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1 Introduction

1.1 Executive Summary

The following jurisdictions have prepared and adopted this 2023 update of the Story County Hazard Mitigation Plan (HMP) that will be effective for the 2024-2029 time period:

- Story County
- Ames
- Cambridge
- Collins
- Colo
- Gilbert
- Huxley
- Kelley
- Maxwell
- McCallsburg
- Nevada
- Roland
- Sheldahl
- Slater
- Story City
- Zearing
- Ames CSD
- Nevada CSD
- Ballard CSD
- Gilbert CSD
- Roland-Story CSD
- Colo-Nesco CSD
- Iowa State University

The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from disasters or hazardous events. Studies have found that hazard mitigation is extremely cost-effective, with every dollar spent on mitigation saving an average of \$6 in avoided future losses. The Federal Emergency Management Agency (FEMA) requires that Hazard Mitigation Plans (HMPs) be updated every five years for the jurisdictions to be eligible for federal mitigation assistance. All sections of the 2018 Story County HMP were reviewed and updated to address natural and human-caused hazards for the purpose of saving lives and reducing losses from future disasters or hazard events.

The goals of the Story County HMP are:

1. Protect lives and reduce injury.
2. Minimize or reduce damage to property, especially critical facilities and infrastructure.
3. Strength communication among agencies and between agencies and the public regarding hazard mitigation.

Story County and its participating jurisdictions developed this Hazard Mitigation Plan update to guide hazard mitigation planning to better protect the people and property of the planning area from the effects of hazard events. By reducing vulnerability to known hazard risks, communities will save lives and property and minimize the social, economic, and environmental disruptions that commonly follow hazard events. This plan demonstrates the jurisdictions' commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources.

This plan was also developed to retain Story County's and the participating jurisdictions' eligibility for federal grant programs, specifically the FEMA hazard mitigation grants including the Hazard Mitigation Grant Program (HMGP), Building Resilient Infrastructure and Communities (BRIC) grant program, and Flood Mitigation Assistance (FMA) program.

Chapter 1 contains this Executive Summary, along with the Plan's background and scope.



Chapter 2 describes the Planning Process followed to update the Plan. A broad range of public and private stakeholders, including agencies, local businesses, nonprofits, and other interested parties were invited to participate. Public input was sought throughout the planning process including online surveys and public review of the draft Plan.

Chapter 3 Community Profile describes the planning area, consisting of Story County and the participating jurisdictions listed above, with updated information on demographics, social vulnerability, and changes in development. Chapter 3 also include a Capability Assessment that describes programs and policies currently in place across the County to reduce hazard impacts, or that could be used to implement hazard mitigation activities and identifies opportunities to enhance those capabilities.

Chapter 4 Risk Assessment identifies the natural and human-caused hazards of greatest concern to the County and describes the risk from those hazards. The information generated through the risk assessment helps communities to prioritize and focus their efforts on those hazards of greatest concern and those assets or areas facing the greatest risk(s). The best available information on the impacts of changing weather conditions was taken into account for each hazard. The hazards profiled in the 2024 Plan and their assessed significance are listed in Table 1-1.

Table 1-1 Hazard Risk Summary

Hazard	Future Probability	Magnitude/ Severity	Location	Overall Significance
Animal/Crop/Plant Disease	Unlikely	Critical	Extensive	Low
Drought	Likely	Critical	Extensive	Medium
Extreme Heat	Likely	Critical	Limited	Medium
Flooding (Flash & River)	Likely	Catastrophic	Significant	High
Grass or Wildland Fire	Likely	Limited	Significant	Medium
Hazardous Materials	Likely	Limited	Significant	Medium
Human Disease	Occasional	Limited	Significant	Medium
Infrastructure Failure	Likely	Critical	Extensive	Medium
Severe Summer Weather (Thunderstorms/Lightning/ Hail)	Highly Likely	Critical	Extensive	High
Severe Winter Storm	Highly Likely	Limited	Extensive	High
Sinkholes	Unlikely	Negligible	Limited	Low
Terrorism	Unlikely	Limited	Extensive	Medium
Tornado/Windstorm	Highly Likely	Critical	Significant	High
Transportation Incident	Highly Likely	Negligible	Limited	Low

Chapter 5 Mitigation Strategy describes what the County and jurisdictions will do to reduce their vulnerability to the hazards identified in Chapter 4. It presents the goals and objectives of the mitigation program and details a broad range of targeted mitigation actions to reduce losses from hazard events. It also describes mitigation activities that have been conducted in the last five years.

Chapter 6 Plan Implementation and Maintenance details how the Plan will be implemented, monitored, evaluated, and updated, and how mitigation will be integrated into other planning mechanisms.

Ensuring active participation from local decision-makers is crucial for contributing innovative ideas and valuable perspectives to future updates of the Story County Hazard Mitigation Plan (HMP). A long-term objective is the seamless integration of the HMP and its identified mitigation strategies into the day-to-day decision-making processes of the local government. Achieving this goal demands ongoing commitment, diligence, and concentrated efforts. Therefore, the current plan updates represent a continued endeavor to enhance the resilience of Story County.

1.2 Purpose

Story County and its participating cities, public school districts, and Iowa State University prepared this Multi-Jurisdictional Hazard Mitigation Plan update to guide hazard mitigation planning to better protect the people and property of the planning area from the effects of hazard events.

This plan demonstrates the jurisdictions' commitments to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources. This plan was also developed to make Story County and the participating jurisdictions eligible for certain federal grant programs, specifically the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Assistance (HMA) grants including the Hazard Mitigation Grant Program, Building Resilient Infrastructure and Communities (BRIC) Grant Program, Pre-Disaster Mitigation Program, and Flood Mitigation Assistance Program.

1.3 Background and Scope

Each year in the United States, disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters because additional expenses to insurance companies and nongovernmental organizations are not reimbursed by tax dollars. Many disasters are predictable, and much of the damage caused by these events can be alleviated or even eliminated.

Hazard mitigation is defined by FEMA as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves society \$6 in avoided future losses, in addition to saving lives and preventing injuries (National Institute of Building Science Multi-Hazard Mitigation Council 2017).

Hazard mitigation planning is the process through which hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set, and appropriate strategies to lessen impacts are determined, prioritized, and implemented. Story County and the incorporated cities, public school districts, and Iowa State University initially developed a multi-jurisdictional Hazard Mitigation Plan in 2014, and subsequently began the process to update that plan in 2018. This current planning effort serves to update the 2018 plan.

This plan documents the hazard mitigation planning process undertaken by the Story County Hazard Mitigation Planning Committee (HMPC). It identifies relevant hazards and vulnerabilities in the planning area and sets forth an updated mitigation strategy to decrease vulnerability and increase resiliency and sustainability in Story County.



The Story County Multi-Jurisdictional Hazard Mitigation Plan is a multi-jurisdictional plan that geographically covers the participating jurisdictions within Story County's boundaries (hereinafter referred to as the planning area). The following jurisdictions officially participated in the planning process:

- Story County
- Ames
- Cambridge
- Collins
- Colo
- Gilbert
- Huxley
- Kelley
- Maxwell
- McCallsburg
- Nevada
- Roland
- Sheldahl
- Slater
- Story City
- Zearing
- Ames CSD
- Nevada CSD
- Ballard CSD
- Gilbert CSD
- Roland-Story CSD
- Colo-Nesco CSD
- Iowa State University

This plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002 (44 CFR §201.6) and finalized on October 31, 2007. (Hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act.) Additionally, this plan is prepared in accordance with the 2013 Local Mitigation Planning Handbook published by FEMA.

While the Disaster Mitigation Act emphasized the need for mitigation plans and more coordinated mitigation planning and implementation efforts, the regulations established the requirements that local hazard mitigation plans must meet in order for a local jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288).

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to communities and their residents by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruptions. The Story County planning area has been affected by hazards in the past and the participating jurisdictions are therefore committed to reducing future impacts from hazard events and becoming eligible for mitigation-related federal funding.

1.4 Plan Organization

This Story County Multi-Jurisdictional Hazard Mitigation Plan update is organized as follows:

- Executive Summary
- Chapter 1: Introduction
- Chapter 2: Planning Process
- Chapter 3: Community Profile and Capability Assessment
- Chapter 4: Hazard Identification and Risk Assessment
- Chapter 5: Mitigation Strategy
- Chapter 6: Plan Implementation and Maintenance
- Appendices



2 Planning Process

44 CFR Requirement 201.6(c)(1)

[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

This plan was collaboratively prepared between January 2023 and January 2024 by Story County and the participating jurisdictions and stakeholders. Professional planning assistance was provided by WSP USA Environment and Infrastructure (WSP) through a contract with the County. WSP's role was to:

- Assist in establishing the Hazard Mitigation Planning Committee (HMPC) as defined by the Disaster Mitigation Act (DMA) and the FEMA policy guide,
- Ensure the updated plan meets the DMA requirements as established by federal regulations and following FEMA's planning guidance,
- Facilitate the entire planning process,
- Identify the data requirements that HMPC participants could provide and conduct the research and documentation necessary to augment that data,
- Assist in facilitating the public input process,
- Produce the draft and final plan update documents, and
- Coordinate the Iowa Homeland Security and Emergency Management Department (HSEMD) and FEMA plan reviews.

2.1 Multi-Jurisdictional Participation

44 CFR Requirement §201.6(a)(3)

Multi-jurisdictional plans may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the plan.

Story County Emergency Management Commission invited the unincorporated areas, incorporated cities, public school districts, Iowa State University, and various other stakeholders in mitigation planning (identified in Appendix B) to participate in the Story County Multi-Jurisdictional Hazard Mitigation Plan update process. The jurisdictions that elected to participate in this plan are listed above in section 1.2. The DMA requires that each jurisdiction that participates in the planning process must officially adopt the multi-jurisdictional hazard mitigation plan. Each jurisdiction that chose to participate in the planning process and development of the plan was required to meet plan participation requirements defined at the first planning meeting, which includes the following:

- Designate a representative to serve on the HMPC;
- Participate in at least two of the three HMPC planning meetings by either direct representation or authorized representation;
- Provide data for and assist in the development of the updated risk assessment that describes how various hazards impact their jurisdiction;
- Provide data to describe current capabilities;
- Develop/update mitigation actions (at least one) specific to each jurisdiction;
- Provide comments on plan drafts as requested;
- Inform the public, local officials, and other interested parties about the planning process and provide opportunities for them to comment on the plan; and
- Formally adopt the mitigation plan.



All of the jurisdictions listed as official participants in this plan met all of these participation requirements. **Table 2.1** shows the representation of each participating jurisdiction at the planning meetings, provision of Data Collection Guides, and update/development of mitigation actions. Sign-in sheets are included in Appendix C: Planning Process Documentation.

Table 2.1: Jurisdictional Participation in Planning Process

Jurisdiction	Data Collection Guide	Action Reporting	New Mitigation Action	Kickoff Meeting	Meeting 2	Meeting 3
Unincorporated Story County	x	x	x	x	x	x
Ames	x	x	x	x	x	x
Cambridge	x	x	x	x	x	x
Collins	x	x	x	x	x	x
Colo	x	x	x	x	x	x
Gilbert	x	x	x	x	x	x
Huxley	x	x	x	x		x
Kelley	x	x	x	x	x	x
Maxwell	x	x	x	x	x	x
McCallsburg	x	x	x	x	x	x
Nevada	x	x	x	x	x	x
Roland	x	x	x	x	x	x
Sheldahl	x	x	x	x	x	x
Slater	x	x	x	x	x	x
Story City	x	x	x	x	x	x
Zearing	x	N/A	x		x	x
Ames CSD	x	x	x	x	x	x
Nevada CSD	x	x	x		x	x
Ballard CSD	x	x	x	x	x	x
Gilbert CSD	x	x	x	x	x	x
Roland-Story CSD	x	x	x	x	x	x
Colo-Nesco CSD	x	x	x	x	x	
Iowa State University	x	x	x	x	x	x

2.2 The Planning Steps

WSP and Story County worked together to establish the framework and process for this planning effort. The plan update followed four general phases:

1. Organize resources,
2. Assess risks,
3. Develop the mitigation plan, and
4. Implement the plan and monitor progress.

Into this process, WSP integrated a detailed 10-step planning process adapted from FEMA's Community Rating System (CRS) and Flood Mitigation Assistance programs. Thus, the process used for this plan meets the requirements of the Disaster Mitigation Act of 2000 as well as the basic requirements for activity 510 under the Community Rating System. **Table 2.2** shows how the process followed fits into FEMA's original four-phase DMA process as well as the revised Nine Task Process outlined in the *2013 Local Mitigation Planning Handbook* and the 10-step CRS process (note: an update to the Local Mitigation Planning



Handbook was released in May 2023 while this plan update was in process but the Tasks largely remain the same).

Table 2.2: Mitigation Planning Process Used to Develop the Story County Multi-Jurisdictional Local Hazard Mitigation Plan

Phase	Community Rating System (CRS) Planning Steps (Activity 510)	Local Mitigation Planning Handbook Tasks (44 CFR Part 201)
Phase I	Step 1. Organize	Task 1: Determine the Planning Area and Resources Task 2: Build the Planning Team 44 CFR 201.6(c)(1)
	Step 2. Involve the public	Task 3: Create an Outreach Strategy 44 CFR 201.6(b)(1)
	Step 3. Coordinate	Task 4: Review Community Capabilities 44 CFR 201.6(b)(2) & (3)
Phase II	Step 4. Assess the hazard	Task 5: Conduct a Risk Assessment 44 CFR 201.6(c)(2)(i) 44 CFR 201.6(c)(2)(ii) & (iii)
	Step 5. Assess the problem	
Phase III	Step 6. Set goals	Task 6: Develop a Mitigation Strategy 44 CFR 201.6(c)(3)(i); 44 CFR 201.6(c)(3)(ii); and 44 CFR 201.6(c)(3)(iii)
	Step 7. Review possible activities	
	Step 8. Draft an action plan	
Phase IV	Step 9. Adopt the plan	Task 8: Review and Adopt the Plan
	Step 10. Implement, evaluate, revise	Task 7: Keep the Plan Current
		Task 9: Create a Safe and Resilient Community 44 CFR 201.6(c)(4)

2.2.1 Phase I Organize Resources

Step 1: Organize the Planning Team (Handbook Tasks 1 & 2)

The planning process resulting in the preparation of this plan document officially began with an initial coordination Conference Call/Webinar on January 30, 2023. Participants of the meeting included the Story County Emergency Management Coordinator; Iowa Homeland Security and Emergency Management Department Hazard Mitigation Office Hazard Mitigation Planner and GIS Coordinator; and the Wood Mitigation Planners and GIS Technician. The purpose of this meeting was to determine the jurisdictions and other stakeholders that would be invited to participate on the HMPC (Step 1), set tentative planning meeting dates, identify GIS needs and resources, discuss the hazards to be included in the plan update and options for the flood risk assessment methodology, and develop an initial public participation strategy. Detailed meeting minutes are included in Appendix C.

After the initial coordination meeting, a formal Kick-off planning conference call/webinar was held on March 29, 2023, followed by two additional planning meetings held on June 29, 2023 and August 22, 2023. A complete list of all representatives of the agencies and organizations that participated on the Story County HMPC is provided in Appendix B.

The HMPC communicated during the planning process with a combination of webinars, face-to-face meetings, phone interviews, and email correspondence. The meeting schedule and topics are listed in **Table 2.3**. The meeting minutes for each of the meetings are included in Appendix C.



Table 2.3: Schedule of HMPC Meetings

Meeting	Topic	Date
Coordination Call	General overview of planning process/requirements and schedule.	January 30, 2023
Kick-off Meeting	Introduction to mitigation planning, the planning process, hazard identification and public input strategy. Distribution of data collection guide to jurisdictions. Preliminary hazard data. Discussion critical facility inventory.	March 29, 2023
Planning Meeting #2	Review of draft Risk Assessment, update plan goals, instructions to update status of previous mitigation actions	June 29, 2023
Planning Meeting #3	Development of new mitigation actions, mitigation action planning and prioritization. Determine process to monitor, evaluate, and update plan.	August 22, 2023

During the kick-off meeting WSP presented information on the scope and purpose of the plan, participation requirements of HMPC members, and the proposed project work plan and schedule. Plans for public involvement (Step 2) and coordination with other agencies and departments (Step 3) were discussed. WSP also introduced hazard identification requirements and data needs. The HMPC discussed potential hazards as well as past events and impacts and refined the identified hazards to be relevant to Story County. The hazard ranking methodology utilized by Iowa Homeland Security and Emergency Management Department in the State Hazard Mitigation Plan was introduced and preliminary information was presented for each hazard identified.

Participants were given the WSP Data Collection Guide to facilitate the collection of information needed to support the plan, such as data on historic hazard events, values at risk, and current capabilities. Each participating jurisdiction completed and returned the worksheets in the Data Collection Guide to WSP. WSP integrated this information into the plan, supporting the development of Chapters 2 and 3.

Step 2: Plan for Public Involvement (Handbook Task 3)

44 CFR Requirement 201.6(b)
<i>An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (1) an opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.</i>

At the kick-off meeting, the HMPC discussed options for soliciting public input on the mitigation plan. To provide an opportunity for the public to comment during the drafting stage, the committee determined that the most effective method would be dissemination of a survey. The survey was announced in a press release and posted to the Story County website and the Story County Emergency Management Facebook page on March 16, 2023 and closed on May 15th, 2023. Newspaper clippings, posters, and website and social media postings announcing the survey are included in Appendix C.

The public survey was developed specific to the Story County Mitigation Plan and provided a brief plan summary as well as a questionnaire to capture public and stakeholder input. The survey was made available online and in community post offices throughout the County. A copy of the survey is provided in Appendix C.

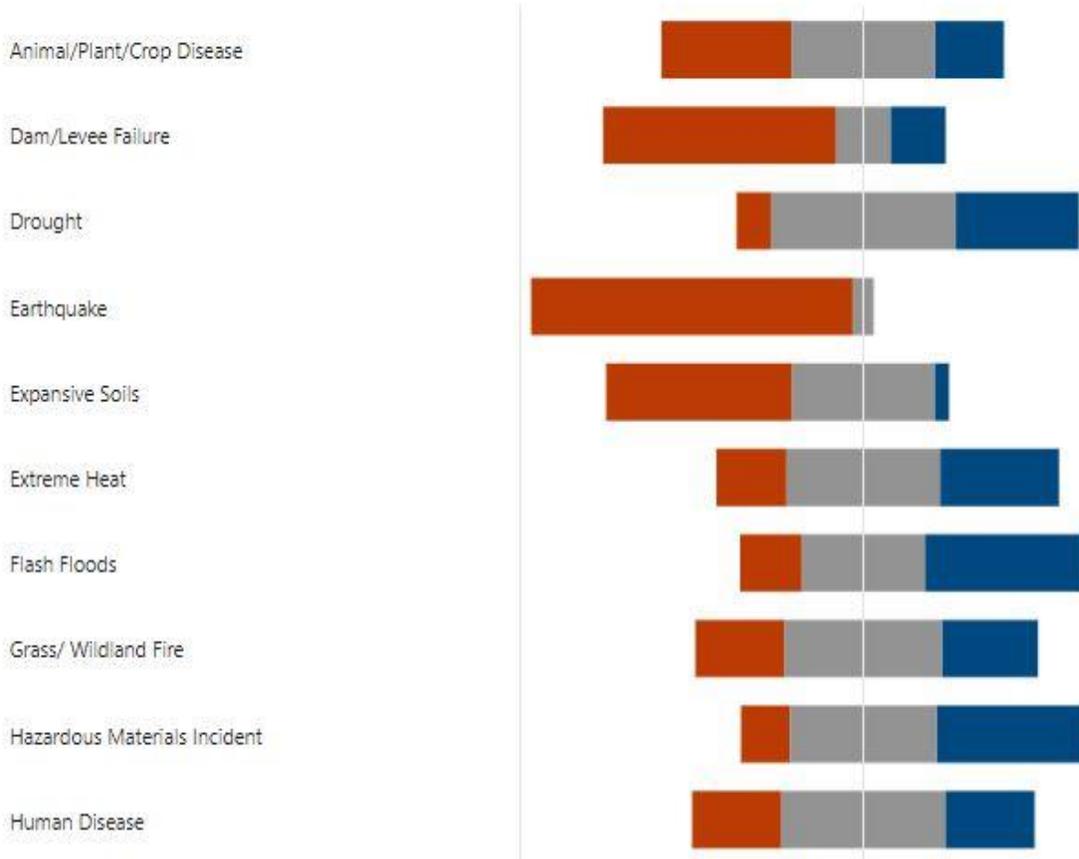
In addition to notification through media outlets described above, committee members distributed the survey link to members of the public and key stakeholders in their own jurisdiction. In all, 50 surveys were completed. One question asked respondents to rank their perception of which hazards were most significant to the planning area. The summary results of this question are provided in **Figure 2.1**. This shows

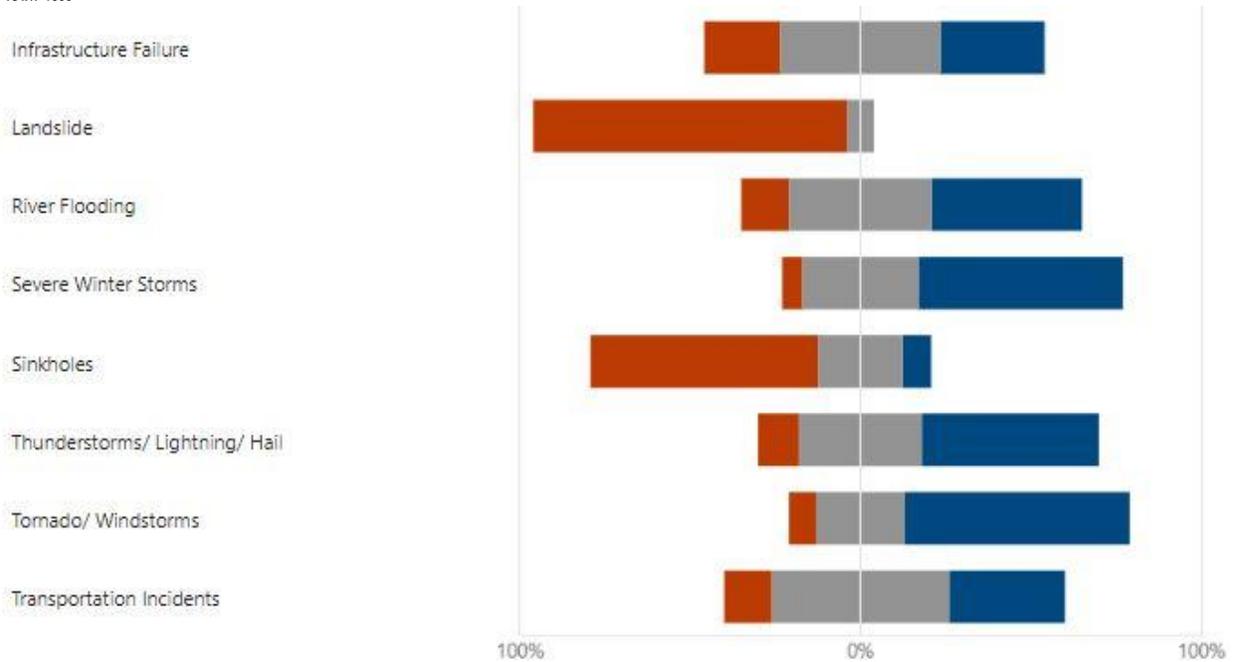


that the public perception is tornado/windstorms, severe winter storms, thunderstorms (severe summer weather) are the most significant hazards in Story County.

Figure 2.1: Survey Results—Hazard Level of Significance

Low Medium High

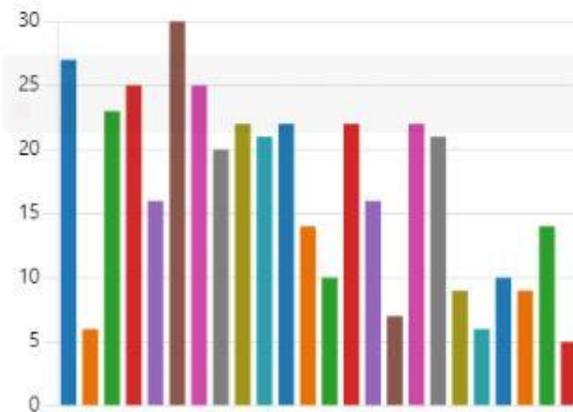




In the survey, the public was also asked to review 24 types of mitigation actions. The Story County HMPC also considered these types of projects in the Story County Multi-Jurisdictional Hazard Mitigation Plan. The survey asked the public to identify mitigation project types that they felt could benefit their community. **Figure 2.2** provides the compiled results of this question. The public opinion is that generators for critical facilities, expanded indoor/outdoor warning, planning/zoning to avoid impact, and continued participation would benefit their jurisdiction the most.

Figure 2.2: Survey Results—Types of Mitigation Projects

● Expanded Indoor/Outdoor War...	27
● Wildfire/Grass Fire Fuels Treatm...	6
● Tornado Safe Rooms	23
● Continued Participation in the N...	25
● Critical Facilities Resiliency	16
● Generators for Critical Facilities	30
● Planning/Zoning to avoid impac...	25
● Public Education/Awareness on ...	20
● Stormwater Drainage Improvem...	22
● Forest Health/Watershed Protec...	21
● Flood Mitigation for residential ...	22
● Education and Discounts on Flo...	14
● Floodprone Property Buyout	10
● Water Conservation	22
● Evacuation route development	16
● Dam safety	7
● Public health incident prepared...	22
● Improve reliability of communic...	21
● Lightning protection for critical f...	9
● Levees or Levee Improvements	6
● Flood Mitigation for commercial ...	10
● Additional snow fences	9
● Hazardous tree management	14
● Other	5





The public was also given an opportunity to provide input on the final draft of the complete plan. A link to the entire plan draft was made available on the Story County website. In addition, 2 hard copies were made available at the Ames Public Library and the Story County Emergency Management Office.

Story County announced the availability of the entire final draft plan and the two-week final public comment period on the County website and via the following media outlets: xxx. Copies of the announcements are provided in Appendix x. The final public comment period was from January X to X, 2024. X comments were received resulting in Y changes in the final plan.

The HMPC invited other targeted stakeholders to comment on the draft plan via an e-mail letter, which is described in greater detail in Step 3: Coordinate with Other Departments and Agencies. X comments were received.

Step 3: Coordinate with Other Departments and Agencies and Incorporate Existing Information (Handbook Task 3)

44 CFR Requirement 201.6(b)

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

There are numerous organizations whose goals and interests' interface with hazard mitigation in Story County. Coordination with these organizations and other community planning efforts is vital to the success of this plan. Many stakeholder agencies were contacted throughout the planning process to obtain data in preparation of the Risk Assessment. This included contact with specific representatives of stakeholder agencies, as well as accessing stakeholder data that has been made available to the public via the internet. These sources have been identified where data is presented. In addition, Story County invited neighboring counties, other local, state, and federal departments and agencies, as well as institutions of higher learning to review and comment on the final draft of the Story County Multi-Jurisdictional Hazard Mitigation Plan prior to final submittal to FEMA. The stakeholders that were invited to comment on the final plan draft are included below:

Stakeholders

- State of Iowa – Department of Natural Resources/Dam Safety
- State of Iowa – Department of Natural Resources/Floodplain Management
- State of Iowa Homeland Security and Emergency Management Department
- State of Iowa Department of Public Safety – State Fire Marshal Division

Private and nonprofit organizations

- Alliant Energy
- Ames Utilities
- The Bridge Home
- Heartland Senior Services



Adjacent Counties and Cities

- Hardin County Emergency Management
- Marshall County Emergency Management
- Jasper County Emergency Management
- Polk County Emergency Management
- Dallas County Emergency Management
- Boone County Emergency Management
- Hamilton County Emergency Management

Appendix C includes a copy of the email letter that was sent providing a link to the draft plan during the final public comment period.

