. The planning area encompasses the reservation, and several tracts of land owned by the Tribe. These tracts include a foreign trade zone on the eastern banks of the Missouri River in Holt County and land in White Cloud, Kansas, owned by the Tribal Housing Authority (**Figure 1-1**). The foreign trade zone site, called the Iowa Tribe of Kansas and Nebraska Distribution Center, is composed of approximately 32 acres within Zone 015 of the Greater Kansas City Foreign Trade Zone.

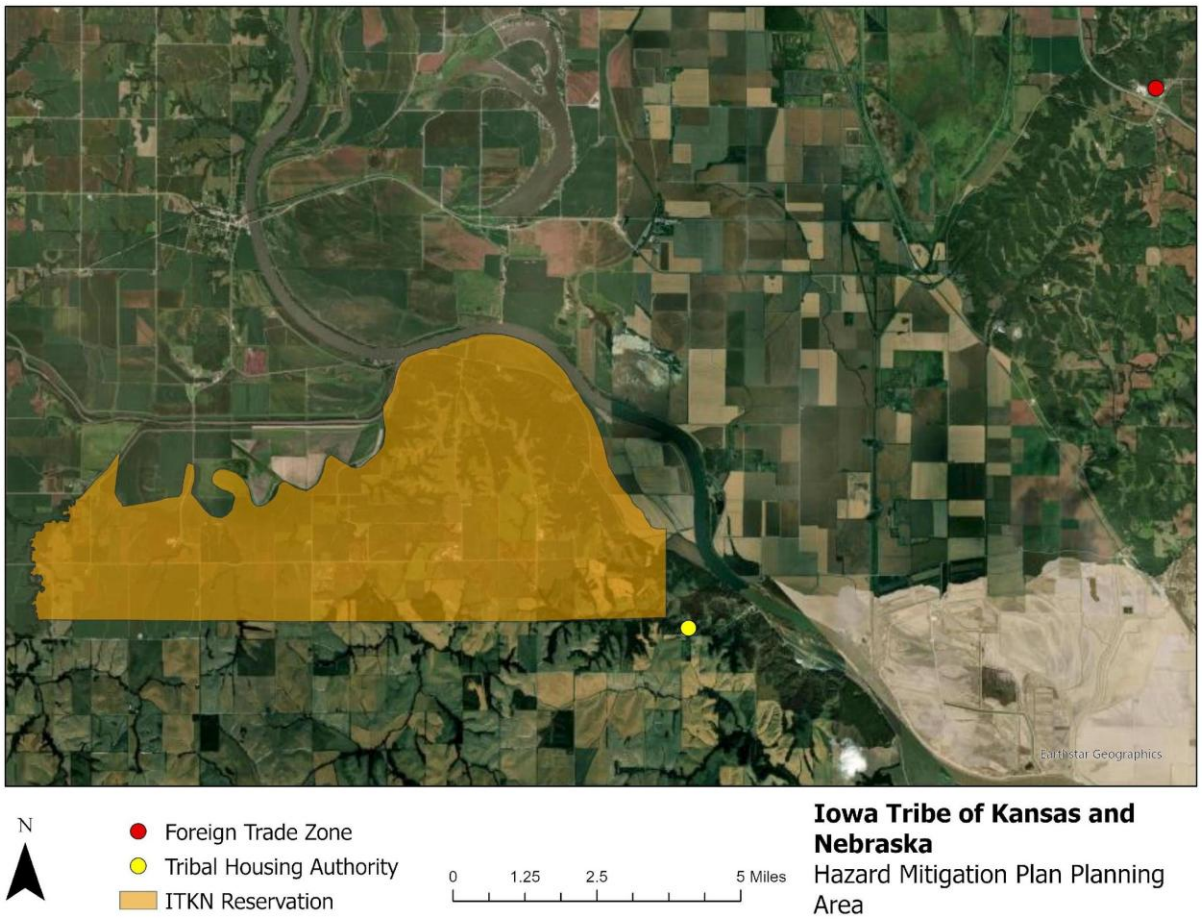

Figure 1-1: Planning Area

1.2 Community Description

The Iowa Tribe is a federally recognized sovereign Indian Tribe and is organized in accordance with Section 16 of the Indian Reorganization Act of 1934, as amended by the Act of June 15, 1935. Its first constitution and bylaws were adopted on February 26, 1937. The Tribe is governed by two bodies: the General Council and the Executive Committee. The General Council is composed of all enrolled members who are at least 18 years of age, and the Executive Committee is composed of five members elected at large from the General Council. The Executive Committee consists of a chairperson, vice-chairperson, secretary, treasurer, and one representative member, and the committee has enumerated powers to negotiate with federal, state, and local governments. The Iowa Tribe has established 14 programs and services, including education, burial assistance, housing, and healthcare. The Tribe also manages several enterprises, including Ioway Farms, Ioway Bee Farm, Grandview Oil, Grey Snow Management Solutions, Grey Snow Sanitation, Soje, and White Cloud Casino. **Section 5.1** lists the Tribe's critical facilities and sacred sites.

The Iowa Tribe currently has 4,874 enrolled members. Approximately 132 members live on the reservation and 794 in the service area, which includes Brown and Doniphan Counties in Kansas, and Richardson County, Nebraska (Iowa Tribe 2023).

In 2020, the Tribe created the Ioway Tribal National Park. The park will be on 440 acres overlooking the Missouri River and is expected to open in 2025. The park land was originally ceded in 1837 through a treaty with the United States and was later purchased by the Nature Conservancy in 1994. In 2018, the Nature Conservancy transferred the land back to the Iowa Tribe. The park sits on the Kansas and Nebraska border, just south of Rulo, Nebraska. The aim of the park is to preserve tribal heritage and cultural traditions that were connected to the landscape and to protect the ecosystem and natural resources.

Agriculture is an important economic driver for the Tribe. Present land use on the reservation is predominantly agricultural, mostly cropland or pastureland but also including orchards, nurseries, and confined feeding operations (Iowa Tribe 2020). **Table 1-1** depicts employment data by industry for the reservation.

Table 1-1: Employment Data by Industry for the Iowa Tribe Reservation in 2022

Industry	Estimated People Employed on the Reservation
Civilian employed population 16 years and over	**104**
Agriculture, forestry, fishing and hunting, and mining	10
Construction	1
Manufacturing	15
Wholesale trade	8
Retail trade	3
Transportation and warehousing, and utilities	10
Information	0

Industry	Estimated People Employed on the Reservation
Finance and insurance, and real estate and rental and leasing	1
Professional, scientific, and management, and administrative and waste management services	1
Educational services, and health care and social assistance	16
Arts, entertainment, and recreation, and accommodation and food services	8
Other services, except public administration	6
Public administration	25

Source : U.S. Census Bureau 2022

1.3 History

The traditional name of the Tribe is Báxoje (Bah Kho-Jeh), meaning "People of the Grey Snow." The Ioway are closely related by language and culture to the Sioux, but conflict with the Sioux over territory in northern Iowa and southern Minnesota began in the 1600s, a consequence of the Beaver Wars and conflicts over the fur trade in the east. By the time white settlers first entered Iowa in the mid-1800s, the Ioway moved their villages into northern Missouri. This was a result of incessant warfare in Iowa between the Sioux in the northern and western parts of the state and the Sauk and Meskwaki in the southern and eastern parts of the state. In 1854, the Kansas-Nebraska Act created the territories of Kansas and Nebraska, drawing a line across the Iowa Reservation, which resulted in the creation of the Iowa Tribe. The current reservation boundaries were established in the Treaty of March 6, 1861.

In 1804, the Ioway population was reduced to 800 because of many factors, but primarily because of smallpox, as Ioways had no natural immunity. In 1906, only 100 Ioways lived in Kansas and 100 lived in Oklahoma. By 1908, the Iowa Tribe had recovered to approximately 1,000 people.

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2.0 The Planning Process

2.1 Description of the Planning Process

From September 2018 to July 2019, the Iowa Tribe participated in the organization, drafting, completion, and adoption of the 2019 Kansas Homeland Security Region K (2019 Kansas Region K) Hazard Mitigation Plan (HMP). The Tribe initiated the process to develop their own tribal HMP in the summer of 2024 with the support of the Federal Emergency Management Agency's (FEMA's) Building Resilient Infrastructure and Communities (BRIC) Direct Technical Assistance (DTA) program. The Iowa Tribe was selected to receive nonfinancial support through BRIC DTA from January 2022 through December 2024. The BRIC DTA team first met with the Tribal Grants and Contracts Administrator in August 2024 to begin developing a plan update. The Tribe's Executive Committee designated 11 individuals to form the HMP Committee. The HMP Committee is the main body tasked with implementing this plan by leading, monitoring, and evaluating individual actions, meeting regularly to maintain the plan and help integrate it into other planning processes, and working to secure funding for mitigation projects through grant opportunities and other sources.

The mitigation planning process officially kicked off in August 2024. A timeline of major tasks and milestones, including community and HMP Committee meetings, is provided in **Table 2-1**. **Table 2-2** lists names and positions of the HMP Committee members. Input was also collected from other tribal administration and tribal enterprise representatives (**Table 2-3**). Appendix B includes documentation from the November 2024 in-person meeting including sign-in sheets, agenda, and minutes.

Table 2-1: HMP Timeline

Date	Tasks/Topics	People Involved
August 9, 2024	HMP kickoff meeting to develop timeline and identify planning team.	Executive Committee, FEMA BRIC DTA Team
August 9 to October 31, 2024	Research and draft hazard profiles	HMP Committee Chair, FEMA BRIC DTA Team
September 20-22, 2024	Survey on natural hazards and mitigation goals distributed at Powwow	HMP Committee Chair, tribal public
October 1 to November 1, 2024	Virtual meetings with tribal representatives and tribal enterprises to determine mitigation goals and discuss hazard mitigation capabilities	HMP Committee Chair, Grey Snow Management Solutions, Tribal Climate Expert, FEMA BRIC DTA Team
November 4, 2024	In-person community tour and discussion of tribal assets and hazards and their impacts with Ioway Farms, Ioway Bee Farm, and the Tribal Housing Authority.	HMP Committee Chair, Ioway Farms, Ioway Bee Farm, Tribal Housing Authority, FEMA BRIC DTA Team
November 5, 2024	In-person grants team meeting to review FEMA pre- and post-disaster grants. In-person HMP Committee meeting to review mitigation goals and develop the mitigation strategy including creating mitigation actions.	HMP Committee, Iowa Tribe Grant Writing Team, FEMA BRIC DTA Team
November 29 to December 14, 2024	Survey posted online to gather responses from the public on natural hazards and mitigation goals	HMP Committee Chair, tribal public

Date	Tasks/Topics	People Involved
December 13, 2024	Working session to finalize mitigation action implementation details including cost estimates and timeframes	HMP Committee, FEMA BRIC DTA Team
December 20, 2024	Virtual working session to determine plan maintenance process	HMP Committee Chair, FEMA BRIC DTA Team
January 22, 2025	Presentation to Executive Committee on the draft HMP	Executive Committee, HMP Committee Chair, FEMA BRIC DTA Team
February 19 to March 12, 2025	Draft HMP posted for public comment and stakeholder input	HMP Committee
August 18, 2025	HMP submitted to FEMA Region 7 for review	Executive Committee, HMP Committee Chair

Table 2-2: HMP Committee

Name	Position Title	Role in Developing the 2025 HMP
Jason Pockrus	Grants and Contracts Administrator	Served as HMP Committee Chair. Coordinated between HMP Committee and BRIC DTA Team.
Nick Hilderbrand	Fire Chief[1]	Participated in planning meetings in fall 2024 and provided input on hazards, mitigation strategy, and public engagement. Provided information on assets and capabilities related to emergency response.
Mike Shay	Acting Chief of Police[1]	Participated in planning meetings in fall 2024 and provided input on hazards, mitigation strategy, and public engagement. Provided information on assets and capabilities related to emergency response.
Vernon Rhodd	Water	Participated in planning meetings in fall 2024 and provided input on hazards, mitigation strategy, and public engagement.
Kate Kyser	Land and Water Office[1]	Participated in planning meetings in fall 2024 and provided input on hazards, mitigation strategy, and public engagement. Provided information on natural hazards impacting community, nature-based mitigation actions, and previous public outreach.
Jolene Anderson	Interim General Manager, Casino White Cloud	Participated in planning meetings in fall 2024 and provided input on hazards, mitigation strategy, and public engagement.
Paul Austin	Clinic Director	Participated in planning meetings in fall 2024 and provided input on hazards, mitigation strategy, and public engagement.
Brad Campbell	Director of Housing, [1] Executive Committee Member	Participated in planning meetings in fall 2024 and provided input on hazards, mitigation strategy, and public engagement.
Jolene Walters	Tribal Administrator*	Participated in planning meetings in fall 2024 and provided input on hazards, mitigation strategy, and public engagement.
Brandon Roberts	EMS/Fire, * Vice Chairman of the Executive Committee	Participated in planning meetings in fall 2024 and provided input on hazards, mitigation strategy, and public engagement. Provided information on assets and capabilities related to emergency response.

Name	Position Title	Role in Developing the 2025 HMP
Olivia Brien	Director of Communications	Participated in planning meetings in fall 2024 and provided input on hazards, mitigation strategy, and public engagement.

Note:
[1]: Indicates agency involved in hazard mitigation activities or with the authority to regulate development.

Table 2-3: Other Contributors to 2025 HMP Update

Name	Position Title	Role in Developing the 2025 HMP
David Tam	CEO, Grey Snow Management Solutions	Participated in virtual meeting to discuss mitigation capabilities.
Brett Ramey	Climate Resilience Planner	Participated in virtual meetings to discuss mitigation capabilities and November 2024 site visit to develop mitigation strategy and prioritize mitigation actions.
Missty Slater	Community Impact Director, Grey Snow Management Solutions	Participated in virtual meeting to discuss mitigation capabilities.
Robert Hullman	Treasurer, Executive Committee	Participated in November 2024 site visit to develop mitigation strategy and prioritize mitigation actions.
Scott Elrod	Fish and Wildlife Officer	Participated in November 2024 site visit to develop mitigation strategy and prioritize mitigation actions.
Chasity Davis	Community Health Coordinator, White Cloud Health Center	Participated in November 2024 site visit to develop mitigation strategy and prioritize mitigation actions.
Lance Foster	Tribal Historic Preservation Officer	Participated in November 2024 site visit to develop mitigation strategy and prioritize mitigation actions.
Mike Shay	Acting Chief of Police	Participated in November 2024 site visit to develop mitigation strategy and prioritize mitigation actions.

2.2 Public Involvement and Opportunities for Stakeholder Input

The Iowa Tribe defines their public as tribal and nontribal members who live or work within the boundaries of the reservation and tribal members who live outside the boundaries of the reservation.

A survey was distributed to attendees of the Báxoje Fall Encampment and Powwow in late September 2024. The survey asked respondents to indicate which hazards had previously affected them and their families and which hazards they were most concerned about impacting the Iowa Tribe. This survey was also posted online for several weeks in December 2024 to provide the public with more opportunity to participate. A total of 48 individuals responded to the survey, sharing their experiences with hazards on the reservation and thoughts about what assets to protect. Appendix A includes a copy of the survey and an analysis of the survey results. The HMP Committee and Executive Committee held a public comment period for the HMP for 2 weeks in February 2025. Copies of the draft HMP were posted in the Administration Building. An online copy was available in the Members section of the Iowa Tribe's website and advertised on Facebook. During the public comment period, copies of the draft HMP were also shared via email with select stakeholders and partners who have the authority to regulate development or interests in the planning process (**Table 2-4**).

Table 2-4: Stakeholders and Partners

Organization	Description
Doniphan County	One of the three counties intersecting the reservation.
Brown County	One of the three counties intersecting the reservation.
Richardson County	One of the three counties intersecting the reservation.
City of White Cloud	City adjacent to the reservation and location of the Tribal Housing Authority.
Holt County	County where the FTZ is located.
Atchison County	Nearby county where several tribe members reside and with which the ITKN has regular contact.
Douglas County	Nearby county which faces issues similar to those seen in the ITKN area.
Jackson County	Nearby county which faces issues similar to those seen in the ITKN area.
Nemaha County	Nearby county which faces issues similar to those seen in the ITKN area.
State of Kansas	One of two states in which the ITKN reservation sits.
Sac and Fox Nation of Missouri in Kansas and Nebraska	Neighboring Tribe with which the ITKN has regular contact.
Kickapoo Tribe in Kansas	Neighboring Tribe with which the ITKN has regular contact.
Prairie Band Potawatomi Nation	Neighboring Tribe with which the ITKN has regular contact.

3.0 Program Integration

3.1 Integrating Hazard Mitigation Planning with Other Processes

Creating a resilient community is a priority for the Iowa Tribe, and the Tribe has integrated hazard mitigation into ongoing planning efforts when possible. The recent Pathways to Climate Resilience Plan encapsulates the community voice and spirit and provides a resilience framework for the Tribe. The Climate Resilience Plan emphasizes the importance of building resiliency within and across all departments and services of the Iowa Tribe and the necessity of collaborations with elders, youth, universities, and local, state, and federal partners (Iowa Tribe 2023). The Máya Wapána internship program provided an opportunity for young tribal members to understand potential climate impacts and contribute to climate resilience efforts on the reservation. In 2020, the Executive Committee established the Ioway Tribal National Park to support environmental and cultural revitalization efforts. Part of the land restoration efforts in the park include preliminary restoration and fire planning. The Iowa Tribe is currently pursuing solar and microgrid opportunities. The Tribe has also integrated hazard mitigation into its electrification plan through efforts to diversify its power supply and increase resilience to hazards, such as strong winds and winter storms.

The 2025 HMP is integrated with FEMA mitigation programs and initiatives to help develop a comprehensive mitigation strategy for reducing risks to life and property and to ensure the continuity of operations of the tribal government and tribal enterprises. For example, the Chairman of the Iowa Tribe's Executive Committee successfully submitted a letter of intent to the FEMA BRIC DTA program with a request for support in the planning and execution of an upcoming renewable energy microgrid initiative for the reservation. The Tribe and FEMA signed a memorandum of understanding to begin this project in January 2022. In summer 2024, the Tribe decided to develop their own tribal HMP with the support of the FEMA BRIC DTA program instead of participating in the Kansas Region K HMP update.

3.2 Integrating Existing Data

The existing plans, studies, and reports in **Table 3-1** were reviewed and incorporated into the 2025 HMP.

Table 3-1: Other Plans Consulted

Name of Plan/Resource	Responsible Agency	Purpose of Plan	Interaction with HMP
Existing Tribal Planning Efforts, Used for Plan Information Integration[1]			
2019 Kansas Region K HMP	State of Kansas, participating jurisdictions (including the Iowa Tribe)	Multijurisdictional HMP to qualify for FEMA assistance. This plan was used as the basis for the 2025 plan update.	The goals of this plan were reviewed for successes and weaknesses to complete the HMP. The hazard profiles were reviewed and revised to be specific to the Tribe.
Iowa Tribe 2024 Priority Climate Action Plan	Iowa Tribe	Report funded through the U.S. Environmental Protection Agency's (EPA's) Climate Pollution Reduction Grant program that developed a greenhouse gas emissions inventory and proposed priority climate action measures to reduce, sequester, and store greenhouse gas emissions.	Provided background information to support community description and capabilities. Priority greenhouse gas reduction measures informed mitigation actions, as appropriate.
Náwo Wapánagun Hinmányiwi Pathways to Climate Resilience	Ioway Climate Resilience Program, Tribal Historic Preservation Office	Report funded through a grant from the Bureau of Indian Affairs Tribal Climate Resilience Program. This report outlines process, activities, and findings from working with the Ioway community and serves as the foundation for future climate resilience and adaptation planning efforts.	Information from this report was used to supplement the hazard profiles and support integration of climate change impacts into the HMP. Priorities and actions identified in this plan were also included in the mitigation strategy.
Sustainable, Comprehensive Economic Development Plan/Strategy 2020	Iowa Tribe	Established strategy to guide economic impacts and boost economic prosperity.	Information from this report was used to support the community description, risk assessment, and mitigation strategy.
National- or Regional-Scale Data or Tools Used to Support the 2025 Plan			
Agricultural Loss from Tornadoes by County	USDA	Data set provides information on payment indemnity and liability in dollars per square mile.	Information from this data set was used to support the tornado hazard profile.
Annual Average Severe Thunderstorm Watches	National Oceanic and Atmospheric Administration (NOAA)	Map provides the annual average of severe thunderstorm watches by county per year from 2004–2023.	Information from this map was used to support both the lightning and the strong wind hazard profiles.
Dam Incident Database	Stanford University's National Performance of Dams Program	Database that provides information on dam incident dates and incident types.	Information from this database was used to support the dam/levee failure hazard profile.
HAZUS Building Valuation	FEMA	Data set provides information on building valuation.	Information from this data set was used to support the lightning hazard profile.
High Wind Events	NOAA NCEI	Data set provides information on the number of days with high wind events, property damage, crop damage, and the highest recorded wind speed.	Information from this data set was used to support the strong wind hazard profile.

Name of Plan/Resource	Responsible Agency	Purpose of Plan	Interaction with HMP
National Inventory of Dams	U.S. Army Corps of Engineers (USACE)	Database of dams nationwide that includes information on dam structure, storage capacity, and inspections.	Information from this database was used to support the dam/levee failure hazard profile.
National Risk Index	FEMA	Tool provides natural hazard risk data across multiple hazards.	Information from the tool was used to support several hazards profiles within this HMP.
National Seismic Hazard Model	U.S. Geological Survey (USGS)	Data, models, and maps that provide information on the likelihood and magnitude of earthquakes over the next 100 years.	Information from this model was used to support the earthquake hazard profile.
Non-Hurricane and Non-Tornadic Extreme Wind Speeds	U.S. Department of Commerce, National Institute of Standards and Technology (NIST)	Map provides information on non-hurricane and non-tornadic extreme wind speeds for the contiguous United States.	Information from this map was used to support the strong wind hazard profile.
Straight-Line Wind Disaster and Emergency Declarations	FEMA	Database provides information on the straight-line wind disaster and emergency declarations, including the declaration number, incident period, the county/counties involved, and the dollars obligated.	Information from this database was used to support the strong wind hazard profile.
Tornado Events and Associated Damage by County	NOAA National Centers for Environmental Information (NCEI)	Database provides information on the number of days with tornadoes, deaths, injuries, property damage and crop damage by county.	Information from this database was used to support the tornado hazard profile.
Tornado Tracks, 1950–2023	Purdue University Midwestern Regional Climate Center	Interactive map provides information on the location of tornado tracks from 1950–2023.	Information from this map was used to support the tornado hazard profile.
U.S. Landslide Inventory	USGS	Interactive map provides an inventory of past landslides and provides tools to predict an area's landslide susceptibility.	Information from this inventory was used to support the landslide hazard profile.
Water Erosion Vulnerability Map	U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS)	Map ranks areas across the United States from low to very high based on their water erosion vulnerability.	Information from this map was used to support the erosion hazard profile.
Wind Erodibility Index	USDA	Map provides an estimation of annual average soil loss from wind erosion per acre for the state of Kansas.	Information from this map was used to support the erosion hazard profile.

Note:
[1]: Includes planning processes where the Tribe participated.