Integration of Other Data, Reports, Studies, and Plans

In addition, input was solicited from many other agencies and organizations that provided information. As part of the coordination with other agencies, the HMPC collected and reviewed existing technical data, reports, and plans. These included:

- Iowa Hazard Mitigation Plan (June 2018)
- Story County Hazard Mitigation Plan (2018)
- Plan Update Guides completed by each jurisdiction
- FEMA Community Information System, National Flood Insurance Program (NFIP), Repetitive Loss Property Data
- Dam Inventory and Inspection Reports for Clinton County, Iowa Department of Natural Resources
- National Drought Mitigation Center Drought Impact Reporter
- US Drought Monitor
- Environmental Protection Agency
- Flood Insurance Administration
- Iowa Department of Agriculture and Land Stewardship, Division of Soil Conservation
- Iowa Department of Education, Bureau of Information and Analysis Services
- Iowa Department of Public Safety
- Iowa Department of Transportation (DOT), Office of Traffic and Safety
- Iowa State University (ISU) Department of Agronomy
- Iowa Utilities Board
- National Oceanic and Atmospheric Administration's (NOAA) National Center for Environmental Information
- National Weather Service
- Pipeline and Hazardous Materials Safety Administration
- Story County Emergency Management
- Story County National Flood Hazard Layer
- US Department of Agriculture, Risk Management Agency
- US Department of Agriculture, US Forest Service (USFS)
- US Department of Transportation
- United States Geological Survey
- National Flood Insurance Program Policy and Loss Statistics
- Various local plans such as Comprehensive Plans, Economic Development Plans, Capital Improvement Plans, etc. For a complete list of local plans that were reviewed and incorporated, see Chapter 2
- US Department of Agriculture's (USDA) Risk Management Agency Crop Insurance Statistics



This information was used in the development of the hazard identification, vulnerability assessment, and capability assessment and in the formation of goals, objectives, and mitigation actions. These sources, as well as additional sources of information, are documented throughout the plan and in [Appendix x, References](#).

2.2.2 Phase 2 Assess Risk (Handbook Task 5)

Step 4: Assess the Hazard: Identify and Profile Hazards

The HMPC identified the hazards that have impacted or could impact communities in Story County. The HMPC examined the history of disaster declarations in Story County. They discussed past hazard events, types of damage, and where additional information might be found. The committee identified 14 natural and human-caused hazards that have the potential to impact the planning area.

The HMPC discussed past events and impacts, analyzed risk assessment data, and came to consensus on the preliminary probability, magnitude, and severity levels on a county-wide basis. Each jurisdiction completed an Update Guide, including information on previous hazard events in their community. Utilizing the information from the Plan Update Guides as well as existing plans, studies, reports, and technical information as well as information available through internet research and GIS analysis, the profile for each hazard identified was updated. Additional information on the hazard identification process and the methodology and resources used to identify and profile the hazards can be found in Chapter 4.

Step 5: Assess the Problem: Identify Assets and Estimate Losses

Assets for each jurisdiction were identified from the Story County Assessor's Department which provided public datasets with parcel and building data. The Story County Emergency Management Coordinator worked with the Story County GIS Department to populate an inventory of critical facilities in the planning area. Population data was obtained from the US Census Bureau. Methodologies and results of the analyses are provided in Chapter 4.

Additional assets such as historic, cultural, and economic assets as well as specific vulnerable populations and structures were obtained from a variety of sources as described in Chapters 3 and 4.

The HMPC also analyzed development trends from data available from the US Census Bureau as well as information obtained from each jurisdiction such as Comprehensive Plans. For each hazard, there is a discussion regarding future development and how it may impact vulnerability to that specific hazard.

After profiling the hazards that could affect Story County and identifying assets, the HMPC collected information to describe the likely impacts of future hazard events on the participating jurisdictions.

Existing mitigation capabilities were also considered in developing loss estimates. This assessment consisted of identifying the existing mitigation capabilities of participating jurisdictions. This involved collecting information about existing government programs, policies, regulations, ordinances, and plans that mitigate or could be used to mitigate risk from hazards. Participating jurisdictions collected information on their regulatory, personnel, fiscal, and technical capabilities, as well as previous and ongoing mitigation initiatives. This information is included in Chapter 3 Story County Community Profile.

Specific capabilities such as participation in the NFIP, designation as FireWise Communities or Storm Ready Communities, and placement of storm sirens are incorporated in the vulnerability analysis discussions, where applicable.

Taking into consideration the vulnerability and capability assessments, a variety of methods was used to estimate losses for each profiled hazard. For geographic hazards such as river flooding, specific assets at risk and loss estimates were determined through GIS analysis. For other hazards such as weather-related



hazards and hazardous materials, loss estimates were developed based on statistical analysis of historic events. For hazards such as dam failure of state-regulated dams, GIS data was not available to identify specific geographic boundaries at risk. Therefore, the risk assessment provides descriptions of the types of improvements located in approximated risk areas downstream of high and significant hazard dams. For some human-caused hazards and the tornado hazard, loss estimates were scenario-based. The methodologies for each loss estimate are described in detail in Chapter 4. Within each hazard section, the text provides details on how the hazard varies by jurisdiction, where applicable.

Results of the preliminary risk assessment were presented at Meeting #2 to inform the planning process as the basis for updating the mitigation strategy.

2.2.3 Phase 3 Develop the Mitigation Plan (Handbook Task 6)

Step 6: Set Goals

During Meeting #2, the HMPC review the goals of the 2018 State HMP. Common categories of mitigation goals were presented for comparison, along with the goals from the 2018 Iowa State HMP. The HMPC then discussed and updated the goals for the 2024-2029 HMP, as described in Section 5.1.

The recommended mitigation action details to meet the identified goals are in Chapter 4. The HMPC developed an implementation plan for each action, which identifies priority level, background information, responsible agency, timeline, cost estimate, potential funding sources, and more.

Step 7: Review Possible Activities

Meeting #3 focused on updating the mitigation strategy. The HMPC reviewed mitigation actions from the 2018 Story County HMP, identified progress that had been made on those actions, and identified any actions that should be deleted from future consideration. The HMPC then identified new actions and prioritized both new and continuing actions. Details on this process can be found in Chapter 5.

Step 8: Draft an Action Plan

A complete draft of the plan was made available to the HMPC for review. Following that review a second draft was posted online and in hard copy for review and comment by the public, other agencies and interested stakeholders. Methods for inviting interested parties and the public to review and comment on the plan were discussed in Steps 2 and 3, and materials are provided in Appendix C. A final plan was then created for submittal to the Iowa HSEMD and FEMA for review and approval per the DMA requirements.

2.2.4 Phase 4 Implement the Plan and Monitor Progress

Step 9: Adopt the Plan (Handbook Task 8)

To secure buy-in and officially implement the plan, the governing bodies of each participating jurisdiction will adopt the plan following FEMA's "approval pending adoption" of the plan. Scanned copies of resolutions of adoption are included in Appendix A of this plan.

Step 10: Implement, Evaluate, and Revise the Plan (Handbook Tasks 7 & 9)

The HMPC developed and agreed upon an overall strategy for plan implementation and monitoring and maintaining the plan over time during Meeting #3. This strategy is described in Chapter 5, Plan Maintenance Process.



Section Break

3 Planning Area profile and Capabilities

This chapter provides a general profile of Story County and participating jurisdictions, including details on existing capabilities, plans, and programs that enhance their ability to implement mitigation strategies.

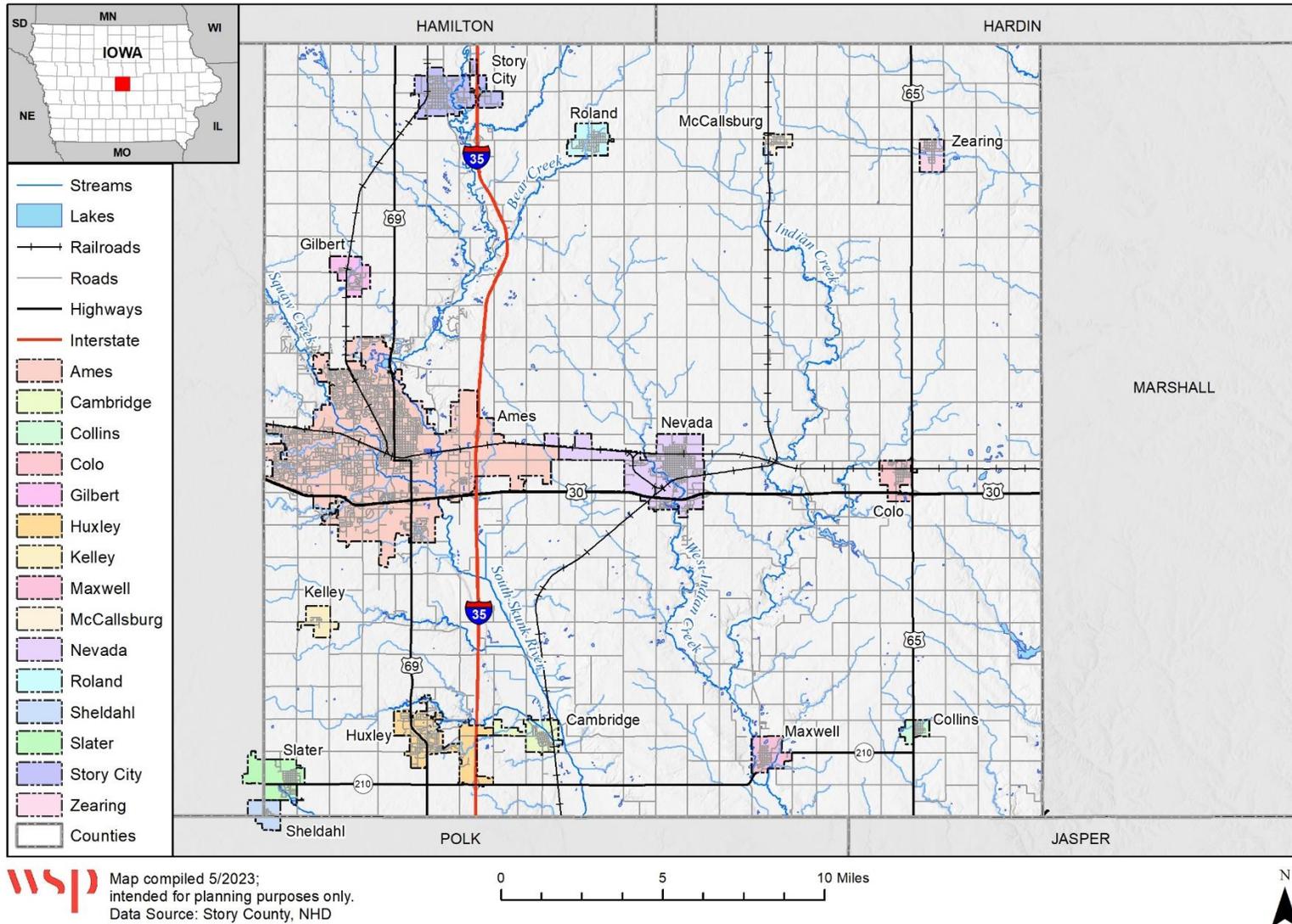
3.1 Story County Planning Area Profile

Figure 3-1 provides a map of the Story County planning area. The planning area boundaries include the unincorporated areas of Story County as well as the following incorporated cities:

- Unincorporated Story County
- City of Ames
- City of Cambridge
- City of Collins
- City of Colo
- City of Gilbert
- City of Huxley
- City of Kelley
- City of Maxwell
- City of McCallsburg
- City of Nevada
- City of Roland
- City of Sheldahl
- City of Slater
- City of Story City
- City of Zearing

Story County's Public School Districts (Ames CSD, Ballard CSD, Gilbert CSD, Roland-Story CSD, Colo-Nesco CSD,) and Iowa State University participated in development of this plan and are also included in the planning area. These schools and their capabilities are discussed in additional detail in Section 2.2.

Figure 3-1 Story County Basemap





3.1.1 Geography and Topography

Story County is located in central Iowa just north of state capital of Des Moines. The County has a total area of 574 square miles. There are several highways that traverse the county, including the following:

- Interstate Highway 35, which travels north and south in the western portion of the county through Story City, Ames, and Huxley.
- U.S. Highway 69, which travels north and south through the western portion of the county through Ames and Huxley.
- U.S. Highway 65, which travels north and south through the eastern portion of the county through the Cities of Zearing, Colo, and Collins.
- U.S. Highway 30, which travels east and west through the center of the county through Ames, Nevada, and Colo.
- Iowa Highway 210, which travels east and west through the southern portion of the county and passes through Slater, Huxley, and Maxwell.

The rest of the roads in the county are county highways and local roads.

Adjacent counties:

- Hamilton County (northwest)
- Hardin County (northeast)
- Marshall County (east)
- Jasper County (southeast)
- Polk County (south)
- Dallas County (southwest)
- Boone County (west)

The land that today is known as Story County was originally prairie, with the exception of some groves along the larger streams in the area. The surface is characterized by nearly level to gently and strongly sloping terrain, the latter of which is most dominant along the South Skunk River and its tributaries. Due to the relatively flat nature of the topography, up to one-half of the county has been drained by artificial systems through the use of tile and open ditches.

All of Story County lies in the Clarion-Nicollet-Webster soil association area which contains some of the best agricultural soils in the State. The general geology consists of the unconsolidated deposits as thick as 200 feet containing silt, clay, sands, and gravels. The uppermost bedrock units in the northwest third of the county are dolomites and limestone. In the remainder of the county, the bedrock unit is mostly shale with thin layers of sandstone.

3.1.2 Major Rivers and Watersheds

The primary waterway features in Story County are the South Skunk River, the West Indian Creek, Bear Creek, Indian Creek, Squaw Creek, and Rock Creek. As depicted in Figure 3-2, Story County crosses six HUC-8 watersheds as follows:

- South Skunk (07080105)
- North Skunk (07080106)
- Upper Iowa (07080207)
- Middle Iowa (07080208)
- Middle Des Moines (07100004)
- Lake Red Rock (07100008)

Figure 3-2 Story County, Iowa Watersheds (Story County is red square)



Source: Environmental Protection Agency, <https://cfpub.epa.gov/surf/locate/index.cfm>

3.1.3 History

Story County’s boundaries were established in 1846. In 1853, it was named after Joseph Story, a pre-eminent United States Supreme Court justice. Three commissioners appointed by the Iowa legislature selected Nevada as the location of the county seat on June 27, 1853. The first settlers in Story County came mainly from Indiana, New York, and Pennsylvania. Many Norwegians, Germans, and Danes came directly from overseas and inhabited the area later. The first large population influx occurred during the 1850s. By 1860, the population had increased to 4,501.

The County has 36 listings on the National Register of Historic Places. All listings are detailed in Table 3-1 below.



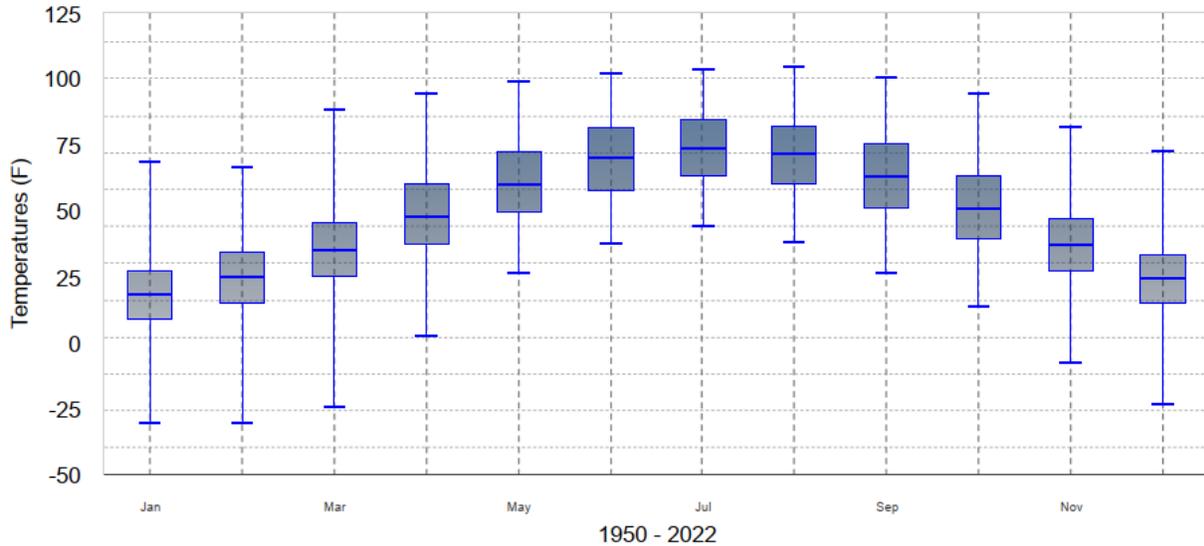
Table 3-1 Story County Listings in National Register of Historic Places

Listing	Date Listed	Location
Agriculture Hall	27-Jun-85	Ames
Alumni Hall	16-Nov-78	Ames
Ames High School	24-Oct-02	Ames
Ames Main Street Historic District	10-May-18	Ames
Bandshell Park Historic District	7-Oct-99	Ames
Briggs Terrace	20-Jul-98	Nevada
Prof. J.L. Budd, Sarah M., and Etta Budd House	8-Aug-01	Ames
Calamus Creek Bridge	15-May-98	Maxwell
Christian Petersen Courtyard Sculptures, and Dairy Industry Building	7-Apr-87	Ames
Colonials Club House	8-Feb-12	Ames
Cranford Apartment Building	24-July-23	Ames
Delta Upsilon Chapter House	10-Nov-10	Ames
East Indian Creek Bridge	15-May-98	Nevada
Edwards-Swayze House	14-Nov-78	Nevada
Engineering Hall	10-Jan-83	Ames
Grand Auditorium and Hotel Block	25-Jan-80	Story City
Henry T. and Emilie (Wiese) Henryson House	20-Apr-05	Story City
Herschel-Spillman Two-Row Portable Menagerie Carousel	6-Jun-86	Story City
Iowa Beta Chapter of Sigma Phi Epsilon	5-Feb-14	Ames
Keigley Branch Bridge	15-May-98	Gilbert
Knapp-Wilson House	15-Oct-66	Ames
Lincoln Township Mausoleum	27-Sep-07	Lincoln Township
Gilmour B. and Edith Craig MacDonald House	6-May-92	Ames
Marston Water Tower	27-May-82	Ames
Masonic Temple	12-Sep-16	Ames
Morrill Hall	28-Jun-96	Ames
Mulcahy Barn	28-Jan-04	Colo
Municipal Building	2-May-97	Ames
Nevada Downtown Historic District	9-May-03	Nevada
Octagon Round Barn, Indian Creek Township	30-Jun-86	Indian Creek Township
Old Town Historic District	2-Jan-04	Ames
Pleasant Grove Community Church and Cemetery	28-May-10	Ames
Roosevelt School	2-Mar-10	Ames
Sheldahl First Norwegian Evangelical Lutheran Church	11-May-84	Sheldahl
Sigma Sigma-Delta Chi Fraternity House	10-Jul-08	Ames
Skunk River Bridge	15-May-98	Ames
William Kennison Wood House	5-Jun-95	Iowa Center

3.1.4 Climate

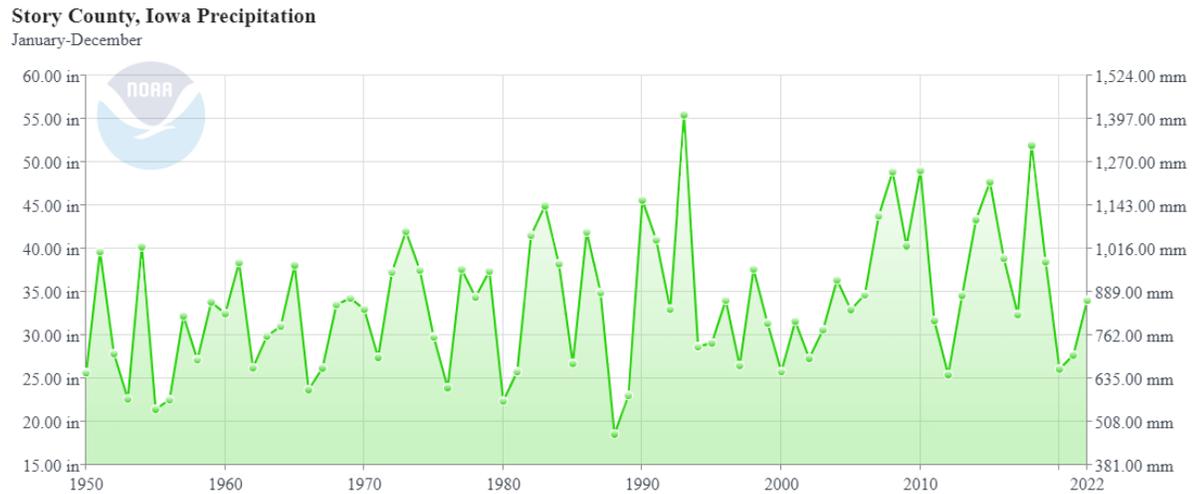
The climate in Story County is described as hot-summer humid continental with cold winters and hot and humid summers. The average annual temperature is 49.7 degrees Fahrenheit (F.) with an average high in July of 74.8 degrees F. and average low in January of 14.4 degrees F. Seasons fluctuate from being very wet to very dry, and temperatures can fluctuate greatly in spring and autumn months. Story County's rainy season occurs from April through September, with the annual precipitation averages 27.88 inches. Figure 3-4 shows that the annual precipitation has gradually increased since 1950. Figure 3-3 also provides the range in average temperature from 1950 to 2022.

Figure 3-3 Ames, Iowa Average Annual Temperatures, 1950-2022



Source: Southwest Climate and Environmental Information Collaborative

Figure 3-4 Story County Monthly Precipitation, 1950-2022



Source: NOAA, Climate at a Glance County Time Series

3.1.5 Population/Demographics

According to the U.S. Census Bureau, Story County has experienced steady population growth, increasing overall by 3.9% from 2016 to 2022. Over this period, the cities of Sheldahl, McCallsburg, Kelley, and Huxley have experienced the most significant growth, each increasing their respective populations by more than 20% over this period, with Sheldahl growing by 53.4%. The cities of Colo, Maxwell, Slater, and Story City have experienced population decline. Table 3-2 provides the populations for each city and the unincorporated county for 2022 American Community Survey (ACS) 5-Year Population Estimates with the number and percent change from 2016 to 2022.



Table 3-2 Story County Population Growth by City, 2016-2022

Jurisdiction	2016 Census Population	2022 Population Estimate	# Change 2016-2022	% Change 2016-2022
Ames	64,073	66,265	2,192	3.4%
Cambridge	853	885	32	3.8%
Collins	458	483	25	5.5%
Colo	886	838	-48	-5.4%
Gilbert	1,183	1,185	2	0.2%
Huxley	3,474	4,331	857	24.7%
Kelley	306	401	95	31.0%
Maxwell	839	776	-63	-7.5%
McCallsburg	325	484	159	48.9%
Nevada	6,796	6,933	137	2.0%
Roland	1,312	1,472	160	12.2%
Sheldahl	249	382	133	53.4%
Slater	1,617	1,546	-71	-4.4%
Story City	3,423	3,352	-71	-2.1%
Zearing	563	655	92	16.3%
Unincorporated Story County	8,477	8,585	108	1.3%
Total	94,834	98,573	3,739	3.9%

Source: U.S. Census Bureau: 2022 ACS 5-Year Estimates. Unincorporated Story County Population was estimated by subtracting populations of incorporated cities from the total Story County populations.

According to the ACS 2022 5-Year Estimates, 3.8 percent of the population is under age 5 and 13.1 percent of the population is over age 65 in Story County. In total, there were 39,531 households with an average household size of 2.19 people.

Social vulnerability is broadly defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards. The 2022 ACS reports that Story maintained the same age average of 26.9 and 4.5 percent increase of people over the age of 25 who obtained a bachelor’s degree or higher. These two factors are likely influenced by the proximity to Iowa State University. The population of people who are below the poverty line also decreased since 2016 by 12.6 percent. This can be the result of the increased cost of living causing low-income families and individuals to move outside the County. Additional details on specific ways vulnerable populations may be impacted by hazards are provided in each hazard profile in Chapter 4.

Table 3-3 Story County Demographic and Social Characteristics, 2016-2022

Story County	2016	2022	% Change
Population	94,834	98,573	3.9%
Median Age	26.9	26.9	0.0%
% of Population under 5	4.5%	3.8%	-0.7%
% of Population over 65	11.5%	13.1%	1.6%
Housing Occupancy Rate	95.5%	94.2%	-1.3%
% of Owner Occupied Housing	51.7%	54.3%	2.6%
% of Renter Occupied Housing	48.3%	45.7%	-2.6%



Story County	2016	2022	% Change
% of Housing Units with no Vehicles Available	7.5%	6.7%	-0.8%
Median Household Income	\$53,371	\$66,033	\$12,662.00
Per Capita Income	\$27,937	\$37,598	\$9,661.00
% of Individuals Below Poverty Level	21.5%	18.2%	-3.3%
# of Households	37,350	39,531	2,181
Average Household Size	2.34	2.19	-0.15
% of Population Over 25 with High School Diploma	18.5%	14.9%	-3.6%
% of Population Over 25 with Bachelor's Degree or Higher	54.8%	59.3%	4.5%
% with Disability	7.8%	9.5%	1.7%
% Speak English less than "Very Well"	5.1%	2.7%	-2.4%

Source: U.S. Census, 2022 American Community Survey, 5-year Estimates

Table 3-4 Story County Demographic and Social Characteristics Compared to the State and Nation, 2022

Demographic & Social Characteristics (as of 2022)	County	Iowa	U.S.
Median Age	26.9	38.9	39.0
% of Population under 5	3.8%	5.6%	5.5%
% of Population over 65	13.1%	18.4%	17.3%
Housing Occupancy Rate	94.2%	92.5%	90.3%
% of Owner Occupied Housing	54.3%	72.0%	65.2%
% of Renter Occupied Housing	45.7%	28.0%	34.8%
% of Housing Units with no Vehicles Available	6.7%	5.6%	8.3%
Median Household Income	\$66,033	\$69,588	\$74,755
Per Capita Income	\$37,598	\$38,917	\$41,804
% of Individuals Below Poverty Level	18.2%	11.0%	12.6%
Average Household Size	2.19	2.33	2.50
% of Population Over 25 with High School Diploma	14.9%	29.5%	26.1%
% of Population Over 25 with bachelor's degree or Higher	59.3%	32.3%	35.7%
% with Disability	9.5%	12.8%	13.4%
% Speak English less than "Very Well"	2.7%	3.6%	8.4%

Source: U.S. Census, 2022 ACS 5-Year Estimates



Table 3-5 Demographics by Race and Sex, 2022

Story County	Population	%
Total Population	98,573	--
Male	51,950	52.1%
Female	47,723	47.9%
White, not Hispanic	82,770	83.0%
Hispanic or Latino	4,078	4.1%
Black	2,940	2.9%
Asian	6,911	6.9%
American Indian and Alaska Native	430	0.4%
Native Hawaiian and Other Pacific Islander	95	0.1%
Some other race	1,635	1.6%
Two or more races	4,892	4.9%

Source: U.S. Census, 2022 ACS 5-Year Estimates

3.1.6 Occupations/Employers

Table 3-6 provides occupation statistics for the incorporated cities and the county as a whole for the civilian employed population 16 years and over.

Table 3-6 Occupation Statistics, Story County, Iowa

Geography	Civilian employed population 16 years and over	Management, business, science, and arts occupations (%)	Service occupations (%)	Sales and office occupations (%)	Natural resources, construction, and maintenance occupations (%)	Production, transportation, and material moving occupations (%)
Story County	57,189	49.4%	16.9%	17.2%	6.1%	10.5%
Ames	36,464	48%	19.5%	17%	5.6%	9.8%
Cambridge	460	32.6%	23.9%	15.0%	9.3%	19.1%
Collins	252	18.7%	31.7%	20.2%	12.7%	16.7%
Colo	438	27.9%	17.8%	22.1%	15.5%	16.7%
Gilbert	667	52.9%	15.7%	18.6%	5.8%	6.9%
Huxley	2,277	54.3%	9.2%	27.6%	3.1%	5.9%
Kelley	286	37.8%	4.9%	12.2%	10.8%	34.3%
Maxwell	386	36.3%	17.6%	19.7%	11.7%	14.8%
McCallsburg	275	22.2%	19.3%	18.5%	16.4%	23.6%
Nevada	3,590	33.2%	17.4%	20.8%	13.4%	15.2%
Roland	874	33.2%	8.1%	28.1%	10.1%	20.5%
Sheldahl	169	36.1%	23.1%	7.7%	8.3%	24.9%
Slater	900	39.7%	18.3%	22.6%	10.1%	9.3%
Story City	1,599	41.2%	24.0%	21.3%	8.5%	5.1%
Zearing	321	40.2%	8.1%	13.7%	23.7%	14.3%

Source: U.S. Census, 2022 American Community Survey, 5-year Estimates



3.1.7 Agriculture

Because of the fertility of its soils and the climate conditions, agricultural crops, and livestock are important contributors to the economy of Story County.