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4.0 Hazard Identification

4.1 Identifying and Analyzing Hazards

In addition to the plans and other resources listed in

Table 3-1, the HMP Committee used historical information gleaned from tribal elders, tribal departments and enterprises, newspapers, and government websites to start the process of identifying and profiling hazards. The hazards profiled in the 2019 Kansas Region K HMP formed the foundation of the hazard identification, analysis, and profiles. In the HMP kickoff meeting, the HMP Committee discussed potential natural hazards that pose new risks to the Tribe since the 2019 Kansas Region K HMP was adopted. **Table 4-1** provides a summary of the hazards discussed, the probability of future occurrence of each hazard, and their potential magnitude. **Section 4.1.1** through **Section 4.1.6** include a brief description of the terms and organizational structure used to profile the hazards for the planning area.

Table 4-1: Hazard Analysis Results

Natural Hazard of Concern	Probability of Future Occurrence	Potential Magnitude
Dam/Levee Failure	Very Low	Negligible
Earthquake	Low	Negligible
Erosion	Limited	Moderate
Extreme Cold	Very High	Critical
Extreme Heat	Very High	Critical
Flooding	High	Limited
Landslides	Low	Critical
Lightning	Very High	Negligible
Strong Wind	Very High	Critical
Tornado	Moderate	Catastrophic
Wildfire	Low	Limited
Winter Storm	High	Critical
Hazardous Materials	Very Low	Critical
Major Disease	Low	Critical

4.1.1 Hazard Overview/Description

The hazard description subsection for each hazard profile includes background information on the hazard and how it may affect the planning area.

4.1.2 Geographical Area Affected

This subsection defines the scales of geographical areas that are likely to be impacted if the hazard occurs in reference to the planning area defined in **Section 1.1**.

4.1.3 Extent and Magnitude

The extent and magnitude represent the expected range of intensity of a hazard. The intensity for each hazard varies, but a standard scoring system is used to compare the extent/magnitude across hazards to understand the overall significance of hazards compared to one another, listed in **Table 4-2**. In each hazard profile, the hazard is ranked from worst case (catastrophic [4]) to best case (negligible [1]) in the extent/magnitude subsection.

Table 4-2: Extent/Magnitude Scoring

Extent/Magnitude Scoring	Definition
4–Catastrophic	▪ Multiple deaths. ▪ Complete shutdown of critical facilities for 30 or more days. ▪ More than 50 percent (%) of property is severely damaged.
3–Critical	▪ Injuries and/or illnesses result in result in permanent disability. ▪ Complete shutdown of critical facilities for at least 2 weeks. ▪ 25%–50% of property severely damaged.
2–Limited	▪ Injuries and/or illnesses do not result in permanent disability. ▪ Complete shutdown of critical facilities for more than 1 week. ▪ 10%–25% of property severely damaged.
1–Negligible	▪ Injuries and/or illnesses are treatable with first aid. ▪ Minor quality of life lost. ▪ Shutdown of critical facilities and services for 24 hours or less. ▪ Less than 1% of property severely damaged.

4.1.4 Previous Occurrences

The previous occurrences subsection discusses past observations of the hazard occurring in the planning area.

4.1.5 Future Probability of Occurrence

This section discusses the future probabilities of the hazard, **Table 4-3** summarizes them. The future probability ranking uses any available reports that look at the future conditions for the hazard and previous occurrences. FEMA's National Risk Index was used to determine future probability for some hazards in the planning area. The National Risk Index calculates an annualized frequency or the expected frequency or probability of a hazard occurrence per year. This value is derived from either the number of recorded hazard occurrences each year or the modeled probability of a hazard occurrence each year (Zuzak et al. 2023).

Table 4-3: Probability of Future Occurrence

Probability	Criteria
Very High	Events that occur at least once every year (100% probability per year).
High	Events that occur up to once in 5 years (20% probability per year).
Moderate	Events that occur up to once in 10 years (10% probability per year).
Low	Events that occur up to once in 20 years (5% probability per year).
Very Low	Events that occur up to once in 50 years (2% probability per year).

4.1.6 Impacts and Vulnerability

This section describes the impacts of each natural hazard to the Tribe and planning area and provides some information about the Tribe's vulnerability to each hazard. An impact is the consequence or effect of the hazard to the tribal community or asset, and the vulnerability is the susceptibility of an asset to harm. **Section 5.3** provides a summary of the Iowa Tribe's vulnerability to every hazard profiled. FEMA's National Risk Index was used to inform the determination of impacts and vulnerability of specific hazards to the planning area. The National Risk Index defines risk as the potential for negative impacts because of a natural hazard. It incorporates three components into a composite risk index value: expected annual loss, social vulnerability, and community resilience (Zuzak et al. 2023).

4.1.7 Implications of Climate Change

This section details climate change considerations for each hazard. Some hazards, such as earthquakes and tornadoes, are minimally influenced by climate change, while others, such as extreme heat, are exacerbated by climate change. Much of the supporting data for this section is from the Native Climate Coupled Model Intercomparison Project Phase 6 Agricultural Climate Projections (Native Climate 2024; Thrasher et al. 2021; Thrasher et al. 2022).

4.1.8 FEMA-Declared Disaster Events

The Iowa Tribe has only received one major disaster declaration from FEMA on March 13, 2020, for COVID-19. **Table 4-4** lists the major disaster declarations for the counties that overlap the reservation boundaries.

Table 4-4: Major Disaster Declarations in Planning Area Counties (2001 to present)

Disaster Number	Declaration Year	Description	Counties Affected
4824	2024	Severe storms, straight-line winds, tornadoes, and flooding	Doniphan
4822	2024	Severe storms, straight-line winds, tornadoes, and flooding	Richardson
4641	2022	Severe storms, straight-line winds, and tornadoes	Richardson
4640	2022	Severe storms and straight-line winds	Brown and Doniphan
4521	2020	COVID-19 pandemic	Brown and Richardson
4504	2020	COVID-19 pandemic	Brown and Doniphan
4449	2019	Severe storms, straight-line winds, tornadoes, flooding, landslides, and mudslides	Brown and Doniphan
4420	2019	Severe winter storm, straight-line winds, and flooding	Brown and Richardson
4417	2019	Severe storms, straight-line winds, and flooding	Doniphan
4230	2015	Severe storms, tornadoes, straight-line winds, and flooding	Brown and Doniphan
4225	2015	Severe storms, tornadoes, straight-line winds, and flooding	Richardson
4035	2011	Flooding	Doniphan
4013	2011	Flooding	Richardson
1945	2011	Severe storms, flooding, tornado, and straight-line winds	Richardson

Disaster Number	Declaration Year	Description	Counties Affected
1932	2010	Severe storms, flooding, and tornadoes	Brown and Doniphan
1924	2010	Severe storms and flooding	Brown and Richardson
1902	2010	Severe storms, ice jams, and flooding	Richardson
1885	2010	Severe winter storms and snowstorms	Brown and Doniphan
1878	2010	Severe winter storms and snowstorm	Brown and Richardson
1864	2010	Severe winter storm	Richardson
1853	2009	Severe storms, flooding, and tornadoes	Richardson
1776	2008	Severe storms, flooding, and tornadoes	Brown
1770	2008	Severe storms, tornadoes, and flooding	Brown and Richardson
1741	2008	Severe winter storms	Brown and Doniphan
1739	2008	Severe winter storm	Richardson
1706	2007	Severe storms, flooding, and tornadoes	Brown and Richardson
1699	2007	Severe storms, tornadoes, and flooding	Brown and Doniphan
1674	2007	Severe winter storms	Brown
1579	2005	Severe winter storms, heavy rains, and flooding	Brown
1373	2001	Severe winter storms, flooding, and tornadoes	Brown

Source: FEMA n.d.-b

4.2 Profiling Hazards

4.2.1 Dam/Levee Failure

Overview

A dam is a barrier across flowing water that obstructs, directs, or slows down the flow, often creating a reservoir, lake, or impoundments. Dams have numerous benefits and are often multipurpose. Dams and their reservoirs can be used for flood control, water supply and storage, recreation, irrigation, navigation, and renewable energy through hydropower. According to the Association of State Dam Safety Officials (2024), overtopping is the leading cause of dam failures in the United States. Overtopping is typically caused by spillway design error or debris blockage of spillways. Other reasons for dam failure include poor foundation condition, piping, cracking, and poor maintenance (Association of State Dam Safety Officials 2024). Often, dam breaches lead to catastrophic consequences as the water rushes downstream, flooding an area referred to as an inundation area. The number of casualties and the amount of property damage will depend upon the timing of the warning provided to downstream residents, the number of people living or working in the inundation area, and the number of structures in the inundation area. A levee is an artificial barrier, usually an earthen embankment, constructed along rivers to protect adjacent lands from flooding. Levee failure is commonly caused by surface erosion because of water velocities, subsurface actions, and flood waters exceeding the capacity of the structure (Kansas Homeland Security 2019).

The Kansas Department of Agriculture–Division of Water Resources has jurisdictional authority over nonfederal dams in the state. The goal of the state's Dam Safety Program is to reduce the risk to life and property from dam failure. This goal is achieved through regulating construction, operation, and the maintenance of all nonfederal dams or other water obstructions.

Location

According to the USACE National Inventory of Dams (2024a), there are three dams and one levee located within the reservation counties. **Table 4-5** provides dam information, and **Figure 4-2** geographically shows this information relative to the reservation. **Table 4-6** Includes levee information, and **Figure 4-1** geographically shows this information relative to the reservation.

Table 4-5: Information on Dams in the Planning Area

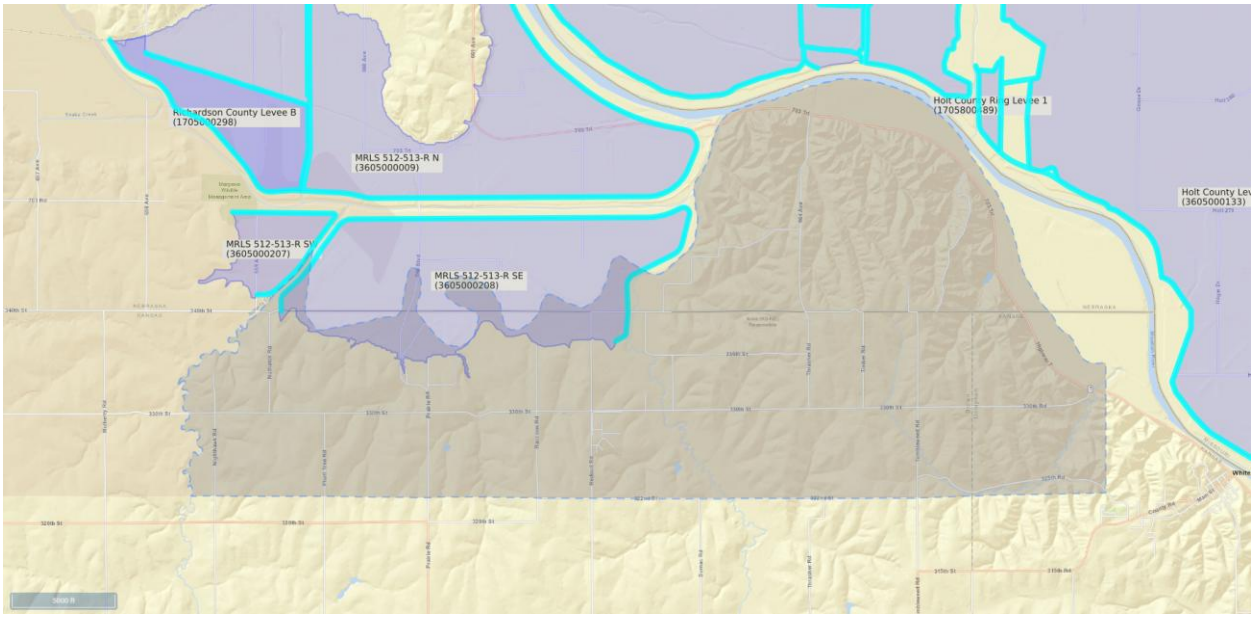
Location	Dam ID	Hazard Classification	Height (Feet [ft])	Normal Storage (Acre-Ft)	Max Storage (Acre-Ft)	Emergency Action Plan	Year Completed	Owner Type
Brown County	KS07059	Low	42	32.5	99	Not required	1986	Local Government
Brown County	KS03051	Low	30	29	48	Not Required	1966	Private
Doniphan County	KS03062	Low	29	8	17	Not Required	1968	Private

Source: USACE 2024a

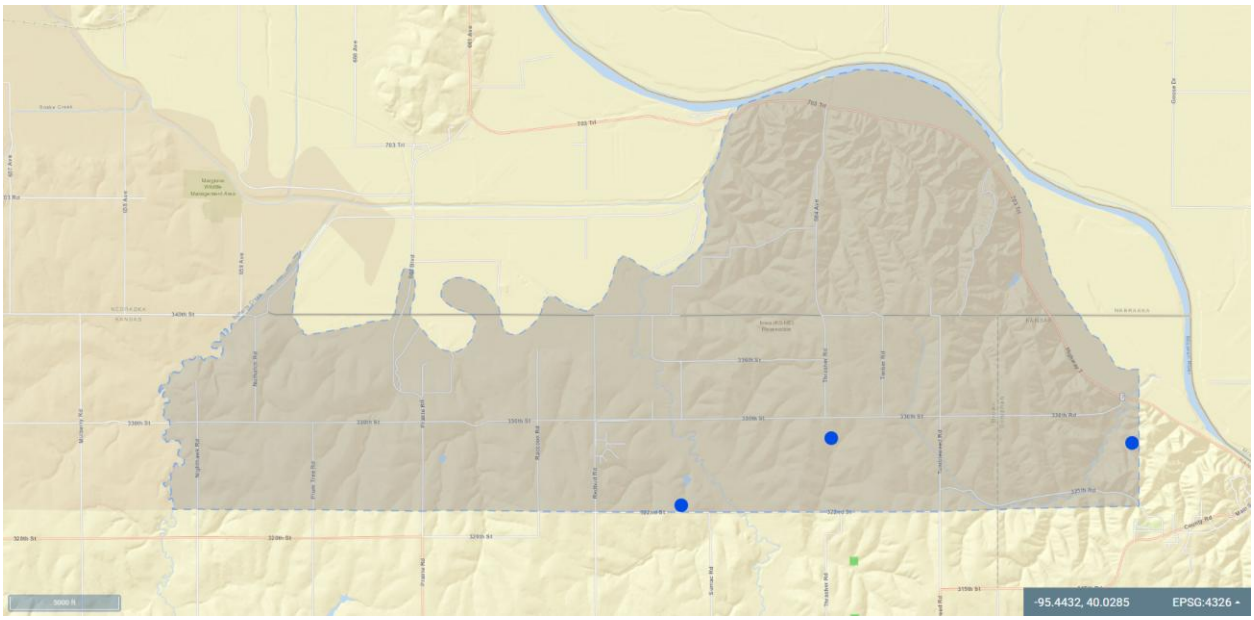
Table 4-6: Information on Levees in the Planning Area

Location	Levee ID	Length (miles)	Average Levee Height (ft)	People at Risk	Structures at Risk	Property Value	Levee Safety Action Risk Classification
Richardson County	MRLS 512-513-R SE	5.762	12	2	2	$200,000	Low

Source: USACE 2024b, 2024c



Source: USACE 2024b
Figure 4-1: Location of Levee within the Planning Area



Source: USACE 2024a
Figure 4-2: Location of Dams within the Planning Area

Extent and Magnitude

Dams in Kansas are assessed according to their risk to life and property. The state has three hazard potential classifications for dams (Kansas Department of Agriculture n.d.-b):

- Class A (low hazard): Failure may cause damage to uninhabited buildings, agricultural land, undeveloped land, or traffic on low-volume roads.

- Class B (significant hazard): Failure may endanger a few lives or cause damage to an isolated home, public utility serving a small volume of customers, traffic on a moderate-volume road, recreation facilities, or low-volume railroad tracks.
- Class C (high hazard): Failure could cause extensive loss of life or damage to more than one home, industrial or commercial facilities, a public utility, traffic on high-volume roads, a frequently used recreational facility, or a high-volume railroad line. Two or more individual Class B hazards below a dam also result in a Class C rating.

The hazard classification does not reflect the physical condition of the dam but rather the downstream impact in the event of dam failure.

All three dams on the tribal reservation are considered low hazard. As a result, the Tribe faces a "negligible" impact from dam failure, with minimal injuries or damage to critical infrastructure expected.

The Levee Safety Action Risk Classification is determined by the risk that exists because of the presence of the levee system. The rating for the levee in Richardson County is considered low risk (Kansas Homeland Security 2019). This means that there is a low consequence of failure and a low probability of overtopping at 1 percent a year (USACE 2024b). However, failure of the levee could cause flood depths of at least 15 ft, loss of life, and economic consequences based on the 2013 risk assessment done by USACE (2024b). Two agricultural structures are behind the levee, but they are on the edge of the leveed area. This information, coupled with a low-risk rating, results in a "negligible" impact on the Tribe from potential levee failure.

Previous Occurrences

According to Stanford University's National Performance of Dams Program Dam Incident Database, there have been no reported incidents for the three dams (2023). Since two of the dams are privately owned, an incident may go unreported.

In March 2019, a major storm struck the Midwest, causing catastrophic flooding in parts of Central and South-Central Nebraska. Spencer Dam, located in Boyd and Holt Counties in Nebraska, failed on March 14, 2019, releasing an 11-ft wall of water (Yoders 2019). The dam lies 300 miles upstream of the Tribe on the Niobrara River, a tributary of the Missouri River. The failure of Spencer Dam combined with the storm resulted in significant damage to the reservation.

The Mississippi River Levee System 512-513 R levee experienced minor damage from erosion during a flood event in 2008 (Kansas Homeland Security 2019). In June 2015, prolonged flood events caused landside and riverside slope failures (GovTribe 2018). In June 2021, an extreme rain event caused significant flooding and erosion to spillways located within the reservation (Iowa Tribe 2023).

Future Probability

Because of increasing effects of climate change and aging infrastructure, the likelihood of dam and levee failure in the future will increase. There is an overall trend for more frequent high intensity precipitation events for the Northern Great Plains region (Knapp et al. 2023), an area upstream of the reservation. Increased precipitation in that region could lead to potential dam failures or overtopping, which could have downstream effects on the Tribe as seen in the 2019 Spencer Dam failure. However, the future

probability of a dam failure is very low for the Iowa Tribe because there is no history of dam or levee failure on the reservation or in the immediate vicinity.

Impacts and Vulnerability

Dam failure for a low-hazard dam results in no probable loss of human life and low economic and/or environmental losses that are principally limited to the owner's property (FEMA 2004). Given that the three dams on the reservation are small, low-hazard earthen dams, the biggest impact from failure would be damage to the agricultural lands in the vicinity. Adverse impacts to agricultural lands could potentially lead to economic loss since agriculture is the primary economic generator for the Tribe (Iowa Tribe 2023). Even though the levee is considered low risk, a 2013 risk assessment estimated that flooding of the leveed area could lead to flood depths of at least 15 ft, which could result in loss of life and economic consequences (USACE 2024b).

Implications of Climate Change

Climate change is anticipated to increase the future probability of dam and levee failure because of increased precipitation. Although research does not show a large projected increase in total annual precipitation for the reservation (Native Climate 2024; Thrasher et al. 2021; Thrasher et al. 2022), Kansas has seen a rise in the frequency of extreme rainfall events (days with 2 inches of precipitation or more) (Frankson et al. 2022). Large amounts of rain in a short period of time increase the potential for overtopping or dam failure.

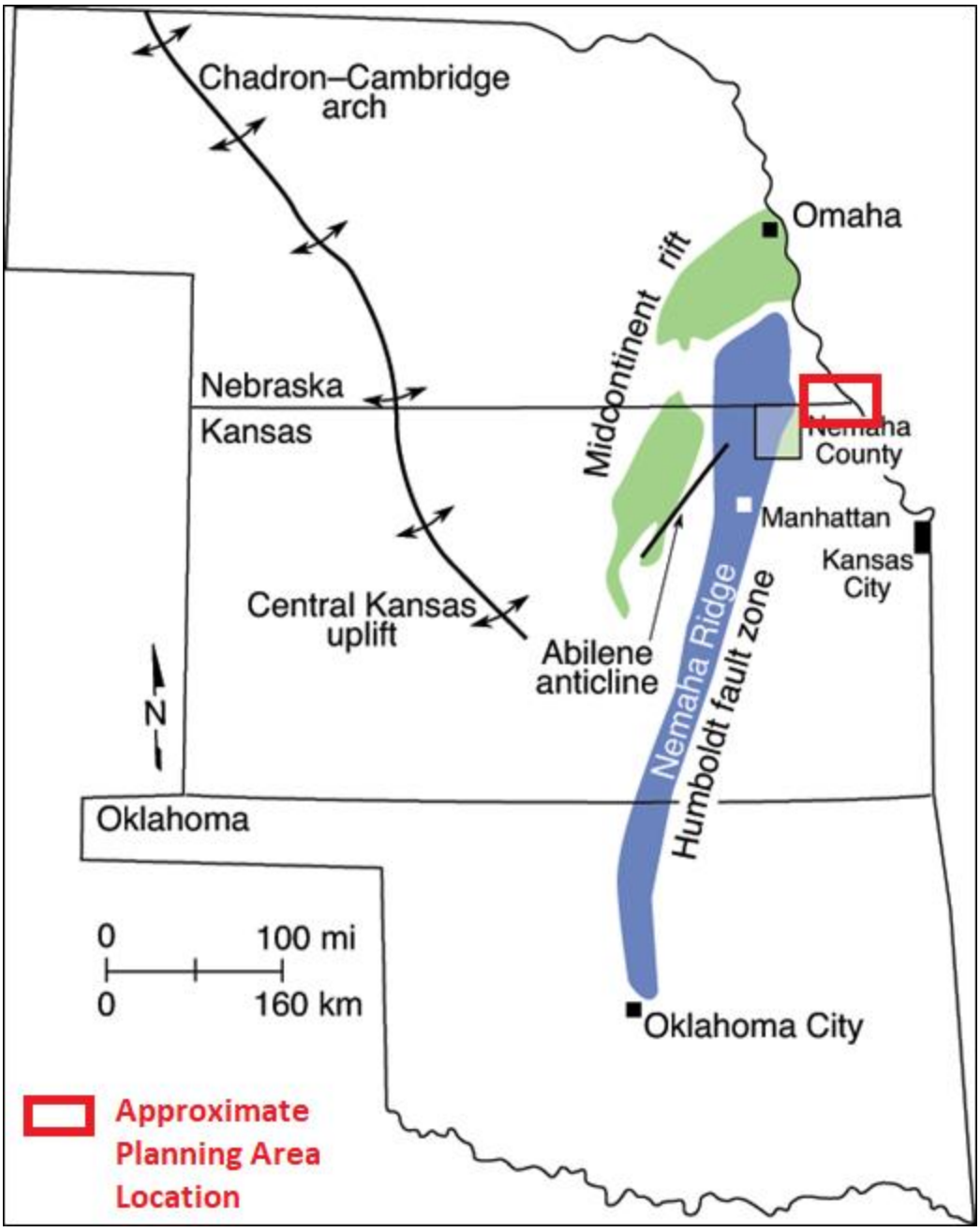
4.2.2 Earthquake

Overview

An earthquake is the result of a sudden release of energy in the Earth's crust that creates seismic waves that are typically caused by the rupturing of geological faults. These seismic waves travel through the Earth's crust and cause ground shaking. Earthquakes can also cause surface faulting, liquefaction, flow failures, landslides, and, more rarely, tsunamis (USGS 2024a). Earthquakes can occur anytime and cannot be predicted, unlike other natural hazards.

Location

The Iowa Tribe's reservation is an area of low seismic activity. The Humboldt fault zone passes through Kansas and part of Nebraska, including the western part of Richardson County, but not through the reservation, as seen in **Figure 4-3**.



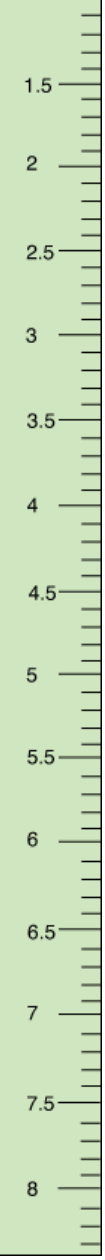
Source: Steeples and Brosius 2014

Figure 4-3: Location of Humboldt Fault Zone

Extent and Magnitude

Earthquake activity is described using two scales, the Richter and Modified Mercalli Intensity scales. The Richter scale is a measurement of an earthquake's magnitude while the Mercalli Intensity scale is based on the observed damage. **Figure 4-4** provides a comparison of the two scales.

Modified Mercalli Scale		Richter Magnitude Scale
I	Detected only by sensitive instruments	
II	Felt by few persons at rest, especially on upper floors; delicately suspended objects may swing	
III	Felt noticeably indoors, but not always recognized as earthquake; standing autos rock slightly, vibration like passing truck	
IV	Felt indoors by many, outdoors by few, at night some may awaken; dishes, windows, doors disturbed; motor cars rock noticeably	
V	Felt by most people; some breakage of dishes, windows, and plaster; disturbance of tall objects	
VI	Felt by all, many frightened and run outdoors; falling plaster and chimneys, damage small	
VII	Everybody runs outdoors; damage to buildings varies depending on quality of construction; noticed by drivers of automobiles	
VIII	Panel walls thrown out of frames; fall of walls, monuments, chimneys; sand and mud ejected; drivers of autos disturbed	
IX	Buildings shifted off foundations, cracked, thrown out of plumb; ground cracked; underground pipes broken	
X	Most masonry and frame structures destroyed; ground cracked, rails bent, landslides	
XI	Few structures remain standing; bridges destroyed, fissures in ground, pipes broken, landslides, rails bent	
XII	Damage total; waves seen on ground surface, lines of sight and level distorted, objects thrown up into air	



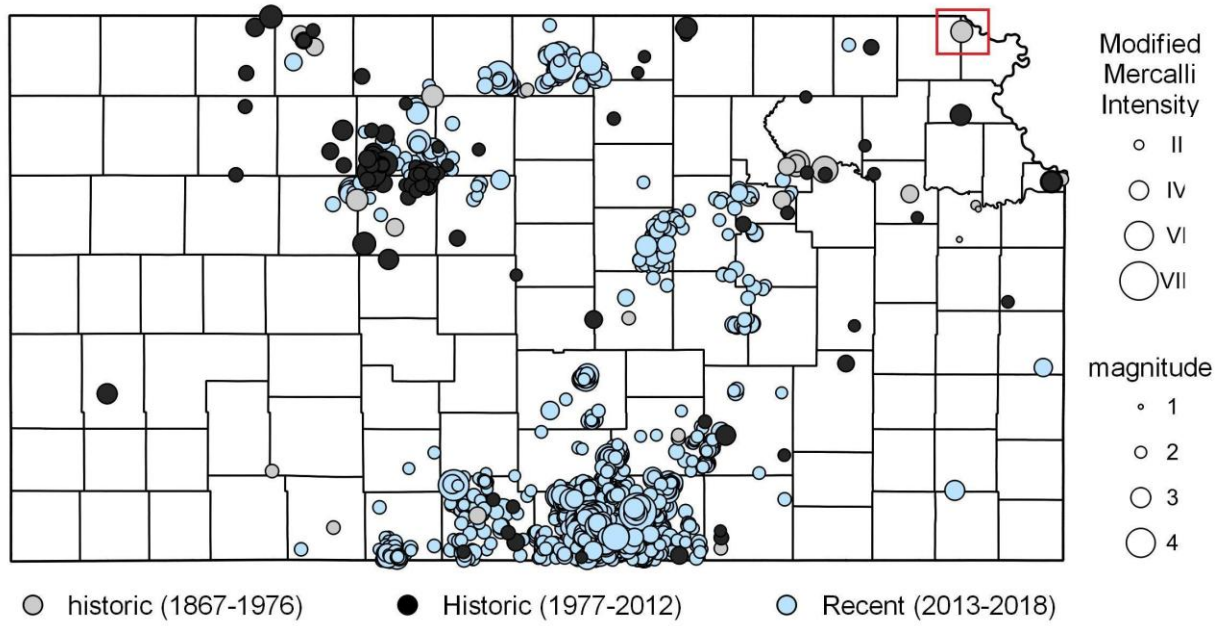
Source: Steeples and Brosius 2014

Figure 4-4: Comparison of Richter and Modified Mercalli Scales

Earthquakes along the Humboldt fault zone can cause minor to moderate damage. The extent of earthquakes is likely negligible because of the location of the reservation in relation to the fault and the lack of previous occurrences.

Previous Occurrences

The only earthquake on record that was felt on the reservation occurred in 1927. **Figure 4-5** displays the location of the 1927 earthquake within the red box. This earthquake was centered around White Cloud, Kansas, and caused houses to shake but no damage or injuries were reported (DuBois and Wilson 1978).

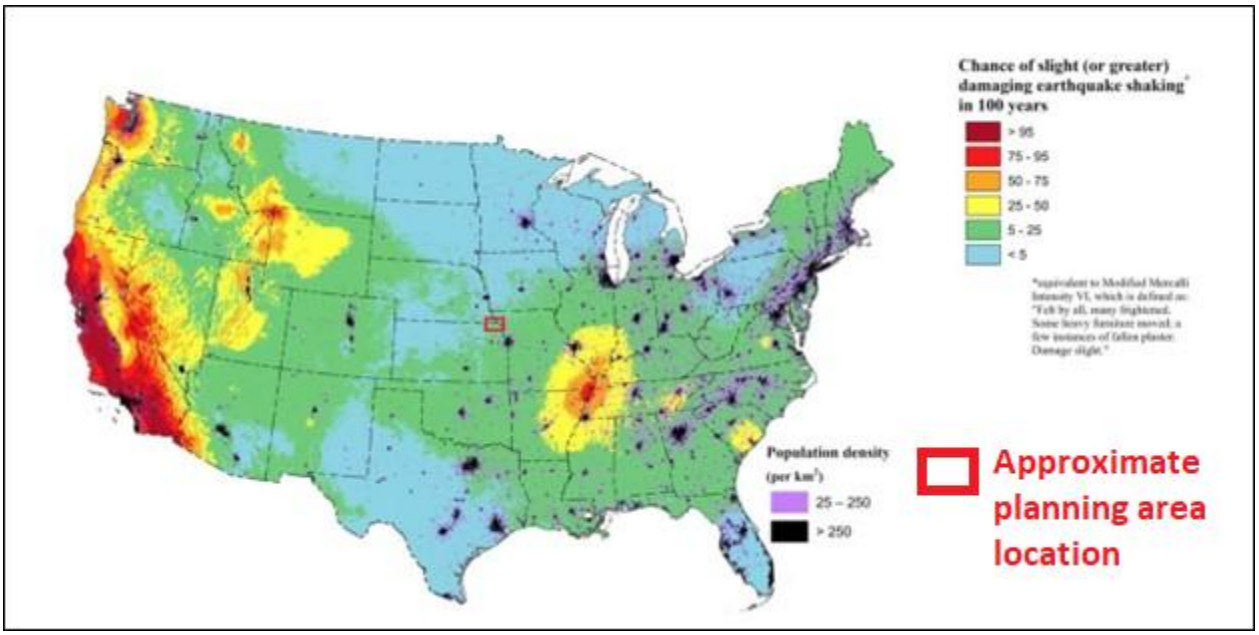


Source: Kansas Geological Survey 2018

Figure 4-5: Kansas Geological Survey Historical Earthquake Map

Future Probability

There is a less than 5 percent chance that the reservation will experience slightly damaging earthquake shaking in the next 100 years (**Figure 4-6**). A slightly damaging earthquake is equivalent to Modified Mercalli Intensity VI, which can be felt by all but result in minimal damage (USGS 2024c). The annualized frequency for earthquakes ranges from 0.015 percent to 0.021 percent across the reservation's three counties. Based on this data, the future probability of earthquakes in the planning area is low.



Source: USGS 2024c

Figure 4-6: National Seismic Hazard Model

Impacts and Vulnerability

The degree of vulnerability during an earthquake is dependent on the number of structures and the ability for people to evacuate those buildings. The number of housing units on the reservation in 2017 was 75 (Kansas Homeland Security 2019) while the number of people aged 65 and over in 2018 was 23 (Iowa Tribe 2020). The elders of the Tribe are well looked after, especially in times of need, with dedicated staff and community members who take care of them (Iowa Tribe 2023). Therefore, they would likely be able to get to safety during an earthquake. According to FEMA's National Risk Index, Brown, Doniphan, and Richardson Counties all have a risk index of "very low" for earthquakes when compared to the rest of the United States (Zuzak et al. 2023).

Implications of Climate Change

Climate change is not anticipated to directly affect the frequency or future probability of earthquakes. However, there is a possibility that sea level rise and increased frequency and strength of storms can increase the hydrostatic pressure underground, which can change the seismic cycle (Bohnhoff and Garzon 2024), but this will only result in small earthquakes with magnitudes less than zero (Buis 2019). More research needs to be done to better understand the relationship between climate change and earthquakes.

4.2.3 Erosion

Overview

The NRCS defines erosion as a geological process in which earthen materials, mainly topsoil, are worn away and transported over time by natural forces, such as water or wind, or by human activity such as farming (Mulvihill 2021). Water erosion occurs when rain or snowmelt displaces the soil on the ground.

Wind erosion is a natural process that moves loose soil from one location to another, sometimes causing destructive dust storms.

Erosion can be a slow, unobserved process or can happen quickly because of extreme environmental factors. Healthy soil is the foundation for agriculture and plays a crucial role in protecting the air, water, and climate. One extreme example of how unhealthy soil can cause destruction is the 1930s Dust Bowl. As a result of years of over plowing, poor land management, and drought, millions of acres of farmland in the Midwest and Great Plains dried up (Mulvihill 2021).

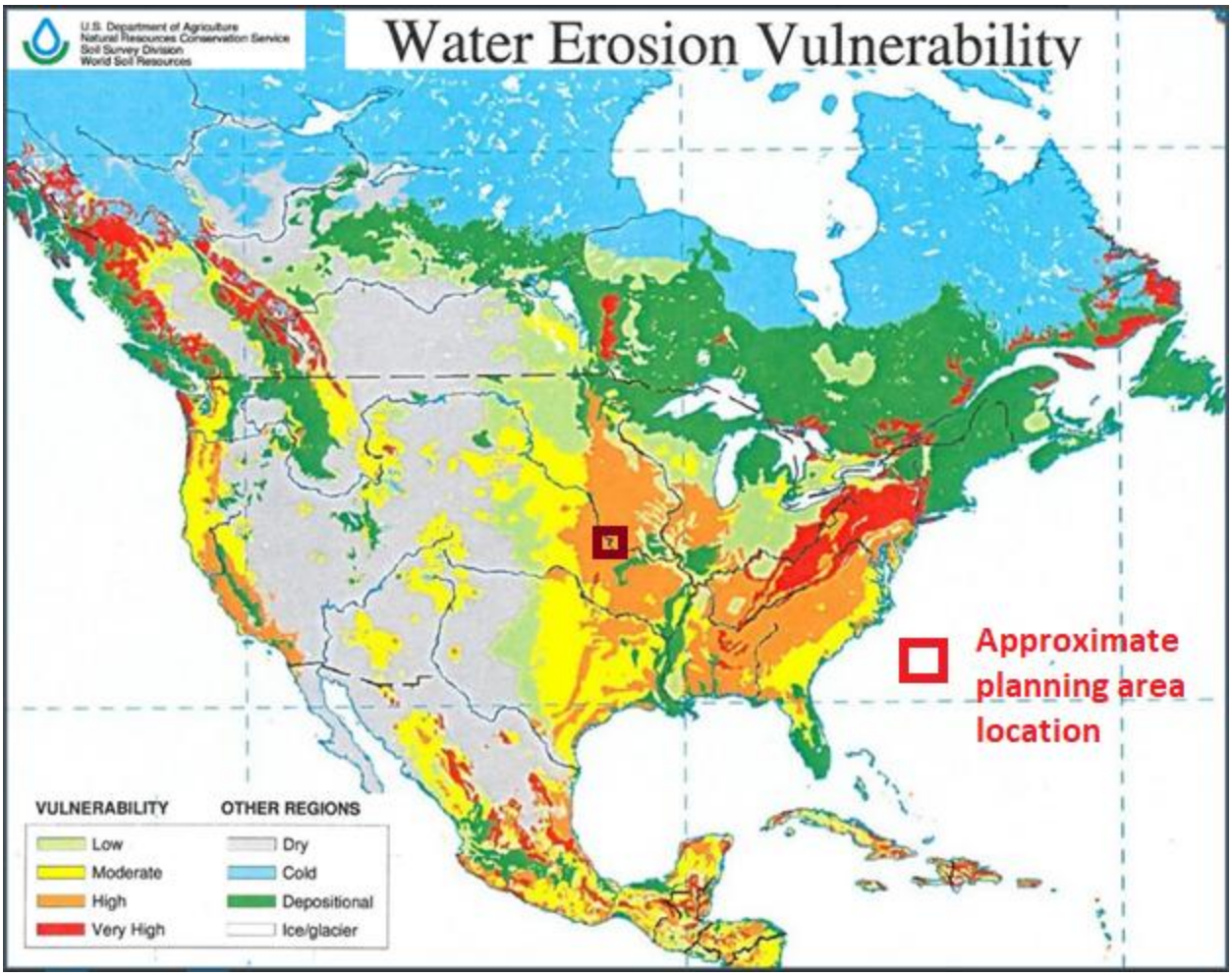
Location

Soil erosion occurs over broad geographic regions. In the United States, soil erosion from wind most commonly occurs in the Great Plains region because of the dry climate and strong winds (Kuzila 2011). Erosion could affect the entire planning area and is especially relevant on steeper slopes or agricultural lands.

Extent and Magnitude

For the Iowa Tribe, the extent and magnitude of soil erosion are considered limited. Soil erosion caused by wind increases during times of drought. Alternatively, erosion by water occurs during intense rain events causing sheet, rill, gully, and/or bank erosion. Erosion can cause damage to crops, the primary economic generator for the Tribe. **Figure 4-7** displays water erosion vulnerability across the United States. The planning area lies within an area of high vulnerability to water erosion. Reasons for high vulnerability could be due to the Missouri and Big Nemaha Rivers near the reservation and the amount of agricultural land use. Lands that are barren with no vegetation are especially vulnerable to water erosion because there is nothing to absorb the water or stabilize the soil. This can lead to increased runoff and erosion from intense weather events (Mulvihill 2021).

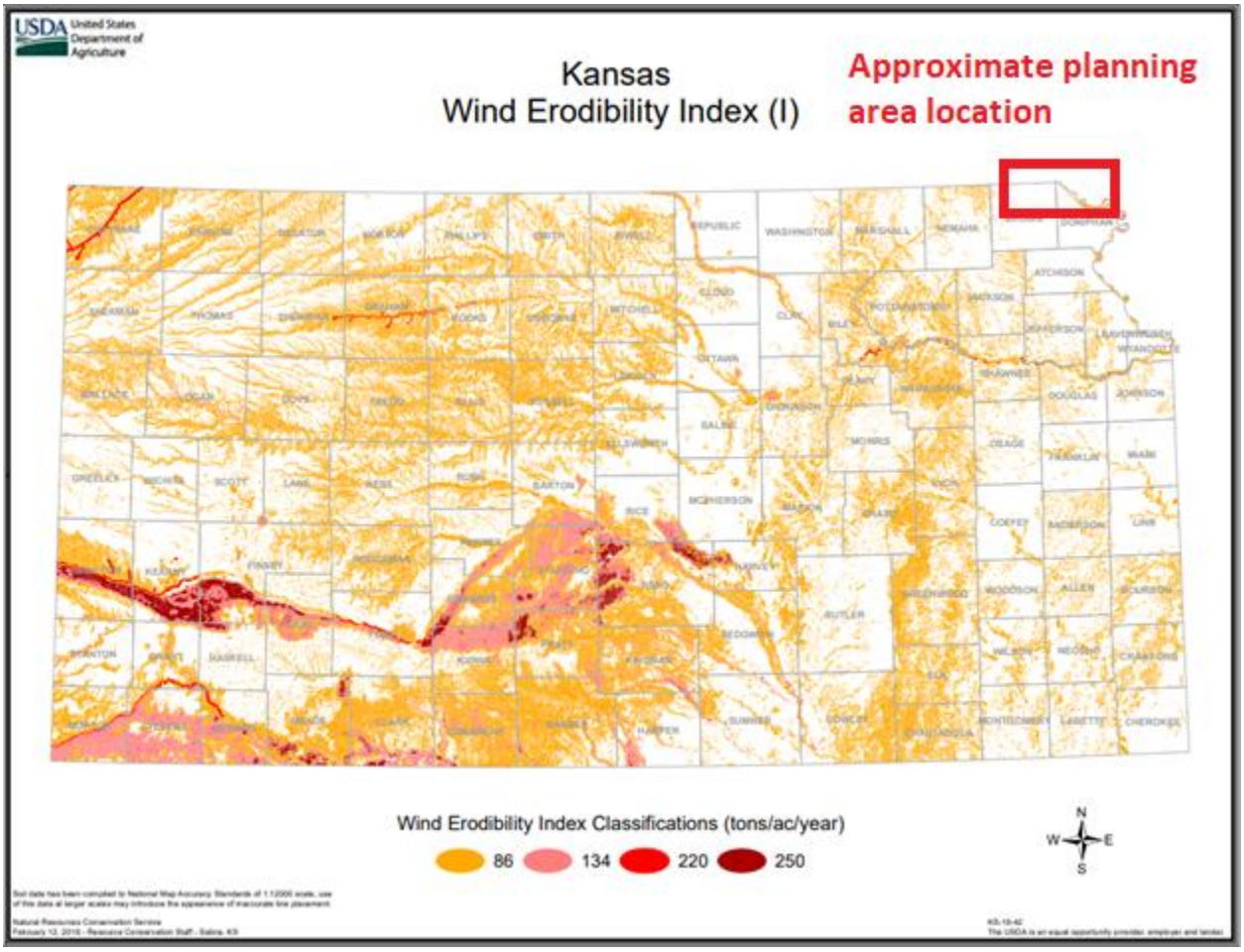
In the drier regions of North America, millions of tons of soil are lost to wind erosion annually (Mulvihill 2021). Effects of wind erosion include crop damage, dust storms, unsafe operating conditions for agricultural workers, and chemical drift (Mulvihill 2021). **Figure 4-8** depicts the estimated annual average of soil loss in tons per acre that would occur from wind erosion. The Iowa Tribe has a Wind Erodibility Index of 86 tons per acre per year. The Division of Conservation in the Kansas Department of Agriculture (n.d.-a) primarily uses this map when determining if any type of emergency tillage would be beneficial or recommended.



Source: USDA NRCS 2022

Figure 4-7: Water Erosion Vulnerability map

Approximate planning area location



Source: USDA NRCS 2019

Figure 4-8: Kansas Wind Erodibility Index Map

Previous Occurrences

Soil erosion is highly likely to occur during any extreme rain or wind event but may not be specifically reported. According to the Tribe, an extreme rain event in June 2021 caused flooding and significant erosion of roads and spillways within the reservation (Iowa Tribe 2023). Another possible previous occurrence was a region-wide dust storm that occurred in October 2020 and moved across Colorado and into Nebraska and Kansas (Mulvihill 2021). The Ioway Farms staff noted that they have previously had erosion issues in a field prone to higher volumes of runoff.

Future Probability

The future probability of soil erosion and dust occurring more frequently is moderate. The is soil becoming drier, rainstorms are becoming more intense, and floods are becoming more severe—all of which can lead to increased soil erosion and loss of crops (Dome 2021). According to a study titled "Dust Impacts of Rapid Agricultural Expansion on the Great Plains," published in the journal *Geophysical Research Letters*, it was found that dust storms have become more common and more intense over the past 20 years because of frequent droughts and the expansion of croplands (Mulvihill 2021).

Future probability of soil erosion and dust may be reduced by tribal initiatives such as planting cover crops, restoring native plants, prairies and woodlands, and transitioning to regenerative agriculture to restore the soil from decades of chemical-intensive practices (Iowa Tribe 2023).

Impacts and Vulnerability

The damage caused by these wind and water erosion events can have lasting effects on people and land depending on the severity of the storm. People who are at the highest risk of being impacted from soil erosion are the elderly and agricultural workers. Erosion can damage crops, which can negatively impact the economy of the Tribe. In a dust storm, the entire tribal population could experience dust inhalation. According to Mary Knapp, a climatologist for the state of Kansas, it is possible that current generations will see another Dust Bowl (Dome 2021). A future Dust Bowl could be catastrophic. The 1930s Dust Bowl damaged vast areas of land, caused farm animals to suffocate, and resulted in the death of approximately 7,000 people from "dust pneumonia" (Mulvihill 2021). Water erosion can wash out roads, spillways, and embankments, as seen in previous occurrences. This can impact drivers and emergency vehicles and more vulnerable people, such as the elderly.

Implications of Climate Change

Erosion is most typically dependent upon precipitation events, droughts, and wildfires. In Kansas, the frequency and severity of wildfires is expected to increase, and increasing temperatures could lead to more intense droughts (Frankson et al. 2022). Drier soils and less vegetation to stabilize slopes and would increase the risk of erosion to the Tribe.

4.2.4 Extreme Cold

Overview

As defined by the 2019 Kansas Region K HMP, an extreme cold event has temperatures at or below freezing for an extended period of time. Extreme cold events are usually part of winter storm events (see **Section 4.2.12**) but can occur during any time of the year.