According to the 2021 Census of Agriculture, there were 955 farms in the County covering 304,022 acres of land (82.7 percent of the 574 sq. miles of land area (367,360 acres) in the County). Crop and livestock production are visible parts of the agricultural economy, but many related businesses contribute by producing, processing, and marketing farm and food products. These businesses generate income, employment and economic activity throughout the region. Farms on average were 318 acres. According to the 2022 ACS 5-year Estimate, Story County agriculture and agriculture-related industries account for 1.6% of the County's workforce providing 932 jobs. Story County agriculture and economic contributions are summarized in additional detail in Section 3.2.2 of Chapter 3.

3.1.8 Land Use Patterns and Trends

Story County's physical characteristics consist of rolling hills and expansive prairies. A prominent waterway is the South Skunk River that flows the county terrain, accompanied by its tributaries. The river holds significant economic importance, contributing to agricultural activities, recreation, and natural habitats. The County's flat landscape coupled with fertile soil and proximity to water sources, establishes Story County as an optimal location for agricultural production.

Several cities in Story County, including Ames, Huxley, Kelley, McCallsburg, Roland, and Sheldahl, have witnessed significant population growth. Notably, the decline in the average household size from 2.34 in 2016 to 2.19 in 2022 signals a multifaceted demographic shift indicating that the population growth is from migration as well as the increased life expectancy. Data that supports this is the drop in population under the age of 5 and the increase in population over the age of 65.

Ames, the largest city in Story County, has experienced a 3.4% increase in population from 2016 to 2022, as reported by US Census data. A significant driver of this growth can be attributed to the expanding community associated with Iowa State University (ISU). The university's influence is particularly evident in the 4.5% rise in the population aged 25 and older who have attained a bachelor's degree or higher since 2016.

Iowa State University, a major educational and research institution, not only attracts students but also plays a pivotal role in drawing staff and fostering local economic development. The university's emphasis on agricultural practices further contributes to the region's appeal, offering compelling job opportunities for recent graduates in the thriving local agricultural industry.

In addition to the enticing prospects in agriculture and education-related employment, the allure of recreational opportunities has likely played a pivotal role in attracting new residents, particularly in the Huxley and Cambridge areas, which boast the scenic High Trestle Trail. Story County stands adorned with numerous parks, natural areas, and green spaces, offering a haven for residents and visitors alike. Notably, Ada Hayden Heritage Park, renowned for its picturesque lake and diverse recreational offerings, stands as a prime example of the leisurely delights available in the region.



3.2 City/County Capabilities

Unincorporated Story County is governed by a three-member Board of Supervisors. Each incorporated city is governed by a six-member Mayor/City Council. Story County has an Emergency Management Commission and an Emergency Management Agency that coordinates emergency management capabilities for the entire county. Story County participates in the Emergency Notification System (CCENS), part of the Alert Iowa system contracted with WENS Inspiron. All jurisdictions within the County have the ability to utilize this service. Table 3-7 and Table 3-8 that follow provide additional capability information for the unincorporated county and incorporated cities.

Table 3-7 Mitigation Capabilities (Story County through City of Kelley)

	Story County - Unincorporated	Ames	Cambridge	Collins	Colo	Gilbert	Huxley	Kelley
City Governance								
City Hall (City Clerk)	Yes, Story County Board Supervisors	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fire Department		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Police Department	Yes, Story County Sheriff's	Yes	Yes	Story County	No	Yes	Yes	Yes
Public Works Department	Yes, Story County Secondary Roads and County Engineer	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Planning & Zoning Commission	Yes	Yes	Yes	Yes	No	Yes	Yes	No
Board of Adjustments	Yes	Yes	No	Yes	No	Yes	Yes	No
Library Board of Trustees	Responsibility with each community	Yes	Yes	Yes	No	Yes	Yes	Yes
Electric Board of Trustees	No	Yes	No	No	No	Yes	No	No
Community Center Board	Responsibility with each community	Yes	No	No	No	N/A	No	No
Policies/Ordinances								
Comprehensive/Land Use Plan	Yes	Yes, Ames Plan 2040	Yes	No	Yes	Yes	Yes	No
Capital Improvement Plan	Yes	Yes	No	Yes	Yes, updates planned	No	in progress	Yes
Local/County Emergency Plan		Yes	Yes, 2012	Yes	No	No	Yes	No



	Story County - Unincorporated	Ames	Cambridge	Collins	Colo	Gilbert	Huxley	Kelley
Local Mitigation Plan	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Flood Mitigation Assistance (FMA) Plan	Yes	Yes	No	No	No	No	No	Yes
Watershed Plan	Yes	Yes, added Headwaters of S Skunk River Watershed Plan	No	No	No	Yes	No	Yes
Critical Facilities Plan (Mitigation/Response/Recovery)	No	Yes	No	No	No	No	No	No
Economic Development Plan	Yes	No	No	No	housing development will need to do	No	No, contract with AEDC	No
Transportation Plan	Yes	Yes, Forward 2045 Plan	No	No	No	No	Yes	No
Firewise or other fire mitigation plan	N/A	No	No	No	No	No	No	No
Zoning Ordinance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Restricted Residential District	Yes	N/A	No	No	No	No	No	No
Subdivision Ordinance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Building Code	No	Yes, update when State does	Yes, State	Yes, State	developing for future housing development	Yes, 2015	Yes, 2015	Yes, 2006
Building Permit Ordinance	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Floodplain Ordinance	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Tree Trimming Ordinance	No	No	Yes	Yes	Yes	Yes	Yes	No
Nuisance Ordinance	Yes	No	Yes	Yes	Yes	Yes	Yes	No
Stormwater Ordinance	Yes	Yes, Ch. 5A & 5B Ames Municipal Code and Conservation Subdivision for	No	No	Yes	Yes	No	No



	Story County - Unincorporated	Ames	Cambridge	Collins	Colo	Gilbert	Huxley	Kelley
		Ada Hayden watershed						
Drainage Ordinance	Yes	Yes	No	No	Yes	No	No	No
Site Plan Review Requirements	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Historic Preservation Ordinance	No	No	No	No	No	No	No	No
Landscape Ordinance	Yes	No	No	No	No	No	Yes	No
Iowa Wetlands and Riparian Areas Conservation Plan	No	Yes	No	No	No	No	No	No
Debris Management Plan	Yes	No	No	No	No	No	No	No
Program								
Zoning/Land Use Restrictions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Codes Building Site/Design	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
National Flood Insurance Program (NFIP) Participant	Yes	Yes	Yes	Yes	No – No Special Flood Hazard Area	Yes	Yes	Yes
NFIP Community Rating System (CRS) Participant	Yes – Class 7	No	No	No	No	No	No	No
Hazard Awareness Program	Yes	Yes	No	No	No	Yes	No	No
Planning/Zoning Boards	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Tree Trimming Program	No	Yes	No	No	No	No	Yes	No
Engineering Studies for Streams (Local/County/Regional)	Yes	Yes, loway Creek (Brookside, S Grand Ave & S Duff Ave)	No	No	No	Yes	No	No
National Weather Service (NWS) Storm Ready	N/A	No	No	No	Yes	No	No	No



	Story County - Unincorporated	Ames	Cambridge	Collins	Colo	Gilbert	Huxley	Kelley
Building Code Effectiveness Grading (BCEGs)	No	Yes	No	No	No	No	No	No
ISO Fire Rating	Varies across fire districts	Yes, evaluation in 2022	05/5X	6	6	N/A	5	Yes
Economic Development Program	Yes	Yes	No	No	Yes	No	Yes (AEDC contract)	No
Land Use Program	Yes	Yes	No	No	No	No	Yes	No
Public Education/Awareness	Yes	Yes	No	No	No	No	Yes	No
Property Acquisition	No	Yes, purchased lands for flood mitigation at S Duff Ave and S Grand/S 5th Ave	No	No	No	No	No	No
Stream Maintenance Program	No	Yes, stream restoration/erosion control projects identified in 5-year CIP	No	No	No	No	No	No
Mutual Aid Agreements	Yes	Yes, updated 2020	Yes	Yes	Yes	Yes	Yes	Yes
Emergency Notification Systems (Sirens, CodeRed, IPAWS/WEA, etc.)	Yes, Story County Iowa Alerts	Yes	Yes	Yes	Yes, Purchasing a new siren in 2023	Yes	Yes	Yes
Staff/Department								
Building Code Official	No	Yes	Yes	No	No, housing development will hire an individual once the development is started	Yes	Yes	No



	Story County - Unincorporated	Ames	Cambridge	Collins	Colo	Gilbert	Huxley	Kelley
Building Inspector	Yes	Yes	No	No	No, housing development will hire an individual once the development is started	Yes	Yes	Contract with Safe Building
Mapping Specialist (GIS)	Yes	Yes	No	No	No, working with Story County on GIS mapping	No	No (contractual)	County
Engineer	Yes	Yes	Yes, as needed	No	No	Yes	Yes	Contract
Public Works Official	N/A	Yes	Yes	Yes	Yes	Yes	Yes	No
Emergency Response Team	Yes, Sheriff's Office	Yes	Yes	Yes	No	No	No	No
NFIP Floodplain Administrator	Yes, also serves as CRS Coordinator	Yes	Yes	Yes	No	Yes	Yes	Yes
Development Planner	Yes	Yes	No	No	No	No	No, contractual	Contract
Emergency Management Coordinator	Yes	No	No	Story County	No	No	Yes, Story County	County
Emergency Response Team	Yes	Yes	Yes	Yes	No	No	No (contractual)	No
Hazardous Materials Expert	No	Yes, Hazmat Tech Team	No	No	No	No	No (contractual)	No
Local Emergency Planning Committee	Yes	Yes	No	No	Yes	No	No (contractual)	No
County Emergency Management Commission	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Sanitation Department	Yes	Yes, Resource Recovery, Water Pollution & Control	No	No	No	No	No	No
Transportation Department	Yes	Yes	No	No	No	Yes	No	No



	Story County - Unincorporated	Ames	Cambridge	Collins	Colo	Gilbert	Huxley	Kelley
Economic Development Department	Yes	No	Yes	No	Yes	No	No (AEDC contract)	No
Housing Department	No	Yes	No	No	No	No	No	No
Planning Consultant	No	No	No	No	No	No	Yes	Contract
Regional Planning Agencies	No	Yes	No	No	No	No	Yes	No
Historic Preservation	No	Yes	No	Yes	Yes	Yes	No	No
Non-Governmental Organizations (NGOs)								
American Red Cross	Yes	No	No	Yes	No	No	No (Ames)	No
Salvation Army	Yes	Yes	No	Yes	No	No	No (Ames)	No
Veterans Groups	Yes	Yes	Yes	No	No	No	No	No
Environmental Groups	Yes, Skunk River Navy, Prairie Rivers of Iowa, Isaac Walton League, Audubon Society	Yes	No	No	No	No	No	No
Homeowner Associations	N/A	Yes	No	No	No	No	Yes	No
Neighborhood Associations	Yes	Yes	No	No	No	No	No	No
Chamber of Commerce	Yes	Yes	Yes	Yes (Not in Collins)	No	Yes	No (Ames)	No
Community Organizations (Lions, Kiwanis, etc.)	Yes	Yes	No	Yes (Not in Collins)	No	No	Yes	No
Local Funding Availability								
Ability to fund projects through Capital Improvements funding	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ability to incur debt through general obligation bonds	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Ability to incur debt through special tax bonds	Yes	No	Yes	No	Yes	Yes	Yes	No



	Story County - Unincorporated	Ames	Cambridge	Collins	Colo	Gilbert	Huxley	Kelley
Ability to incur debt through private activities	No	No	No	No	Yes	Yes	Yes	No
Ability to withhold spending in hazard prone areas	No	No	Yes	Yes	Yes	No	No	No
Fees for water, sewer, gas, or electric services	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Apply for Community Development Block Grants	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Authority to levy taxes for a specific purpose	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Impact fees for new development	No	N/A	Yes	Yes	Yes	Yes	Yes	No
Other Local Funding Availability	Yes, ARPA	--	--	--	--	--	--	--

Table 3-8 Mitigation Capabilities (City of Maxwell through City of Zearing)

	Maxwell	McCallsburg	Nevada	Roland	Sheldahl	Slater	Story City	Zearing
City Governance								
City Hall (City Clerk)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fire Department	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Police Department	Story County	Story County	Yes	Story County	Yes	Story County	Yes	Story County
Public Works Department	Yes	No	Yes	Yes	No	Yes	Yes	Yes
Planning & Zoning Commission	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Board of Adjustments	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Library Board of Trustees	Yes	No	No	Yes	Yes	Yes	Yes	Yes



	Maxwell	McCallsburg	Nevada	Roland	Sheldahl	Slater	Story City	Zearing
Electric Board of Trustees	N/A	No	No	No	No	No	Yes	Yes
Community Center Board	Yes	No	No	No	No	No	Yes	Park Board
Policies/Ordinance								
Comprehensive/Land Use Plan	Yes, 1996	Updates planned	Yes	Yes, 2008	No	Yes	Yes	No
Capital Improvement Plan	Yes, 2013	Updates planned	Yes	Yes, reviewed yearly	No	Yes	Yes	Yes, beginning update
Local/County Emergency Plan	Yes, 2018	Yes	Yes, 2015	Yes, part of Story County plan	Yes	Yes	Yes – updated 2022	No
Local Mitigation Plan	Yes, 2018	No	Yes, 2018	Yes, 2014	No	No	Yes	No
Flood Mitigation Assistance (FMA) Plan	Yes, 2015	No	No	No	No	No	No	No
Watershed Plan	No	No	Yes, 2002	Yes, within Comprehensive Plan	No	Four Mile Creek Watershed Group	Yes	No
Critical Facilities Plan (Mitigation/Response/Recovery)	Yes, 2018	Yes, Chapter 30	Yes	Yes, within Comprehensive Plan	No	No	Yes	No
Economic Development Plan	No	No	Yes	No	No	No	Yes	No
Transportation Plan	No	No	Yes	No	No	No	Yes	No
Firewise or other fire mitigation plan	No	No	No	No	No	No	No	Yes
Zoning Ordinance	Yes	Yes	Yes	Yes, Ch. 165	Yes	Yes	Yes	Yes
Restricted Residential District	No	No	No	No	No	No	No	No
Subdivision Ordinance	Yes	Yes	No	Yes, Ch. 170	No	Yes	Yes	Yes
Building Code (year)	Yes, 2020	Yes, 2020	Yes, 2015 IBC	Yes (2021)	No	No	Yes, 2006	Yes, 2003
Building Permit Ordinance	Yes	Yes	Yes	Yes	Yes	Yes	Building permits required	No
Floodplain Ordinance	Yes, 2020	Yes	Yes	Yes	No – NA not mapped	Yes	Yes	Yes
Tree Trimming Ordinance	Yes	Yes	No	Yes, Ch. 151.04	Yes	No	Yes	Yes
Nuisance Ordinance	Yes	Yes	No	Yes, Ch. 50	Yes	Yes	Yes	Yes



	Maxwell	McCallsburg	Nevada	Roland	Sheldahl	Slater	Story City	Zearing
Stormwater Ordinance	No	Yes	Yes	Yes, Ch. 95.04(2), 97.01, 170.43	No	No	Yes	Yes
Drainage Ordinance	No	Yes	Yes	Yes, Ch. 97.02, 170.43	No	No	Through site plan review	Yes
Site Plan Review Requirements	Yes	No	No	Yes, Ch. 165.9	Yes	No	Yes	No
Historic Preservation Ordinance	No	No	No	Yes, Ch. 170.48	No	Yes	No	No
Landscape Ordinance	No	No	No	No	No	No	No – does cover trees in subdivisions	No
Iowa Wetlands and Riparian Areas Conservation Plan	No	No	No	No	No	No	No	No
Debris Management Plan	Yes, 2020	Yes	No	Yes	No	No	Yes	No
Program								
Zoning/Land Use Restrictions	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Codes Building Site/Design	Yes, 2012	Yes	Yes	Yes	No	Yes	Yes	No
National Flood Insurance Program (NFIP) Participant	Yes	Yes	Yes	Yes	No – Not mapped/not required	Yes	Yes	Yes
NFIP Community Rating System (CRS) Participant	No	No	No	No	No	No	No	No
Hazard Awareness Program	Yes	No	Yes	No	No	No	No	No
Planning/Zoning Boards	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Tree Trimming Program	Yes	No	Yes	No	No	No	Yes	No
Engineering Studies for Streams (Local/County/Regional)	No	No	No	Yes	No	Four Mile Creek Watershed Group	Yes	No
National Weather Service (NWS) Storm Ready	No	Yes	Yes, yearly training at FD	No	No	No	No	No
Building Code Effectiveness Grading (BCEGs)	No	No	Yes, 4	No	No	No	No	No
ISO Fire Rating	6	5	3	5	No	Yes	04	No
Economic Development Program	Yes	Yes	No	City of Ames Chamber	No	Yes	Yes	No



	Maxwell	McCallsburg	Nevada	Roland	Sheldahl	Slater	Story City	Zearing
Land Use Program	No	No	No	Sub Section of Comprehensive Plan	No	No	Yes	No
Public Education/Awareness	No	No	Yes	No	No	No	Yes	No
Property Acquisition	Yes	No	Yes	No	No	No	No	No
Stream Maintenance Program	No	No	Yes	No	No	No	Yes	No
Tree Trimming Program	Yes	No	Yes	No	No	Yes	Yes	No
Engineering Studies for Streams (Local/County/Regional)	No	No	Yes	Yes	No	No	Yes	No
Mutual Aid Agreements	Yes	Yes	Yes	Yes, Sheriff, Ambulance, Fire	Yes	Yes	Yes	Yes
Emergency Notification Systems (Sirens, CodeRed, IPAWS/WEA, etc.)	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Staff/Department								
Building Code Official	Yes	No	Yes	No	No	Yes	Yes	No
Building Inspector	Yes	No	Yes	Yes, Veenstra & Kimm	No	Yes	Yes	No
Mapping Specialist (GIS)	No	Yes	Yes	No	No	County	No	No
Engineer	Yes, Snyder & Assoc	No	Yes	Yes	No	Contracted	Yes	Yes, contracted only
Public Works Official	Yes	No	Yes	Yes	No	Yes	Yes	Yes
Emergency Response Team	Yes	No	Yes	Yes	Yes	No	Yes	No
NFIP Floodplain Administrator	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Development Planner	No	No	Yes	Yes	No	Yes	No	No
Emergency Management Coordinator	Yes, Story County	No	Yes, with Story County	Yes, Story County	No	Yes, Story County	Yes, Story County	No
Emergency Response Team	Yes	No	Yes, Story County Sheriff's Office	Yes	No		Yes	No
Hazardous Materials Expert	No	No	Yes, FDChief	Yes	No	No	Yes	No



	Maxwell	McCallsburg	Nevada	Roland	Sheldahl	Slater	Story City	Zearing
Local Emergency Planning Committee	Yes	Yes	Yes	No	No	No	Yes	No
Sanitation Department	Yes	No	Yes, outsourced	No	Yes	No	No	No
Transportation Department	No	No	Yes	No	No	No	Yes	No
Economic Development Department	No	Yes	Yes, with NEDC	Yes	No	No	Yes	No
Housing Department	No	No	No	No	No	No	Yes	No
Planning Consultant	No	No	No	Yes	No	No	Yes	No
Regional Planning Agencies	No	No	No	No	No	No	Yes	No
Historic Preservation	No	No	Yes	No	No	State	Yes	No
Non-Governmental Organizations (NGOs)								
American Red Cross	No	No	Yes	No	Yes	Yes	No	Yes, Ames
Salvation Army	No	No	Yes	No	No	No	No	Yes, Ames
Veterans Groups	Yes	No	Yes	Yes	Yes	Yes, Post 260?	Yes	No
Environmental Groups	No	No	Yes	No	No	No	No	No
Homeowner Associations	No	No	Yes	No	No	No	No	No
Neighborhood Associations	No	No	Yes	No	No	No	No	No
Chamber of Commerce	No	No	Yes	No	No	Yes, Slater Community Club	Yes	No
Community Organizations (Lions, Kiwanis, etc.)	Yes	No	Yes	Yes	No	Yes	Yes	No
Local Funding Availability								
Ability to fund projects through Capital Improvements funding	Yes	Yes	Yes	Yes	No	Yes	Yes	No
Ability to incur debt through general obligation bonds	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Ability to incur debt through special tax bonds	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No



	Maxwell	McCallsburg	Nevada	Roland	Sheldahl	Slater	Story City	Zearing
Ability to incur debt through private activities	No	Yes	Yes	Yes	No	??	No	No
Ability to withhold spending in hazard prone areas	No	Yes	Yes	No	Yes	??	No	No
Fees for water, sewer, gas, or electric services	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Apply for Community Development Block Grants	Yes	Yes	Yes	No	Yes	No	Yes	No
Authority to levy taxes for a specific purpose	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Impact fees for new development	No	Yes	Yes	Yes	Yes	No	No	No
Other Local Funding Availability	--	--	--	County Emergency Management Short Term Loan	--	--	Yes	--



3.2.1 NFIP Participation

In support of the NFIP, FEMA identifies flood hazard areas through the US and its territories by producing Flood Hazard Boundary Maps (FHNMs), Flood Insurance Maps (FIRMs) and Flood Boundary and Floodway Maps (FBFMs). Several areas of flood hazards are commonly identified on these maps. One of these areas is the Special Flood Hazard Area (SFHA) or high-risk area defined as any land that would be inundated by a flood having a 1% chance of occurring any given year (also referred to as the base flood level).

Participation in the NFIP is completely voluntary (although some states require NFIP participation as part of their flood plain management program) by cities and participation is on a community rather than an individual basis. Participating in the program allows those who want to purchase flood insurance for their insurable property, whether it is a home or other property. Almost every type of walled and roofed building that is principally above ground and not entirely over water may be insured if it is in a participating community.

Table 3-9 Story County NFIP Participating Jurisdictions

Jurisdiction	Adoption of NFIP Min. Floodplain Management Criteria	Current Effective Map Date: 1/15/2021	Implementation & Enforcement of Local Flood-Plain Regulation on Development in SFHAs	Designee/ Agency to Implement NFIP Requirements	Describe How Jurisdiction Implements Substantial Improvement/ Substantial Damage Provision
Story County	Yes	Yes	Yes (floodplain ordinance)	County Planning and Development	The County floodplain ordinance treats substantially improved/ substantially damaged properties the same as new construction for purposes of meeting floodplain requirements.
Ames	Yes	Yes	Yes (floodplain ordinance)	Director of Planning and Housing	The City floodplain ordinance treats substantially improved/ substantially damaged properties the same as new construction for purposes of meeting floodplain requirements.
Cambridge	Yes	Yes	Yes (floodplain management ordinance)	Mayor	Building improvements determined to be a SI/SD based on an improvement of 50% of market value or damaged more than 50% of market value are required to submit a floodplain application to be reviewed and approved prior to a floodplain construction permit being issued.
Collins	Yes	Yes	Yes (floodplain management ordinance)	City Clerk	Building improvements determined to be a SI/SD based on an improvement of 50% of market value or damaged more than 50% of market value are required to submit a floodplain application to be reviewed and approved prior to a floodplain construction permit being issued.



Jurisdiction	Adoption of NFIP Min. Floodplain Management Criteria	Current Effective Map Date: 1/15/2021	Implementation & Enforcement of Local Flood-Plain Regulation on Development in SFHAs	Designee/ Agency to Implement NFIP Requirements	Describe How Jurisdiction Implements Substantial Improvement/ Substantial Damage Provision
Gilbert	Yes	Yes	Yes (Floodplain Regulations)	Mayor	The City floodplain ordinance treats substantially improved/ substantially damaged properties the same as new construction for purposes of meeting floodplain requirements.
Huxley	Yes	Yes	Yes (floodplain management ordinance)	Zoning Administrator	The City floodplain ordinance treats substantially improved/ substantially damaged properties the same as new construction for purposes of meeting floodplain requirements.
Kelley	Yes	Yes	Yes (floodplain management ordinance)	City Clerk	Building improvements determined to be a SI/SD based on an improvement of 50% of market value or damaged more than 50% of market value are required to submit a floodplain application to be reviewed and approved prior to a floodplain construction permit being issued.
Maxwell	Yes	Yes	Yes (floodplain management ordinance)	Building Inspector	Building improvements determined to be a SI/SD based on an improvement of 50% of market value or damaged more than 50% of market value are required to submit a floodplain application to be reviewed and approved prior to a floodplain construction permit being issued.
McCallsburg	Yes	Yes	Yes (Floodplain Regulations)	Mayor	Building improvements determined to be a SI/SD based on an improvement of 50% of market value or damaged more than 50% of market value are required to submit a floodplain application to be reviewed and approved prior to a floodplain construction permit being issued.
Nevada	Yes	Yes	Yes (Floodplain Regulations)	Zoning Administrator	Building improvements determined to be a SI/SD based on an improvement of 50% of market value or damaged more than 50% of market value are required to submit a floodplain application to be reviewed and approved prior to a floodplain construction permit being issued.



Jurisdiction	Adoption of NFIP Min. Floodplain Management Criteria	Current Effective Map Date: 1/15/2021	Implementation & Enforcement of Local Flood-Plain Regulation on Development in SFHAs	Designee/ Agency to Implement NFIP Requirements	Describe How Jurisdiction Implements Substantial Improvement/ Substantial Damage Provision
Roland	Yes	Yes	Yes (Floodplain Regulations)	City Clerk/Administrator	Building improvements determined to be a SI/SD based on an improvement of 50% of market value or damaged more than 50% of market value are required to submit a floodplain application to be reviewed and approved prior to a floodplain construction permit being issued.
Slater	Yes	Yes	Yes (Floodplain Regulations)	City Administration	Building improvements determined to be a SI/SD based on an improvement of 50% of market value or damaged more than 50% of market value are required to submit a floodplain application to be reviewed and approved prior to a floodplain construction permit being issued.
Story City	Yes	Yes	Yes (floodplain management ordinance)	Zoning Administrator	Building improvements determined to be a SI/SD based on an improvement of 50% of market value or damaged more than 50% of market value are required to submit a floodplain application to be reviewed and approved prior to a floodplain construction permit being issued.
Zearing	Yes	Yes	Yes (floodplain regulations)	Zoning Administrator	Building improvements determined to be a SI/SD based on an improvement of 50% of market value or damaged more than 50% of market value are required to submit a floodplain application to be reviewed and approved prior to a floodplain construction permit being issued.

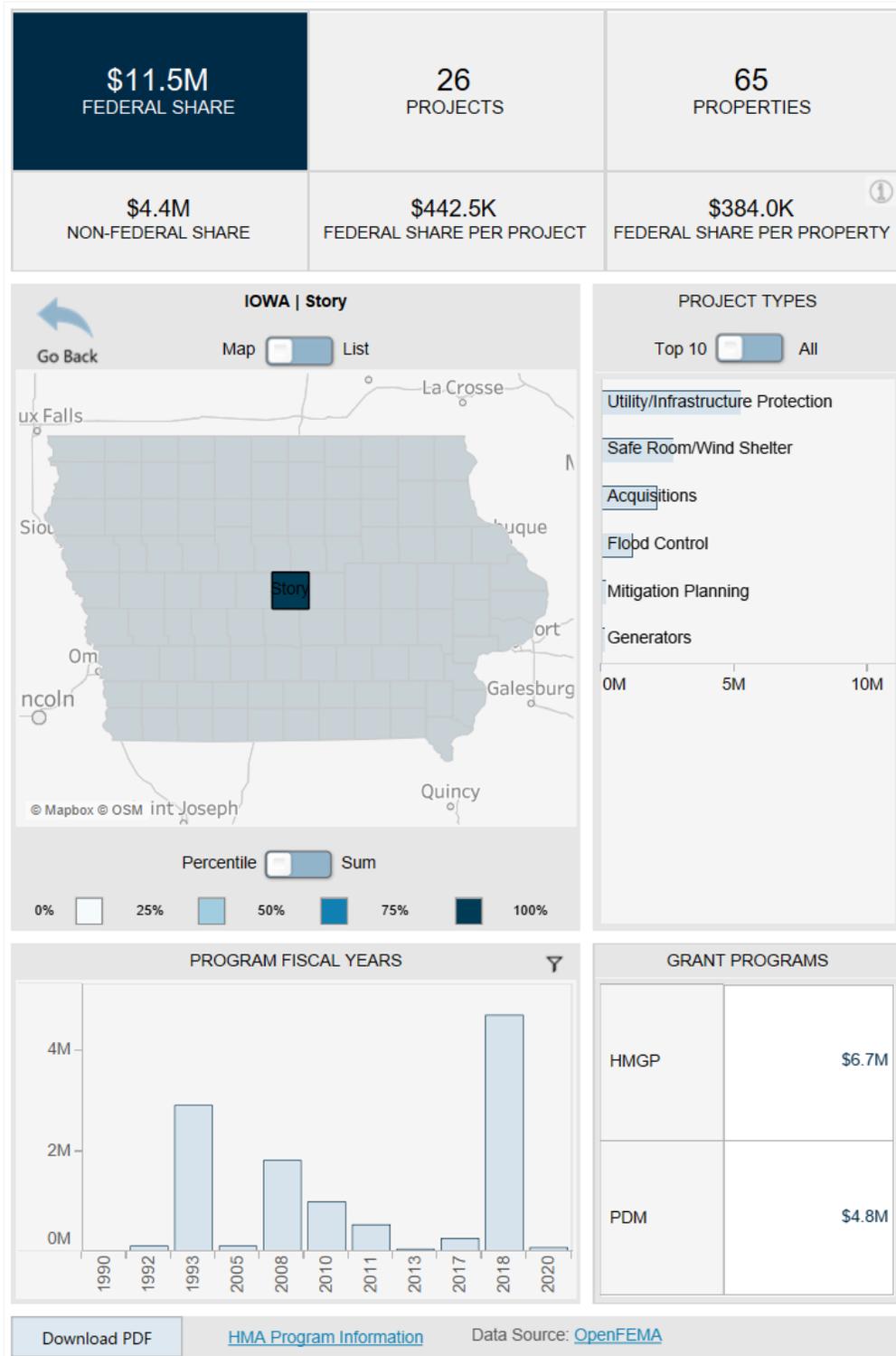
Source: HMPC, NFIP Community Information System

3.2.1.1 FEMA Hazard Mitigation Assistance Grants in Planning Area

According to FEMA, Story County and its jurisdictions have received Hazard Mitigation Assistance (HMA) funding for 26 different projects since 1990, totaling approximately \$11.5 million in federal assistance funds. \$6.7 million was under the Hazard Mitigation Grant Program (HMGP) and \$4.8 in Pre-Disaster Mitigation (PDM) funds. These grants were used for a variety of mitigation activities, including utility/infrastructure protection projects, safe rooms, property acquisitions, flood control, mitigation planning, and generators. Figure 3-5 below provides a visualization summary of the HMA funds received by Story County, as well as information on how the funds were utilized, what fiscal years they were received in, and the program funding was secured through.



Figure 3-5 Story County Hazard Mitigation Assistance Visualization





3.2.2 Summary of Capabilities and Opportunities for Improvement

Story County and the participating jurisdictions collectively have robust regulatory capabilities with adequate plans for implementing mitigation activities. These plans include a Comprehensive Plan, Capital Improvement Plan, Local Emergency Plan and Mitigation Plan. Notably, all participating jurisdictions, except the City of Colo and Sheldahl, actively participate in the National Flood Insurance Program (NFIP). The County extends emergency service support to the majority of jurisdictions, further strengthening its overall preparedness. Moreover, the State of Iowa has provided valuable assistance in conducting vulnerability assessments.

However, the CPT has noted gaps in capabilities that leave communities vulnerable. These gaps include the absence of essential components such as building codes, comprehensive land use zoning and regulations, critical facilities plan, fire safety programs, and hazard awareness programs.

Story County

- To address these deficiencies, it is recommended that the County explores innovative approaches to engage the public in discussions on hazard mitigation and awareness. Establishing an ongoing local mitigation committee could also help keep organizations and residents engaged in these issues.
- In addition, the County in concert with the incorporated jurisdictions should enhance the accessibility of information on their websites related to potential hazards, emergency preparedness, and response measures. Creating a dedicated webpage with consolidated information, including evacuation routes, emergency alerts, and links to County, State, and Federal resources, would greatly benefit residents. Such a resource hub will empower residents to learn more about potential hazards and easily access information in the event of an incident, contributing to a more informed and resilient community. Other items that the County should
- County should consider adopting building codes as noted in **Table 5-3** in the Mitigation Action Plan.
- County should consider opportunities for increasing CRS rating to potentially lower the cost of flood insurance for residents in the unincorporated area.

City of Ames

- Consider partnering with jurisdictions on a comprehensive Critical Facilities Plan that identifies and prioritizes key infrastructure and facilities critical for community functioning. This plan should include strategies for mitigation, response, and recovery.
- Consider joining the NFIP Community Rating System (CRS) Program for discounts on flood insurance.
- Join the Firewise USA program, which empowers communities to reduce the risk of wildfire damage by implementing fire-safe practices.
- Consider adopting a system for emergency notification and warnings.
- Incorporate hazard mitigation considerations into zoning regulations and comprehensive plans.
- Partner with the Iowa State University for GIS mapping, research, and community outreach and education.

City of Cambridge

- Consider partnering with jurisdictions on a comprehensive Critical Facilities Plan that identifies and prioritizes key infrastructure and facilities critical for community functioning. This plan should include strategies for mitigation, response, and recovery.



- Join the Firewise USA program, which empowers communities to reduce the risk of wildfire damage by implementing fire-safe practices.
- Incorporate hazard mitigation considerations into zoning regulations and comprehensive plans.
- Work to increase public awareness of potential hazards and mitigation actions they should take through education outreach programs.
- Consider adopting a system for emergency notification and warnings

City of Collins

- Consider partnering with jurisdictions on a comprehensive Critical Facilities Plan that identifies and prioritizes key infrastructure and facilities critical for community functioning. This plan should include strategies for mitigation, response, and recovery.
- Incorporate hazard mitigation considerations into zoning regulations and comprehensive plans
- Work to increase public awareness of potential hazards and mitigation actions they should take through education outreach programs.
- Consider adopting a system for emergency notification and warnings

City of Colo

- Consider partnering with jurisdictions on a comprehensive Critical Facilities Plan that identifies and prioritizes key infrastructure and facilities critical for community functioning. This plan should include strategies for mitigation, response, and recovery.
- Incorporate hazard mitigation considerations into zoning regulations and comprehensive plans.
- Work to increase public awareness of potential hazards and mitigation actions they should take through education outreach programs.

City of Gilbert

- Consider partnering with jurisdictions on a comprehensive Critical Facilities Plan that identifies and prioritizes key infrastructure and facilities critical for community functioning. This plan should include strategies for mitigation, response, and recovery.
- Incorporate hazard mitigation considerations into zoning regulations and comprehensive plans.
- Consider adopting a system for emergency notification and warnings
- Conduct a comprehensive review of the existing building codes and ordinances to ensure they align with the latest national and international standards.
- Partner with state, county, or neighboring jurisdictions on sharing staff resources such as a grant writer or GIS mapping specialist.

City of Huxley

- Consider partnering with jurisdictions on a comprehensive Critical Facilities Plan that identifies and prioritizes key infrastructure and facilities critical for community functioning. This plan should include strategies for mitigation, response, and recovery.
- Work to increase public awareness of potential hazards and mitigation actions they should take through education outreach programs.
- Conduct a comprehensive review of the existing building codes and ordinances to ensure they align with the latest national and international standards.

City of Kelley

- Consider partnering with jurisdictions on a comprehensive Critical Facilities Plan that identifies and prioritizes key infrastructure and facilities critical for community functioning. This plan should include strategies for mitigation, response, and recovery.



- Work to increase public awareness of potential hazards and mitigation actions they should take through education outreach programs.
- Conduct a comprehensive review of the existing building codes and ordinances to ensure they align with the latest national and international standards.
- Incorporate hazard mitigation considerations into zoning regulations and comprehensive plans.

City of Maxwell

- Join the Firewise USA program, which empowers communities to reduce the risk of wildfire damage by implementing fire-safe practices.
- Incorporate hazard mitigation considerations into zoning regulations and comprehensive plans.
- Partner with state, county, or neighboring jurisdictions on sharing staff resources such as a grant writer or GIS mapping specialist.

City of McCallsburg

- Incorporate hazard mitigation considerations into zoning regulations and comprehensive plans.
- Work to increase public awareness of potential hazards and mitigation actions they should take through education outreach programs.
- Conduct a comprehensive review of the existing building codes and ordinances to ensure they align with the latest national and international standards.
- Incorporate hazard mitigation considerations into zoning regulations and comprehensive plans.

City of Nevada

- Join the Firewise USA program, which empowers communities to reduce the risk of wildfire damage by implementing fire-safe practices.
- Work to increase public awareness of potential hazards and mitigation actions they should take through education outreach programs.

City of Roland

- Incorporate hazard mitigation considerations into zoning regulations and comprehensive plans.
- Work to increase public awareness of potential hazards and mitigation actions they should take through education outreach programs.
- Partner with state, county, or neighboring jurisdictions on sharing staff resources such as a grant writer or GIS mapping specialist.

City of Sheldahl

- Incorporate hazard mitigation considerations into zoning regulations and comprehensive plans.
- Consider adopting a system for emergency notification and warnings.
- Partner with state, county, or neighboring jurisdictions on sharing staff resources such as a grant writer or GIS mapping specialist.

City of Slater

- Consider partnering with jurisdictions on a comprehensive Critical Facilities Plan that identifies and prioritizes key infrastructure and facilities critical for community functioning. This plan should include strategies for mitigation, response, and recovery.
- Incorporate hazard mitigation considerations into zoning regulations and comprehensive plans.
- Work to increase public awareness of potential hazards and mitigation actions they should take through education outreach programs.



- Conduct a comprehensive review of the existing building codes and ordinances to ensure they align with the latest national and international standards.

Story City

- Incorporate hazard mitigation considerations into zoning regulations and comprehensive plans.
- Work to increase public awareness of potential hazards and mitigation actions they should take through education outreach programs.
- Conduct a comprehensive review of the existing building codes and ordinances to ensure they align with the latest national and international standards.
- Partner with state, county, or neighboring jurisdictions on sharing staff resources such as a grant writer or GIS mapping specialist.

City of Zearing

- Consider adopting building codes to improve structure resilience to hazards.
- Partner with state, county, or neighboring jurisdictions on sharing staff resources such as a grant writer or GIS mapping specialist.

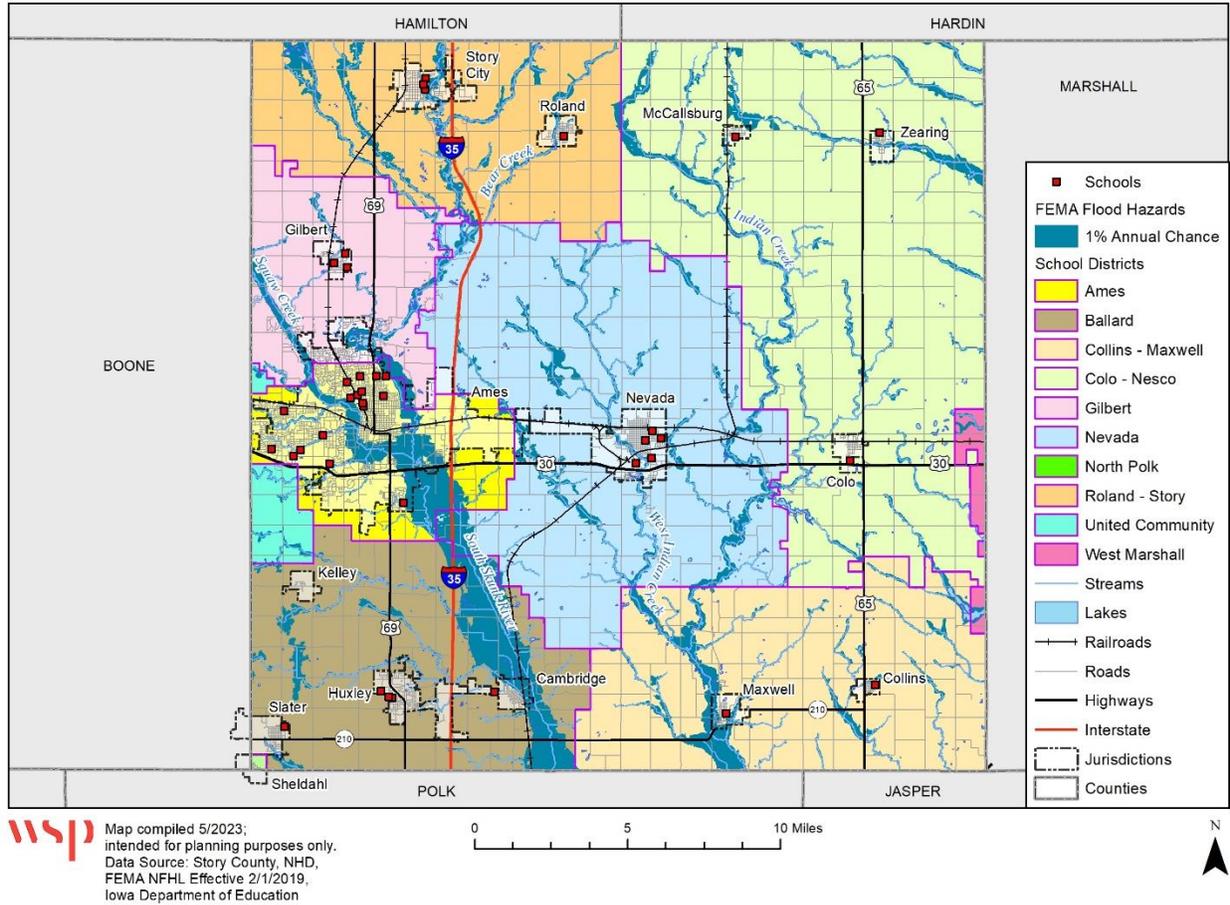
School Districts

- Improve integration of hazard information into strategic/general plans.
- Develop educational material on hazards for students, staff, and parents.
- Consider becoming NWS StormReady communities.

3.2.3 Public School District and State University Profiles and Mitigation Capabilities

This section includes general profile information for the Story County Public School Districts and Iowa State University. Figure 3-6 provides the boundaries of the school districts in Story County.

Figure 3-6 Story County Public School Districts



Potential capabilities to implement mitigation programs and projects can vary among school districts. To determine mitigation capabilities, Story County’s public school districts and Iowa State University completed Data Collection Guides to report planning, personnel, fiscal, and other capabilities related to the implementation of mitigation programs and projects. Table 3-10 provides a summary of the District’s reported capabilities.



Table 3-10 Summary of Mitigation Capabilities, Story County Public School Districts and Iowa State University

Capability	Ames CSD	Ballard CSD	Colo- Nesco CSD	Gilbert CSD	Nevada CSD	Roland CSD	Iowa State University
Planning Elements							
Master Plan	Yes	Yes, 2023	Yes	Yes	n/a	Yes, 2014	Yes, 2000
Capital Improvement Plan	Yes	Yes, 2023	No	Yes	Yes	No	Yes
School Emergency Plan	Yes	Yes, 2022	Yes	Yes	Yes	Yes, 09/2017	Yes, 2017 – Comprehensive Emergency Operation Plan, Shelter in place protocols, campus evacuation protocols
Weapons Policy	Yes	Yes, 2017	Yes, 2017	Yes	Yes, 01/2017	Yes, 07/2008; board policy 502.6	Yes, 2008
Personnel Resources							
Full-time building official (i.e. principal)	Yes, Principal	Yes, Superintendent	Yes, Buildings & Grounds	Yes	Yes, Principal and Buildings & Grounds	Yes, Principal	Yes, Senior Vice President for University Services
Emergency Manager	No	No	No	No	Story County	Yes, Principal	Observer status only; state law does Not recognize universities as political subdivisions with EM commission representation
Grant Writer	No	No	No	No	No	No	Yes, Office of Sponsored Programs Administration
Public Information Officer	Yes, Media Relations Director	No	Yes, Principal	Yes	Yes, Superintendent	Yes, Superintendent	Yes, University Relations
Financial Resources							
Capital Improvements project funding	Yes	Yes	Yes	Yes	Yes	Yes, PPEL & SAVE	Yes
Local funds	No	No	Yes	Yes	Yes	No	No
General obligation bonds	Yes	Yes	Yes	Yes	Yes	Yes	No



Capability	Ames CSD	Ballard CSD	Colo-Nesco CSD	Gilbert CSD	Nevada CSD	Roland CSD	Iowa State University
Bonds	No	No	Yes	Yes	Yes	Yes	Yes
Private activities/donations	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State and federal funds	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Public Education Programs							
Fire evacuation training	Yes	Yes	Yes	No	Yes	No	Yes
Tornado sheltering Exercises	Yes	Yes	Yes	No	Yes	No	Yes
Public Address/Emergency Alert System	Yes, Public Address through fire alarm system speakers	Yes, available through every phone	Yes, PA system	Yes, intercom system and a radio system for all building offers and bus systems; fire and tornado alarms	Yes, intercom system and radio system for all building offices and bus system; fire and tornado alarms	Yes, intercom system	Some buildings have indoor PA system; Campus has outdoor warning system; ISU Alert notification system
NOAA Weather Radios	Yes	Yes	Yes	Yes	Yes	No	Yes
Mitigation Programs	New construction with fire sprinklers, fire alarms, door access control, current life safety compliance and building code compliance	Development of training plan for emergency preparedness	Fire & tornado drills	Yes	Fire, tornado, and ALICE drills	Installed security cameras and door access controls	Dry-floodproofed three campus buildings: Lied Recreation Athletic Facility, Hilton Coliseum, and Scheman Building
Tornado Shelter/Saferoom	Yes	No, Middle School in Huxley has access to City's saferoom	Yes	Yes, meets FEMA standards	Yes, meets FEMA standards	No	Yes, two meet FEMA standards; other buildings have designated shelter areas
Campus Police	No	No	No	No (contract with Story County Sheriff)	No, rely on Nevada Police Department	No, rely on the Story City Police and Story County Sheriff's Dept.	Yes, 30 police officers and dispatchers provide 24/7 service



4 Risk Assessment

44 CFR Requirement §201.6(c)(2)

[The plan shall include] A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards. The risk assessment shall include:

- (i) A description of the type, location, and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.*
- (ii) A description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. The plan should describe vulnerability in terms of:
 - (A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas;*
 - (B) An estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate;*
 - (C) Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.**
- (ii) For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.*

The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure within Story County, Iowa to these hazards. The goal of the risk assessment is to estimate the potential loss in the planning area, including loss of life, personal injury, property damage, and economic loss, from a hazard event. The risk assessment process allows communities in the planning area to better understand their potential risk to the identified hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

A key step to mitigate disaster losses is to develop a comprehensive understanding of the community's hazards, vulnerabilities, and risks. The following terms are used throughout the Plan to facilitate comparisons between communities.

- **Hazard:** Event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss. Hazards may be naturally occurring (flood, tornado, etc.) or human-caused (active threat, hazmat, etc.).
- **Vulnerability:** Degree of susceptibility to physical injury, harm, damage, or economic loss; depends on an asset's construction, contents, and economic value of its functions.
- **Risk:** The potential for damage, loss, or other impacts created by the interaction of hazards with vulnerabilities.

The risk assessment evaluates potential loss from hazards by assessing the vulnerability of the County's population, built environment, critical facilities, and other assets. Environmental and social impacts are also taken into consideration wherever possible. This risk assessment covers the entire geographical area of Story County. Since this is a multi-jurisdictional plan, the Planning Team also evaluated how the hazards and risks vary from jurisdiction to jurisdiction.



The risk assessment for Story County and participating jurisdictions followed the methodology described in the 2013 FEMA Local Mitigation Planning Handbook, which includes a four-step process:

- Step 1 – Describe Hazards
- Step 2 – Identify Community Assets
- Step 3 – Analyze Risks
- Step 4 – Summarize Vulnerability

4.1 Hazard Identification

The Hazard Identification and Risk Assessment (HIRA) focuses attention on areas most in need by analyzing the populations and facilities that are most vulnerable to hazards and to what extent damages may occur. The risk assessment identifies how people, properties, and structures will be damaged due to a hazardous event. If the hazard can harm structures or people, that is considered a vulnerability. Finding weak points in the system include identifying building types that are vulnerable to damage and anticipating the loss in high-risk areas. This will help the community to decide what mitigation efforts are required or should be undertaken and how to implement the selected activities.

The HMPC reviewed the 18 natural and human-caused hazards profiled in the 2018 Story County HMP, along with the 19 natural and human-caused hazards in the 2018 State of Iowa HMP. The HMPC then discussed changes in priority and probability of these various hazards or any new information that would change the hazards that can affect Story County. Table 4-1 provides the details of the comparison.

Table 4-1: Hazard Identification and Comparison Chart

2018 State of Iowa HMP	2018 Story County HMP	2023 Story County HMP
Animal/Plant/Crop Disease	Animal/Plant/Crop Disease	Animal/Plant/Crop Disease
Dam/Levee Failure	Dam/Levee Failure	--
Drought	Drought	Drought
Earthquake	Earthquake	--
Expansive Soils	Expansive Soils	--
Extreme Heat	Extreme Heat	Extreme Heat
Flooding	Flash Flood & River Flooding	Flooding
Grass Fire or Wildland Fire	Grass/Wildland Fire	Grass/Wildland Fire
Hazardous Materials	Hazardous Materials Incident	Hazardous Materials Incident
Infrastructure Failure	Human Disease	Human Disease
Landslide	Infrastructure Failure	Infrastructure Failure
Pandemic Human Disease	Landslide	--
Radiological Incident	--	---
Severe Winter Storm	Severe Winter Storm	Severe Winter Storm
Sinkhole	Sinkhole	Sinkhole
Terrorism	Terrorism	Terrorism
Thunderstorm/Lightning/Hail	Thunderstorm/Lightning/Hail	Thunderstorm/Lightning/Hail
Tornado/Windstorm	Tornado/Windstorm	Tornado/Windstorm
Transportation Incident	Transportation Incident	Transportation Incident



The hazards detailed above which have been evaluated in this plan include those that have occurred historically or have the potential to cause significant human and/or monetary losses in the future. Based on these criteria, the HMPC determined the following hazards were not significant enough to the planning area to address them further:

- **Dam/Levee Failure:** It was decided that the few dams which are present in Story County do not present a major threat to populated areas or infrastructure. Relevant details have been incorporated in the Flooding chapter.
- **Earthquake:** As the planning area is a relatively aseismic region with little to no potential for strong ground shaking, and no major history of damaging past events, the HMPC agreed that this hazard did not present a major concern for Story County.
- **Expansive Soils:** This hazard is recognized as a possible geologic process to occur in the planning area, but one that is very unlikely to cause major damages or casualties. As such, the HMPC agreed this hazard did not present a significant concern for Story County.
- **Landslide:** No specific previous occurrences of landslides were reported by the HMPC or discovered during research, and the HMPC did not identify any specific assets or areas of development vulnerable to possible landslides. This hazard does not present a significant concern for Story County.

Additionally, while the 2018 Plan profiled Flash Flood & River Flood separately, the HMPC elected to combine them for the 2023 Plan to align with the State HMP.

4.1.1 Disaster Declaration History

Additional Information utilized to identify hazards relevant for Story County was obtained by examining events that triggered federal disaster declarations. Federal and/or state declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government’s capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. If the disaster is so severe that both the local and state governments’ capacities are exceeded, a federal disaster declaration (DR) may be issued allowing for the provision of federal assistance.

FEMA also issues emergency declarations, which are more limited in scope and do not include the long-term federal recovery programs of major disaster declarations. Determinations for declaration type are based on scale and type of damages and institutions or industrial sectors affected.

Table 4-2 lists federal disaster declarations that included Story County for the period from 1965 to 2023.

Table 4-2: Disaster Declarations that included Story County, Iowa, 1969-2023

Disaster Number	Declaration Date	Title	Incident Begin Date	Incident End Date
259	4/25/1969	Flooding	4/25/1969	4/25/1969
443	6/24/1974	Severe Storms & Flooding	6/24/1974	6/24/1974
868	5/26/1990	Severe Storms & Flooding	5/18/1990	7/6/1990
911	7/12/1991	Severe Storms & Flooding	6/1/1991	6/15/1991
996	7/9/1993	Severe Storms & Flooding	4/13/1993	10/1/1993
1133	8/21/1996	Severe Storms, And Flooding	6/15/1996	6/30/1996
1230	7/2/1998	Severe Storms, Tornadoes and Flooding	6/13/1998	7/15/1998
1282	7/22/1999	Severe Storms and Flooding	7/2/1999	8/10/1999
1518	5/25/2004	Severe Storms, Tornadoes, and Flooding	5/19/2004	6/24/2004



Disaster Number	Declaration Date	Title	Incident Begin Date	Incident End Date
1688	3/14/2007	Severe Winter Storms	2/23/2007	3/2/2007
1763	5/27/2008	Severe Storms, Tornadoes, and Flooding	5/25/2008	8/13/2008
1880	3/2/2010	Severe Winter Storm	1/19/2010	1/26/2010
1930	7/29/2010	Severe Storms, Flooding, and Tornadoes	6/1/2010	8/31/2010
4016	8/24/2011	Severe Storms, Straight-Line Winds, and Flooding	7/9/2011	7/14/2011
4126	7/2/2013	Severe Storms, Tornadoes, and Flooding	5/19/2013	6/14/2013
4386	8/20/2018	Severe Storm	6/6/2018	7/2/2018
3480	3/13/2020	Biological	1/20/2020	5/11/2023
4483	3/23/2020	Biological	3/17/2020	5/11/2023
4557	8/17/2020	Severe Storm	8/10/2020	8/11/2020

Source: Federal Emergency Management Agency, www.fema.gov/

The U.S. Department of Agriculture’s Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans (EM) to producers suffering losses in those counties, and in counties that are contiguous to a designated county. In addition to EM eligibility, other emergency assistance programs, such as Farm Service Agency (FSA) disaster assistance programs, have historically used disaster designations as an eligibility requirement trigger.

Table 4-3 provides the USDA Secretarial disaster declarations that included Story County from 2012 to 2022. Details on USDA declarations prior to 2012 are not available.

Table 4-3: USDA Secretarial Disaster Declarations Including Story Co. (2012-2022)

County	Crop Year	Designation No.	Drought	Wind, High Winds	Fire, Wildfire	Heat, Excessive heat High temp. (incl. low humidity)	Frost, Freeze	Insects	Begin Date	Description of disaster
Story	2012	S3310	1	1	1	1		1	7/24/2012	Drought-FAST TRACK
Story	2013	S3614	1	1	1	1		1	8/27/2013	Drought-FAST TRACK
Story	2013	S3618	1						7/15/2013	Drought
Story	2020	S4756	1						8/24/2020	Drought-FAST TRACK
Story	2020	S4786		1					9/3/2020	Derecho
Story	2020	S4788	1						9/8/2020	Drought-FAST TRACK
Story	2021	S5037	1						8/10/2021	Drought-FAST TRACK
Story	2022	S5301	1						10/3/2022	Drought-FAST TRACK

Source: U.S. Department of Agriculture; <https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index>

4.1.2 Data Sources

Hazard data was obtained from various federal, state, and local sources such as FEMA, the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI), the United States Geological Survey (USGS), and others. Together, these sources were examined to assess the significance of these hazards to the County.