Location

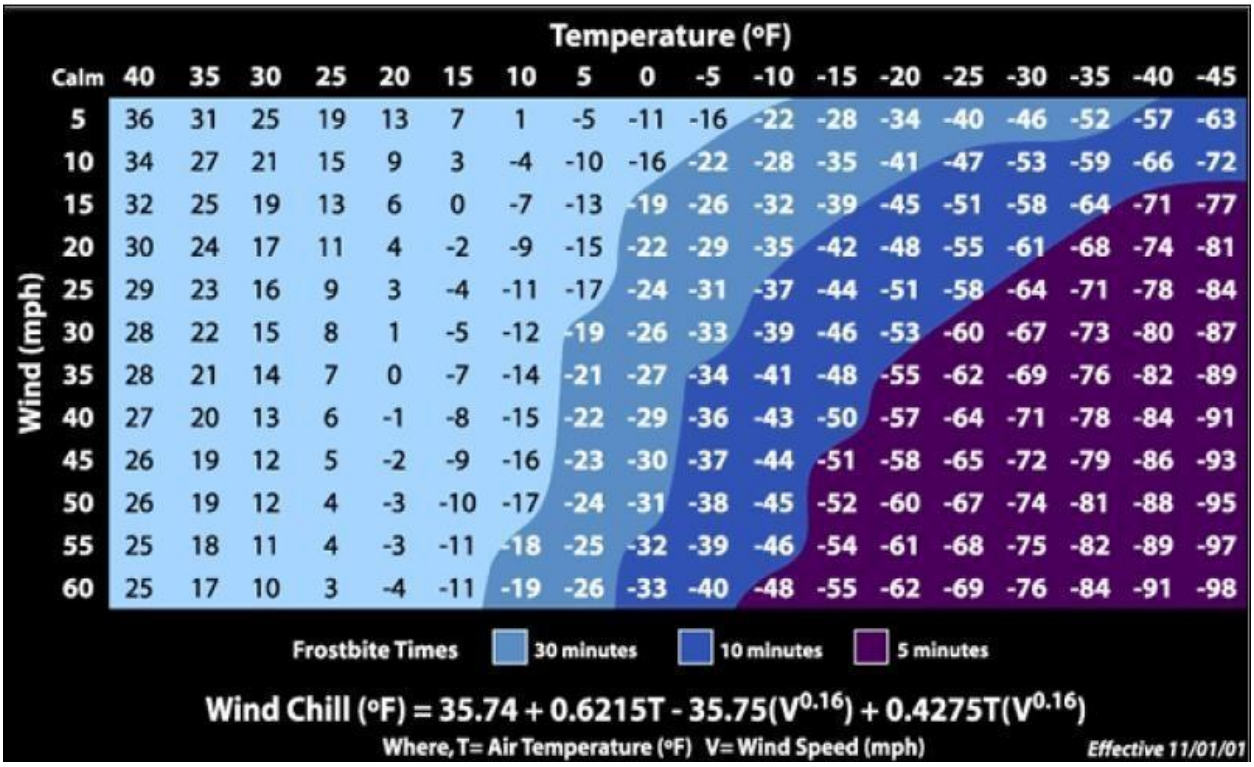
The Midwest is known for being susceptible to extreme temperatures, putting all the planning area at risk. Kansas lacks mountain ranges that could act as a barrier to cold air masses from the north. Additionally, the area does not have any oceans or large bodies of water that could provide a moderating effect on the climate. The polar jet stream is often located over the region during the winter, bringing frequent storms and precipitation. **Table 4-7** includes average minimum temperatures in White Cloud, Kansas.

Table 4-7: Average Minimum Temperatures in White Cloud, Kansas

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Average Minimum Temperature (degrees Fahrenheit [°F])	14	19	30	42	53	62	67	64	55	43	31	20

Extent and Magnitude

The extent of extreme cold temperatures is generally measured through the Wind Chill Temperature Index, introduced by the National Weather Service (NWS) in 2001. This index calculates the dangers from winter winds and freezing temperatures. Wind chill temperature is the temperature that people and animals feel when outside based on the rate of heat loss from exposed skin by the effects of wind and cold. **Figure 4-9** shows three shaded areas of frostbite danger, each showing how long a person can be exposed before frostbite develops.



Source: NOAA 2024h

Figure 4-9: NWS Wind Chill Chart

NWS also issues six alerts related to extreme cold (NOAA 2024d):

- Extreme cold warning: Dangerously cold air temperatures or wind chill values are expected or occurring.
- Extreme cold watch: Dangerously cold air temperatures or wind chill values are possible.
- Cold weather advisory: Seasonably cold air temperatures or wind chill values, but not extremely cold values, are expected or occurring.
- Freeze warning: Temperatures are forecasted to go below 32°F for a long period of time.
- Freeze watch: There is a potential for significant, widespread freezing temperatures within the next 24 to 36 hours.
- Frost advisory: Areas of frost are expected or occurring.

The freeze and frost alerts can be especially relevant for crops during the growing season, as cold air can damage or kill produce. Because of the Tribe's numerous agricultural enterprises and the potential impact of extreme cold on vulnerable populations, the extent of impact of this hazard is critical.

Previous Occurrences

The planning area has been historically susceptible to extreme cold events. Within a span of 10 years, the reservation has experienced an average of at least two extreme cold events per year. As shown in **Table 4-8,** from January 2015 to July 2024, Doniphan County experienced four extreme cold events with the following impacts (NOAA n.d.-f):

Table 4-8: NOAA Storm Events Database Extreme Cold Events Data 2015–2024

Data	Recorded Impact
Number of County/Zone areas affected:	1
Number of Days with Event:	4
Number of Days with Event and Death:	0
Number of Days with Event and Death or Injury:	0
Number of Days with Event and Property Damage:	0
Number of Days with Event and Crop Damage:	0
Number of Event Types reported:	1

While there have been no recorded deaths or injuries related to historic extreme cold events, there are lasting concerns for the health and wellness of community members and infrastructure throughout the reservation.

Future Probability

The future probability of extreme cold events is very high. These events are expected to occur annually, but they are more likely to occur during the months of November through March. Although they are not expected to increase in frequency because of climate change, extreme cold events will continue to be a risk for the community and of significant risk to outdoor workers and community members without adequate heating sources or insulated shelter.

Impacts and Vulnerability

One of the most significant concerns related to extreme cold events is the risk to human health. Outdoor workers, the unhoused population, and elders are at higher risk of extreme cold impacts. However, strains or damage to power and water systems can put the entire population of the Tribe at risk. Personal impacts from extreme cold events include the possibility of frozen or burst water pipes and asphyxiation from toxic fumes or household fires caused by emergency heaters and fireplaces. During a previous extreme cold event, the bingo hall at Casino White Cloud served as a warming shelter, and portable generators were distributed to individuals.

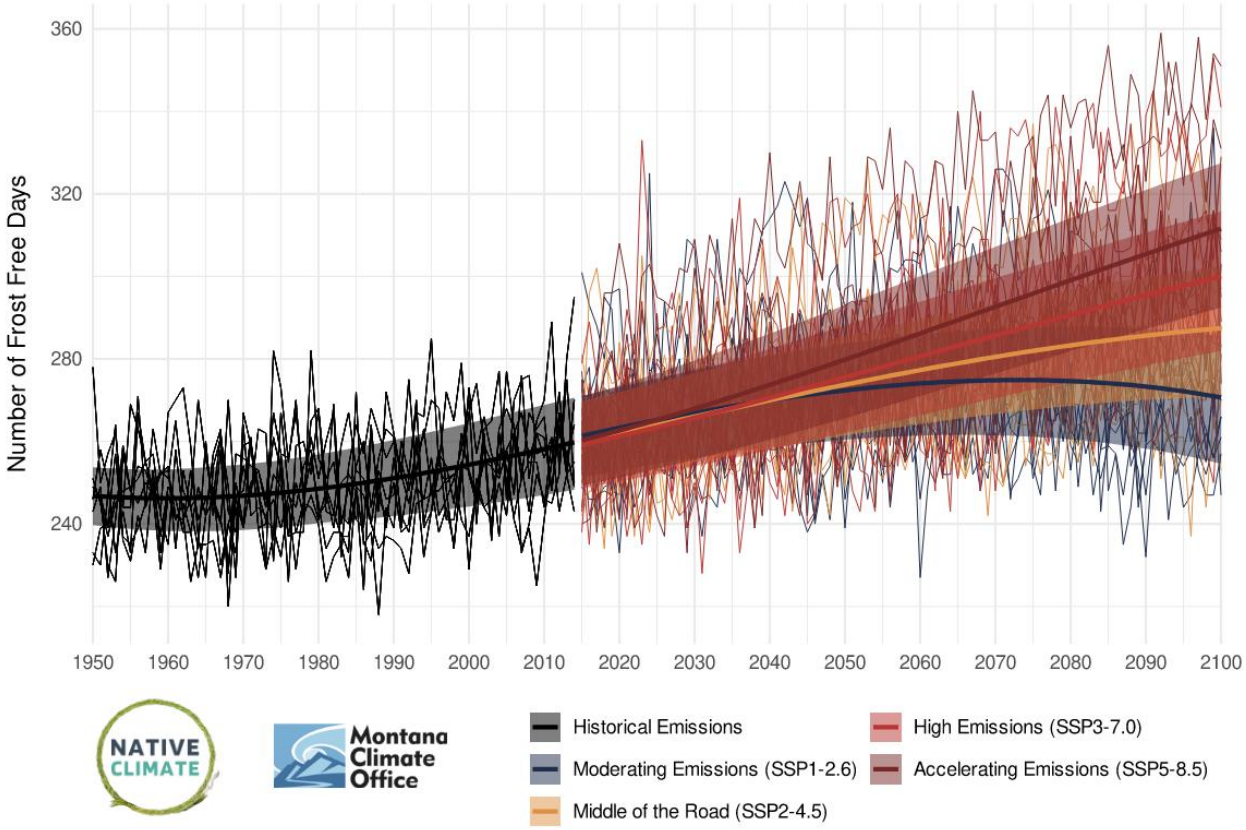
Extreme cold can adversely impact crops and affect the timing and duration of the planting season. The USDA Risk Management Agency provides data on the number of crop damage claims, the number of acres damaged, and the damage claims amount associated with extreme cold, although that data was

not analyzed in this plan. Extreme cold can also have some benefits to agriculture, freezing the soils and trapping nutrients and suppressing insects.

Extreme cold events can create a serious public health risk and threaten infrastructure. Extreme cold events have the potential to impact a wide variety of essential services and community assets and operations.

Implications of Climate Change

Since 1990, Kansas has experienced a mostly below average number of very cold nights (minimum temperature below 0°F), and the freeze-free season has lengthened (Frankson et al. 2022). As depicted in **Figure 4-10**, the number of frost-free days for the planning area is expected to increase. As this overall warming trend continues, it will reduce the risk of extreme cold to the Iowa Tribe.



Source: Native Climate 2024, Thrasher et al. 2021, Thrasher et al. 2022
Figure 4-10: Climate Projects of Number of Frost-Free Days for Iowa Tribe Reservation

4.2.5 Extreme Heat

Overview

FEMA defines extreme heat in most of the United States as a long period (2 to 3 days or more) of high heat and humidity with temperatures above 90°F. Humidity is key to the risk of extreme heat because it increases the feeling of heat as measured by a heat index. Extreme heat may cause heat cramps, heat exhaustion, heat stroke, and other heat-related illnesses. Specific to the areas in White Cloud, Kansas,

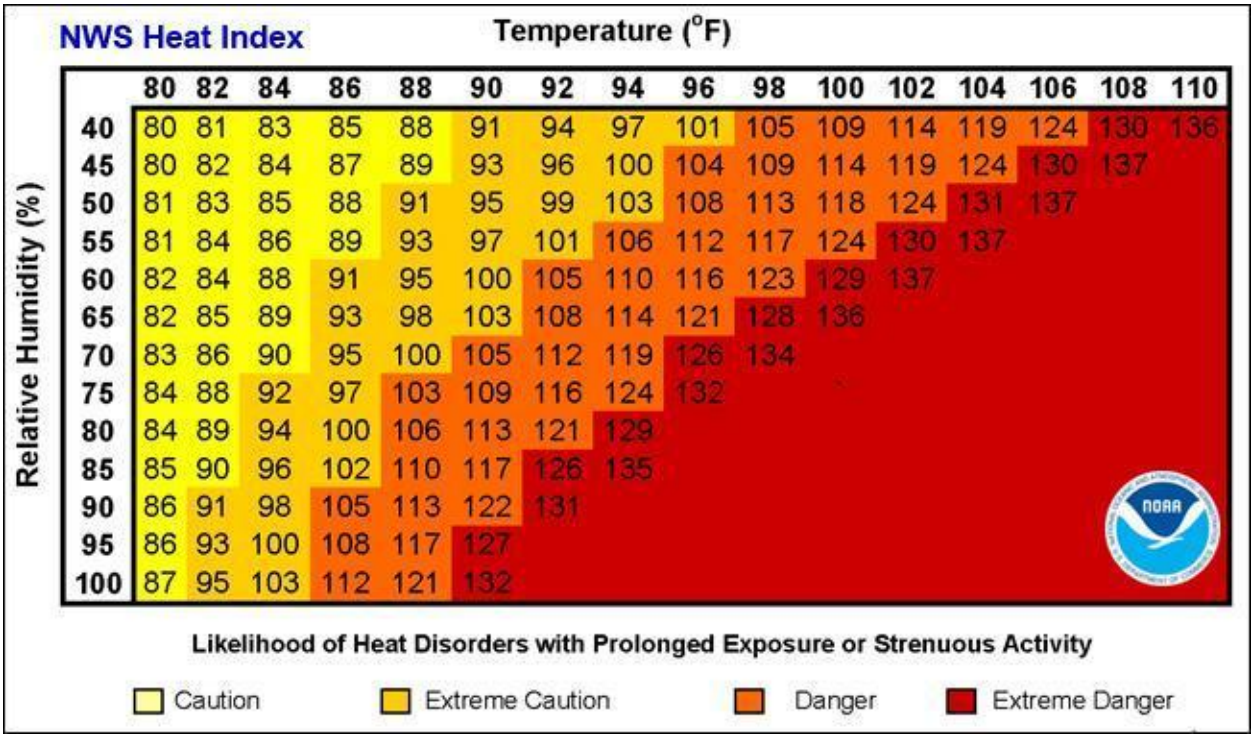
First Street Technology has created a significant heat factor profile that notes a hot day is anything that "feels like" 106°F (First Street Technology 2024). While temperatures over 100°F are dangerous for everyone, temperatures over 90°F are physically hazardous for high-risk individuals.

Location

Extreme heat can happen anywhere throughout the United States and typically occurs between mid-July through mid-August. Throughout the Midwest, the climate is susceptible to extreme heat. Specifically, Kansas lacks any mountain ranges that could act as a barrier to hot and humid air masses from the south or any oceans or large bodies of water that could provide a moderating effect on the climate. Kansas summers are generally warm and humid because of the clockwise air rotation caused by Atlantic high-pressure systems bringing warm humid air up from the Gulf of Mexico. As a result, the entire planning area is vulnerable to extreme heat.

Extent and Magnitude

The heat index scale is used to measure the severity of extreme heat. The scale combines relative humidity with actual air temperature to determine the risk to humans. NWS issues a heat advisory when the heat index is forecast to reach 100°F to 104°F for 2 or more days. NWS issues an excessive heat warning if the heat index is forecast to reach over 105°F for 2 or more days. **Figure 4-11**shows the relationship between the heat index and relative humidity. The extent of extreme heat in the planning area will depend on the duration of the event and the associated temperatures, but it could be critical.



Source: NOAA 2024i

Figure 4-11: Heat Index Determination

Previous Occurrences

The Iowa Tribe's reservation has experienced several extreme heat events, including in August 2021, when extreme heat was compounded by smoke from wildfires in central Canada and the western United States, and in September 2022, when unseasonable heat during the Ioway Powwow led to health emergencies for elders (Iowa Tribe 2023).

Future Probability

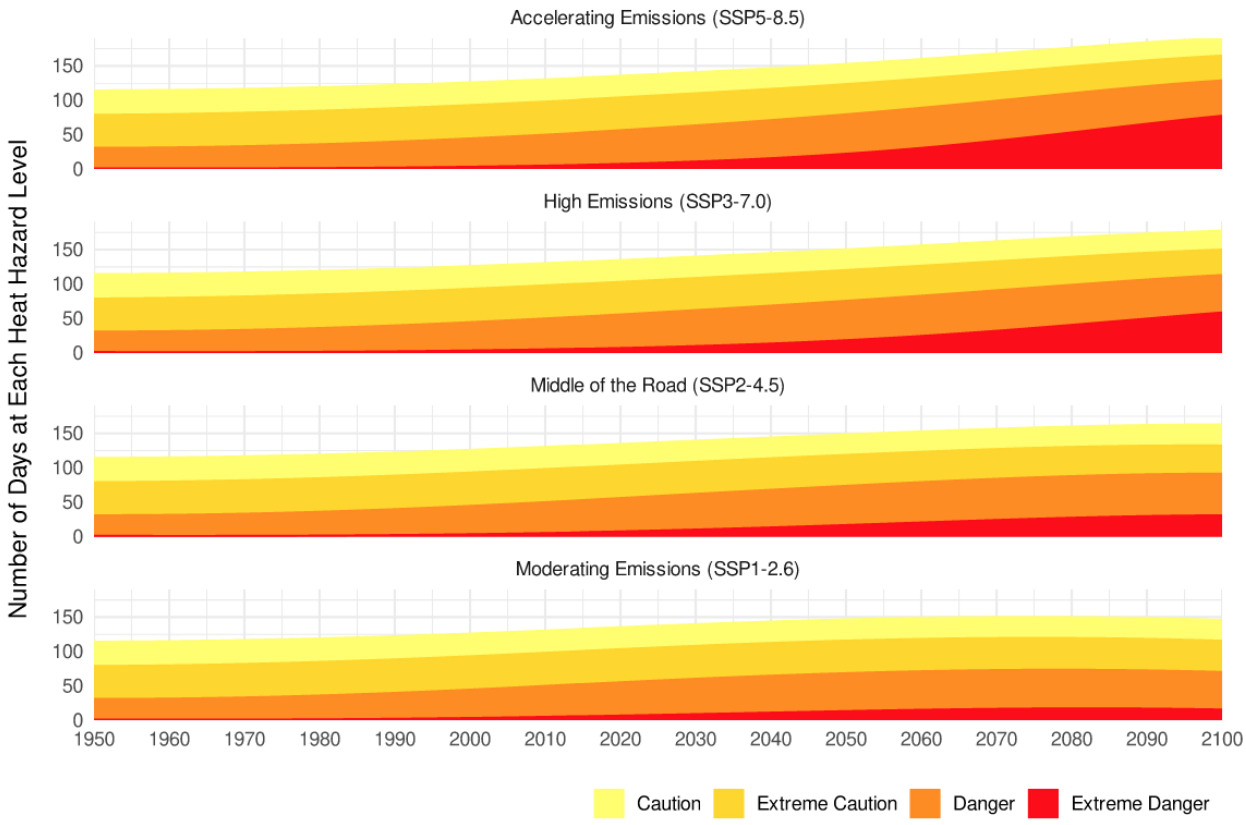
Rising average temperatures produce a more variable climate system that may result in an increase in the frequency and severity of some extreme weather events, including longer and hotter heat waves (and, by correlation, an increased risk of wildfires), higher wind speeds, greater rainfall intensity, and increased tornado activity. Since 1900, Kansas has experienced a 1.5°F increase in temperature (Frankson et al. 2022). The future probability of extreme heat events across the reservation is very high, and the planning area will continue to be susceptible to extreme heat temperatures and related health risks.

Impacts and Vulnerability

Extreme heat is expected to occur regularly throughout the planning area, especially during the summer months. Primary concerns for extreme heat impacts are the risks to human health. Higher risk groups include outdoor workers, farmers, and elders. Possible fatalities are a major concern during extreme heat events because of overexposure to heat, which can lead to a variety of illnesses. Loss of electrical power because of increased strain on power generation and distribution for air conditioning is another widespread concern that can impact the entire planning area.

Implications of Climate Change

Figure 4-12 depicts levels of heat index hazard using four colors: (1) caution, where fatigue is possible with prolonged exposure and activity and continuing activity could result in heat cramps; (2) extreme caution, where heat cramps and heat exhaustion are possible and continuing activity could result in heat stroke; (3) danger, where heat cramps and heat exhaustion are likely and heat stroke is probable with continued activity; and (4) extreme danger, where heat stroke is imminent (Native Climate 2024; Thrasher et al. 2021; Thrasher et al. 2022). Under all emissions scenarios, the reservation is expected to see an increased number of days with an extreme danger heat hazard level. Originally projected to have seven hot days in 2024, with increasing average temperatures, White Cloud has experienced 22 dangerously hot days over 100°F and 43 days of temperatures over 90°F (Waterman 2024).



Source: Native Climate 2024, Thrasher et al. 2021, Thrasher et al. 2022
Figure 4-12: Climate Projections of Heat Index Hazard for the Iowa Tribe's Reservation

4.2.6 Flooding

Overview

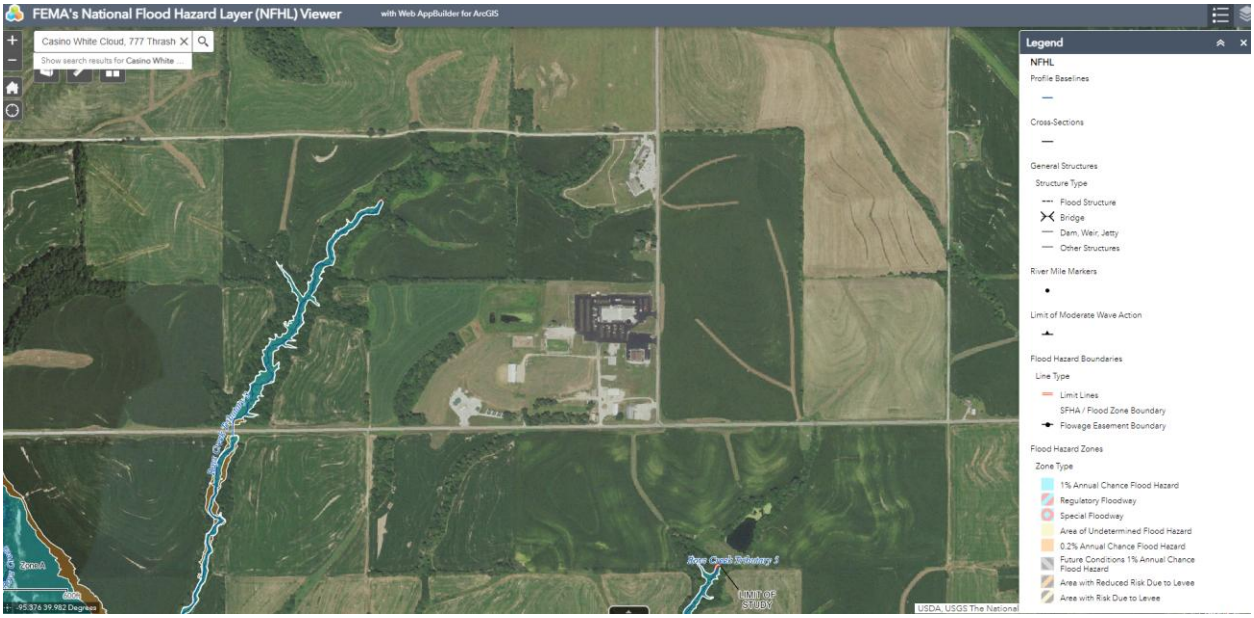
Flooding is the overflow of water onto normally dry land. It is caused by rising water in an existing waterway, such as a river, stream, or drainage ditch (NOAA 2024e). Floods are most common in seasons of rain and thunderstorms. Floods that threaten the reservation can be generally classified under two categories:

- **Flash Flood**: The product of heavy, localized precipitation in a short time over a given location. NWS provides the following definitions of warnings for actual and potential flood conditions for flash floods:
  - *Flash Flood Watch*: Current or developing hydrologic conditions that are favorable for flash flooding in and close to the watch area, but the occurrence is neither certain nor imminent.
  - *Flash Flood Warning*: Flash flooding is in progress, imminent, or highly likely.
  - *Flash Flood Statement*: In hydrologic terms, a statement by NWS that provides follow-up information on flash flood watches and warnings.