Additional data on locations and past impacts of hazards in the planning area was collected from the following sources:

- Digital Flood Insurance Rate Map (DFIRM), FEMA
- Story County Emergency Management
- Story County Flood Insurance Study, FEMA
- Data Collection Guides completed by each jurisdiction
- Environmental Protection Agency
- Federal Emergency Management Agency (FEMA)
- Flood Insurance Administration
- Hazards US (Hazus)
- Iowa Department of Agriculture and Land Stewardship, Division of Soil Conservation
- Iowa Department of Education, Bureau of Information and Analysis Services
- Iowa Department of Natural Resources
- Iowa Department of Public Safety
- Iowa Department of Transportation, Office of Traffic and Safety
- Iowa State Hazard Mitigation Plan (2018)
- Iowa Utilities Board
- National Drought Mitigation Center Drought Reporter
- National Fire Incident Reporting System (NFIRS)
- National Oceanic and Atmospheric Administration's (NOAA) National Center for Environmental Information (NCEI)
- Pipeline and Hazardous Materials Safety Administration
- U.S. Army Corps of Engineers
- U.S. Department of Agriculture's (USDA) Risk Management Agency Crop Insurance Statistics
- U.S. Department of Transportation
- United States Geological Survey
- Various articles and publications available on the internet (sources are indicated where data is cited)

While this plan takes advantage of the data that is available through NOAA's National Center for Environmental Information (NCEI) Storm Events Database and other sources, some hazards have a shorter span of time for which data is available. The NCEI database is used as a primary source for many hazards discussed in this plan, but for some hazards and/or some communities, only partial records of significant events are available. In addition, details about each hazard event may not be available if the data is older. For example, tornado data from the 1950's classifies tornado events at the county level and often does not give a specific location of the event within the county. Historical trends can help us predict the probability of each hazard, but realistically, many hazards analyzed in this plan could occur at any point in time. The hazard identification and risk assessment activities rank hazards according to the data that was available at the time of the plan update.

For flash flooding, communities described flood events in which short periods of heavy rainfall flooded streets, basements, and backed up sewer systems. In some cases, any period of prolonged rainfall could cause streets or sewers to flood; NCEI data did not capture the frequency of these events, but communities did not feel that it was necessary to add to the events that NCEI data already reported. It should be noted

that these events may not cause substantial damage to houses or structures, but they may result in flood costs that the county taxpayers and individual property owners must finance.

Data frames vary for each hazard. For most hazards with established data sets (i.e.: NCEI, IDNR hazardous spills summary reports, Iowa Department of Public Health, etc.), the data frame begins with the earliest year in which data was available and ends with 2022. The year 2022 was used as an ending date for data to allow for a complete year of data as data collection and the planning process began in 2023. Some instances use half-year data for 2023, which is noted on a case-by-case basis. For hazards that relied more on the knowledge of city officials, public works employees, firefighters, and emergency responders as a data source, a ten-year data frame was used. The ten-year period for this type of data allows people to recall events and problems to the best of their knowledge. Hazards that used a ten-year period include grass or wildland fire, infrastructure failure, terrorism, and transportation incident. Note that some of these hazards used supplementary data in addition to local knowledge; this data also concentrated on a ten-year time frame.

4.1.3 Hazard and Risk Assessment Methodology

The planning committee's next step was to profile each hazard that was identified from the first step. Through the profiling process the planning committee discussed: historical occurrences; the probability of the hazard occurring again in the future; the vulnerability of the population that will be affected by the hazard; the maximum geographic extent; the magnitude or severity of the hazard in terms of injuries/fatalities, personal property, and infrastructure; the amount of warning time available before the hazard occurs; and the duration of the hazard event.

The economic impact of disasters is a relatively new area of record-keeping and is generally restricted to major disasters involving both state and federal funding. Smaller, less significant events often do not reflect the economic impact of the incident. For these smaller events, there is a greater reliance on local information and records of impacts.

As described in Section 3.1.4 below, the anticipated impacts of climate change on each hazard were also taken into account, to ensure the profiles reflected the likely hazard behavior in the future, rather than just looking at past behavior.

Hazards were profiled and ranked based on the following factors:

- **Location (Spatial Extent):** How much of the planning area is potentially at risk from the hazard?
 - Extensive: 50-100% of planning area.
 - Significant: 10-50% of planning area.
 - Limited: Less than 10% of planning area.
- **Magnitude/Severity:** What are the likely impacts of the hazard?
 - Catastrophic: Multiple deaths, shutdown of facilities for 30 days or more, >50% of property is severely damaged.
 - Critical: Multiple severe injuries, shutdown of facilities for at least 2 weeks, >25% of property is severely damaged.
 - Moderate: Some injuries, shutdown of critical facilities for more than one week, >10% of property is severely damaged.
 - Negligible: Minor injuries, minimal quality-of-life impact, interruption of facilities and services for 24 hours or less, less than 10% of property is severely damaged.

- **Probability of Future Occurrence:** How often is the hazard likely to occur?
 - Highly Likely: Near 100% probability each year.
 - Likely: Between 10 and 100% probability per year or at least one chance in ten years.
 - Occasional: Between 1 and 10% probability per year or at least one chance in next 100 years.
 - Unlikely: Less than 1% probability in next 100 years.

- **Overall Significance:** Based on a combination of the previous three factors, as well as input and opinions from the HMPC on the perceived risk to Story County.
 - High: widespread potential impact.
 - Medium: moderate potential impact.
 - Low: minimal potential impact.

The results of this risk assessment for the planning area as a whole are summarized in Table 4-4. Hazards were profiled and ranked based on the following factors that are defined in the table including probability, magnitude/severity, and location/spatial extent. The general combination of these factors yields an overall significance. The table below summarizes hazard significance for the county overall. Jurisdictional variations in the significance rating are described in Section 3.4.

Table 4-4 Hazard Risk Summary

Hazard	Future Probability	Magnitude/Severity	Location	Hazard Significance
Animal/Crop/Plant Disease	Unlikely	Critical	Extensive	Low
Drought	Likely	Critical	Extensive	Medium
Extreme Heat	Likely	Critical	Limited	Medium
Flooding (Flash & River)	Likely	Catastrophic	Significant	High
Grass or Wildland Fire	Likely	Limited	Significant	Medium
Hazardous Materials	Likely	Limited	Significant	Medium
Human Disease	Occasional	Limited	Significant	Medium
Infrastructure Failure	Likely	Critical	Extensive	Medium
Severe Summer Weather (Thunderstorms/Lightning/Hail)	Highly Likely	Critical	Extensive	High
Severe Winter Storm	Highly Likely	Limited	Extensive	High
Sinkholes	Unlikely	Negligible	Limited	Low
Terrorism	Unlikely	Limited	Extensive	Medium
Tornado/Windstorm	Highly Likely	Critical	Significant	High
Transportation Incident	Highly Likely	Negligible	Limited	Low
Location <u>Extensive:</u> 50-100% of planning area <u>Significant:</u> 10-50% of planning area <u>Limited:</u> Less than 10% of planning area Potential Magnitude/Severity <u>Catastrophic:</u> Multiple deaths, shutdown of facilities for 30 days or more, >50% of property is severely damaged		Probability of Future Occurrence <u>Highly Likely:</u> Near 100% probability each year. <u>Likely:</u> Between 10 and 100% probability per year or at least one chance in ten years. <u>Occasional:</u> Between 1 and 10% probability per year or at least one chance in next 100 years. <u>Unlikely:</u> Less than 1% probability in next 100 years.		

Hazard	Future Probability	Magnitude/ Severity	Location	Hazard Significance
<p><u>Critical</u>: Multiple severe injuries, shutdown of facilities for at least 2 weeks, >25% of property is severely damaged</p> <p><u>Moderate</u>: Some injuries, shutdown of critical facilities for more than one week, >10% of property is severely damaged</p> <p><u>Negligible</u>: Minor injuries, minimal quality-of-life impact, interruption of facilities and services for 24 hours or less, less than 10% of property is severely damaged.</p>				<p>Overall Significance (Based on the preceding three factors)</p> <p><u>High</u>: widespread potential impact</p> <p><u>Medium</u>: moderate potential impact</p> <p><u>Low</u>: minimal potential impact</p>

4.1.4 Climate Change

In accordance with FEMA Administrator Policy 2011-OPPA-01, where possible, this plan update has considered the potential impacts of climate change on the hazards profiled. In 2010, the Iowa Climate Change Advisory Council reported to the Governor and the Iowa General Assembly on Climate Change Impacts in Iowa. Climate change considerations are further discussed under each hazard profile.

The Report summarized the following climate changes Iowa is already experiencing:

More Precipitation

- Increased frequency of precipitation extremes that lead to flooding.
- Increase of 8 percent more precipitation from 1873 to 2008.
- A larger increase in precipitation in eastern Iowa than in western Iowa.

Higher Temperatures

- Long-term winter temperatures have increased six times more than summer temperatures.
- Nighttime temperatures have increased more than daytime temperatures since 1970.
- Iowa’s humidity has risen substantially, especially in summer, which now has 13 percent more atmospheric moisture than 35 years ago, as indicated by a 3 – 5-degree F rise in dew-point temperature. This fuels convective thunderstorms that provide more summer precipitation.

Agricultural Challenges

- Climate extremes, not averages, have the greater impact on crop and livestock productivity.
- Increased soil erosion and water runoff.
- Increased challenges associated with manure applications.
- Favorable conditions for survival and spread of many unwanted pests and pathogens.

Habitat Changes

- Plants are leafing out and flowering sooner.
- Birds are arriving earlier in the spring.
- Particular animals are now being sighted farther north than in the past.

Public Health Effects

- Increases in heart and lung programs from increasing air pollutants of ozone and fine particles enhanced by higher temperatures.
- Increases in infectious diseases transmitted by insects that require a warmer, wetter climate.
- An increase prevalence of asthma and allergies.

Climate change considerations and expected or potential impacts to the dynamics of hazards are further discussed under each respective hazard profile.

4.2 Assets at Risk

This section inventories the population, structures, critical facilities and infrastructure, and other important assets in the planning area that may be at risk to hazards. It is important for communities to be prepared and minimize risks from the direct and indirect impacts of natural and manmade hazards. Assessing future development was something that Story County took into account when looking at their vulnerability to hazards. Critical facilities were identified by the planning team and each jurisdictions vulnerability to hazards are addressed in the hazard profiles. Property

Building counts and building exposure values are calculated based on parcel data provided by the Story County Assessor’s Office. The methodology employed to extract the summary of building/improvement counts and values from the parcel data is provided below:

- Parcel values that had an associated dwelling or improvement value were used to determine the number of improved parcels.
- The contents exposure values were calculated by factoring a multiplier to the building exposure values based on usage type. The contents multipliers were derived from FEMA and are defined below.
- Land values have been purposely excluded from the tables because land remains following disasters, and subsequent market devaluations are frequently short-term and difficult to quantify. Additionally, state and federal disaster assistance programs generally do not address loss of land or its associated value (other than crop insurance).

Building Exposure values are based on the 2023 tax year parcel data provided by the Story County GIS Department. Contents Exposure Values were calculated by factoring a multiplier to the Building Exposure Values based on property type. According to the assessor’s data, the sum of the actual value improvements in the County (total building exposure) is \$8.7 billion. Contents exposure is added to that, estimated as a percent of the improvement value (specifically, 50% of the improvement value for agriculture dwelling, residential and multi-family structures, 150% for industrial structures, 100% for agricultural, commercial, exempt, and mixed-use structures), based on standard FEMA methodologies. Together they come to \$14.1 billion in total value. Table 4-5 below provides a summary of the improved parcel counts and values by usage type. Table 4-6 breaks those values down by property type and gives structure counts by type per jurisdiction for the 32,940 improved parcels in the planning area.

Table 4-5 Story County Total Exposure by Jurisdiction Summary

Jurisdiction	Improved Parcel Count	Improved Value	Estimated Contents Value	Total Value
Ames	19,480	\$5,514,106,700	\$3,442,582,550	\$8,956,689,250
Cambridge	372	\$60,602,000	\$38,774,850	\$99,376,850
Collins	247	\$33,828,300	\$21,939,950	\$55,768,250
Colo	392	\$58,789,300	\$35,007,650	\$93,796,950
Gilbert	492	\$130,536,800	\$80,980,800	\$211,517,600
Huxley	1,702	\$436,431,800	\$271,946,850	\$708,378,650
Kelley	147	\$21,020,200	\$12,224,950	\$33,245,150
Maxwell	396	\$59,509,200	\$34,383,250	\$93,892,450



Jurisdiction	Improved Parcel Count	Improved Value	Estimated Contents Value	Total Value
McCallsburg	175	\$19,689,000	\$10,657,950	\$30,346,950
Nevada	2,468	\$613,765,700	\$484,109,650	\$1,097,875,350
Roland	568	\$93,037,900	\$52,190,900	\$145,228,800
Sheldahl	75	\$8,549,400	\$4,389,450	\$12,938,850
Slater	631	\$136,242,600	\$84,856,350	\$221,098,950
Story City	1,434	\$360,327,000	\$276,619,500	\$636,946,500
Zearing	274	\$34,557,200	\$18,836,900	\$53,394,100
Unincorporated	4,087	\$1,083,855,400	\$615,272,000	\$1,699,127,400
Total	32,940	\$8,664,848,500	\$5,484,773,550	\$14,149,622,050

Source: Story County Assessor's GIS Office, WSP Analysis

Table 4-6 Story County Total Exposure by Property Type

Jurisdiction	Property Type	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value
Ames	Agriculture	6	\$123,300	\$123,300	\$246,600
	Agriculture Dwelling	9	\$2,722,100	\$1,361,050	\$4,083,150
	Commercial	912	\$917,246,100	\$917,246,100	\$1,834,492,200
	Exempt	112	\$21,802,200	\$21,802,200	\$43,604,400
	Industrial	30	\$168,676,400	\$253,014,600	\$421,691,000
	Mixed Use	51	\$94,534,000	\$94,534,000	\$189,068,000
	Multi-Family	444	\$519,395,000	\$259,697,500	\$779,092,500
	Residential	17,916	\$3,789,607,600	\$1,894,803,800	\$5,684,411,400
	Total	19,480	\$5,514,106,700	\$3,442,582,550	\$8,956,689,250
Cambridge	Agriculture	1	\$5,100	\$5,100	\$10,200
	Agriculture Dwelling	4	\$1,224,400	\$612,200	\$1,836,600
	Commercial	51	\$12,115,300	\$12,115,300	\$24,230,600
	Exempt	2	\$4,341,100	\$4,341,100	\$8,682,200
	Mixed Use	3	\$486,200	\$486,200	\$972,400
	Multi-Family	2	\$248,200	\$124,100	\$372,300
	Residential	309	\$42,181,700	\$21,090,850	\$63,272,550
	Total	372	\$60,602,000	\$38,774,850	\$99,376,850
Collins	Agriculture Dwelling	1	\$246,800	\$123,400	\$370,200
	Commercial	45	\$9,871,600	\$9,871,600	\$19,743,200
	Exempt	1	\$122,000	\$122,000	\$244,000
	Mixed Use	1	\$58,000	\$58,000	\$116,000
	Multi-Family	2	\$372,700	\$186,350	\$559,050
	Residential	197	\$23,157,200	\$11,578,600	\$34,735,800
	Total	247	\$33,828,300	\$21,939,950	\$55,768,250
Colo	Agriculture Dwelling	1	\$97,300	\$48,650	\$145,950



Jurisdiction	Property Type	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value
	Commercial	48	\$11,022,200	\$11,022,200	\$22,044,400
	Mixed Use	2	\$203,800	\$203,800	\$407,600
	Multi-Family	3	\$737,400	\$368,700	\$1,106,100
	Residential	338	\$46,728,600	\$23,364,300	\$70,092,900
	Total	392	\$58,789,300	\$35,007,650	\$93,796,950
Gilbert	Agriculture Dwelling	1	\$51,800	\$25,900	\$77,700
	Commercial	43	\$23,349,400	\$23,349,400	\$46,698,800
	Exempt	1	\$8,075,400	\$8,075,400	\$16,150,800
	Multi-Family	11	\$3,250,200	\$1,625,100	\$4,875,300
	Residential	436	\$95,810,000	\$47,905,000	\$143,715,000
	Total	492	\$130,536,800	\$80,980,800	\$211,517,600
Huxley	Agriculture	1	\$1,500	\$1,500	\$3,000
	Agriculture Dwelling	1	\$253,400	\$126,700	\$380,100
	Commercial	152	\$56,178,300	\$56,178,300	\$112,356,600
	Exempt	3	\$23,178,600	\$23,178,600	\$46,357,200
	Industrial	8	\$14,035,200	\$21,052,800	\$35,088,000
	Mixed Use	1	\$33,100	\$33,100	\$66,200
	Multi-Family	6	\$4,915,800	\$2,457,900	\$7,373,700
	Residential	1,530	\$337,835,900	\$168,917,950	\$506,753,850
	Total	1,702	\$436,431,800	\$271,946,850	\$708,378,650
Kelley	Agriculture	2	\$137,300	\$137,300	\$274,600
	Agriculture Dwelling	1	\$157,700	\$78,850	\$236,550
	Commercial	18	\$2,817,600	\$2,817,600	\$5,635,200
	Exempt	1	\$800	\$800	\$1,600
	Industrial	1	\$237,000	\$355,500	\$592,500
	Multi-Family	1	\$104,600	\$52,300	\$156,900
	Residential	123	\$17,565,200	\$8,782,600	\$26,347,800
	Total	147	\$21,020,200	\$12,224,950	\$33,245,150
Maxwell	Agriculture	2	\$37,100	\$37,100	\$74,200
	Agriculture Dwelling	4	\$1,357,200	\$678,600	\$2,035,800
	Commercial	48	\$8,512,100	\$8,512,100	\$17,024,200
	Exempt	1	\$54,400	\$54,400	\$108,800
	Mixed Use	2	\$653,700	\$653,700	\$1,307,400
	Multi-Family	3	\$587,800	\$293,900	\$881,700
	Residential	336	\$48,306,900	\$24,153,450	\$72,460,350
	Total	396	\$59,509,200	\$34,383,250	\$93,892,450
McCallsburg	Agriculture	1	\$11,600	\$11,600	\$23,200
	Commercial	35	\$1,585,300	\$1,585,300	\$3,170,600
	Exempt	1	\$30,000	\$30,000	\$60,000



Jurisdiction	Property Type	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value
	Multi-Family	1	\$234,500	\$117,250	\$351,750
	Residential	137	\$17,827,600	\$8,913,800	\$26,741,400
	Total	175	\$19,689,000	\$10,657,950	\$30,346,950
Nevada	Agriculture	1	\$1,500	\$1,500	\$3,000
	Agriculture Dwelling	2	\$193,600	\$96,800	\$290,400
	Commercial	229	\$120,230,300	\$120,230,300	\$240,460,600
	Exempt	6	\$22,693,200	\$22,693,200	\$45,386,400
	Industrial	30	\$104,831,000	\$157,246,500	\$262,077,500
	Mixed Use	15	\$1,866,600	\$1,866,600	\$3,733,200
	Multi-Family	63	\$36,392,100	\$18,196,050	\$54,588,150
	Residential	2,122	\$327,557,400	\$163,778,700	\$491,336,100
	Total	2,468	\$613,765,700	\$484,109,650	\$1,097,875,350
Roland	Agriculture Dwelling	1	\$202,000	\$101,000	\$303,000
	Commercial	48	\$8,772,400	\$8,772,400	\$17,544,800
	Exempt	1	\$38,600	\$38,600	\$77,200
	Industrial	2	\$1,233,700	\$1,850,550	\$3,084,250
	Mixed Use	2	\$65,500	\$65,500	\$131,000
	Multi-Family	4	\$1,272,100	\$636,050	\$1,908,150
	Residential	510	\$81,453,600	\$40,726,800	\$122,180,400
	Total	568	\$93,037,900	\$52,190,900	\$145,228,800
Sheldahl	Agriculture	1	\$1,100	\$1,100	\$2,200
	Commercial	7	\$228,400	\$228,400	\$456,800
	Residential	67	\$8,319,900	\$4,159,950	\$12,479,850
	Total	75	\$8,549,400	\$4,389,450	\$12,938,850
Slater	Agriculture	1	\$35,800	\$35,800	\$71,600
	Agriculture Dwelling	3	\$1,082,400	\$541,200	\$1,623,600
	Commercial	54	\$26,749,200	\$26,749,200	\$53,498,400
	Exempt	3	\$4,772,400	\$4,772,400	\$9,544,800
	Industrial	2	\$790,200	\$1,185,300	\$1,975,500
	Mixed Use	1	\$332,300	\$332,300	\$664,600
	Multi-Family	7	\$2,701,100	\$1,350,550	\$4,051,650
	Residential	560	\$99,779,200	\$49,889,600	\$149,668,800
	Total	631	\$136,242,600	\$84,856,350	\$221,098,950
Story City	Agriculture Dwelling	2	\$699,600	\$349,800	\$1,049,400
	Commercial	151	\$67,327,300	\$67,327,300	\$134,654,600
	Exempt	6	\$2,030,300	\$2,030,300	\$4,060,600
	Industrial	13	\$60,214,800	\$90,322,200	\$150,537,000
	Mixed Use	13	\$3,124,800	\$3,124,800	\$6,249,600
	Multi-Family	20	\$5,588,800	\$2,794,400	\$8,383,200



Jurisdiction	Property Type	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value
	Residential	1,229	\$221,341,400	\$110,670,700	\$332,012,100
	Total	1,434	\$360,327,000	\$276,619,500	\$636,946,500
Zearing	Agriculture	2	\$33,100	\$33,100	\$66,200
	Agriculture Dwelling	2	\$95,400	\$47,700	\$143,100
	Commercial	46	\$2,860,300	\$2,860,300	\$5,720,600
	Exempt	1	\$44,700	\$44,700	\$89,400
	Mixed Use	1	\$178,500	\$178,500	\$357,000
	Multi-Family	5	\$3,739,100	\$1,869,550	\$5,608,650
	Residential	217	\$27,606,100	\$13,803,050	\$41,409,150
	Total	274	\$34,557,200	\$18,836,900	\$53,394,100
Unincorporated	Agriculture	396	\$12,303,400	\$12,303,400	\$24,606,800
	Agriculture Dwelling	1,012	\$259,097,000	\$129,548,500	\$388,645,500
	Commercial	159	\$126,249,000	\$126,249,000	\$252,498,000
	Exempt	1	\$0	\$0	\$0
	Industrial	7	\$4,068,100	\$6,102,150	\$10,170,250
	Multi-Family	5	\$1,859,700	\$929,850	\$2,789,550
	Residential	2,507	\$680,278,200	\$340,139,100	\$1,020,417,300
	Total	4,087	\$1,083,855,400	\$615,272,000	\$1,699,127,400
Grand Total	32,940	\$8,664,848,500	\$5,484,773,550	\$14,149,622,050	

Source: Story County Assessor's GIS Office, WSP Analysis

4.2.1 People

Population numbers come from the 2020 Census and estimates come from the U.S. Census Bureau American Community Survey (ACS) 5-year estimates as shown in Table 4-7. This allows for the estimation of residents living in hazard areas in the following hazard profiles.

Table 4-7 Story County Population Data

Jurisdiction	2020 Population	2021 Average Household Size	2021 Est. Population
Ames	66,427	2.4	65,522
Cambridge	827	2.48	975
Collins	495	2.48	431
Colo	845	2.33	809
Gilbert	1,211	2.47	1,082
Huxley	4,244	3.00	4,293
Kelley	304	2.13	381
Maxwell	859	2.41	823
McCallsburg	353	2.55	491
Nevada	6,925	2.28	7,017
Roland	1,362	2.33	1,386

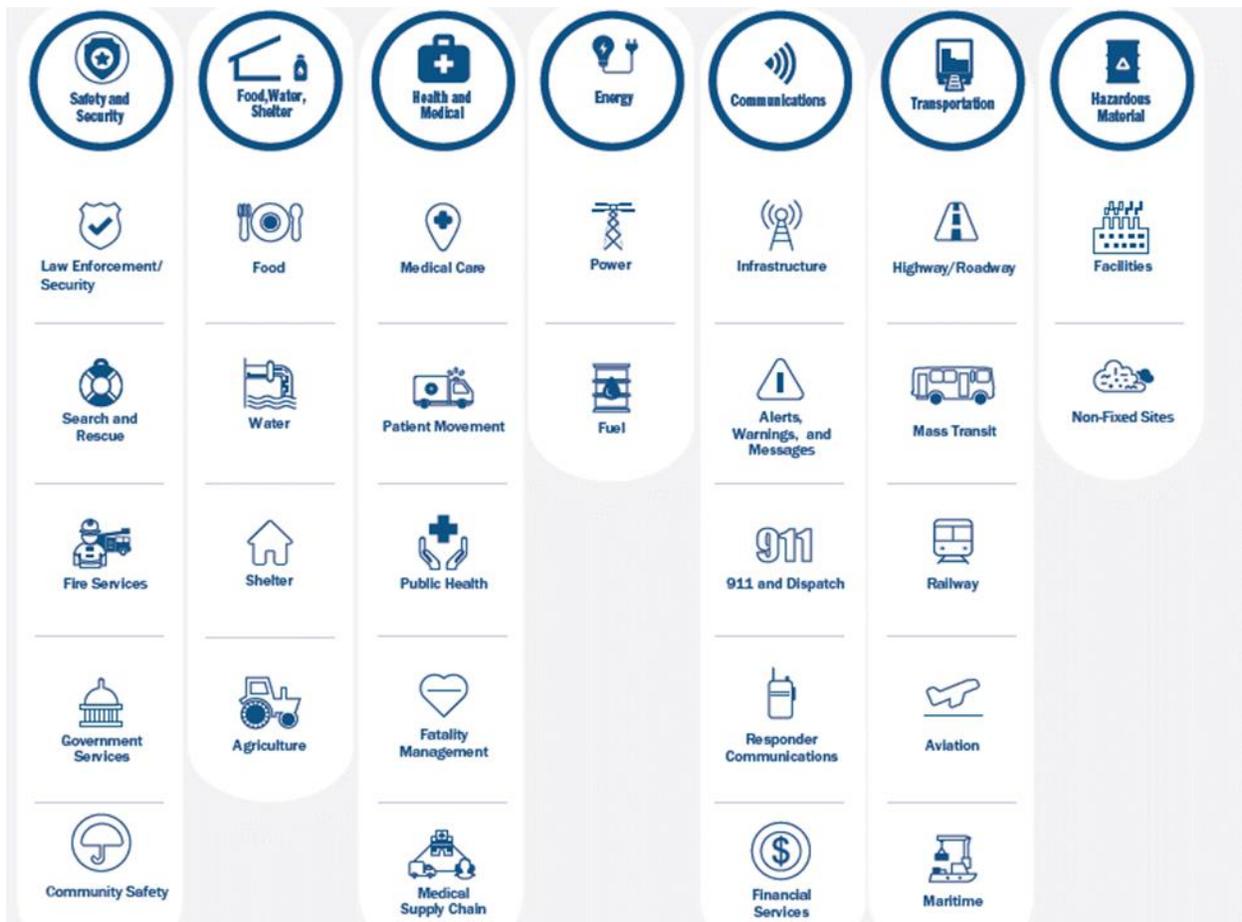
Jurisdiction	2020 Population	2021 Average Household Size	2021 Est. Population
Sheldahl	297	2.72	349
Slater	1,543	2.51	1,540
Story City	3,352	2.25	3,400
Zearing	528	2.26	531
Unincorporated	8,965	2.5	9,076
Total	98,537	2.44	98,106

Source: 2020 U.S. Census Bureau

4.2.2 Critical Facilities and Infrastructure

For the purposes of this plan, a critical facility is defined as one that is essential in providing utility or direction either during the response to an emergency or during the recovery operation. FEMA organizes critical facilities into seven lifeline categories as shown in Figure 4-1.

Figure 4-1 FEMA Lifeline Categories



Source: FEMA Version 2.1

These lifeline categories standardize the classification of critical facilities and infrastructure that provide indispensable service, operation, or function to a community. A lifeline is defined as providing indispensable

service that enables the continuous operation of critical business and government functions and is critical to human health and safety, or economic security. These categorizations are particularly useful as they:

- Enable effort consolidations between government and other organizations (e.g. infrastructure owners and operators).
- Enable integration of preparedness efforts among plans; easier identification of unmet critical facility needs.
- Refine sources and products to enhance awareness, capability gaps, and progress towards stabilization.
- Enhance communication amongst critical entities, while enabling complex interdependencies between government assets.
- Highlight lifeline related priority areas regarding general operations as well as response efforts.

To develop a comprehensive list of critical facilities in Story County, three data sources were compiled and broken down along the seven aforementioned critical asset categories.

The best available data was used, but some limitations include the lack of complete or comprehensive data and values such as replacement costs. These databases were used in vulnerability assessments for hazards such as dams and floods and are represented in maps and tables in the vulnerability by hazard section that follows.

Table 4-8 Critical Facilities by Jurisdiction and Lifeline

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation	Total
Ames	23	18	47	40	21	81	38	268
Cambridge	2	-	4	1	1	6	1	15
Collins	1	-	-	2	1	3	-	7
Colo	2	1	3	1	1	3	1	12
Gilbert	1	-	2	1	2	9	1	16
Huxley	2	1	7	2	2	11	6	31
Kelley	-	-	2	-	2	1	-	5
Maxwell	-	-	4	3	1	4	5	17
McCallsburg	-	-	-	2	1	2	-	5
Nevada	10	4	-	13	8	23	12	70
Roland	1	-	3	-	1	3	1	9
Sheldahl	-	-	-	1	-	-	-	1
Slater	2	-	5	2	1	4	-	14
Story City	5	3	4	5	6	9	1	33



Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation	Total
Zearing	-	-	1	1	2	3	3	10
Unincorporated	32	19	65	22	-	2	229	369
Total	81	46	147	96	50	164	298	882

Source: Story County, DNR, HIFLD, National Bridge Inventory, WSP GIS Analysis

Table 4-9 Critical Facilities by Jurisdiction and Facility Type

Jurisdiction	FEMA Lifeline	Facility Type	Count
Ames	Communications	Cellular Tower	2
		Land Mobile Tower	2
		Microwave Service Tower	16
		Paging Transmission Tower	3
	Energy	Power Plant	7
		Substation	11
	Food, Water, Shelter	Open Feedlot	1
		Water Treatment Plant	2
		Water Use Well	44
	Hazardous Material	Contaminated Facilities	7
		EHS Tier II Facility	22
		Tier II Facility	11
	Health and Medical	Animal Health	2
		EMS Station	4
		Hospital	1
		Nursing Home	12
		Public Health Office	1
	Safety and Security	Urgent Care Facility	1
		Childcare	34
		College/University	2
Fire Station		3	
Government		1	
Law Enforcement		2	
Private School		2	
Public School		8	
School Services		1	
Solid Waste Facility		26	
Supplemental College	1		
University	1		



Jurisdiction	FEMA Lifeline	Facility Type	Count
	Transportation	Airport	1
		Non-Scour Fair Condition Bridge	23
		Non-Scour Good Condition Bridge	14
	Total		268
Cambridge	Communications	Microwave Service Tower	2
	Food, Water, Shelter	Feed Distribution	1
		Water Treatment Plant	1
		Water Use Well	2
	Hazardous Material	EHS Tier II Facility	1
	Health and Medical	EMS Station	1
	Safety and Security	Childcare	4
		Fire Station	1
		Public School	1
Transportation	Non-Scour Fair Condition Bridge	1	
Total		15	
Collins	Communications	Microwave Service Tower	1
	Hazardous Material	Tier II Facility	2
	Health and Medical	EMS Station	1
	Safety and Security	Childcare	1
		Fire Station	1
		Public School	1
Total		7	
Colo	Communications	Microwave Service Tower	2
	Energy	Substation	1
	Food, Water, Shelter	Feed Distribution	1
		Water Treatment Plant	2
	Hazardous Material	EHS Tier II Facility	1
	Health and Medical	EMS Station	1
	Safety and Security	Childcare	1
		Fire Station	1
		Public School	1
Transportation	Non-Scour Fair Condition Bridge	1	
Total		12	
Gilbert	Communications	Microwave Service Tower	1
	Food, Water, Shelter	Water Treatment Plant	1
		Water Use Well	1
	Hazardous Material	EHS Tier II Facility	1
	Health and Medical	EMS Station	2
	Safety and Security	Childcare	4
		Fire Station	1
Public School		4	



Jurisdiction	FEMA Lifeline	Facility Type	Count
	Transportation	Non-Scour Fair Condition Bridge	1
		Total	16
Huxley	Communications	Cellular Tower	1
		Microwave Service Tower	1
	Energy	Substation	1
	Food, Water, Shelter	Waste Water Treatment Plant	1
		Water Department	1
		Water Treatment Plant	2
		Water Use Well	3
	Hazardous Material	EHS Tier II Facility	1
		Tier II Facility	1
	Health and Medical	EMS Station	1
		Nursing Home	1
	Safety and Security	Childcare	7
		Fire Station	1
		Law Enforcement	1
		Public School	2
	Transportation	Non-Scour Fair Condition Bridge	4
		Scour Fair Condition Bridge	1
Transportation		1	
		Total	31
Kelley	Food, Water, Shelter	Water Treatment Plant	1
		Water Use Well	1
	Health and Medical	EMS Station	2
	Safety and Security	Fire Station	1
		Total	5
Maxwell	Food, Water, Shelter	Water Treatment Plant	1
		Water Use Well	3
	Hazardous Material	Contaminated Facilities	1
		EHS Tier II Facility	1
		Tier II Facility	1
	Health and Medical	EMS Station	1
	Safety and Security	Childcare	2
		Fire Station	1
		Public School	1
	Transportation	Non-Scour Fair Condition Bridge	2
Non-Scour Good Condition Bridge		1	
Non-Scour Poor Condition Bridge		1	
Scour Poor Condition Bridge		1	
		Total	17
McCallsburg	Hazardous Material	EHS Tier II Facility	2



Jurisdiction	FEMA Lifeline	Facility Type	Count
	Health and Medical	EMS Station	1
	Safety and Security	Childcare	1
		Fire Station	1
	Total		
Nevada	Communications	Cellular Tower	1
		Microwave Service Tower	9
	Energy	Energy Dept	1
		Power Plant	1
		Substation	2
	Hazardous Material	Contaminated Facilities	3
		EHS Tier II Facility	7
		Tier II Facility	3
	Health and Medical	EMS Station	2
		Hospital	2
		Nursing Home	4
	Safety and Security	Childcare	13
		Courthouse	1
		EOC	1
		Fire Station	1
		Justice Center	1
		Law Enforcement	2
		Public School	3
		Solid Waste Facility	1
	Transportation	Non-Scour Fair Condition Bridge	7
Non-Scour Good Condition Bridge		3	
Non-Scour Poor Condition Bridge		2	
Total			70
Roland	Communications	Microwave Service Tower	1
	Food, Water, Shelter	Water Treatment Plant	1
		Water Use Well	2
	Health and Medical	EMS Station	1
	Safety and Security	Childcare	1
		Fire Station	1
		Public School	1
Transportation	Non-Scour Poor Condition Bridge	1	
Total			9
Sheldahl	Hazardous Material	EHS Tier II Facility	1
	Total		
Slater	Communications	Microwave Service Tower	2
	Food, Water, Shelter	Feed Distribution	1
		Water Treatment Plant	1
		Water Use Well	3
	Hazardous Material	EHS Tier II Facility	2



Jurisdiction	FEMA Lifeline	Facility Type	Count
	Health and Medical	EMS Station	1
	Safety and Security	Childcare	2
		Fire Station	1
		Public School	1
	Total		
Story City	Communications	Microwave Service Tower	5
	Energy	Power Plant	1
		Substation	1
		Utility	1
	Food, Water, Shelter	Water Dept	1
		Water Use Well	3
	Hazardous Material	EHS Tier II Facility	3
		Tier II Facility	2
	Health and Medical	EMS Station	2
		Hospital	1
		Nursing Home	3
	Safety and Security	Childcare	5
		Fire Station	1
		Law Enforcement	1
Public School		2	
Transportation	Non-Scour Good Condition Bridge	1	
Total			33
Zearing	Food, Water, Shelter	Water Treatment Plant	1
	Hazardous Material	EHS Tier II Facility	1
	Health and Medical	EMS Station	1
		Nursing Home	1
	Safety and Security	Childcare	1
		Fire Station	1
		Public School	1
	Transportation	Non-Scour Fair Condition Bridge	2
Non-Scour Poor Condition Bridge		1	
Total			10
Unincorporated	Communications	Cellular Tower	2
		Microwave Service Tower	29
		Paging Transmission Tower	1
	Energy	Power Plant	10
		Substation	8
		Wind Energy	1
	Food, Water, Shelter	Feed Distribution	1
		Open Feedlot	25
Water Treatment Plant		8	



Jurisdiction	FEMA Lifeline	Facility Type	Count
	Hazardous Material	Water Use Well	31
		Contaminated Facilities	3
		EHS Tier II Facility	14
		Tier II Facility	5
	Safety and Security	Childcare	1
		Solid Waste Facility	1
	Transportation	Non-Scour Fair Condition Bridge	102
		Non-Scour Good Condition Bridge	82
		Non-Scour Poor Condition Bridge	41
		Scour Fair Condition Bridge	1
		Scour Poor Condition Bridge	1
		Transportation	2
	Total		369
	Grand Total		882

Source: Story County, DNR, HIFLD, National Bridge Inventory, WSP GIS Analysis

4.2.3 Historic, Cultural, and Natural Resources

Assessing the vulnerability of the planning area to disaster also involves inventorying the natural, historic, cultural, and economic assets of the area. This is important for the following reasons:

- The plan participants may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- If these resources are impacted by a disaster, knowing about them ahead of time allows for more prudent care in the immediate aftermath when the potential for additional impacts is higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, such as wetlands and riparian habitat, which help absorb and attenuate floodwaters.
- Losses to economic assets (e.g., major employers or primary economic sectors) could have severe impacts on a community and its ability to recover from disaster.

Historic Properties

The National Register of Historic Places is the official list of the Nation's cultural resources worthy of preservation. Authorized under the National Historic Preservation Act of 1966, the National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect our historic and archeological resources. The National Register is administered by the National Park Service under the Secretary of the Interior. Properties listed in the National Register include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture. Table 4-10 provides the list of properties on the National Register in Story County.



Table 4-10: Properties/Landmarks on the National Register of Historic Places, Story County

City	Resource	Address	Year Listed
Ames	Agriculture Hall	2519 Union Drive	6/27/1985
Ames	Alumni Hall	2433 Union Drive	11/16/1978
Ames	Ames High School	515 Clark Ave.	10/24/2002
Ames	Ames Main Street Historic District	Main Street from Duff Ave to Grand Ave	5/10/2018
Ames	Bandshell Park Historic District	Duff Ave & 6th Street	10/7/1999
Ames	Budd, Prof. J.L., Sarah M., and Etta Budd, House	804 Kellogg Ave.	8/8/2001
Ames	Christian Petersen Courtyard Sculptures, and Dairy Industry Building	536 Farm House Lane	4/7/1987
Ames	Colonials Club House	217 Ash Ave.	2/8/2012
Ames	Cranford Apartment Building	103 Stanton Ave.	7/24/2023
Ames	Delta Upsilon Chapter House	117 Ash Ave	11/10/2010
Ames	Engineering Hall	2519 Union Drive	1/10/1983
Ames	Iowa Beta Chapter of Sigma Phi Epsilon	228 Gray Ave.	2/5/2014
Ames	Knapp-Wilson House	301 Farm House Lane	10/15/1966
Ames	MacDonald, Gilmour B. and Edith Craig, House	517 Ash St.	5/6/1992
Ames	Marston Water Tower	Next to 606 Bissel Rd	5/27/1982
Ames	Masonic Temple	413-429 Douglas Ave.	9/12/2016
Ames	Morrill Hall	603 Morrill Road	6/28/1996
Ames	Municipal Building	420 Kellogg Ave.	5/2/1997
Ames	Old Town Historic District	Bet. Duff and Clark Ave., and 7th and 9th Sts.	1/2/2004
Ames	Pleasant Grove Community Church and Cemetery	56971 170th St	5/28/2010
Ames	Roosevelt School	921 9th St.	3/2/2010
Ames	Sigma Sigma-Delta Chi Fraternity House	405 Hayward Ave.	7/10/2008
Ames	Skunk River Bridge	East End of Ken Maril Rd	5/15/1998
Colo	Mulcahy Barn	25623 710th Ave.	1/28/2004
Gilbert	Keigley Branch Bridge	150th St & 550th Ave	5/15/1998
Iowa Center	Octagon Round Barn, Indian Creek Township	Off CR S14	6/30/1986
Iowa Center	Wood, William Kennison, House	29947 663rd Ave	6/5/1995
Maxwell	Calamus Creek Bridge	325th St/663rd Ave	5/15/1998
Nevada	Briggs Terrace	1204 H Ave	7/20/1998
Nevada	East Indian Creek Bridge	W of 665th Ave on 260th St	5/15/1998
Nevada	Edwards-Swayze House	1110 9th Street	11/14/1978
Nevada	Nevada Downtown Historic District	6th Street from I Ave -M Ave	5/9/2003
Sheldahl	Sheldahl First Norwegian Evangelical Lutheran Church	3rd & Willow Streets	5/11/1984
Story City	Grand Auditorium and Hotel Block	500 Blk of Broad St	1/25/1980
Story City	Henryson, Henry T. and Emilie (Wiese), House	619 Grand Ave	4/20/2005
Story City	Herschel-Spillman Two-Row Portable Menagerie Carousel	North Park, Story St & Grove Ave.	6/6/1986
Zearing	Lincoln Township Mausoleum	70725 130th St	9/27/2007

Source: National Park Service, <https://www.nps.gov/subjects/nationalregister/data-downloads.htm>

As defined by the National Environmental Policy Act (NEPA), any property over 50 years of age may be considered a historic resource and is potentially eligible for the National Register. Thus, in the event that

the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation.

Threatened and Endangered Species

Table 4-11 includes Federally Threatened, Endangered, Proposed and Candidate Species in Story County, Iowa.

Table 4-11: Threatened and Endangered Species in Story County

Common Name	Scientific Name	Status
Indiana bat	Myotis sodalist	Endangered
Northern long-eared bat	Myotis septentrionalis	Threatened
Prairie bush clover	Lespedeza leptostachya	Threatened
Western prairie fringed orchid	Platanthera praeclara	Threatened

Source: U.S. Fish and Wildlife Service, http://www.fws.gov/midwest/endangered/lists/iowa_cty.html

Natural Resources

Story County Conservation Board manages parks, wildlife refuges, historic sites, and natural areas throughout the county. These areas include developed parks and wildlife habitat areas where the public can enjoy camping, hiking, picnicking, boating, fishing, hunting, trapping, bird watching, and other outdoor activities. The Board strives to be wise stewards of Story County wildlife, lands, and water.

4.3 Hazard Profiles and Vulnerability

The following hazard profiles are organized as follows:

- **Risk Summary:** Summarizes the key pieces of information for each hazard.
- **Description:** General description of the hazard and associated problems, followed by details on the hazard specific to Story County.
- **Location:** Discusses what parts of the County are most likely to be affected by the hazard.
- **Past Occurrences:** Overview history of the hazard’s occurrences, compiled from multiple data sources, to include information provided by the Planning Team and the public. Significant incidents are profiled in greater detail and include scope, severity, and magnitude, and known impacts.
- **Probability of Future Occurrence:** Estimates the likelihood or probability of future occurrences of the hazard.
- **Magnitude/Severity:** Summarizes the anticipated magnitude and severity of a hazard event based largely on previous occurrences and specific aspects of the planning area. Speed of onset and duration are also factored in.
- **Climate Change Considerations:** Discusses how the projected impacts of climate change may affect the likelihood and severity of the hazard in the future.
- **Vulnerability:** Describes the likely impacts of the hazard on people, property, critical infrastructure, government services, the economy, and historical, cultural, and natural resources.
- **Development Trends:** Summarizes how projected trends in land use, and development have the potential to increase or decrease the impact of the hazard.

4.3.1 Animal/Plant/Crop Disease

Future Probability	Magnitude/Severity	Location	Hazard Ranking
Unlikely	Critical	Extensive	Low

Risk Summary

Animal/plant/crop disease is ranked as an overall low significance hazard.

- For purposes of determining probability of future occurrence, the HMPC defined “occurrence” as an infestation occurring suddenly, a new infestation, or an infestation that overwhelmed normal control efforts. Based on this definition, the future probability is considered **unlikely**.
- The magnitude of animal/crop/plant disease would be slightly less in the cities and for the school districts due to less agriculture within city limits. The overall magnitude is considered **critical**.
- The location of animal/plant/crop disease is considered **extensive**.
- An infestation of the Emerald Ash Borer would likely have a larger impact in the incorporated areas.
- The economy of incorporated areas is heavily dependent on agriculture.
- Animal/plant/crop disease vulnerability may increase over time as demand for corn, soy, poultry, and pork products grow.
- The duration of an animal/plant/crop disease will last more than one week. This hazard can take a significant amount of time to manage and stop the disease.
- Climate change may result in an increase in the frequency and severity of animal/plant/crop disease which could severely affect the local economy.
- Related hazards: Extreme Heat, Human Disease.

Description

Agricultural infestation is the naturally occurring infection of vegetation, crops, or livestock with insects, vermin, or diseases that render the crops or livestock unfit for consumption or use. Because of Iowa’s substantial agricultural industry and related facilities and locations, the potential for infestation of crops or livestock poses a significant risk to the economy of the State. Iowa cropland is vulnerable to disease and other agricultural pests.

Some level of agricultural infestation is normal in Iowa. The concern is when the level of an infestation escalates suddenly, or a new infestation appears, overwhelming normal control efforts. The levels and types of agricultural infestation appear to vary by many factors, including cycles of heavy rains and drought.

Animal Disease

Agricultural incidents are naturally occurring infections of livestock with insects, vermin, or diseases that render the livestock unfit for consumption or use. The livestock inventory for the State of Iowa includes over 4 million cattle and calves. According to the USDA National Agricultural Statistics Service, as of January 1, 2023, Story County ranked 79th in the state with 15,300 head of cattle and calves. According to the 2017 Census of Agriculture, there were also 62,420 head of hogs and pigs in Story County.

With this substantial agricultural industry and related facilities throughout the County, the potential for infestation of livestock poses a significant risk to the economy in the planning area.

The Iowa Department of Agriculture and Land Stewardship (IDALS) monitors and reports on the following animal reportable diseases in Iowa:

- Avian Influenza
- Bovine Spongiform Encephalopathy (BSE) Disease
- Chronic Wasting Disease
- Exotic Newcastle Disease
- Foot and Mouth Disease
- Johne's Disease
- Pseudo rabies
- Scrapie
- West Nile Virus

Producers are required by state law to report any of the reportable animal diseases to the IDALS's Bureau of Animal Industry. The IDALS's Bureau of The Center for Agriculture Security is the lead coordinating bureau for any emergency response for an agriculture incident.

Avian influenza continues to be of concern in Iowa. According to the 2017 Census of Agriculture, Iowa is ranked 11th in poultry and egg sales, totaling approximately \$1.5 billion in sales.

Bovine Spongiform Encephalopathy (BSE) "mad cow" disease is a chronic, degenerative disease affecting the central nervous system of cattle. Cases have been found worldwide since 1986.

Chronic Wasting Disease (CWD) is a fatal, neurological disease of farmed and wild deer and elk. The disease has been identified in wild and captive mule deer, white-tailed deer and North American elk, and in captive black-tailed deer.

Exotic Newcastle Disease (END) is a contagious and fatal viral disease affecting all species of birds. END is probably one of the most infectious diseases of poultry in the world. END is so virulent that many birds die without showing any clinical signs.

Johne's (yo-knees) Disease is a contagious, chronic, and eventually fatal infection that affects the small intestine of ruminants, including cattle, sheep, and goats. Johne's, also called Para tuberculosis, is a slow progressive wasting disease with an incubation period of usually two or more years. Johne's is a reportable disease, but not a quarantinable disease.

Pseudo Rabies is a viral disease most prevalent in swine, often causing newborn piglets to die. Older pigs can survive the infection, becoming carriers of the pseudo rabies virus for life. Other animals infected from swine die from pseudo rabies, which is also known as Aujeszky's disease and "mad itch." Infected cattle and sheep can first show signs of pseudo rabies by scratching and biting themselves. In dogs and cats, pseudo rabies can cause sudden death. The virus does not cause illness in humans. Due to an extensive eradication program, Iowa and the rest of the United States are free of pseudo rabies.

Scrapie is a fatal, degenerative disease affecting the central nervous system of sheep and goats that is very similar to BSE (mad cow disease), although it does not cause disease in humans, and has been present in the U.S. for over 50 years. Infected flocks that contain a high percentage of susceptible animals can experience significant production losses. In these flocks, over a period of several years, the number of infected animals increases and the age at onset of clinical signs decreases making these flocks economically unviable. Animals sold from infected flocks spread scrapie to other flocks. The presence of scrapie in the U.S. also prevents the export of breeding stock, semen, and embryos to many other countries. Currently, there is a national program underway to eradicate scrapie in the U.S.

West Nile Virus is the leading cause of mosquito-borne disease in the continental United States. It is most commonly spread to people by the bite of an infected mosquito. Cases of WNV occur during mosquito season, which starts in the summer and continues through fall. There are no vaccines to prevent or medications to treat WNV in people. Fortunately, most people infected with WNV do not feel sick. About 1 in 5 people who are infected develop a fever and other symptoms. About 1 out of 150 infected people develop a serious, sometimes fatal, illness.

Disease outbreaks can also occur in wild animal populations. The IDALS's Bureau of Animal Industry also monitors wild animal species and game throughout the state as well as diseases that may impact them.

Crop Pests/Diseases

A plant disease outbreak or a pest infestation could negatively impact crop production and agriculturally dependent businesses. An extreme outbreak or infestation could potentially result in billions of dollars in production losses across the U.S. The cascading net negative economic effects could result in wide-spread business failures, reduction of tax revenues, harm to other state economies, and diminished capability for this country to compete in the global market.

Coordination and communication are essential when plant diseases or pest infestations occur. The United States Department of Agriculture/ Animal Plant Health Inspection Service, Iowa Department of Agriculture and Land Stewardship, local producers, local government, assessment teams, and state government entities must work together to effectively diagnose the various plant hazards to determine if immediate crop quarantine and destruction is required.

The College of Agriculture and Life Sciences at Iowa State University (ISU) houses the Plant and Insect Diagnostic Clinic. The Clinic provides diagnosis of plant problems (plant diseases, insect damage, and assessment of herbicide damage) and the identification of insects and weeds from the field, garden, and home. Specific plant pests can vary from year to year. For complete details of all insects and diseases that can impact crops in Story County, see the website above. ISU also has several farms throughout the County. Several other agricultural labs are located in the County, including USDA and APHIS.

Emerald Ash Borer threatens Iowa's forests and urban landscape. This pest is a slender, emerald-green beetle that is 1/2 inch long, and responsible for the destruction of approximately 20 million ash trees in Ohio, Michigan, Indiana, Illinois, and Ontario, Canada. Emerald Ash Borer has made its way into all but two of Iowa's counties, including Story County in 2018.

Wildlife

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

Location

All of Story County is subject to animal/livestock incidents and agricultural infestations, therefore the location is considered **extensive**. According to the 2017 Census of Agriculture, there were 955 farms in the County covering 304,022 acres of land (82.9% percent of the 573 square miles of land area (366,720 acres) in the County).

Table 4-12 provides a summary of the value of agricultural products sold in the planning area. Agricultural infestation of crops or livestock in the planning area would severely affect the economy.

**Table 4-12: Market Value of Agricultural Products Sold, 2012 – Story County, IA**

Market Value of Products Sold	\$224,922,000
Market Value of Crops	\$164,193,060 / (73 percent)
Market Value of Livestock	\$60,728,940 / (27 percent)
Average Per Farm	\$235,520

Source: USDA National Agricultural Statistics Service, 2017 Census of Agriculture.

Animal Location/Extent

In addition to the animal farm operations, there are also confined and open feeding operations in Story County. According to data from the Iowa NRGIS Repository eMMP Application, there are 37 Animal Feeding Operations in Story County listed in the Iowa Department of Natural Resources Animal Feeding Operations Database. This includes 34 Confined Animal Feeding Operations, 12 Open Feedlots, and 9 combination Confined/Open feedlot.

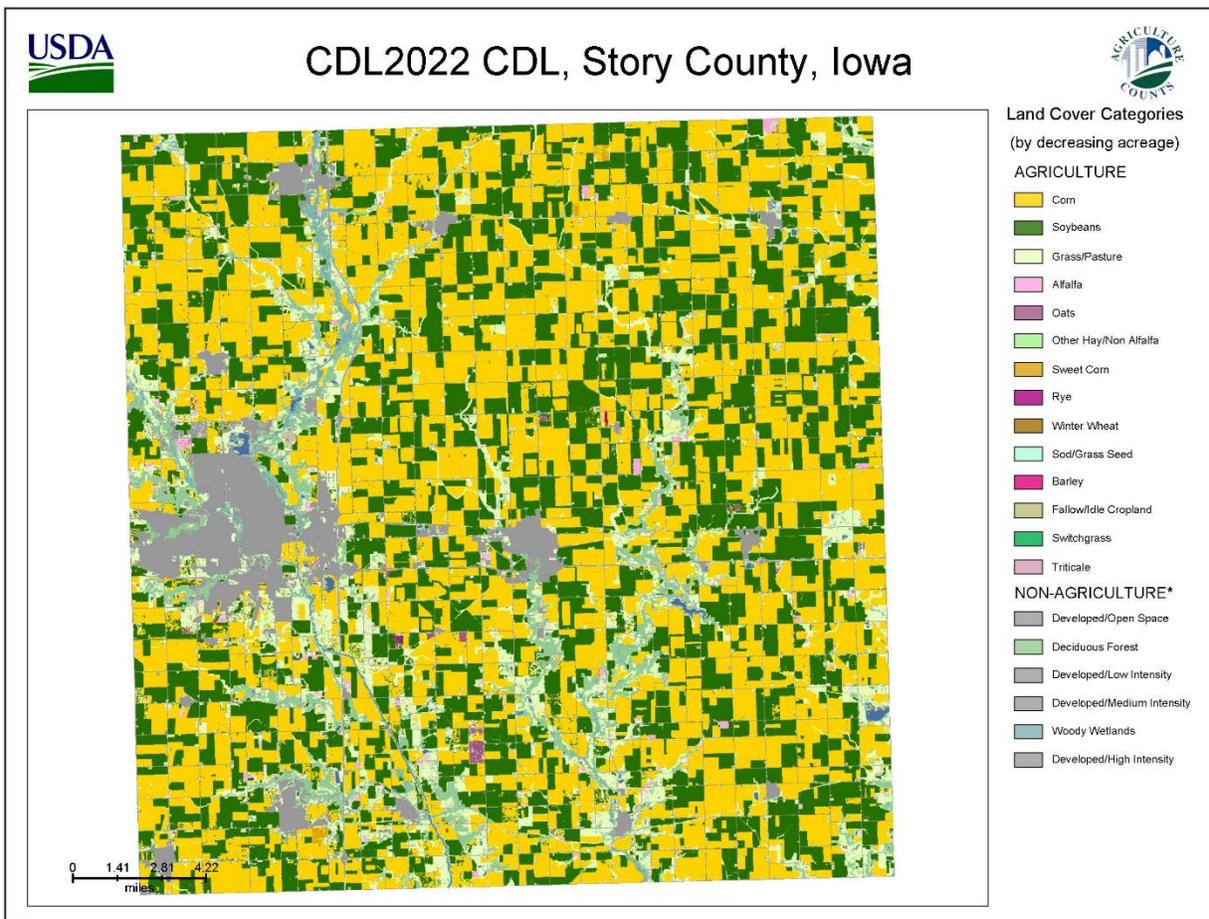
Crop Location/Extent

According to the National Agricultural Statistics Service, in 2022 Story County’s top crop items included the following:

- Corn for Grain (State Rank 32nd) – 156,400 acres harvested
- Soybeans (State Rank 38th) – 110,700 acres harvested

Additionally, the HMPC noted that the county is a center for seed development, with test fields located all over the county. As can be seen in the USDA Cropland Data Layer (CDL) in Figure 4-2, the majority of land in Story County outside the incorporated areas is in agricultural use, with primary crops of corn and soybeans.