- **Riverine Flood**: Riverine flooding occurs from the overflow of rivers, streams, drains, and lakes because of excessive rainfall. NWS provides the following definitions of warnings for actual and potential flood conditions for riverine flooding:
  - *Flood Potential Outlook*: In hydrologic terms, an NWS outlook that is issued to alert the public of potentially heavy rainfall that could send rivers and streams into flood or aggravate an existing flood.
  - *Flood Watch*: Informs the public and cooperating agencies that current and developing hydrometeorological conditions are such that there is a threat of flooding, but the occurrence is neither certain nor imminent.
  - *Flood Warning*: In hydrologic terms, a release by NWS to inform the public of flooding along larger streams in which there is a serious threat to life or property. A flood warning will usually contain river stage (level) forecasts.
  - *Flood Statement*: In hydrologic terms, a statement issued by NWS to inform the public of flooding along major streams in which there is not a serious threat to life or property. It may also follow a flood warning to give later information.

Location

In general, flash flooding occurs across areas that are low lying or do not have adequate drainage, although there are not many of these areas on the reservation. All areas on the reservation located near a stream or river are at risk of riverine flooding. As shown in **Figure 4-13**, the extent of riverine flooding does not impact Casino White Cloud, the administrative buildings, and other assets concentrated in this central area of the reservation. However, members of the HMP Committee described specific areas of flooding with low-lying river crossings including where Roy's Creek crosses 330th Road between Starling Road and Sagebrush Road and further down Roy's Creek near the Powwow grounds.



Source: FEMA 2024b

Figure 4-13: Riverine Flooding Extent Near Tribal Administrative Buildings and Casino White Cloud

Extent and Magnitude

Water levels in the planning area's rivers, streams, and wetlands rise and fall seasonally and during high rainfall events. At any time, heavy rainfall may create conditions that raise water levels in rivers and streams above bank full stage, which then overflow to adjacent land. **Figure 4-13** shows riverine flooding extent near the center of the reservation. Based on past records and the experiences of the HMP Committee and the public, the extent of flooding is considered limited with some damage to roads or property.

Previous Occurrences

In June 2021, the reservation experienced an 11-inch rain event that caused flooding and significant erosion of roads and spillways (Iowa Tribe 2023). Tribal members noted that serious flooding events are occurring more frequently than expected. Since 2000, Brown, Doniphan, and Richardson Counties have received a total of 20 flood-related major disaster declarations (**Table 4-9**).

Table 4-9: Flood-Related Major Disaster Declarations for Planning Area Counties

Disaster Number	Declaration Year	Description	Counties Affected
4824	2024	Severe storms, straight-line winds, tornadoes, and flooding	Doniphan
4822	2024	Severe storms, straight-line winds, tornadoes, and flooding	Richardson
4449	2019	Severe storms, straight-line winds, tornadoes, flooding, landslides, and mudslides	Brown and Doniphan
4420	2019	Severe winter storm, straight-line winds, and flooding	Brown and Richardson
4417	2019	Severe storms, straight-line winds, and flooding	Doniphan
4230	2015	Severe storms, tornadoes, straight-line winds, and flooding	Brown and Doniphan
4225	2015	Severe storms, tornadoes, straight-line winds, and flooding	Richardson
4035	2011	Flooding	Doniphan
4013	2011	Flooding	Richardson
1945	2011	Severe storms, flooding, tornado, and straight-line winds	Richardson
1932	2010	Severe storms, flooding, and tornadoes	Brown and Doniphan
1924	2010	Severe storms and flooding	Brown and Richardson
1902	2010	Severe storms, ice jams, and flooding	Richardson
1853	2009	Severe storms, flooding, and tornadoes	Richardson
1776	2008	Severe storms, flooding, and tornadoes	Brown
1770	2008	Severe storms, tornadoes, and flooding	Brown and Richardson
1706	2007	Severe storms, flooding, and tornadoes	Brown and Richardson
1699	2007	Severe storms, tornadoes, and flooding	Brown and Doniphan
1579	2005	Severe winter storms, heavy rains, and flooding	Brown
1373	2001	Severe winter storms, flooding, and tornadoes	Brown

Source: FEMA n.d.-b

Future Probability

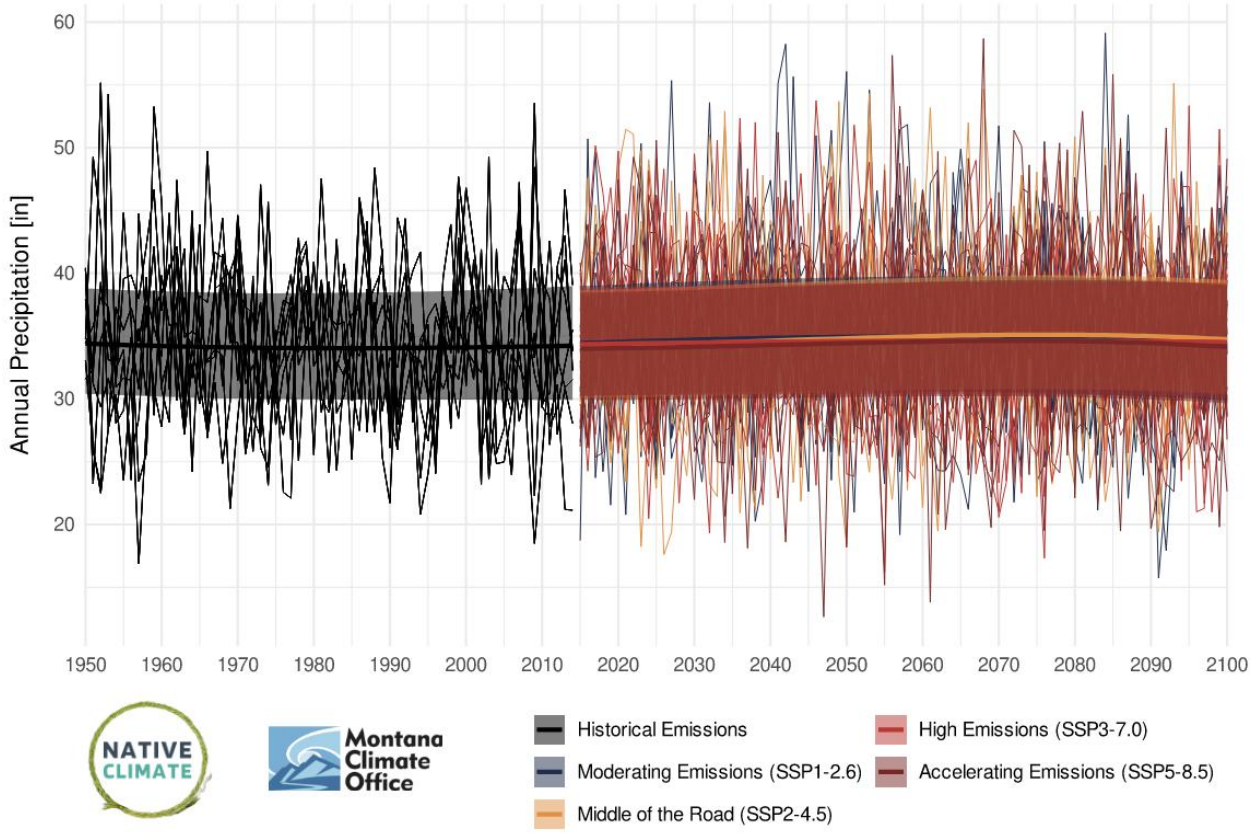
Given the number of previous flood-related disaster declarations in the planning area and previous occurrences on the reservation, the future probability of flood events is high.

Impacts and Vulnerability

The loss of life and property are the most significant risks related to flooding. Regardless of full property loss, residents are continually at risk of being displaced and having to evacuate because of a major flooding event. During evacuations, residents may encounter impacted roadways from damaged infrastructure or debris that may have moved and made roadways inaccessible. The disruption of roadways not only impacts resident transportation but will also impede social services and first responders' ability to reach residents in need. Flooding also can impact the economic health of the community. Personally, residents may incur relocation, debris cleanup, and/or repair costs after experiencing a flood. As a community, the duration of a flood can impact the ability of businesses to maintain regular operations or impede access to tribal headquarters, the health clinic, and Casino White Cloud, which is the largest employer and economic driver on the reservation (Iowa Tribe 2023). Additionally, there is a significant risk of infrastructure damage that may be costly to repair. Beyond the anticipated impacts to resident well-being and infrastructure, flooding has the potential to negatively impact crop life and land across the Iowa Tribe reservation area. Crop damage can impact the economic potential of the community and reduce available produce for consumption or profit.

Implications of Climate Change

As described in this section, there are some specific locations in the planning area at risk from riverine flooding. Although precipitation is expected to increase, projections for the reservation do not indicate a substantial increase in precipitation (**Figure 4-14**). Although precipitation totals may increase slightly, the overall warming trend for the planning area will likely lead to more precipitation falling as rain rather than snow, with a later annual day of first snow.



Source: Native Climate 2024, Thrasher et al. 2021, Thrasher et al. 2022
Figure 4-14: Climate Projections of Annual Precipitation for the Iowa Tribe's Reservation

4.2.7 Landslide

Overview

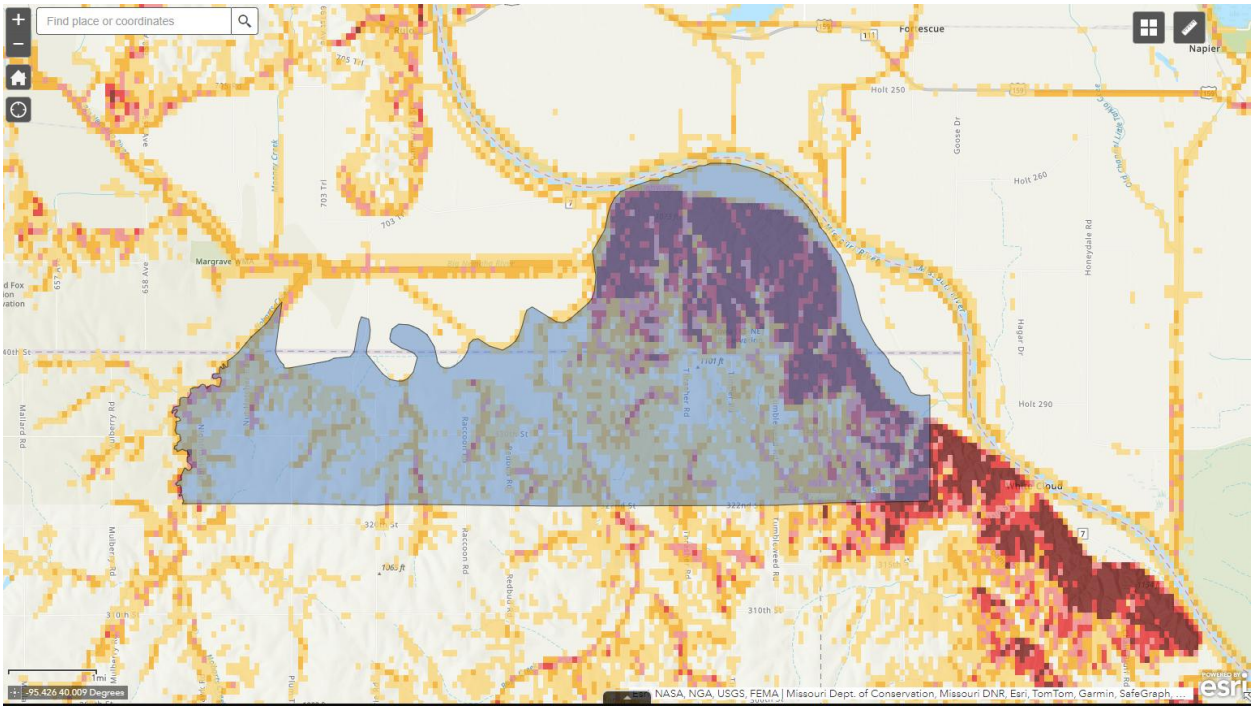
Landslides can be initiated by a variety of other events such as storms, rainfall, snowmelt, water level changes, steam erosion, groundwater changes, earthquakes, volcanic activity, human modification, wildfires, or a combination of these (USGS 2024b). A landslide is the movement of a mass of rock, debris, or earth down a slope. Landslides encompass downslope movement of soil and rock under the influence of gravity. Landslides are typically not the result of a single cause but occur when the forces acting downslope exceed the strength of the earth materials that compose the slope.

Location

Landslides have the potential of occurring anywhere in the planning area. However, landslides require a slope that is covered in rock or earth. Areas that are flat and lack the slope required for landslide are at reduced risk. Geologically, the tribal land lies in the Central Lowland Province of the Interior Plains. This includes a variety of various geological areas that come with different conditions and potential for landslide such as irregularly trending escarpments that have erosion resistant limestones and shales, undulating, drift-controlled, erosion surfaces, or areas along the Missouri River with steep-sided valleys and ravines (Iowa Tribe 2020).

Extent and Magnitude

Landslides can range in extent, but when they occur, they can result in multiple deaths and injuries and will result in the damage or destruction of infrastructure in their path. **Figure 4-15** depicts the reservation in blue, with shading ranging from yellow to dark red to indicate landslide susceptibility. Darker colors indicate areas where landslides are more likely to occur, as seen on the northeast and eastern side of the reservation where the land borders the Missouri River.



Source: USGS 2024d

Figure 4-15: U.S. Landslide Inventory and Susceptibility Map

The extent of landslides for the Iowa Tribe ranges could be critical depending on the size and the location of the event and the amount of damage caused.

Previous Occurrences

The USGS United States Landslide Inventory identified a landslide that occurred in May 2015 just east of the reservation where 330th Street intersects State Highway 7. This was a small mudslide that occurred on the eastern bank of State Highway 7 after heavy rains (USGS 2024d). No landslides have been reported in the planning area.

Future Probability

Based on the information in **Figure 4-15**, the future probability of landslides is low in the areas of the reservation more susceptible to landslides.

Impacts and Vulnerability

When landslides occur, they have the potential to damage all life and property in their paths, which can result in infrastructure damage, death, and destruction of agricultural lands. For the Tribe, this could result in the economic burden of repairing and rebuilding damaged or lost infrastructure and the economic burden of losing agricultural products. If a landslide were to occur, the impacts would be critical. Water quality impacts are also possible after landslides because of soils, debris, and possible contaminants flowing into rivers and lakes.

Implications of Climate Change

Future climate change will not directly cause an increase in landslides. However, climate change can increase the likelihood of other hazards that can increase the potential for landslides to occur, such as drought, wildfire, and extreme precipitation.

4.2.8 Lightning

Overview

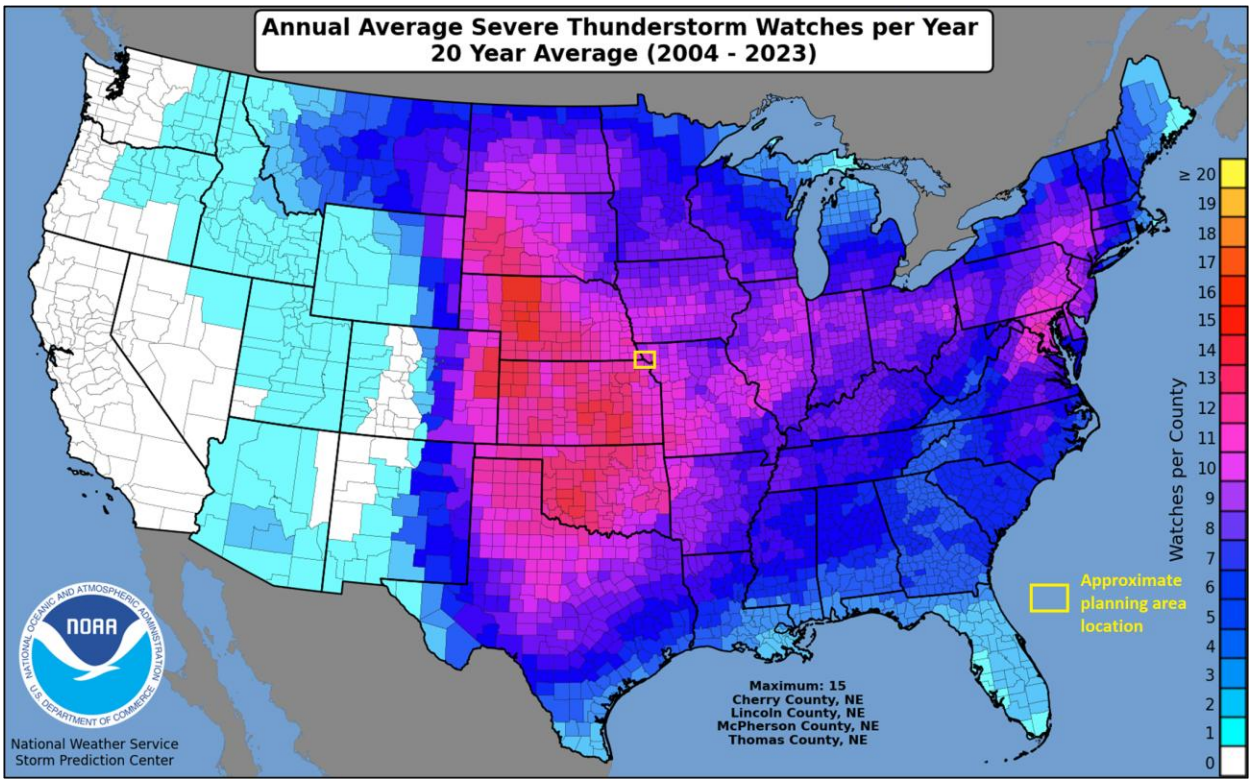
Lightning is a spark of electricity in the atmosphere when positive and negative charges build up and create a rapid discharge of electricity (NOAA 2024f). Lightning is categorized as either intracloud lightning, between opposite charges within the thunderstorm cloud, or cloud-to-ground lightning, between opposite charges in the cloud and on the ground.

Location

Lightning can occur anywhere in the continental United States where there is enough upward air motion, instability, and moisture. These conditions most often occur during warm weather months (NOAA 2024f). Within the planning area, both natural and human-made infrastructures are at risk of being directly impacted by lightning strikes. Generally larger structures, trees, bluffs, or high points around the reservation will be at greater risk from a direct lightning strike. Occurring over broad geographic regions, all areas related to the Iowa Tribe are at risk of being impacted by lightning.

Extent and Magnitude

Severe thunderstorms are the most common generator of lightning. **Figure 4-16** presents a map of the average number of severe thunderstorm watches per year. The counties that encompass the Iowa Tribe's lands experienced an annual average of 10 severe thunderstorm watches between 2004 and 2023. The extent of lightning for the Iowa Tribe is negligible.



Source: NOAA 2024a

Figure 4-16: Severe Thunderstorms in the United States

Previous Occurrences

There have been no major severe storm declarations related to the Iowa Tribe's jurisdictions. However, the consistent risk of severe storms creates conditions that put the Tribe at risk.

Future Probability

The geography of Kansas renders it particularly vulnerable to thunderstorms, allowing for cold, dry air from the north to combine with warm, moist air from the Gulf of Mexico (Frankson et al. 2022). The planning area is in the region of the United States with the highest number of watches per year. Additionally, the annualized frequency of lightning events for Brown and Doniphan Counties is 89 per year and 79.6 per year for Richardson County (Zuzak et al. 2023). As a result, the future probability of lightning strikes on the reservation will continue to be very high.

Impacts and Vulnerability

Impacts of lightning strikes vary depending on the severity of the event. Lightning can harm individuals who are caught without proper shelter and damage infrastructure, such as downing utility lines, which can result in power outages. Lightning can also lead to wildfires, which **Section 4.2.11** discusses in detail.

Implications of Climate Change

It is difficult to quantify how climate change will impact the frequency and intensity of severe thunderstorms and associated lightning events. Models predict that increased temperatures can lead to an increase in the conditions required for the formation of a severe thunderstorm, but it is harder to predict whether there will be an increase in severe thunderstorms because of climate change (Lepore et

al. 2021). Other studies have predicted that the number of lightning strikes in the United States will increase by about 12 percent for every degree of rise in global average air temperature (Romps et al. 2014).

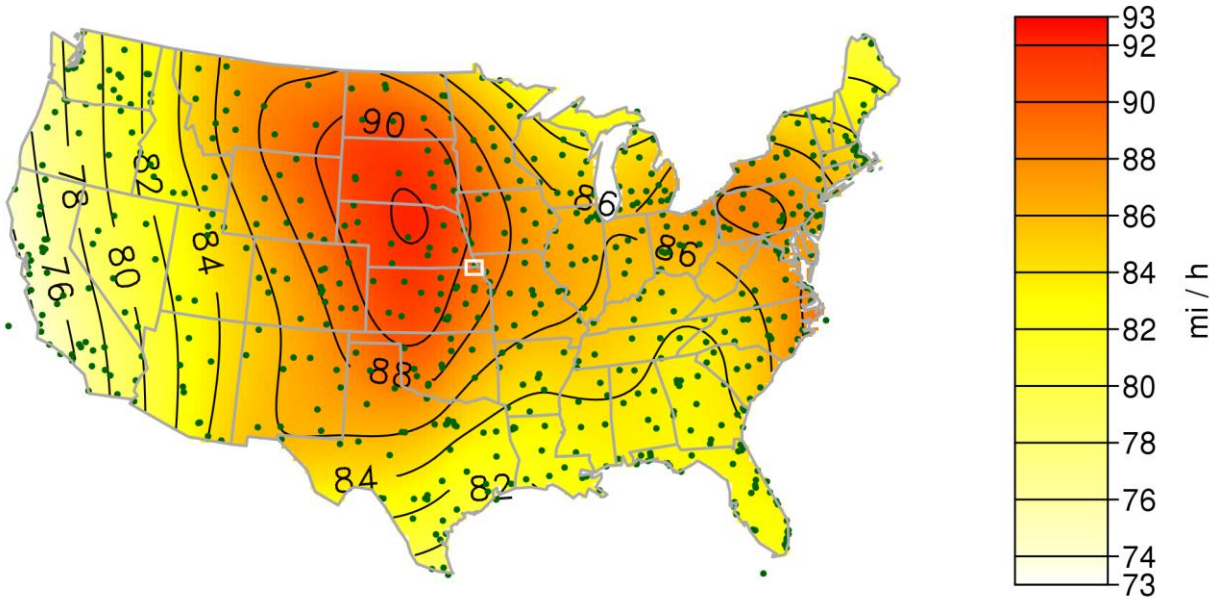
4.2.9 Strong Wind

Overview

Winds are created when high-pressure air pushes into an area with low pressure air. Straight-line winds are generally any thunderstorm wind that is not associated with rotation. These winds, which can exceed 100 miles per hour (mph), represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms. Since thunderstorms do not have narrow tracks like tornadoes, the associated wind damage can be extensive and affect entire counties or regions. Objects like trees, barns, outbuildings, high-profile vehicles, and power lines or poles can be toppled or destroyed. Roofs, windows, and homes can also be damaged as wind speeds increase (Kansas Homeland Security 2019).