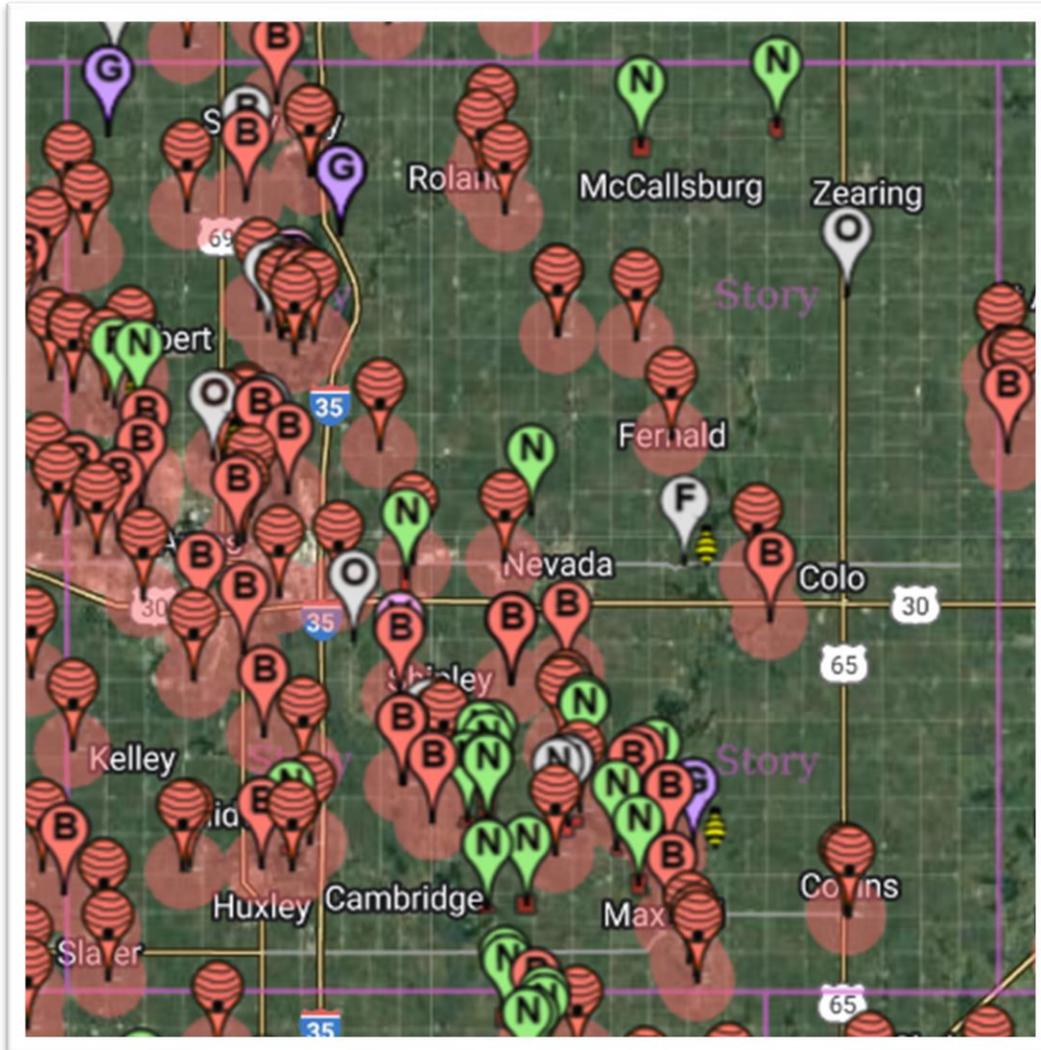
Figure 4-2: Story County Cropland Data Layer



Source: USDA, produced by CropScape, <https://nassgeodata.gmu.edu/CropScape/>

Figure 4-3 provides the locations of the sites included on the Sensitive Crops Registry according to the Iowa Department of Agriculture and Land Stewardship, Pesticide Bureau. The types of sensitive crops in the county include berries, fruits, grapes, non-specified organic, and beehives.

Figure 4-3: Sensitive Crops Registered Sites, Story County, IA

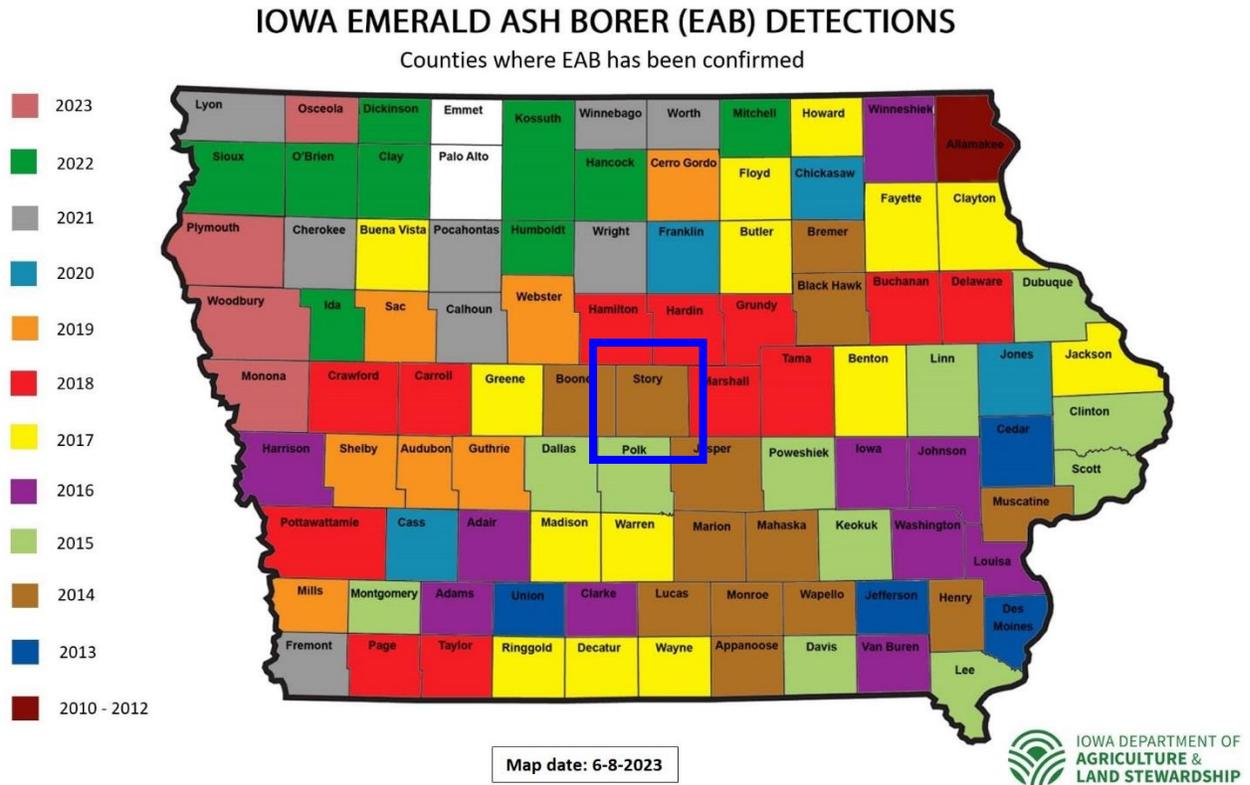


Source: Iowa Specialty Crop Site Registry, <https://ia.driftwatch.org/map>

Emerald Ash Borer Location/Extent

Figure 4-4 shows the counties in Iowa in which the Emerald Ash Borer has been detected. Story County is shaded brown, indicating Emerald Ash Borer was detected in the County in 2014.

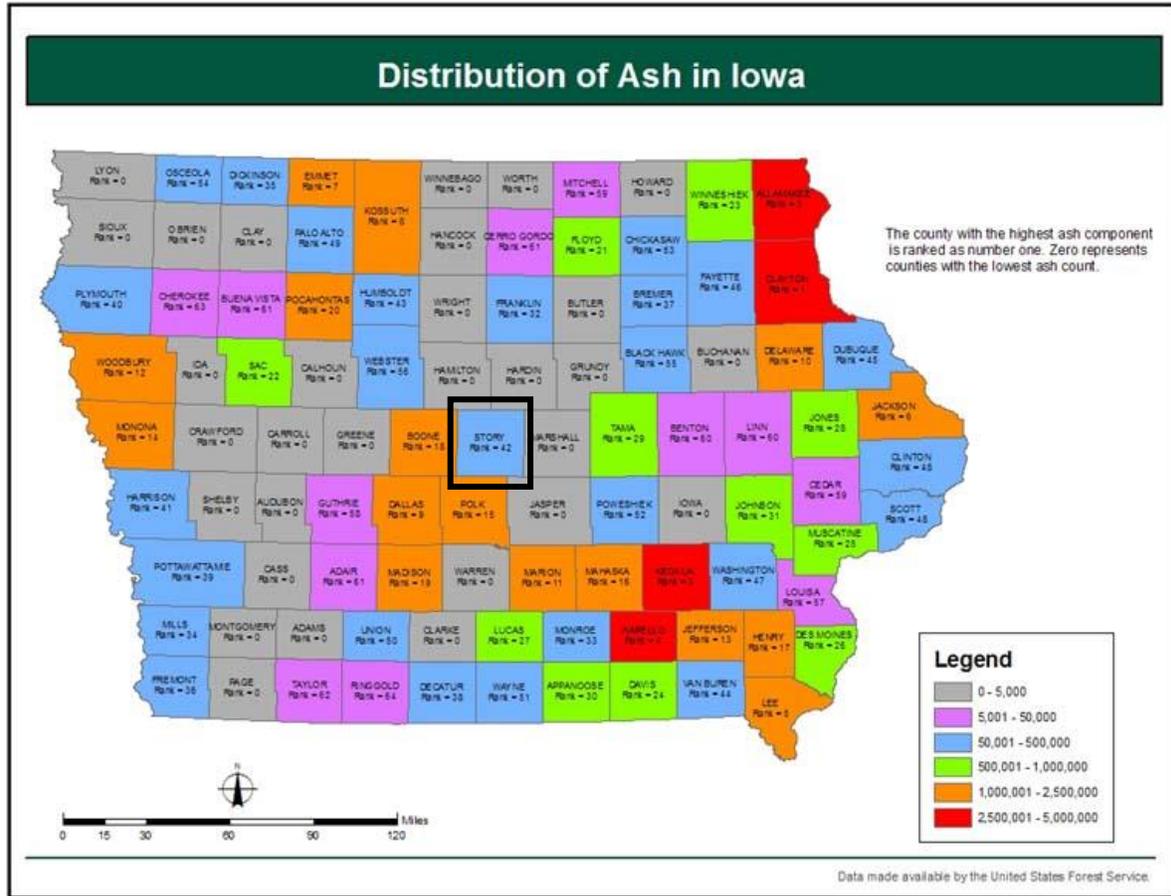
Figure 4-4 Iowa Counties Affected by Emerald Ash Borer, by Detection Date



Source: Iowa Department of Agriculture and Land Stewardship, Entomology and Plant Science Bureau

It is estimated by the Iowa Department of Natural Resources – Forestry Bureau that approximately 16 percent of public trees in Iowa cities are ash trees, although that number can be as high as 50% in some areas (AP 2022). Statewide, there are over 50 million ash trees (green, white and black) in forested areas and another 3 million in urban areas (AP 2022). As seen in Figure 4-5 below, Story County ranks 42nd in the state with 50,001 to 500,000 ash trees in the County according to data from the U.S. Forest Service. Also, a cooperative state and federal effort has developed the “Iowa Emerald Ash Borer Readiness Plan” <https://www.iowadnr.gov/Portals/idnr/uploads/forestry/Forest%20Health/IA%20EAB%20Readiness%20Plan%202020JAN%202013%20DRAFT.pdf> to help stop this pest by education, monitoring, surveillance, containment and communication.

Figure 4-5: Distribution of Ash Trees in Iowa



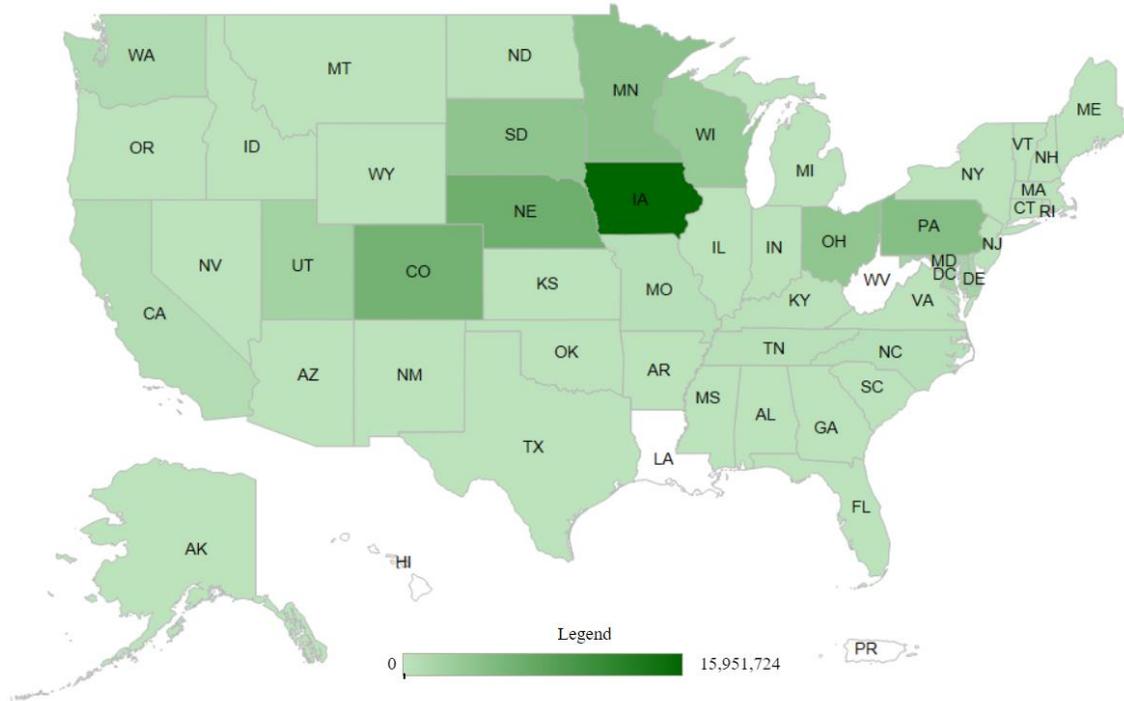
Source: Iowa State University Extension Office
<http://www.extension.iastate.edu/pme/EAB%20other%20forms/Iowa%20Ash%20Tree%20Distribution%202006%20map.jpg>
 Note: Story County is outlined in black.

Past Occurrences

Animal Disease Past Occurrences

As of August 2023, 58.8 million birds had been impacted by the 2022-2023 highly pathogenic avian influenza (HPAI). A total of 839 confirmed flocks in 47 US States had confirmed cases of HPAI. As shown in Figure 4-6, Iowa has been hit hardest by this outbreak with 15.9 million confirmed detections. The Governor issued a series of emergency declarations related to the outbreak, although Story County was not included.

Figure 4-6 Birds Affected by 2022-23 HPAI By State



Source: USDA Animal and Plant Health Inspection Service (APHIS), 2023

Bovine Spongiform Encephalopathy (BSE) (A.K.A. Mad Cow Disease)

To date, BSE has been confirmed in Great Britain, Belgium, France, Germany, Spain, Switzerland, Japan, Canada, and the United States. In the United States, the first positive BSE cow was discovered in Washington. As a result of a surveillance program from June 2004 to March 2006, two additional positive domestic cows were found; one each in Texas and Alabama. Since 1997 FDA implemented a feed ban prohibiting the feeding of feedstuff derived from ruminants to other ruminants. The results of this ban and enhanced surveillance indicate that while BSE is present, it is at an extremely low level in U.S. cattle.

Chronic Wasting Disease (CWD)

The first case of CWD in Iowa was found in 2012 on a hunting preserve in the southeastern part of the state. In that case, it was determined the CWD-positive mature buck had been transferred to the hunting preserve from a deer farm in north central Iowa. Subsequent testing found CWD at the deer farm. The Iowa Department of Agriculture and Land Stewardship conducted testing. Results were released in early October 2014, stating that 284 of 356 deer (80 percent) from a captive herd in north-central Iowa tested positive for chronic wasting disease.

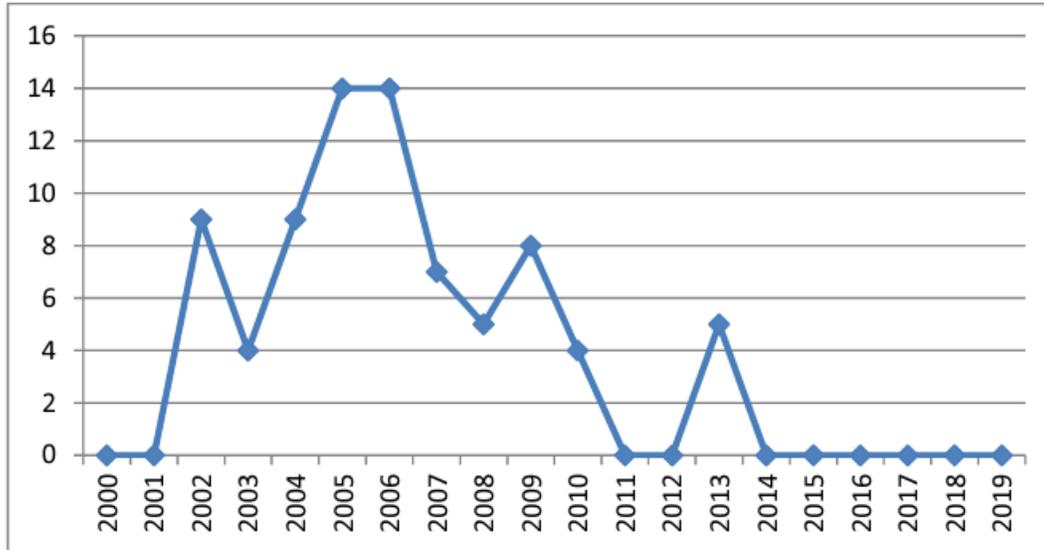
As of August 2023, there were 260 confirmed cases of CWD in wild deer in Iowa, up from 96 cases in 2022 and 53 in 2021. Confirmed cases were reported in 16 counties. While there were no recorded cases in Story County, two cases were confirmed in neighboring Marshall (2023) and Jasper (2022) Counties.

Scrapie

A total of 86 herds in Iowa have been found to be infected with Scrapie since the accelerated national Scrapie Eradication Program started in November 2001. The last case of Scrapie in an Iowa producer's herd

was in a found in January 2014, from a heard that had been diagnosed in 2013. Figure 4-7 shows the progress of scrapie eradication in Iowa since 2001.

Figure 4-7 Iowa Infected & Source Flocks by Year



Source: Iowa Department of Agriculture and Land Stewardship (IDALS), 2020

Rabies

According to the Iowa Department of Public Health, Center for Acute Disease Epidemiology, there were 10 confirmed animal rabies cases in Iowa in each 2017 and 2018. In Story County, there have been six confirmed cases of rabies since 2011. Table 4-13 summarizes the occurrence of rabies in Iowa and Story County from 2011-2018, the most current data available.

Table 4-13: Rabies Cases in Iowa and Story County, 2011-2018

Year	Confirmed Rabies Cases in Story County (#/Animal)	Confirmed Rabies Cases in Iowa
2018	0	10
2017	0	10
2016	2/Bat	19
2015	0	12
2014	0	15
2013	0	12
2012	2 – 1/Bat, 1/Skunk	31
2011	2/Bat	25

Source: Iowa Department of Public Health, Center for Acute Disease Epidemiology, <https://idph.iowa.gov/rabies/resources>

Crop Disease Past Occurrences

According to the U.S. Department of Agriculture’s Risk Management Agency (RMA), during the 15-year period from 2007-2021, combined crop insurance payments for damages resulting from insects and crop disease was \$802,900 in Story County. The Iowa statewide average for insurable crop acres with insurance is 93.0 percent (RMA 2022). Table 4-14 provides a summary of insured crop losses as a result of crop infections and infestations.

Table 4-14: Story County Crop Insurance Payments for Crop Pests/Diseases 2007-2016

Damage Cause	Sum of Indemnity Amount	Sum of Determined Acres
Insect Damage	\$11,269	248
2012	\$11,269	248
Plant Disease	\$49,053	645
2009	\$4,447	59
2010	\$6,630	236
2011	\$12,660	88
2014	\$10,220	77
2015	\$15,096	185
Mycotoxin (Aflatoxin)	\$742,580	1,995
2010	\$742,580	,1995
Grand Total	\$802,902	2,888

Source: USDA RMA

Probability of Future Occurrence

The planning area experiences some level of agricultural loss every year as a result of naturally-occurring diseases that impact animals/livestock. The concern is when the level of an infestation escalates suddenly, or a new infestation appears, overwhelming normal control efforts. Normal control efforts include crop insurance and employment of various other agricultural practices that limit impact. For purposes of determining probability of future occurrence, the HMPC defined “occurrence” as an infestation occurring suddenly, a new infestation, or an infestation that overwhelmed normal control efforts. Research did not reveal any infestations in Story County that have reached this level of defined “occurrence”. Therefore, it was determined that the probability of this defined “occurrence” of agricultural infestation is “**Unlikely**”.

Magnitude/Severity

Animal/plant/crop disease is considered to have “**limited**” magnitude and severity. Animal health emergencies can take many forms: disease epidemics, large-scale incidents of feed and water contamination, extended periods without adequate water, harmful exposure to chemical, radiological, or biological agents, and large-scale infestations of disease-carrying insects or rodents, to name a few. One of the principal dangers of disease outbreaks is that they can rapidly overwhelm the animal care system.

However, State and federal animal health programs have been very successful in preventing or limiting the scope and magnitude of animal emergencies. If all these safeguards failed, a disease outbreak might cause injury, illness, or major property damage (in the form of agricultural losses). Critical facilities and emergency services could be shut down or overwhelmed for more than 24 hours.

The duration of an animal/plant/crop disease will typically last more than one week. This hazard can take a significant amount of time to manage and stop the disease. The economic impacts of these hazards could be felt for months and years to follow given the agricultural nature of the State of Iowa.

Climate Change Considerations

The climate change impacts below are excerpted from the 2010 Report on Climate Change Impacts on Iowa, the most recent report available, developed by the Iowa Climate Change Impacts Committee.

Animals

Despite the fact that Iowa ranks first in hog and fourth in cattle production nationwide, there is a lack of information about the effects of climate change on animal production in Iowa. Nevertheless, our general knowledge and principles pertaining to livestock and extreme weather events are applicable to Iowa's changing climate conditions. High temperatures have been shown to reduce summer milk production, impair immunological and digestive functions of animals, and increase mortality rates among dairy cattle. In general, domestic livestock can adapt to gradual changes in environmental conditions; however, extended periods of exposure to extreme conditions greatly reduce productivity and is potentially life threatening.

Crops

Despite great improvements in yield potential over the last several years, crop production remains highly dependent on climate in conjunction with other variables. The overall effect of climate change on crop productivity in Iowa remains unclear, as positive climatic events could be overridden by the impacts of poor management or genetics, or favorable management and genetics could override negative climate events.

Regardless of these interactions, it is certain that climate changes will affect future crop production. Greenhouse and growth chamber studies suggest increases in atmospheric carbon dioxide (CO₂) will generally have a substantial positive effect on crop yields by increasing plant photosynthesis and biomass accumulation.

Greater precipitation during the growing season, as we have been experiencing in Iowa, has been associated with increased yields; however, excessive precipitation early in the growing season adversely affects crop productivity. Waterlogged soil conditions during early plant growth often result in shallower root systems that are more prone to diseases, nutrient deficiencies, and drought stress later in the season.

An increase in temperature, especially during nighttime, reduces corn yield by shortening the time in which grain is accumulating dry matter (the grain fill period). According to research, Iowa's nighttime temperatures have been increasing more rapidly than daytime temperatures.

The current changes in precipitation, temperature, wind speeds, solar radiation, dew-point temperatures, and cloud cover imply less ventilation of crops and longer dew periods. Soybean plants in particular readily absorb moisture, making harvest problematic. One adaptive approach to these conditions involves farmers purchasing larger harvesting equipment to speed harvest, compensating for the reduced daily time suitable for soybean harvest.

The recent extreme weather events involving greater intensity and amount of rainfall have increased the erosive power of Iowa's precipitation, resulting in significant erosion of topsoil. The impact of climate change on the erosive force of precipitation in the U.S. is expected to increase by as much as 58%. These rates are expected to increase exponentially as precipitation continues to rise. Plant disease can also increase as temperature, soil wetness, and humidity increase, as these conditions favor the development of various plant diseases.

Vulnerability

People

A widespread infestation of animals/livestock and crops could impact the economic base of the county and its communities. According to the USDA 2017 Census of Agriculture, Story County has 955 farms. Jobs could be negatively impacted during an agriculture emergency; jobs tangentially tied to the agriculture industry

could also be affected. Disease can exacerbate the impacts from other hazards, and an example of this is adverse weather. Dead branches weakened by Emerald Ash Borer can be broken by high winds, and there are reports of these branches falling and causing harm to people.

Property

Buildings, infrastructure, and critical facilities are not vulnerable to this hazard. Its impacts are primarily economic and environmental, rather than structural effects.

Critical Facilities and Infrastructure

Animal, crop, or plant disease is not expected to have any impacts on critical facilities or infrastructure.

Economy

A widespread infestation of livestock or crops could impact the economy of the County. According to the 2019 Iowa Agricultural Economic Contribution Study, Story County agriculture provides 5,933 jobs, representing 9 percent of total jobs in the County. Those jobs are evenly split between jobs derived from crops (3 percent of total jobs), jobs derived from livestock (3 percent of total jobs), and jobs derived from other agricultural products (3 percent of total jobs). The total value-added of Story County's agricultural products sold was \$533.2 million. With this contribution of agriculture to the economy, a wide-scale agricultural infestation could severely impact the economic stability of the County.

Rough estimates of potential direct losses from a maximum threat event fall in a range of 1-50 percent of annual crop receipts. The market value of all crops grown in Story County in 2017 was \$164,285,000. Based on a worst-case scenario where 50 percent of crop production is lost in a given year due to agricultural infestations, the total direct costs could exceed \$82 million.

Rough estimates of potential direct losses from a maximum threat event fall in a range of 1-75 percent of livestock receipts. The market value of all livestock in Story County in 2017 was \$60,636,000. Based on a worst-case scenario where 75 percent of livestock is lost in a given year due to animal disease, the total direct costs could exceed \$45.5 million.

Environment and Cultural Resources

The U.S. Forest Service estimates that Story County has up to 500,000 ash trees in the County. Removal of debris if an EAB infestation would occur would be challenging and costly. If only 10 percent of the ash trees in the County were impacted, that could translate to 50,000 impacted trees. It is estimated that it costs \$2,000 to \$5,000 to replace each ash tree (AP 2022). In Story County, the cost of a 10 percent loss could translate to over \$250 million.

Invasive species typically harm native species through predation, habitat degradation and competition for shared resources. They can have a significant impact on crops by reducing crop yields, increasing production costs, or even causing the loss of entire crops. Invasive species can also spread diseases that can affect crops and livestock.

Development Trends

Future development is not expected to significantly impact the planning area's vulnerability to this hazard. However, if crop production and numbers of animals/livestock increases, the amount vulnerable to infestation also increases. Regarding EAB, the Iowa Department of Natural Resources recommends that other native tree species be planted in lieu of ash trees to avoid increasing vulnerability to infestation.

4.3.2 Drought

Future Probability	Magnitude/ Severity	Location	Overall Significance
Likely	Critical	Extensive	Medium

Risk Summary

Overall, drought is ranked **medium**.