Location

High winds occur over broad geographic regions. The entire reservation and much of the surrounding area is at risk of high wind events, such as tornadoes and other severe windstorms. **Figure 4-17** is of non-hurricane and non-tornadic extreme wind speeds for the contiguous United States (U.S. Department of Commerce 2016). The Iowa Tribe sits on the outskirts of peak windspeeds in the center of the country, as seen in the white box.



Source: U.S. Department of Commerce 2016

Figure 4-17: Map of Non-Hurricane and Non-Tornadic Extreme Wind Speeds

Extent and Magnitude

The Beaufort scale, shown in **Table 4-10**, measures wind speed and the correlating potential for damage.

Table 4-10: Beaufort Wind Scale

Beaufort Number	Wind Speed (mph)	Effects on Land
0	0–1	Calm; smoke rises vertically.
1	1–3	Direction of wind shown by smoke drift but not by wind vanes.
2	4–7	Wind felt on face; leaves rustle; ordinary vanes moved by wind.
3	8–12	Leaves and small twigs in constant motion; wind extends light flag.
4	13–18	Raises dust and loose paper; small branches are moved.
5	19–24	Small trees in leaf begin to sway; crested wavelets form on inland waters.
6	25–31	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty.
7	32–38	Whole trees in motion; inconvenience felt when walking against the wind.
8	39–46	Breaks twigs off trees; generally impedes progress.
9	47–54	Slight structural damage occurs (chimney pots and slates removed).
10	55–63	Seldom experienced on land; trees uprooted; considerable structural damage occurs.
11	64–72	Very rarely experienced on land; usually with widespread damage.
12	Greater than 73	Violence and destruction.

Source: NOAA n.d.-e

As discussed in **Section 4.2.8**, the counties overlapping the reservation experience an annual average of 10 severe thunderstorms watches (**Figure 4-16**). Severe thunderstorms are any storm that produces either a tornado, damaging winds at a speed of 58 mph or greater, and/or hail 1 inch in diameter or larger (NOAA n.d.-d). According to the Beaufort scale, wind speeds exceeding 58 mph would uproot trees and cause considerable structural damage. Based on the regular occurrence of thunderstorms and the associated wind speeds and the planning area's potential for extreme wind speeds, the extent of strong winds is critical.

Previous Occurrences

Since 2001, the counties intersecting the reservation have received 10 straight-line wind-related major disaster declarations (**Table 4-11**).

Table 4-11: Straight-Line Wind-Related Major Disaster Declarations for Planning Area Counties

Disaster Number	Declaration Year	Description	Counties Affected
4824	2024	Severe storms, straight-line winds, tornadoes, and flooding	Doniphan
4822	2024	Severe storms, straight-line winds, tornadoes, and flooding	Richardson
4641	2022	Severe storms, straight-line winds, and tornadoes	Richardson
4640	2022	Severe storms and straight-line winds	Brown and Doniphan
4449	2019	Severe storms, straight-line winds, tornadoes, flooding, landslides, and mudslides	Brown and Doniphan

Disaster Number	Declaration Year	Description	Counties Affected
4420	2019	Severe winter storm, straight-line winds, and flooding	Brown and Richardson
4417	2019	Severe storms, straight-line winds, and flooding	Doniphan
4230	2015	Severe storms, tornadoes, straight-line winds, and flooding	Brown and Doniphan
4225	2015	Severe storms, tornadoes, straight-line winds, and flooding	Richardson
1945	2011	Severe storms, flooding, tornado, and straight-line winds	Richardson

Source: FEMA n.d.-b

Two wind events in 2021 and 2022 had significant negative impacts on the reservation. In December 2021, historic wind events brought damaging wind gusts, smoke from grassfires in central Kansas, and record warm temperatures. Several areas on the reservation, including elder housing, were without power for several days (Iowa Tribe 2023). In the spring of 2022, winds were consistently very strong, which impacted greenhouse seedling operations (Iowa Tribe 2023). **Table 4-12** shows the amount of high wind events over 20 years for each county in the reservation. High wind events include high wind, strong wind, and thunderstorm wind.

Table 4-12: High Wind Events from January 2004 through April 2024

County	Number of Days with Events	Property Damage	Crop Damage	Highest Recorded Wind Speed
Brown	47	$50,000	$30,000	80.5 mph
Doniphan	30	$240,000	0	74.8 mph
Richardson	49	$16,000	0	80.5 mph

Source: NOAA n.d.-f

Future Probability

Because of the geographic location of the planning area and past records, it is highly likely that multiple severe thunderstorm events will occur each year, bringing strong winds to the planning area. The annualized frequency for strong wind ranges from 4.6 to 6 events per year across the three reservation counties. Therefore, the future probability of strong winds in the planning area is very high.

Impacts and Vulnerability

Since most thunderstorms produce some straight-line winds, anyone living in a thunderstorm-prone area is vulnerable. Mobile homes residents are especially at risk from injury and death (NOAA n.d.-g). The elderly are also more vulnerable to being negatively impacted by high wind events and severe thunderstorms. According to participants from the August 2024 HMP kickoff meeting, there are approximately six underground storm shelters that each seat 20 people. However, it is unlikely that these shelters meet the standards for a FEMA safe room. High wind events also have the potential to cause the most damage to property and agriculture. Since agriculture is the primary economic generator, there can also be economic loss because of high wind events.

Implications of Climate Change

As described in **Section 4.2.8**, it is difficult to predict whether climate change will result in an increase in thunderstorms. Thunderstorms that produce high winds are already common in the planning area and can be expected to continue occurring.

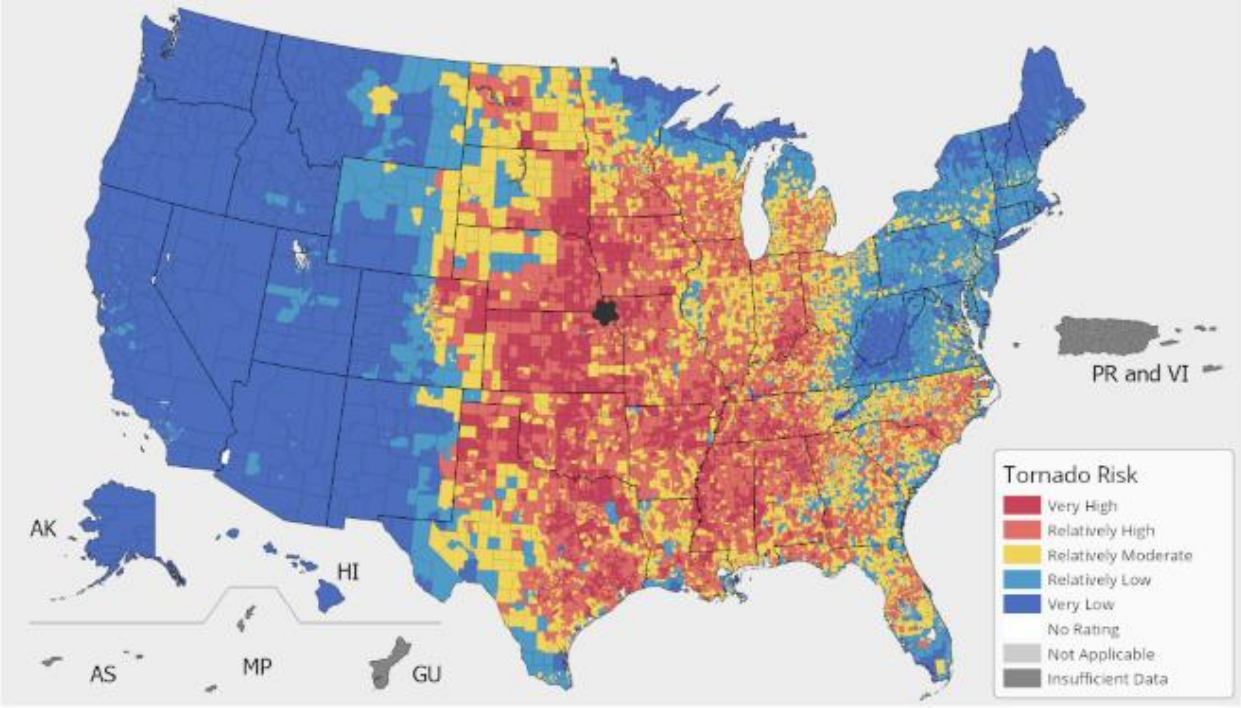
4.2.10 Tornado

Overview

Tornadoes are columns of rapidly rotating air that stretch from a thunderstorm to the ground (NOAA n.d.-a). Although they are often illustrated as elongated, dark funnels of swirling mass, tornadoes are invisible unless surrounded by sleeves of water droplets and other debris (NOAA n.d.-a). Tornadoes are one of the most extreme atmospheric storms and can strike at any location, with minimal warning (NOAA n.d.-a).

Location

As tornadoes can occur anywhere, all of the reservation is at risk. Encompassing land in northeastern Kansas and southeastern Nebraska, the Iowa Tribe falls in the "Great Plains tornado belt," a region notorious for frequent tornadoes. In this area, cold, dry air from the north and warm, moist air from the south converge to create the unstable atmospheric conditions that can lead to tornadoes (University Corporation for Atmospheric Research n.d.). **Figure 4-18** shows relative tornado risk in the planning area.



Source: FEMA n.d.-a

Figure 4-18: U.S. Map of Tornado Risk with Planning Area Indicated by Black Star

Extent and Magnitude

Since 2007, the Enhanced Fujita Scale (EF Scale) has been used to relate estimated tornado wind speeds to their associated damage (NOAA n.d.-b). The EF Scale builds upon the historic Fujita Scale, which had assigned Fujita Scale numbers to tornadoes based on observed post event damage (NOAA n.d.-c). Although the original Fujita Scale included a range of approximate wind speeds for each scale number, the EF Scale was revised to understand the anticipated storm damage to structures based on observed

3-second gusts (NOAA n.d.-b). The EF Scale classes in **Table 4-13** are assigned according to damage observed across 28 damage indicators, including one- or two-family residences, strip malls, schools, transmission lines, and trees (NOAA n.d.-b).

Table 4-13: Enhanced Fujita Scale

Rating	Wind Speed (mph)	Damage Description
EF-0	65–85	Minor: Tree branches broken, shallow-rooted trees uprooted, some chimneys damaged.
EF-1	86–110	Moderate: Mobile homes tipped over, windows broken, roof tiles possibly blown off, some tree trunks snapped.
EF-2	111–135	Considerable: Mobile homes destroyed, roofs damaged, debris flying in air, large trees snapped/uprooted.
EF-3	136–165	Severe: Roofs and walls ripped off buildings, small buildings destroyed, most trees uprooted.
EF-4	166–200	Devastating: Well-built homes destroyed, buildings lifted off foundations, cars blown away, large debris flying in air.
EF-5	Greater than 200	Incredible: Well-built homes lifted from foundations, reinforced concrete buildings damaged, bark stripped from trees, car-sized debris flying in air.

Source: National Geographic Society 2023a

Tornadoes are characterized by the pattern of associated damage, rather than the amount of the damage (International Code Council 2020). Thus, a tornado cannot be confirmed or rated until after surveying has occurred.

In addition to the most devastating events that prompt presidential disaster declarations, lesser tornadoes can inflict damage to life, health, property, and crops. NOAA's NCEI (2024b) maintains a database of storm events. **Table 4-14** summarizes tornado events and their associated damage. The extent of a tornado for the planning area is catastrophic.

Table 4-14: NCEI Tornado Events and Associated Damage by County, 1950–2024

County	Number of Days with Tornado	Deaths	Injuries	Property Damage	Crop Damage
Brown	31	0	5	$5,480,000	$100,000
Doniphan	19	0	2	$26,080,000	$0
Richardson	16	0	0	$593,000	$0

Source: NOAA 2024b

Previous Occurrences

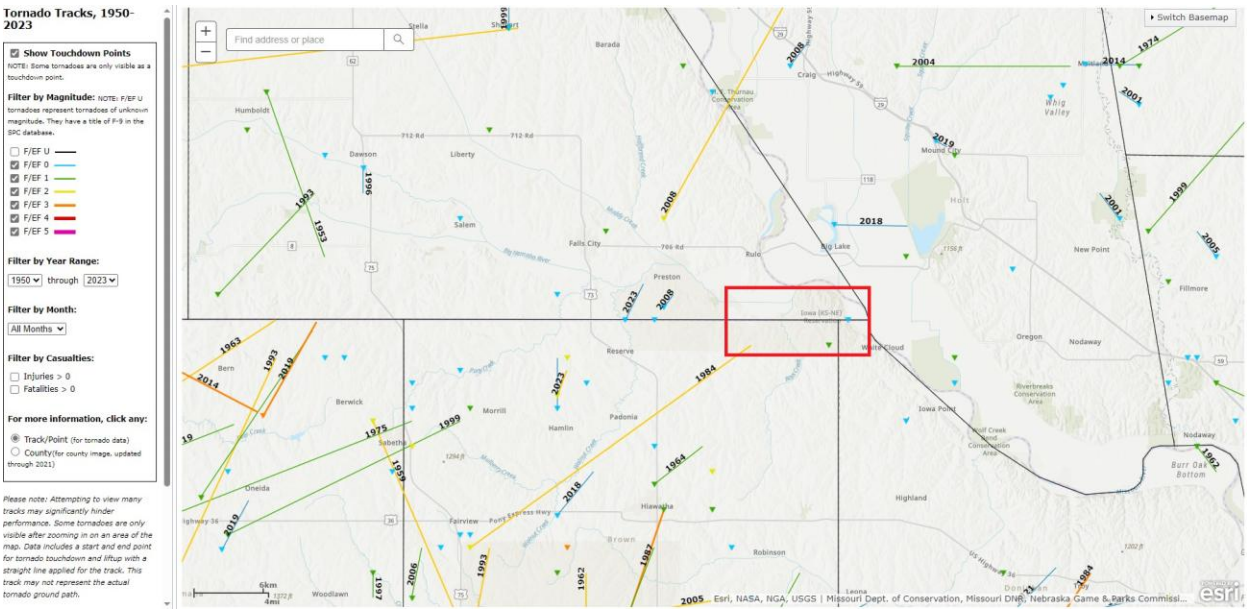
Although no tornado disaster declarations have been made specifically for the Iowa Tribe's reservation, since 2000, there have been 14 tornado-related major disaster declarations in the counties overlapping the reservation (**Table 4-15**).

Table 4-15: Tornado-Related Disaster Declarations

Disaster Number	Declaration Year	Description	Counties Affected
4824	2024	Severe storms, straight-line winds, tornadoes, and flooding	Doniphan
4822	2024	Severe storms, straight-line winds, tornadoes, and flooding	Richardson
4641	2022	Severe storms, straight-line winds, and tornadoes	Richardson
4449	2019	Severe storms, straight-line winds, tornadoes, flooding, landslides, and mudslides	Brown and Doniphan
4230	2015	Severe storms, tornadoes, straight-line winds, and flooding	Brown and Doniphan
4225	2015	Severe storms, tornadoes, straight-line winds, and flooding	Richardson
1945	2011	Severe storms, flooding, tornado, and straight-line winds	Richardson
1932	2010	Severe storms, flooding, and tornadoes	Brown and Doniphan
1853	2009	Severe storms, flooding, and tornadoes	Richardson
1776	2008	Severe storms, flooding, and tornadoes	Brown
1770	2008	Severe storms, tornadoes, and flooding	Brown and Richardson
1706	2007	Severe storms, flooding, and tornadoes	Brown and Richardson
1699	2007	Severe storms, tornadoes, and flooding	Brown and Doniphan
1373	2001	Severe winter storms, flooding, and tornadoes	Brown

Source: FEMA n.d.-b

In the Preliminary Damage Assessment report for DR-4641, the 2022 tornado-related major disaster declaration, utility damage was cited as the primary impact (FEMA 2022a). Of the 25 counties included in the declaration, Richardson County was estimated to have the second largest per capita disaster impact at $53.40 (FEMA 2022a). Beyond tornadoes that have caused damage to Brown, Doniphan, and Richardson Counties, the overall frequency of tornadoes is also notable to contextualize historic tornadoes that could have caused damage or caused damage elsewhere on their paths. Although there are no recorded tornadoes on the reservation, there have been dozens of such tornadoes recorded within a radius of about 15 miles from the reservation since 1950 (Midwestern Regional Climate Center 2023). In the 73 years before 2023, there were 29 tornado events, including touchdown points and tracks. Although there were more observed tornadoes across the entirety of the three counties that overlap with the reservation, a 15-mile radius was taken as an indicator of tornado occurrences that may have inflicted damage on the Tribe. **Figure 4-19** depicts tornado events between 1950 and 2023 near the planning area, indicated by a red box. Early tornado warning alerts monitor within a 30-mile radius (earlyAlert n.d.), suggesting that a 15-mile radius comprises tornado events that could both be detected and cause damage.



Source: Midwestern Regional Climate Center 2023
Figure 4-19: Map of Tornado Tracks 1950–2023

Future Probability

The annualized frequency of tornadoes across the reservation counties ranges from 0.3 to 0.4 events per year (Zuzak et al. 2023). Based on this determination and the lack of previous occurrences in the planning area, the future probability of tornadoes in the planning area is moderate.

Impacts and Vulnerability

For consistency with the Tribe's previous HMP, high or increasing population and high structural valuation are considered the main indicators of greater potential vulnerability to hazards. Relative to the Tribe's previous HMP adoption in 2017 (Kansas Homeland Security 2019), the Tribe's population has increased from 191 in 2017 to 794 in 2022, or 316 percent in the last 5 years. The Iowa Tribe also has an estimated structural valuation of $7,712,800 (Kansas Homeland Security 2019).

Damage to residences, natural resources including farmland, and community infrastructure would dramatically increase a tornado's fiscal impact. Impacts on the Tribe's casino are of particular concern as the casino is a major keystone of the Iowa Tribe's economy. The potential associated emotional/psychological and environmental impacts are immeasurable. Even tornadoes for which no material damage was recorded can affect communities by interrupting daily operations, increasing strain on emergency preparedness resources (shelters, essential stores), and causing fatigue from hypervigilance.

Ioway people have always lived in close relationship to seasons. Seasonal transitions have historically guided not only the Tribe's farming operations but also the governance structure of the Tribe itself (Iowa Tribe 2023). The Iowa Tribe's fundamental integration with seasonal patterns exacerbates the potential impacts of tornadoes, whose formation is heavily impacted by the season. In particular, the most critical crop-growing seasons of spring and summer are also the times of the year when tornadoes are most common (NOAA n.d.-a).

Implications of Climate Change

With rising global temperatures, maximum atmospheric moisture content also increases to intensify the unstable atmospheric conditions that create tornadoes. Global warming is also anticipated to decrease atmospheric turbulence by decreasing wind shear. Unprecedented levels of climate change also limit the scientific community's ability to predict future atmospheric and weather patterns. Therefore, the overall or net impact on the rates of tornado events because of global warming is unclear (National Geographic Society 2023b).

4.2.11 Wildfire

Overview

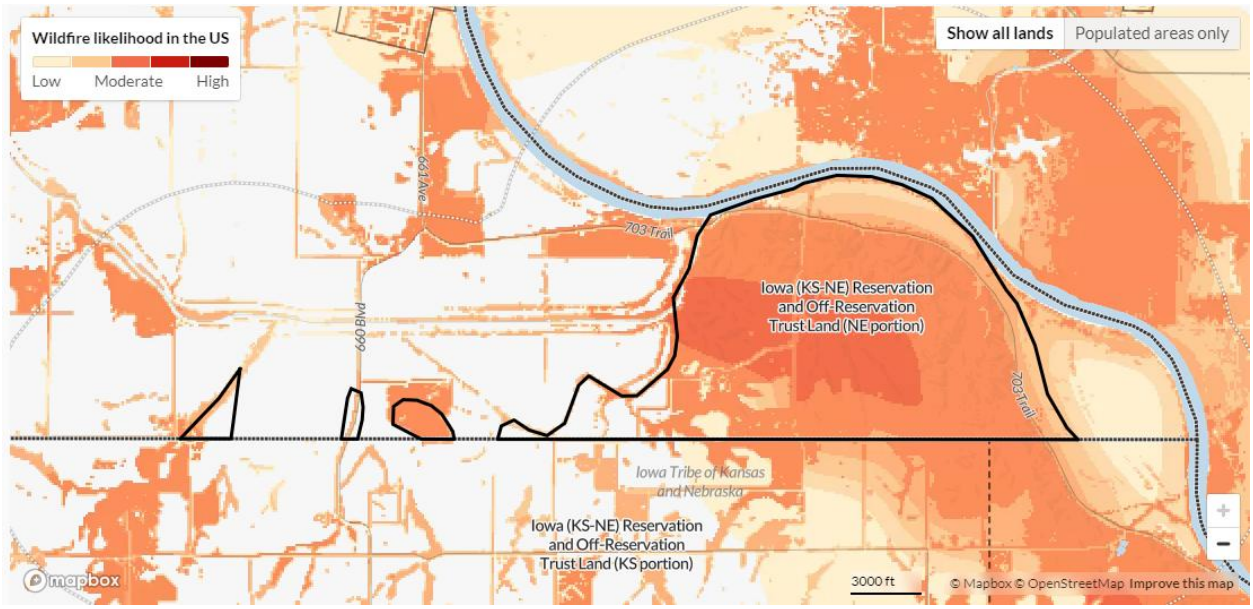
Wildfires are typically fires triggered by fuel sources such as lightning or human-related acts, involving full-sized trees and meadows and scrublands. Fire conditions typically arise from some combination of hot weather, an increase in young vegetation, and low moisture content in both the air and the fuel. Population sprawl in the United States has resulted in rapid development in the outlying fringe of metropolitan areas and in rural areas with attractive recreational and aesthetic amenities, especially forests. This expansion has increased the likelihood that wildfires will threaten life and property (Kansas Homeland Security 2019).

Location

Wildfires typically originate in prairie or pasture areas because of the ignition of grasses. Current land use of the planning area is predominantly agricultural, consisting of mostly cropland or pastureland, but it also includes orchards, nurseries, and feeding operations. The eastern half of the land area is forestland. There are also areas of rangeland with scattered urban areas (towns) (Iowa Tribe 2020). Therefore, wildfires can affect most of the planning area.

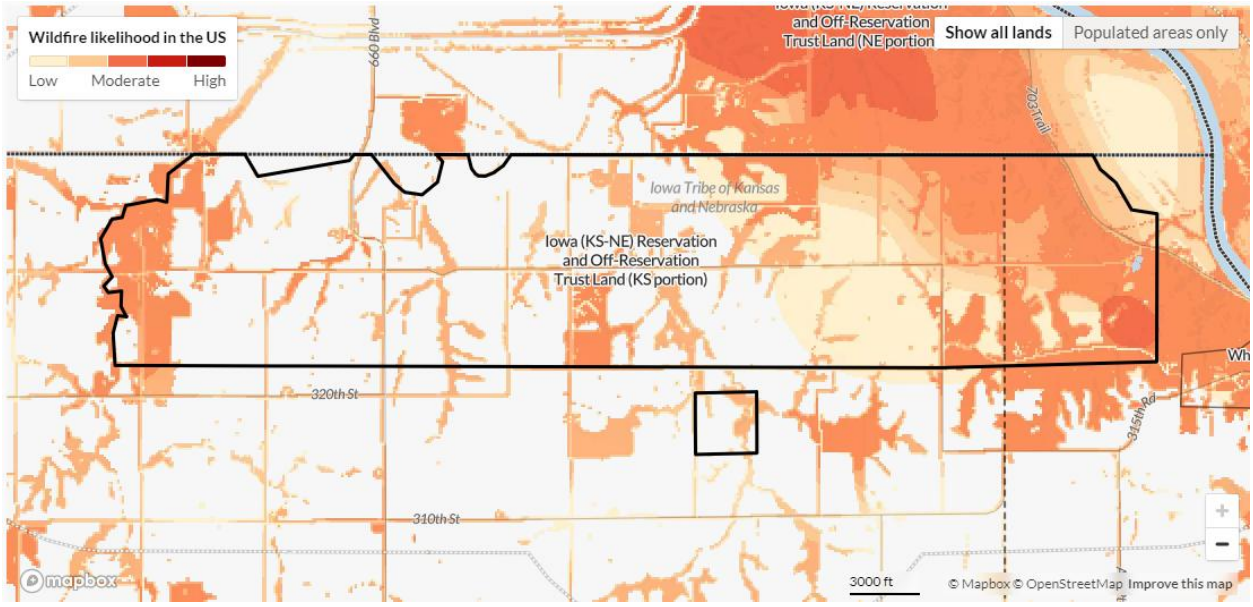
Extent and Magnitude

According to USDA Forest Service's Wildfire Risk to Communities website, both the Kansas and Nebraska regions of the reservation are at medium risk of wildfire (USDA Forest Service 2024). The wildfire likelihood for both regions is illustrated in **Figure 4-20** and **Figure 4-21**. As a result, the extent of wildfire in the planning area is considered limited.



Source: USDA Forest Service 2024

Figure 4-20: Wildfire Likelihood on the Iowa Tribe Reservation (Nebraska Portion)



Source: USDA Forest Service 2024

Figure 4-21: Wildfire Likelihood on the Iowa Tribe Reservation (Kansas Portion)

Previous Occurrences

There have been no major disaster declarations of wildfire in Brown, Doniphan, or Richardson Counties since 2000. HMP Committee members and the public also did not have any recollection of previous wildfire events.

Future Probability

Although the Iowa Tribe has not previously experienced any wildfires, an increased probability of drought will create favorable conditions for wildfires in the future. The annualized frequency for

wildfires is 0.028 percent to 0.039 percent for the reservation's counties (Zuzak et al. 2023). As a result, future probability of wildfire remains low for the planning area.

Impacts and Vulnerability

When wildfires occur, they can result in infrastructure damage to property, loss of life, and destruction of agricultural lands. This can result in the economic burden of repairing and rebuilding damaged infrastructure and the economic burden of losing agricultural products. Wildfires also impact air quality, which is of specific concern for vulnerable populations, such as elders and people with respiratory health conditions. The tribal community and tribal lands can also be impacted by wildfires located outside of the planning area. For example, in August 2021, the Tribe experienced adverse air quality impacts because of smoke from wildfires in central Canada and the western United States (Iowa Tribe 2023). Wildfires combined with storms can also result in a decrease of local water quality because of increased runoff and fire debris.

Implications of Climate Change

Increasing temperatures and reduced moisture as a result of climate change will continue to create favorable conditions for wildfires. In Kansas, the frequency and severity of wildfires are projected to increase (Frankson et al. 2022). The intensity of future droughts is also projected to increase, which will lead to an increase in the occurrence and severity of wildfires (Frankson et al. 2022).

4.2.12 Winter Storm

Overview

Winter storms are a combination of heavy snow, blowing snow, or dangerous wind chills. There are four main types of winter storms, including blizzards, ice storms, lake-effect storms, and snow squalls. Typically, blizzards create winds of 35 mph or more with snow and blowing snow reducing visibility to less than a quarter mile for an extended period (NOAA 2024c).

- *Blizzards* are a combination of blowing snow and wind resulting in very low visibilities. Often blizzards are accompanied by heavy snowfalls and severe cold temperatures. Occasionally, strong winds pick up snow that has already fallen and create a ground blizzard.
- *Ice storms* result in the accumulation of at least ¼ inch of ice on exposed surfaces. Tree branches and powerlines can easily break from bearing the weight of the ice and increase the risk of already hazardous driving and walking conditions.
- *Lake-effect storms* mainly impact the Great Lakes region when the air picks up moisture from the Great Lakes and dumps the water as snow in areas generally to the south and east of the lakes.
- *Snow Squalls* are brief intense snow showers accompanied by strong gusty winds. Like lake-effect storms, snow squalls typically happen in the Great Lakes region, and accumulation may be significant.

Beyond the four storm types, winter conditions can also create precipitation in the forms of snow, sleet, and freezing rain.

Location

Winter storms typically cover large geographic areas, and the entire planning area is susceptible to winter storms.

Extent and Magnitude

NOAA has developed a winter storm severity index that categorizes potential winter storm impacts that can be used in conjunction with alerts, watches, and warnings issued by NWS to determine the potential severity of a winter storm (NOAA 2024g):

- Winter weather area: winter driving conditions.
- Minor impacts: expect a few inconveniences to daily life. Winter driving conditions. Use caution while driving.
- Moderate impacts: expect disruptions to daily life. Hazardous driving conditions. Use extra caution while driving. Closures and disruptions to infrastructure may occur.
- Major impacts: expect considerable disruptions to daily life. Dangerous or impossible driving conditions. Avoid travel if possible. Widespread closures and disruptions to infrastructure may occur.
- Extreme impacts: expect substantial disruptions to daily life. Extremely dangerous or impossible driving conditions. Travel is not advised. Extensive and widespread closures and disruptions may occur. Life-saving actions may be needed.

The extent of winter storms in the planning area could be critical depending on the duration of the event and associated precipitation, winds, and damage.

Previous Occurrences

As shown in **Table 4-16**, since 2000, the counties intersecting the reservation have received nine major disaster declarations related to winter storms.

Table 4-16: Winter Storm-Related Major Disaster Declarations for Planning Area Counties

Disaster Number	Declaration Year	Description	Counties Affected
4420	2019	Severe winter storm, straight-line winds, and flooding	Brown and Richardson
1885	2010	Severe winter storms and snowstorms	Brown and Doniphan
1878	2010	Severe winter storms and snowstorm	Brown and Richardson
1864	2010	Severe winter storm	Richardson
1741	2008	Severe winter storms	Brown and Doniphan
1739	2008	Severe winter storm	Richardson
1674	2007	Severe winter storms	Brown
1579	2005	Severe winter storms, heavy rains, and flooding	Brown
1373	2001	Severe winter storms, flooding, and tornadoes	Brown

Source: FEMA n.d.-b

Future Probability

The reservation can expect to continue to experience various winter weather conditions. The annualized frequency of winter storms ranges from 2.4 to 2.8 events per year (Zuzak et al. 2023). Based on this rating and the previous occurrences, the future probability of winter storms in the planning area is high.

Impacts and Vulnerability

Most commonly, throughout the region winter storms include light to heavy snow or freezing rain. A major storm can last for several days and be accompanied by high winds, freezing rain, sleet, heavy snowfall, and cold temperatures. Winter storm conditions have also previously created heavy accumulations of ice because of freezing rain. These conditions can cause damage to trees and utility lines, such as power and communication services, resulting in an increased risk to community members. Winter storms often also result in the related hazard of extremely cold temperatures, which poses a risk to individuals who lose power and cannot keep their houses warm.

Implications of Climate Change

Winter precipitation is projected to increase in Kansas because of climate change. However, warmer temperatures may lead to more precipitation falling as rain rather than snow (Frankson et al. 2022). It is difficult to further predict how climate change will impact winter storms.

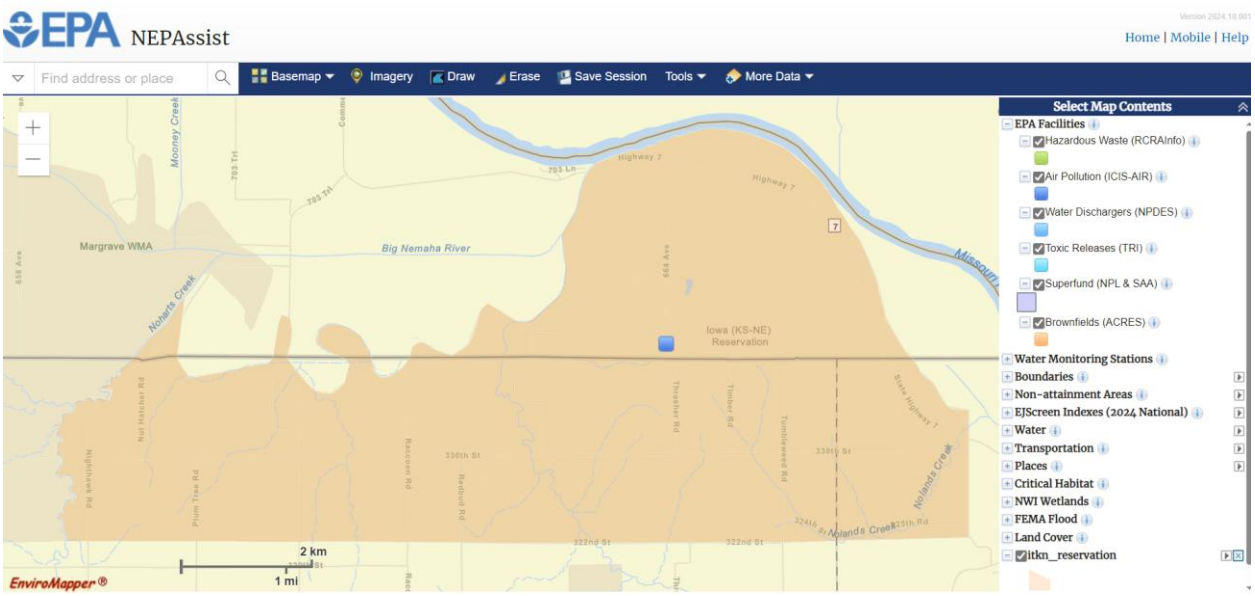
4.2.13 Hazardous Materials

Overview

Materials are designated as hazardous if their release presents a potential risk to life, health, or property (FEMA n.d.-c). Materials can be deemed hazardous based on chemical, physical, or biological properties. Typically, hazardous materials are categorized relative to both the amount of a given substance deemed hazardous and the level of risk posed by potential exposure. Examples of hazardous materials include explosive, flammable/combustible, corrosive, poisonous, and radioactive or radiological substances.

Location

Hazardous materials can be generally categorized into fixed incidents and transportation incidents. The EPA NEPAssist tool documents the location of hazardous waste facilities, water dischargers, toxin releases, Superfund sites, brownfields, and Toxic Substance Control Act sites. According to this database, one air pollution facility is located within the planning area (**Figure 4-22**). This site is a Bureau of Indian Affairs burn site that results in minor air emissions and has no compliance issues in the past 3 years (EPA 2024).



Source: EPA 2024

Figure 4-22: Facilities or Sites Subject to Environmental Regulation in the Planning Area

Much of the reservation is farmland that has been subjected to decades of chemical-intensive agricultural practices, presenting another risk of hazardous materials exposure.

There are 23 miles of roadway throughout the reservation that present a risk through the transportation of hazardous materials.

Extent and Magnitude

The severity of hazardous material exposure depends on the material and how widely the contamination is spread. Impacts can range from localized spills to contaminants that pollute an entire water system. The extent of hazardous material risk to the Tribe could be critical depending on the incident.

Previous Occurrences

Iowa Tribe farmers have previously identified insecticides at harmful concentrations in the reservation's alfalfa fields (Pry 2024). Following sudden pollinator death, the Tribe recognized their soil was oversaturated with substances from the neonicotinoid chemical class, which prompted the Tribe to invest in regenerative agricultural practices. In 2024, the Iowa Tribe experienced a water quality issue because of nitrates from fertilizer infiltrating the water supply.

Future Probability

Incidents of hazardous material exposure are not predictable. However, previous occurrences and prevalence of hazardous materials facilities or sites in the planning area can be used as an indicator. Based on those factors, the future probability that hazardous materials will pose a risk to the planning area is very low.

Impacts and Vulnerability

Hazardous materials can cause long-term damage to physical health for individuals and, as already described, adverse effects to wildlife, water, and crops. Pollinator death and the associated crop loss would have resulted in economic loss and limited food available for consumption and sale. Water quality issues raise concerns about the reliability and safety of the water supply and can result in incurred costs for residents who have to purchase bottled water and incurred costs for the community if the Tribe needs to drill a new well for drinking water.

Implications of Climate Change

Climate change is not anticipated to affect the frequency, probability, or magnitude of hazardous material threats.

4.2.14 Major Disease

Overview

Major disease is the collection of infectious human diseases caused by viruses, bacteria, parasites, and other microscopic agents or their toxins (Kansas Homeland Security 2019).

Location

The entire tribal reservation is susceptible to a transmissible disease outbreak.

Extent and Magnitude

The spread of major disease may occur through direct contact with an infected person or animal, ingestion of contaminated food or water, vectors including ticks or mosquitos, or contact with contaminated surroundings including animal droppings, infected droplets, or aerosolization. The extent of transmissible disease outbreaks are typically quantified through proxy indicators including the numbers of infections, related hospitalizations, and preventable deaths. The extent of major disease for the planning area is critical.

Previous Occurrences

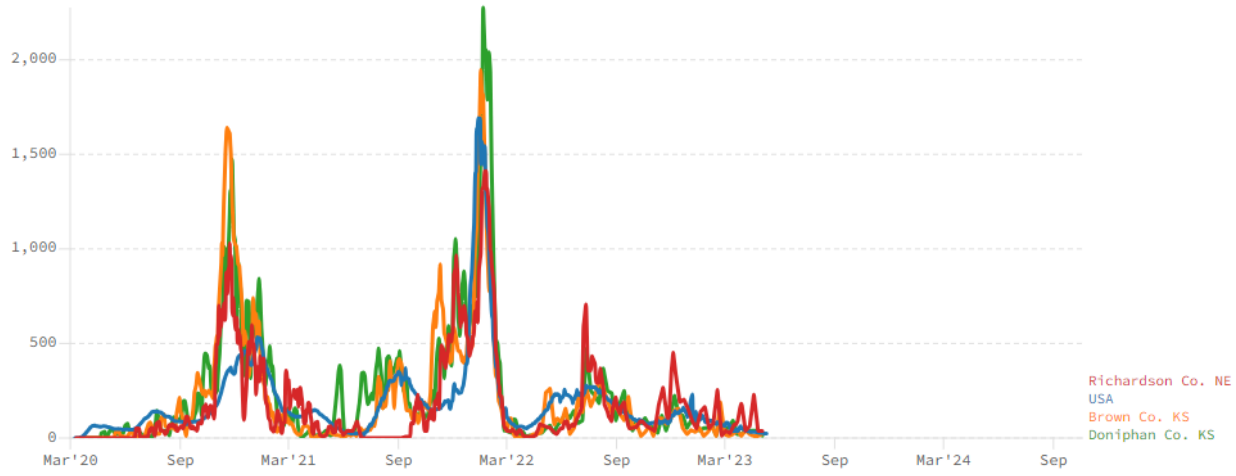
The most recent data from the Kansas Department of Health and the Environment, as of July 2019, included reports of the following contagious and/or human-transmissible diseases (Kansas Homeland Security 2019):

- Haemophilus influenzae invasive disease
- Measles (rubeola)
- Meningococcal Infections
- Mumps
- Pertussis
- Streptococcus pneumoniae, invasive
- West Nile virus
- Zika virus

Additionally, a disaster declaration (EM-3491) for COVID-19 was made on March 13, 2020, for the Iowa Tribe. The incident period began on January 20, 2020, and concluded on May 11, 2023, with continued funeral assistance until September 30, 2025 (FEMA 2020). In describing the severity of the coronavirus outbreak for the Tribe, the Executive Committee "believes that all tribal members have been financially or otherwise impacted by the COVID-19 pandemic" (Iowa Tribe n.d.).

Future Probability

Although the spread of infectious diseases varies heavily by disease type and is difficult to predict, historic trends in weekly reported COVID-19 cases may be considered a proxy for the relative airborne transmissibility of infections. Compared to the rest of the country, Brown and Doniphan Counties generally appeared to observe more reported infections during major peaks when cases spiked (Covid ActNow 2024). During the increased wave of new cases between September 2020 and March 2021, the rates of change of reported cases for Brown, Doniphan, and Richardson Counties were higher than the national average (Covid ActNow 2024). These relatively steep rates of change among reported cases, coupled with the relatively high magnitude of new cases per 100,000 people, suggest airborne outbreaks in the counties around the planning area spread faster and to more people. **Figure 4-23** shows historical trends in counties overlapping the reservation relative to the national trend. The future probability of a major disease outbreak for the planning area is low, based on previous occurrences and the low population density in the planning area.



Source: Covid ActNow 2024

Figure 4-23: Historical Trend of Weekly Reported Covid-19 Cases per 100,000 in Counties Overlapping the Iowa Tribe Reservation Compared to Nationwide

Impacts and Vulnerability

The effects of COVID-19 were substantial and not limited to infections and fatalities associated with the disease. The Iowa Tribe suspended all community activities and closed several assets and critical facilities for 2 weeks in March 2020, including Casino White Cloud, Administration Building, Grandview Oil, and the White Cloud Health Clinic. Residents were unable to purchase food at grocery stores off the reservation when travel and shopping was restricted. Vaccinations and boosters helped to mitigate the impact of COVID-19 on planning area residents by increasing immunity throughout the community. The

Iowa Tribe converted an old building into an isolation center for infected individuals; this structure is preserved for any future outbreaks.

Implications of Climate Change

Although there is limited evidence that climate change directly affects COVID-19 transmission or the transmission of other major diseases, several studies have been conducted on the interactions between climate change and COVID-19 (Ford et al. 2022). These studies explored various topics including the relationship between extreme events and physical distancing, impacts of air quality on COVID-19-related deaths, and the difficulty of differentiating between COVID-19 and other climate-sensitive diseases (Ford et al. 2022). It is likely that climate change and the associated extreme events will continue to complicate the response to major disease outbreaks.

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5.0 Risk Assessment

5.1 Asset Inventory

Table 5-1 lists assets and critical facilities for the Iowa Tribe. Agricultural assets not listed include greenhouses, orchard, chicken coops, and cattle and cattle pastures. Food sovereignty is a priority for the Iowa Tribe and current efforts include working to increase access to traditional and cultural foods to ensure a healthy tribal population, healthy lands, and healthy economy (Iowa Tribe 2023). The Tribe's farm enterprises contribute produce to United Tribes of Kansas and Southeast Nebraska, an organization that operates a food distribution program on the reservation.

Table 5-1: Iowa Tribe Assets and Critical Facilities

Asset Name	Address	Replacement or Estimated Value[1]
White Cloud Health Center	3349 Thrasher Road, White Cloud, KS 66094	$1,719,584
Administrative Building	3345 Thrasher Road, White Cloud, KS 66094	$957,395
Fire Station	3309 C Thrasher Road, White Cloud, KS 66094	$252,225
Police Station	3301 Thrasher Road, White Cloud KS 66094	$441,646
Gas Station	2334 330th Thrasher Road, White Cloud, KS 66094	$534,717
Casino White Cloud	777 Jackpot Road, White Cloud, KS 66094	$4,800,000
Water Tower	3374 Thrasher Road, White Cloud, KS 66094	$800,000
Boys and Girls Club	2169 Iowa Drive, White Cloud, KS 66094	$2,161,799
Hemp Processing Facility	3307 Thrasher Road, White Cloud, KS 66094	$756,009
Honey Processing Buildings	70340 664 Avenue, White Cloud, KS 66094	$398,450
Farm Buildings	2340 330th Road, White Cloud, KS 66094	$3,024,303
Wind Turbines (two 40 kilowatt)	3345 Thrasher Road, White Cloud, KS 66094	$117,920
Iowa Community Building/Tribal Historic Preservation Office	2340 330th Road, White Cloud, KS 66094	$305,132

Note:
[1] Replacement or estimated values were determined using information from the 2019 Kansas Region K HMP or the Hazus Inventory Technical Manual (FEMA 2022b). Building square footage was obtained from FEMA's USA Structures data set (FEMA 2024a).

The Iowa Tribe has many sites of cultural importance including Tesson Cemetery, Partlow Cemetery, Franklin Cemetery, Campbell Cemetery, Leary Site, Pow Wow Grounds, Mouth of the Nemaha, and Chief James White Cloud House. In general, bluffs and springs around the reservation are considered sacred. The Iowa and Sac and Fox Mission is also a historic site, although it is located outside the planning area.

5.2 Existing Infrastructure and Future Development

The major roads crossing the reservation are maintained with blacktop surface by the Road Maintenance Department. The Iowa Tribe water utility provides potable water to some households. However, the lack of centralized water continues to be a limiting factor for growth and development. The water utility is continuing to explore federal funding opportunities to finance expansion of the service area to cover the entire reservation (Iowa Tribe 2020). Landline telephone service and electric service are available from third-party service providers throughout the reservation. Broadband internet

is available to most of the reservation through a recently completed fiber project. The Tribe is in the process of increasing their broadband and communication capabilities across the reservation.

Very few changes in development have occurred on the reservation since the adoption of the 2019 Kansas Region K HMP. The Tribe installed a livestock watering system so they would not be on the potable water system. An emergency hookup is expected to be completed by spring 2025 to pipe water from Hiawatha. The Iowa Tribe is working on several proposed improvements including expanding broadband and communications capabilities on the reservation, expanding the service area of the water utility to serve more customers on the reservation, and the development of solar energy capabilities to boost energy resilience. There has also been some discussion of relocating wells to areas that have not been farmed recently and are lower in nitrates.

5.3 Vulnerability Summary

A more detailed description of the hazards can be found in the hazard profiles located above. **Table 5-2** summarizes impacts and vulnerabilities for each hazard profiled.

Table 5-2: Hazard Impacts and Vulnerabilities

Hazard	Impacts	Vulnerabilities
DAM/LEVEE FAILURE	▪ Failure of dams upstream of the planning area or within the planning area could cause flooding, damaging agricultural lands or structures near the dams/levees.	▪ Loss of income associated with crops and produce damaged by floods.
EARTHQUAKE	▪ A severe earthquake could cause damage to infrastructure, such as roads. ▪ A severe earthquake could also damage critical facilities, such as the clinic.	▪ Residents would be unable to access emergency services. ▪ Emergency responders would be unable to provide services to neighboring jurisdictions. ▪ The clinic could be damaged and unable to provide services in the event of any other natural hazard.
EROSION	▪ Erosion can damage crops and diminish soil health. ▪ Water erosion could wash out roads, spillways, and embankments.	▪ Extensive erosion leading to crop loss and diminished soil health would be a major economic setback for the Iowa Tribe, limiting the Tribe's ability to provide programs and services. ▪ Erosion that results in loss of crops would reduce produce available for the United Tribes Food Distribution Program to low-income households.
EXTREME COLD	▪ Extremely cold temperatures can adversely affect bee colonies at the Ioway Bee Farm. ▪ Extreme cold temperatures can damage power and water systems, which could result in loss of life, especially for vulnerable populations.	▪ The loss of bee colonies at Ioway Bee Farm would reduce the production of honey products and associated income. Fewer bees would be available to pollinate plants in the greenhouses.

Hazard	Impacts	Vulnerabilities
EXTREME HEAT	▪ Extreme heat can cause deaths and illnesses. Many vulnerable people (such as elders and infants) reside on the reservation and need to have ways to escape the heat when temperatures are extremely high or remain high over an extended period. Also, lower-income residents may not have air conditioning, leaving them vulnerable to heat. ▪ Crops are vulnerable to heat waves and average temperature increases. An increase in temperature may prolong the growing season. However, extreme heat could harm Ioway Farm production, resulting in economic losses for the Tribe. ▪ Energy grid outages as a result of high heat increases energy needs	▪ Much of the cattle herd owned by the Tribe are black angus, a breed more vulnerable to injury and fatality from extreme heat because of their dark coloring. ▪ Energy outages affect the Casino's revenues as machines will automatically stop working at any sign of energy variance
FLOODING	▪ Flooding can deposit debris on roads throughout the reservation or submerge them, rendering them impassable.	▪ The Iowa Tribe has limited staff and budget to clear debris from roads after floods. Floods would strain personnel and financial resources. ▪ Impassable roads limit the ability of businesses to maintain regular operations and impede access to important buildings and enterprises.
LANDSLIDE	▪ Landslides can result in loss of life and infrastructure damage. ▪ Landslides can damage sites of cultural importance. These may be difficult, impossible, or costly to repair or replace.	▪ The Tribe has a small budget and staff for road maintenance that would be stretched if a landslide damaged a road on the reservation.
LIGHTNING	▪ The risk of lightning strikes on the ground and open fields where tree lines are close by could lead to wildfires, threatening structures and residents and adversely impacting air quality.	▪ Wildfires caused by lightning strikes can damage crops, farmland, and residential structures. Residential structures are especially at risk because current building practices do not include fire-resistant materials.
STRONG WIND	▪ High winds can damage electrical infrastructure, leading to loss of power. ▪ High winds can also cause damage to assets like the greenhouses and bee hives.	▪ Loss of power would be especially dangerous for populations that rely on electricity to power at-home medical equipment.
TORNADO	▪ Minor tornado impacts include broken tree branches, uprooting of shallow-rooted trees, and damaged chimneys. These may result in minor financial losses for the Tribe/individuals. ▪ Larger tornadoes can damage homes and buildings or lift them off the foundation, blowing cars away and creating large airborne debris. Vulnerable populations living in mobile homes or inadequate structures may be at risk of injury or death. If the Tribe were directly hit, economic losses would be significant.	▪ Existing tornado shelters are not necessarily built to current FEMA requirements or of large enough capacity.

Hazard	Impacts	Vulnerabilities
WILDFIRE	▪ Wildfires can damage residential structures, critical infrastructure, and cropland. ▪ Wildfires can result in smoke and adverse impacts to air quality.	▪ Wildfires can damage crops, farmland, and residential structures. Residential structures are especially at risk because current building practices do not include fire-resistant materials. ▪ Smoke from wildfires adversely impacts air quality, and vulnerable populations such as elders or those with respiratory conditions are especially at risk.
WINTER STORM	▪ Winter storms can bring heavy snow, making roads impassable on the reservation. This could result in road closures or impassable roads, limiting mobility within and on and off the reservation. ▪ Winter storms can also damage infrastructure such as power lines.	▪ Emergency responders, such as the two Emergency Medical Services workers on the reservation, may not be able to access individuals in need. ▪ Loss of power could further expose individuals without another heat source to extremely cold temperatures.

6.0 Mitigation Strategy

6.1 Capabilities Assessment

As part of the HMP process, the HMP Committee performed a capability assessment, an inventory and analysis of existing authorities and resources available to accomplish mitigation.

6.1.1 Planning and Regulatory

Planning and regulatory capabilities are the ordinances, policies, laws, plans, and programs that the Iowa Tribe uses to guide physical development and growth on tribal lands. **Section 3.0** details existing planning processes available for integrating hazard mitigation into future updates, and integrating information from those planning processes into updates of this HMP. The Tribe has the following additional planning and regulatory capabilities:

- Standard agricultural practices such as planting cover crops to help reduce risk to hazards like erosion.
- Electrification plan to add future energy grid facilities and increase resilience to hazards such as wind storms and winter storms that could affect power supply.
- The Center of Excellence for Regenerative Native Agriculture to guide the transition of tribally owned farming enterprises to regenerative agriculture practices.

The Iowa Tribe does not have a zoning ordinance or other formal laws or regulations regulating development in hazard-prone areas on the reservation or related to hazard mitigation. The Tribe uses universal building codes to regulate development.

6.1.2 Administrative and Technical

Administrative and technical capabilities are the Iowa Tribe's staff, skills, and tools that can be used for mitigation planning and to implement specific mitigation actions. The Tribe has the following administrative and technical capabilities:

- Tornado sirens that are tested monthly.
- Grant writer on staff to develop grant applications.
- Mutual aid agreements with all fire departments in neighboring jurisdictions.

6.1.3 Financial

Financial capabilities are resources to fund mitigation actions. The Tribe has the following financial capabilities:

- Revenue from tribal enterprises including Casino White Cloud, Grey Snow Management Solutions, Ioway Farms, Grandview Oil, and Ioway Bee Farm. Grandview Oil is the main source for on-reservation sales of tribally produced foods to consumers, and Ioway Bee Farm is the largest tribal apiary in North America (Iowa Tribe 2024).

6.1.4 Outreach and Education

Outreach and education capabilities are programs and methods that could be used to encourage risk reduction behavior change and communicate hazard-related information in the community. The Tribe has the following outreach and education capabilities:

- Facebook and social media notifications are used to notify the public about road closures and the closures of other facilities, such as the gas station and casino, during hazardous events.
- Phone trees help different entities communicate with each other during hazard events.
- The Powwow is an annual gathering with the opportunity to host information sessions and distribute surveys to the community.
- General council meetings are held quarterly and open to tribal members and their families.
- Agriculture and climate internship programs with local universities.

6.2 Mitigation Goals

Goals express the kind of outcome the Tribe wants to achieve related to avoiding or lessening harm from future disasters. The goals in the 2025 HMP were drafted and reviewed by the Tribal Grants and Contracts Administrator and tribal departments listed in **Section 2.1**. They were developed to be in alignment with the goals listed for the Disaster Mitigation Plan in the 2020 Sustainable, Comprehensive Economic Development Plan/Strategy and support several of the priority areas listed in the Pathways to Climate Resilience report including emergency preparedness and public health. The following goals will be used to guide and measure progress over time to reflect changes in development and changes in priorities:

1) Reduce natural hazard-related injury and loss of life.
2) Promote a sustainable economy for the Iowa Tribe.
3) Increase public awareness and ability to respond to disasters.
4) Preserve the cultural resources and identity of the Iowa Tribe.
5) Respect and sustain the natural environment and natural resources.
6) Promote infrastructure resilience and sustainability.

6.3 Identifying Mitigation Actions

Mitigation actions have been developed to address the vulnerabilities identified in the risk assessment and to better prepare the Tribe to protect and manage impact to life and property in the event of a natural hazard. Mitigation actions are activities, measures, or projects supporting the goals of a mitigation plan and will support the Tribe in expanding and improving upon the capabilities identified in **Section 6.1**. The mitigation actions were identified by the HMP Committee through a brainstorming process during the November 2024 site visit. They were categorized into the primary types of mitigation actions, as listed in **Table 6-1**.

Table 6-1: Mitigation Action Category

Type	Description
Structure and infrastructure	Involve modifying existing structures and infrastructure or constructing new structures to reduce the impact of hazards.
Plans and regulations	Include government authorities, policies, or codes that encourage risk reduction, such as building codes and planning regulations. This may also include planning studies.
Natural systems protection	Minimize losses while also reserving or restoring the function of natural systems.
Education and awareness programs	Include long-term, sustainable programs to inform and educate tribal members and stakeholders about hazards and mitigation options. This category could also include training.

6.4 Evaluating and Prioritizing Mitigation Actions

During the November 2024 site visit, after generating a list of mitigation actions, the HMP Committee prioritized each action as high, medium, or low, based on community priorities and previous occurrences of hazards. The Tribe's priorities have not changed significantly since the adoption of the 2019 Kansas Region K HMP. The Tribe's highest priority is ensuring community members are safe and have adequate shelter and power during hazard events.

6.5 Progress on Tribal Mitigation Efforts and Priorities

Through the 2019 Kansas Region K HMP, the Iowa Tribe identified three mitigation actions. **Table 6-2** provides more detail on the three mitigation actions including a status update for 2024. The HMP Committee decided to carry all three actions forward for the 2025 plan update.

Additionally, through the Pathways to Climate Resilience planning effort, the Tribe identified several potential mitigation efforts including riparian buffer restoration and restoring native prairie and woodlands. The Iowa Tribe is currently completing the Tánji Gri Prairie Restoration Project. The project seeks to revitalize traditional Ioway land stewardship practices, replanting Indigenous plants, and promoting native habitats (Haswood 2024).

6.6 Tribal Funding Sources

Other than revenues from the tribal enterprises listed in **Section 1.2**, tribal operations are funded through many grants. The Tribe has successfully obtained grants through the Bureau of Indian Affairs, EPA, FEMA, USDA, and other sources. These same organizations provide grants and technical assistance that support sustaining the resources of the Tribe; these grants can be pursued in the future. Past and current sources of funds for mitigation planning and projects include FEMA BRIC DTA and the Bureau of Indian Affairs Tribal Climate Resilience Program.

Table 6-2: 2019 Kansas Region K HMP Mitigation Actions for the Iowa Tribe

Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed1	Estimated Cost	Potential Funding Source	Proposed Completion Time Frame	Status Update
Seek funding for the design and construction of a community safe room	Tornado, Strong Wind, All Hazards	Tribal Council	High	1, 2	$500,000	Federal Grants, Tribal Funds	3 years	Not started–staff turnover
Raise all low water crossings on reservation	Flood	Tribal Departments	High	1, 2	$400,000 each	Federal Grants, Tribal Funds	3 years	In progress–have identified low water crossings
Improve, upgrade, and enhance hazard warning systems to include sirens, internal warning systems, and NWS satellite coverage	Tornado, All Hazards	Tribal Departments	High	1, 2	$80,000	Tribal, Federal, State	3 years	In progress–some community members receive warnings via email

Note:

[1]: Goal 1: Reduce or eliminate risk to the people and property of Kansas Region K from the impacts of the identified hazards in this plan. Goal 2: Strive to protect all vulnerable populations, structures, and critical facilities in Kansas Region K from the impacts of the identified hazards.

6.7 Mitigation Action Plan

The mitigation action plan presents mitigation projects as ranked through the prioritization process. The mitigation action plan as shown in **Table 6-3** includes details for each mitigation action:

- **Project ID:** Unique identifier for each mitigation action.
- **Mitigation Goal(s):** Mitigation goal(s) aligned with the proposed mitigation action.
- **Hazard(s) Addressed:** The hazard(s) to be addressed by the mitigation action.
- **Type:** The type of mitigation action classified in **Table 6-1**.
- **Potential Funding Sources:** Funding opportunities that may be applicable for the mitigation action.
- **Priority:** Priorities are high, medium, and low, based on the evaluation criteria (see **Section 6.4**).
- **Cost Estimate:** The estimated costs are summarized in ranges and include an estimate for the full project cost from planning, design, and permitting through construction and materials:
  - *Nominal:* Likely within the Executive Committee's current budget (e.g., staff time).
  - *Low:* Less than $100,000.
  - *Medium:* $100,000 to $250,000.
  - *High:* More than $250,000.
- **Proposed Completion Time Frame:** The time frame indicates how long an action may take to implement:
  - *Ongoing:* Part or all of the action is underway.
  - *Short:* The action may be completed within a 5-year time frame.
  - *Long:* The action may take longer than 5 years to complete.
- **Responsible Agency:** The agency that would lead the implementation and maintenance of the mitigation action. The Iowa Tribe has different departments that will share the responsibility for supporting project implementation.

Table 6-3: Mitigation Action Plan

Project ID	Mitigation Action	Mitigation Goal(s)	Hazard(s) Addressed	Type	Potential Funding Sources	Priority	Cost Estimate	Proposed Completion Time Frame	Responsible Department
1	*Seek funding for the design and construction of a community safe room*	*1, 6*	*Strong Wind, Winter Storm*	*Structure and Infrastructure*	*FEMA BRIC*	*High*	*High*	*Long*	*Hazard Mitigation and Emergency Management Committee*
2	*Raise all low water crossings on reservation*	*1, 6*	*Dam/Levee Failure, Flooding*	*Structure and Infrastructure*	*FEMA BRIC*	*High*	*High*	*Long*	*Road Maintenance*
3	*Improve, upgrade, and enhance hazard warning systems to include sirens, internal warning systems, and NWS satellite coverage*	*1, 3, 6*	*Strong Wind, Tornado, Winter Storm*	*Education and Awareness Programs*	*Tribal funds*	*High*	*Low*	*Ongoing*	*Police Department, Communications Department*
4	Plan, design, and construct a reinforced shelter for tornadoes	1, 6	Tornado, Strong Wind	Structure and Infrastructure	FEMA BRIC	High	Medium	Long	Hazard Mitigation and Emergency Management Committee
5	Protect cultural resources data and information	4	Tornado, Flooding, Strong Wind, Wildfire	Structure and Infrastructure	Tribal funds, Bureau of Indian Affairs	Low	Low	Long	Chief Information Officer, Tribal Historic Preservation Officer
6	Increase resilience to storms through more robust backup power supply options and warming buildings	1, 6	Extreme Cold, Strong Wind, Winter Storm	Structure and Infrastructure	Bureau of Indian Affairs, Department of Energy, FEMA BRIC	High	High	Ongoing	Hazard Mitigation and Emergency Management Committee
7	Conduct a comprehensive watershed study to identify existing and potential areas of flooding and explore potential mitigation actions	5, 6	Flooding, Erosion	Plans and Regulations	USDA NRCS	Medium	Low	Short	Land and Water and Climate Resilience

Project ID	Mitigation Action	Mitigation Goal(s)	Hazard(s) Addressed	Type	Potential Funding Sources	Priority	Cost Estimate	Proposed Completion Time Frame	Responsible Department
8	Explore developing tribal building codes	1, 6	Earthquake	Plans and Regulations	FEMA BRIC	Low	Nominal	Short	Hazard Mitigation and Emergency Management Committee
9	Identify and implement nature-based solutions to reduce flooding such as creation of wetlands and restoration of riparian buffers	1, 4, 5, 6	Flooding	Natural Systems Protection	FEMA BRIC, USDA NRCS	Medium	Medium to High	Ongoing	Land and Water and Climate Resilience
10	Increase community awareness about what to do during hazards and how to mitigate against various hazard events (e.g., fire-resistant building materials brochure)	1, 3	All Hazards	Education and Awareness Programs	FEMA BRIC	Medium	Nominal	Short	Communications Department, Adult Education Program
11	Create and designate members for a Hazard Mitigation and Emergency Management Committee	All	All Hazards	Plans and Regulations	Tribal funds	High	Nominal	Ongoing	Executive Committee

Note: *Italicized* actions were carried forward from the 2019 Kansas Region K HMP.

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7.0 Plan Maintenance

According to 44 Code of Federal Regulations (CFR) § 201.7(c)(4)(i), the plan maintenance process must include the following:

- A section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan.
- A system for monitoring implementation of mitigation measures and project closeouts.
- A process by which the tribal government incorporates the requirements of the mitigation plan into other planning mechanisms such as reservation master plans or capital improvement plans, when appropriate.
- Discussion on how the tribal government will continue public participation in the plan maintenance process.
- A system for reviewing progress on achieving goals and activities and projects identified in the mitigation strategy.

Previously, the Iowa Tribe adopted the 2019 Kansas Region K HMP and participated in the plan maintenance and update process established in that plan. Moving forward, the Tribe will implement the plan maintenance process described in this section.

7.1 Monitoring, Evaluating, and Updating the Plan

Monitoring, evaluating, and updating of the plan will be led by the Tribal Administrator and will occur at least once on the anniversary of the HMP's adoption, and the plan will be reevaluated following any natural disaster or major change in leadership or priorities. Members of the HMP Committee or Executive Committee and tribal departments will meet at least once annually to: (1) confirm that all hazards are still relevant, (2) review if any new data has been released or if any new priorities should change the plan, (3) ensure goals are accurate and relevant, and (4) discuss any progress on the mitigation strategy and projects.

The Executive Committee will be responsible for updating the plan on a 5-year cycle from the date of initial plan adoption. Plan updates will build on this HMP and will include, at a minimum, the following elements:

- The Executive Committee will select a new HMP Committee.
- The hazard profiles will be reviewed and updated to include the best available data. If necessary, hazards can be added or removed at the discretion of the HMP Committee.
- The mitigation action plan will be reviewed, and a status update will be provided for each mitigation action.
- The draft update will be made available for public comment before adoption.
- The Executive Committee will adopt the updated plan.

7.2 Monitoring Progress of Mitigation Activities and Closeout Procedures

Mitigation action implementation and project closeouts will be overseen by the corresponding responsible departments identified in **Table 6-3**. Appendix C includes a series of worksheets that can be used as a template to track progress on implementations, such as accomplishments, obstacles, and whether the action needs to be modified.

7.3 Incorporation into Other Planning Mechanisms

The process of developing the 2025 HMP provided an opportunity for the Iowa Tribe to explore how hazard mitigation is currently incorporated into planning mechanisms and to consider how hazard mitigation might be incorporated in the future. As described in **Section 3.1**, the Tribe already integrates hazard mitigation principles and requirements into existing planning processes. The hazards profiled in this plan, along with the risk assessment and mitigation strategy, will be used to inform any planning mechanisms developed within the next 5 years as appropriate, such as a climate adaptation plan. Several mitigation actions focus on enhancing the Tribe's planning and regulatory capabilities, including conducting a comprehensive watershed study and exploring the implementation of building codes.

7.4 Continued Public Involvement

The Tribe is dedicated to involving the public directly in review and updates of the plan. Copies of the plan will be cataloged and kept at the appropriate locations on the reservation for review (e.g., a hard copy will be kept on file at the library and tribal Administration Building for ongoing review and tribal input). Tribal input may be submitted via email, phone call, or preferred internal communication tool to the Tribal Administrator directly or to the department heads responsible for specific mitigation actions. For 5-year plan updates, the future HMP Committee will be responsible for determining a public engagement strategy that best fits the Tribe's capabilities and capacity at the time of the update. At a minimum, this will include sharing updates on the Tribe's website and social media and inviting public comment on the draft HMP.

8.0 Plan Adoption and Assurances

8.1 Plan Adoption Process

In accordance with the tribal constitution of the Iowa Tribe, this plan was adopted into tribal law by a formal resolution passed by the Executive Committee on August 13, 2025. Appendix D includes a copy of the formal adoption resolution.

8.2 Assurances

The tribal resolution in **Section 8.1** provides documentation of tribal commitment to ensure project completion and compliance with FEMA requirements and other applicable statutes and regulations. The Tribe will continue to comply with all applicable federal statutes and regulations during the periods for which it receives grant funding, in compliance with 44 CFR 13.11(c), and will amend its plan whenever necessary to reflect changes in tribal or federal laws and statutes as required in 44 CFR 13.11(d).

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Appendix A Planning Process Documentation for the 2025 Plan

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Meeting Agendas

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Tribal Member Input Survey and Results

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Appendix B November 2024 BRIC DTA Site Visit Materials

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Agenda

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Sign-In Sheets

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Site Visit Minutes

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Appendix C Plan Maintenance Worksheet Templates

These worksheets can serve as a foundation for plan maintenance. The worksheets included here are from the 2019 FEMA Tribal Mitigation Planning Handbook (www.fema.gov/sites/default/files/2020-06/fema-tribal-planning-handbook_05-2019.pdf). The Iowa Tribe's HMP Committee can update these worksheets as needed to help track the status of mitigation actions and provide ongoing maintenance to the plan as new information and priorities change. Any use of these worksheets will be done at the request of the Committee, in accordance with tribal customs and policies throughout the next 5 years.

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Mitigation Action Implementation Worksheet

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Mitigation Action Progress Report

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Plan Monitoring and Evaluation Worksheet

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Appendix D Adoption and Approval Documentation

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Iowa Tribe of Kansas and Nebraska
3345 B Thrasher Road
White Cloud, KS 66094

RESOLUTION 25-R-24

IOWA TRIBE OF KANSAS AND NEBRASKA

2025 HAZARD MITIGATION PLAN

WHEREAS, the Iowa Tribe of Kansas and Nebraska recognizes the threat that natural hazards pose to people and property within the Iowa Tribe of Kansas and Nebraska;

WHEREAS, the Iowa Tribe of Kansas and Nebraska has prepared a hazard mitigation plan (HMP) in accordance with the Disaster Mitigation Act of 2000 and the requirements in Title 44 Code of Federal Regulations (CFR) Section 201.7;

WHEREAS, the HMP specifically addresses hazard mitigation strategies and plan maintenance procedures for the Iowa Tribe of Kansas and Nebraska;

WHEREAS, the HMP recommends several hazard mitigation actions and projects that will provide mitigation for specific natural hazards that impact the Iowa Tribe of Kansas and Nebraska, with the effect of protecting people and property from losses associated with those hazards; and

WHEREAS, adoption of this HMP will make the Iowa Tribe of Kansas and Nebraska eligible for funding to alleviate the impacts of future hazards on tribal land.

NOW, **THEREFORE**, **BE IT RESOLVED**, by the Iowa Tribe of Kansas and Nebraska Executive Committee that:

- The HMP is hereby adopted as an official plan of the Iowa Tribe of Kansas and Nebraska.
- The respective officials identified in the mitigation strategy of the HMP are hereby directed to pursue implementation of the recommended actions assigned to them.
- The Iowa Tribe of Kansas and Nebraska will comply with all applicable federal statutes and regulations in effect, with respect to the periods for which it receives grant funding, including 2 CFR Parts 200 and 3002, and will amend the HMP whenever necessary to reflect applicable changes in tribal or federal laws and statutes.

PASSED AND APPROVED BY A DULY CONSTITUTED QUORUM OF THE Iowa Tribe of Kansas and Nebraska, this 20th day of August, 2025.

Signed: _____

Timothy N. Rhodd, Chairperson

Attest: _____

Anthony G. Fee, Secretary

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