- Droughts typically occur over a larger, regional area, therefore the location of drought is considered **extensive**, because more than 50% of the county will likely be experiencing drought conditions at a time.
- The magnitude and severity of drought is potentially **critical**, as the impacts to agriculture and the economy in Story County could be severe. According to the USDA, since 2007 almost \$32 million in crop insurance payments have been issued in Story County due to drought.
- The probability of future droughts is considered **likely**, as there have been multiple past periods of drought over the last 10 years.
- Drought vulnerability may increase over time as demand for water from different sectors increases and as the County plans for economic development around the use of water resources.
- Climate change may result in an increase in the frequency and severity of drought which could lead to impacts to the recreation and tourism industry in the County.
- The effects of recent droughts have exposed the vulnerability of the planning area’s economy to drought events.
- Related hazards: Extreme Heat, Wildfire

Description

Drought is generally defined as a condition where moisture levels are significantly below normal for an extended period of time and over a large area, which in turn adversely affects plants, animal life, and humans. There are four types of drought conditions relevant to Iowa:

Meteorological drought is defined on the basis of the degree of dryness (in comparison to some “normal” or average amount) and the duration of the dry period. A meteorological drought must be considered as region-specific since the atmospheric conditions that result in precipitation deficiencies are highly variable from region to region.

Hydrological drought is associated with the effects from periods of precipitation shortfalls (including snowfall) on surface or subsurface water supply (e.g., streamflow, reservoir and lake levels, ground water). The frequency and severity of hydrological drought is often defined on a watershed or river basin scale. Although all droughts originate with a deficiency of precipitation, hydrologists are more concerned with how this deficiency plays out through the hydrologic system. Hydrological droughts are usually out of phase with or lag the occurrence of meteorological and agricultural droughts. It takes longer for precipitation deficiencies to show up in components of the hydrological system such as soil moisture, streamflow, and ground water and reservoir levels. As a result, these impacts are out of phase with impacts in other economic sectors.

Agricultural droughts focus on soil moisture deficiencies, differences between actual and potential evaporation, reduced ground water or reservoir levels, and so forth. Plant water demand depends on

prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil.

Socioeconomic drought refers to the effects on people from physical water shortages.

The four different types of drought can all occur in Iowa. A meteorological drought is the easiest to determine based on rainfall data and is an easier drought to monitor from rain gauges and reports. A hydrological drought means that stream and river levels are low, which also has an impact for surface water and ground water irrigators. In addition, in-stream discharges that fall below a pre-required level also place the State in regulatory difficulty with U.S. Fish and Wildlife, and with neighboring states over cross-border flow rights. An agricultural drought represents difficulty for Iowa's agricultural-based economy but is relatively easy to monitor based on crop viabilities for different regions.

The National Drought Mitigation Center (NDMC), located at the University of Nebraska in Lincoln, provides a clearinghouse for information on the effects of drought, based on reports from media, observers, impact records, and other sources. NDMC's website is found at <http://www.drought.unl.edu/>. Specific drought impacts by county are recorded at <http://droughtreporter.unl.edu/>.

The NDMC categorizes impacts of drought as economic, environmental, or social. Many economic impacts occur in agriculture and related sectors, including forestry and fisheries, because of the reliance of these sectors on surface and subsurface water supplies. In addition to obvious losses in yields in both crop and livestock production, drought is associated with increases in insect infestations, plant disease, and wind erosion. Droughts also bring increased problems with insects and disease to forests, frequently reducing growth potentials. The incidence of forest and range fires increases substantially during extended droughts, which in turn places both human and wildlife populations at higher levels of risk. Income loss is another indicator used in assessing the impacts of drought because so many sectors are affected.

Although drought is not predictable, long-range outlooks may indicate an increased chance of drought, which can serve as a warning. A drought period can last for months, years, or even decades. It is rarely a direct cause of death, though the associated heat, dust and stress can all contribute to increased mortality.

Additionally, drought can have cascading impacts, including the prevalence of grass fires caused in ditches, grass, and fields. Grass and Wildland Fire is discussed further in Section 4.3.4.

Location

The location of drought in Story County is "**extensive**". While the entire planning area in Story County is at risk to drought, the agricultural areas are more vulnerable to the immediate effects of drought. According to the 2017 USDA Census of Agriculture, the most recent published version, of the 366,720 total acres of land area in Story County, about 304,022 acres were dedicated to agriculture, across an estimated 955 farms. The map in Figure 4-2 in the Animal/Plant/Crop Disease hazard section displays the locations of various cropland uses in Story County.

Past Occurrences

Based on the National Centers for Environmental Information from NOAA, the mean annual precipitation for Story County is approximately 32 inches, based on the record range from 1895 to 2023. This total comes close to the State average of approximately 34 inches per year, representing enough rainfall to prevent drought. However, successive years of below-average rainfall are the cause of drought impacts in the planning area.

Table 4-15 provides the damage causing events that drought has caused on property and crops. July of 2012 had the most impact on crops in Story County which led to a total of \$105,720,000 in crop damage. In July 2012 much the State of Iowa recorded less than 50% of normal rainfall for the month, with a few locations under 10% of normal rainfall. This created a rapid deterioration of the corn and soybean crops. Over the years, the majority of drought conditions begin in late June and continue into July and August. According to the NCEI database, approximately \$105 million in crop losses have been reported attributable to drought in Story County since 2000, shown below in Table 4-15.

Table 4-15: Damages Caused by Drought in Story County, 1950-2022

Date	Crop Damage
8/14/2000	\$4,690,000
9/1/2000	\$5,030,000
8/1/2001	\$11,350,000
8/1/2003	\$12,650,000
7/1/2012	\$45,000,000
8/1/2012	\$6,000,000
8/1/2013	\$21,000,000
Total	\$105,720,000

Source: NCEI, 1950-2022

The rainfall history at the Iowa – Central Climate Division weather station from 1893 to December 2017 (obtained from the Iowa Environment Mesonet). Rainfall totals for complete years with less than 32 inches of total rain are highlighted in blue. The lowest annual precipitation on record occurred in 1911, with a total of 18.06 inches.

Droughts have affected all jurisdictions in Story County. Effects have been considerable in Story County due to its high concentration of agricultural land. This has resulted in the expensive construction of regional water supplies, which rely upon surface water. Droughts have been a major concern over the impact they have had on the economy and quality of life of all jurisdictions. Most or all of Iowa experienced severe drought conditions throughout 2012 and into 2013. Prolonged hot and dry weather in summer 2012 and limited rain and snow during the spring, fall and winter have caused extreme drought in some areas. Water source lakes and streams were critically low. Heavy rain beginning in March 2013, which carried over into 2014, has lessened the drought severity in all of Iowa and eliminated drought conditions in much of Iowa, including Story County.

According to the National Drought Mitigation Center’s Drought Impact Reporter, during the 10-year period from January 2013 through December 2022, 146 listed drought impacts were noted for the State of Iowa. Of these impacts, 10 were reported to affect Story County. The following are the categories and reported number of impacts. Note that some impacts have been assigned to more than one category, and hence show duplicated:

- Agriculture – 4
- Fire – 1
- Plants & Wildlife - 1
- Relief, Response & Restrictions – 2
- Water Supply & Quality – 2

The impacts of recent drought periods in Iowa that affected Story County (from 2008 to 2017) are provided below.

July 2016 – Corn yield potential went down throughout Iowa, starting early July of 2016 and still ongoing. This event affects both agriculture and the water supply and quality systems.

September 2013 – Thirty-five Iowa counties, including Story County, received authorization from the Farm Service Agency for emergency haying and grazing, as hot and dry weather was heavily affecting the agriculture sector as well as relief, response, and restrictions services. The event took place from September 7, 2013 to the 29th of that month.

July 2013 – Soybean and corn crops were suffering from inadequate rain near Nevada, in Story County. This event began July 22, 2013 and lasted for an unspecified amount of time, hurting the agricultural sector.

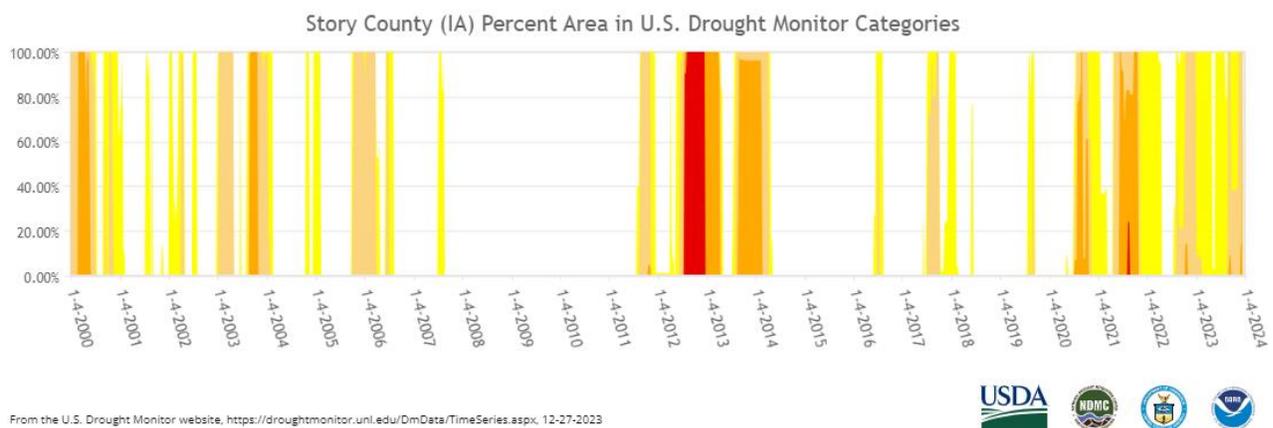
January 2013 – Drought-related USDA disaster declarations in 2013 impacted the agricultural sector as well as relief, response, and restrictions services. This event took place from January 8, 2013 to May 15, 2013.

July 2012 – This event hurt relief, response, and restrictions services as well as the water supply and quality near Ames, Story County, as water transfers in that city needed to be conducted to bolster groundwater recharge rates. The event began July 26, 2012, lasting for an unknown amount of time.

Losses due to drought reported on the National Centers for Environmental Information (from NOAA) Storm Events database total \$12,650,000 in property damage and \$93,070,000 in crop damage for Story County, Iowa. The 7 events logged in the system date from August 2000 to August of 2013, though the entire period of recorded history was queried against the database (1950 to 2022).

Figure 4-8 below provided by the U.S. Drought Monitor, summarizes the historical drought conditions for Story County by intensity and percent area from 2000 through January 2024. The county periodically experiences moderate to severe drought; extreme and severe drought intensity was experienced in 2012 and 2013 and again more recently in 2021.

Figure 4-8 Historic Drought Intensity (Percent Area), 2000-January 2024



According to the USDA’s Risk Management Agency (RMA), during the time period from 2007-2021, the sum of claims paid for crop damage as a result of drought in Story County was \$34,508,608. The 2016 Iowa Crop Insurance Profile from USDA’s Risk Management Agency claims that 89% of the insurable crops in Iowa are

indeed insured with USDA Crop Insurance. Table 4-16 summarizes the last fourteen years’ agricultural losses as reported in the RMA system:

Table 4-16: Crop Losses Resulting from Drought in Story County, Iowa 2007-2021

Year	Commodity Affected	Determined Acres	Indemnity Amount
2007	Corn, Soybeans	1,042	\$83,131
2008	Corn, Soybeans	689	\$55,846
2011	Corn, Soybeans	2,881	\$243,271
2012	Corn, Soybeans, Hybrid Corn seed, Other Crops	33,546	\$5,386,633
2013	Corn, Soybeans, Hybrid Corn seed, Other Crops	122,501	\$25,922,640
2014	Corn, Soybeans	134	\$12,964
2016	Corn	22	\$2,652
2017	Corn, Soybeans, Hybrid Corn seed	5,323	\$278,515
2018	Corn, Soybeans	743	\$157,979
2019	Soybeans	35	\$1,247
2020	Corn, Soybeans, Hybrid Corn Seed	17,896	\$1,807,745
2021	Corn, Soybeans	5,524	\$565,446
TOTAL		166,145	\$31,985,653

Probability of Future Occurrence

The probability of future droughts is considered “**likely**”. NCEI’s (National Centers for Environmental Information) uses the U.S. Palmer Drought Indices and the Standardized Precipitation Index to monitor and predict drought conditions. Lack of precipitation for a given area is the primary contributor to drought conditions. Since precipitation levels cannot be predicted in the long term, the following indices can be used to determine the probability of future occurrences of drought.

- **Palmer Z** Index monitors short-term monthly moisture conditions when depart from normal
- **Palmer Drought Severity Index** measures the duration and intensity of the long-term (meteorological) drought patterns
- **Palmer Hydrological Drought Index** measures long-term (hydrological) drought and wet conditions reflecting groundwater and reservoir levels
- **Standardized Precipitation Index** is a probability index that considers only precipitation. This is important to farmers to estimate soil moisture

Overall, given the few major drought events in the county through recorded history (as noted in sources such as the Drought Impact Reporter and NOAA’s NCDC), it is not predicted that drought will significantly impact the local populations or economy in future times. Major drought events are those that incur losses in property or crops, for example, and hence have a quantifiable impact on the county and its populations.

However, droughts may begin to occur more and more with warming climates due to issues such as climate change, but those relationships may need to be explored in more detail in future studies and assessments about drought hazards. In addition, based on the reported drought events, the agricultural sector does become impacted by drought, and will likely continue to suffer occasionally due to this hazard. As such, the probability of future occurrence of drought within Story County is “Likely.”

Magnitude/Severity

The magnitude of drought in Story County can be “**critical**”. Those dependent on rain would be the most vulnerable during a drought. This means that agriculture, agribusiness, and consumers would be impacted. A drought limits the ability to produce goods and provide services. Because citizens draw their drinking water from groundwater sources, a prolonged severe drought may impact all citizens if there were to be a dramatic drop in the water table. Fire suppression can also become a problem due to the dryness of the vegetation and possible lack of water. Generally, a drought event may directly or indirectly impact facilities for at least 2 weeks and potentially cause more than 25% damage to property. A prolonged drought would have a larger impact.

Drought warning is based on a complex interaction of many different variables, water uses, and consumer needs. Drought warning is directly related to the ability to predict the occurrences of atmospheric conditions that produce the physical aspects of drought, primarily precipitation, and temperature. There are so many variables that can affect the outcome of climatic interactions, and it is difficult to predict a drought in advance. An area may already be in a drought before it is recognized. While the warning of the drought may not come until the drought is already occurring, the secondary effects of a drought may be predicted and warned against weeks in advance.

Drought in the U.S. seldom results directly in the loss of life. Deaths associated with drought are usually related to a heat wave. Drought more directly affects agricultural crops, livestock, natural vegetation, and stream flows that include fish and aquatic vegetation. Impacts are costly to the economy, environment, and general population. Drought may cause short-term property damage until drought conditions dissipate.

Climate Change Considerations

According to the Fourth National Climate Assessment, climate change impacts in the Midwest will include increased frequency of late-growing season drought conditions. Future conditions of surface soil moisture are projected to increase in insufficient levels in summer driven by an increase in temperatures leading to greater loss of moisture through evaporation (U.S. Global Change Research Program 2018).

Many climate change studies have shown increases in precipitation, rather than decreases, especially in areas that are usually cold and humid. However, drought cycles still continue in many parts of the world. Climate change studies have also shown some increases in average temperatures and decreases in the overall number of days with precipitation, though. If this occurs during a drought cycle, the drought impacts will be exacerbated and increased agricultural and other losses will be sustained (e.g., impacting the Recreation and Tourism economy sectors).

Vulnerability

People

The historical and potential impacts of drought on populations include agricultural sector job loss, secondary economic losses to local businesses and public recreational resources, increased cost to local and state government for large-scale water acquisition and delivery, and water rationing and water wells running dry for individuals and families. As drought is often accompanied by prolonged periods of extreme heat, negative health impacts such as dehydration can also occur, where children and elderly are most susceptible. Other public health issues can include impaired drinking water quality, increased incidence of mosquito-borne illness, an increase in wildlife-human confrontations, and respiratory complications as a result of declined air quality in times of drought.



Property

No structures will be directly affected by drought conditions, though some structures may become vulnerable to wildfires, which are more likely following years of drought. Droughts can also have significant impacts on landscapes, which could cause a financial burden to property owners. However, these impacts are not considered critical in planning for impacts from the drought hazard.

Critical Facilities and Infrastructure

Drought typically affects crops and cropland more than it affects structures, but all critical facilities in the area could still experience effects. These critical facilities include, but are not limited to, schools, health care facilities, police and fire stations, water towers, lift stations, city and county buildings, and sirens.

Areas associated with agricultural use are vulnerable to drought conditions, which could result in a decrease in crop production or a decrease in available grazing area for livestock. Drought has no direct effect on houses and buildings, unless the hazard is coupled with the effects of expansive soils or landslides, in which case effects could be seen indirectly in property and infrastructure by drying out of the ground, for example. Drought impacts in Story County are likely to be minimal in terms of landscaping. However, if populations were forced to reduce or even stop irrigation altogether for prolonged periods of time, landscaping and other areas frequently watered would definitely be affected.

As mentioned under the Previous Occurrences sub-section of this chapter, according to the USDA's RMA database, Story County has received payments from insured crop losses as a result of drought. This means that droughts have been severe enough to incur losses in the past, and as such, the threat is rather moderate in significance throughout the county. Future losses, even if minor, could be expected in years to come.

Economy

Economic impacts will be largely associated with industries that use water or depend on water for their business. For example, landscaping businesses were affected in the droughts of the past as the demand for service significantly declined because landscaping was not watered. Agricultural industries will be impacted if water usage is restricted for irrigation. Losses associated with this hazard can be very high, depending on the region, particularly for agriculture. Crop insurance coverage mitigates some adverse economic impacts somewhat, but secondary impacts such as reduced revenue throughout the planning region or even the state may not be as easy to mitigate. Nevertheless, Story County in particular tends to suffer less frequently from drought hazards than other counties (especially those towards the south). As such, the expected magnitude of the hazard risk is "critical." However, it was noted by the HMPC that Ames has shallow wells which make the City more vulnerable to drought due to their more limited capacity. Other communities have deeper wells that help to mitigate the potential impacts of drought.

Environmental and Cultural Resources

Story County jurisdictions are impacted by drought because it is an expensive weather disaster; it reduces agricultural productivity and causes a strain on water supplies. In the county, farmers bear the most direct stress from drought as wells may run dry, crops wilt and die, and forage for livestock becomes scarce and costly.

Story County contains 966 farms that cover 306,000 acres of land. This translates to 83.3% of the surface land in the County being used for agriculture. Therefore, the planning area has a high exposure to this hazard. Aside from agricultural impacts, other losses related to drought include increased costs of fire suppression and damage to roads and structural foundations due to the shrink dynamic of expansive soils during excessively dry conditions. Drought also presents hazards to public health in extreme cases, where



drinking water production cannot keep up with demand, for example, or even air quality decreases from added dust particles. Water wells become less productive during drought and a failure of the remaining productive wells (due to power outage, etc.) can cause public drinking water supplies to become compromised.

If a drought event were to occur in Story County, crops and grassland areas may be more susceptible to fire, water for fire suppression may be limited, and jurisdictions may have to limit water consumption or look for alternative water sources. Cultural facilities would likely not be impacted by drought unless water usage was limited, or a facility was affected by a grass or wildland fire.

Development Trends

Increases in acreage planted with crops would increase the exposure to drought-related agricultural losses. In addition, increases in population impose additional strains on water supply systems to meet the growing demand for treated water, and these strains could prove impactful during times of drought.

4.3.3 Extreme Heat

Future Probability	Magnitude/Severity	Location	Overall Significance
Likely	Critical	Limited	Medium

Risk Summary

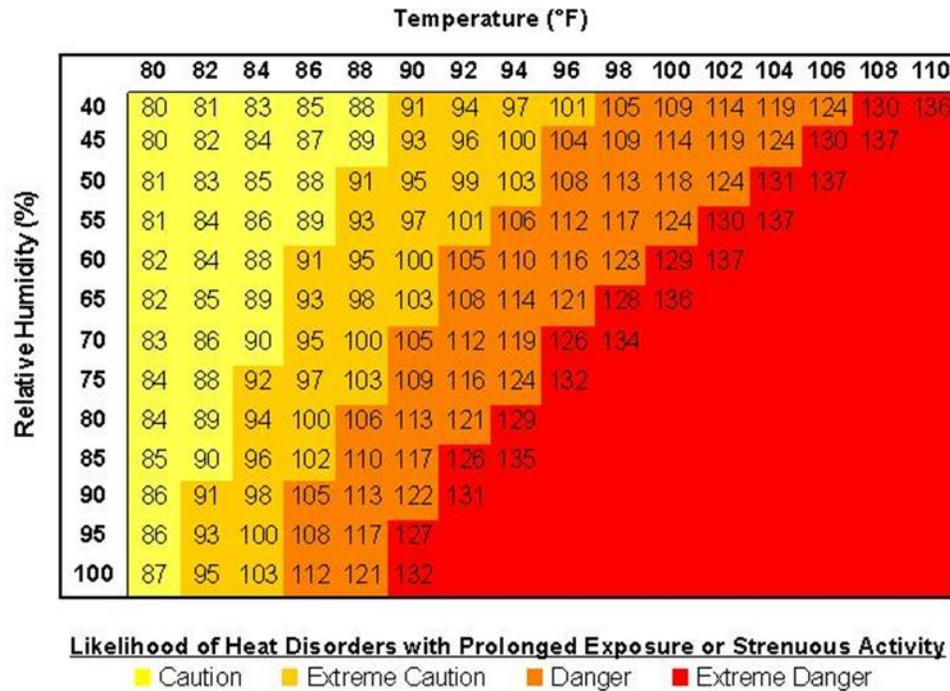
The overall significance of extreme heat is **Medium**.

- Because the weather patterns that create extreme heat conditions are regional events, instances of extreme heat will be felt throughout the entirety of Story County, giving an Location rating of **extensive**.
- Future extreme heat events are **likely** to occur throughout the County, and the magnitude of extreme heat events is potentially **critical**.
- The effects of recent droughts have exposed the vulnerability of the planning area’s economy to drought events.
- Climate change may result in an increase in the frequency and severity of extreme heat which could lead to impacts to the agriculture industry in the County.
- This hazard and its impacts do not vary substantially by jurisdiction.
- Extreme heat events are likely throughout the County, and the magnitude of heat events is low.
- Related hazards: Drought, Wildfire

Description

According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Ambient air temperature is one component of heat conditions, with relative humidity being the other. The relationship of these factors creates what is known as the apparent temperature. The Heat Index Chart in Figure 4-9 uses both of these factors to produce a guide for the apparent temperature or relative intensity of heat conditions.

Figure 4-9: Heat Index (HI) Chart



Source: National Weather Service (NWS) http://www.nws.noaa.gov/os/heat/heat_index.shtml

Note: Exposure to direct sun can increase Heat Index values by as much as 15°F. The shaded zone above 105°F corresponds to a HI that may cause increasingly severe heat disorders with continued exposure and/or physical activity.

During these conditions, the human body has difficulties cooling through the normal method of the evaporation of perspiration. Health risks rise when a person is overexposed to heat.

The most dangerous place to be is in a permanent home, with little or no air conditioning. Those at greatest risk for heat-related illness include people 65 years of age and older, young children, people with chronic health problems such as heart disease, people who are obese, people who are socially isolated, and people who are on certain medications, such as tranquilizers, antidepressants, sleeping pills, or drugs for Parkinson’s disease. However, even young and healthy individuals are susceptible if they participate in strenuous physical activities during hot weather or are not acclimated to hot weather. In agricultural areas, the exposure of farm workers, as well as livestock, to extreme heat is a major concern. Table 4-17 lists typical symptoms and health impacts of exposure to extreme heat.

Table 4-17: Typical Health Impacts of Extreme Heat

Heat Index (HI)	Disorder
80-90° F (HI)	Fatigue possible with prolonged exposure and/or physical activity
90-105° F (HI)	Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and/or physical activity
105-130° F (HI)	Heatstroke/sunstroke highly likely with continued exposure

Source: National Weather Service Heat Index Program, www.weather.gov/os/heat/index.shtml

The National Weather Service has a system in place to initiate alert procedures (advisories or warnings) when the Heat Index is expected to have a significant impact on public safety. The expected severity of the

heat determines whether advisories or warnings are issued. A common guideline for issuing excessive heat alerts is when the maximum daytime Heat Index is expected to equal or exceed 105 degrees Fahrenheit (°F) and the nighttime minimum Heat Index is 80°F or above for two or more consecutive days. A heat advisory is issued when temperatures reach 105 degrees, and a warning is issued at 115 degrees.

Location

The geographic location of extreme heat is **extensive**. The entire planning area is subject to extreme heat and all participating jurisdictions are affected.

Past Occurrences

The 10-year average for heat related fatalities is 97. No heat-related deaths are reported for Iowa within the last 10 years; the last heat-related death in the state occurred in 2006.

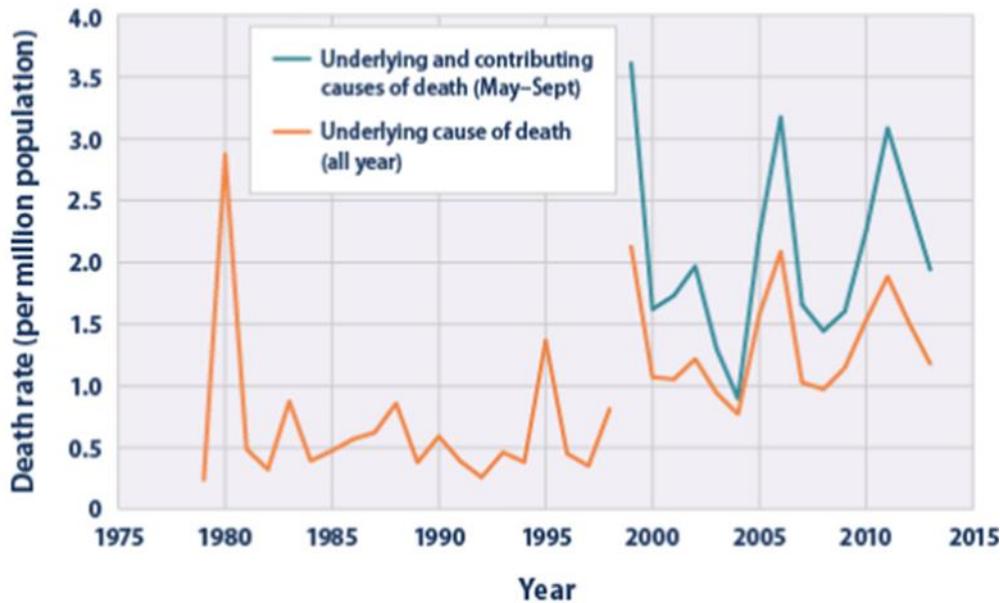
Table 4-18: National Heat-Related Deaths, 2008-2017

Year	Heat-Related Deaths
2008	71
2009	45
2010	138
2011	206
2012	156
2013	92
2014	20
2015	45
2016	94
2017	107

Source: National Weather Service, <http://www.nws.noaa.gov/om/hazstats.shtml>

Figure 4-10 shows heat-related deaths in the United States using two methodologies. One method shows deaths for which excessive natural heat was stated as the underlying cause of death from 1979 to 2013. The other data series shows deaths for which heat was listed as either the underlying cause or a contributing cause, based on a broader set of data that at present can only be evaluated back to 1999. For example, in a case where cardiovascular disease was determined to be the underlying cause of death, heat could be listed as a contributing factor because it can make the individual more susceptible to the effects of this disease. Because excessive heat events are associated with summer months, the 1999–2013 analysis was limited to May through September.

Figure 4-10: Deaths Classified as “Heat Related” in the United States, 1979-2015



Source: Environmental Protection Agency, https://www3.epa.gov/climatechange/pdfs/print_heat-deaths-2015.pdf

The 2013 Iowa State Hazard Mitigation Plan reports the following additional instances of agricultural losses due to extreme heat:

July 2011 – The Iowa Cattlemen’s Association reported that approximately 4,000 cattle died due to extreme heat.

1995 – Livestock-related economic losses due to heat stress were estimated to be \$31 million in Iowa.

On average, the hottest months of the year are July and August. According to the High Plains Regional Climate Center, the average temperature in Story County for the month of July is 73.2 degrees Fahrenheit (°F) with an average maximum temperature of 84.0 °F; and the average temperature for the month of August is 71.1 °F with an average maximum temperature of 82.4 °F. (Source: <http://climod.unl.edu/>)

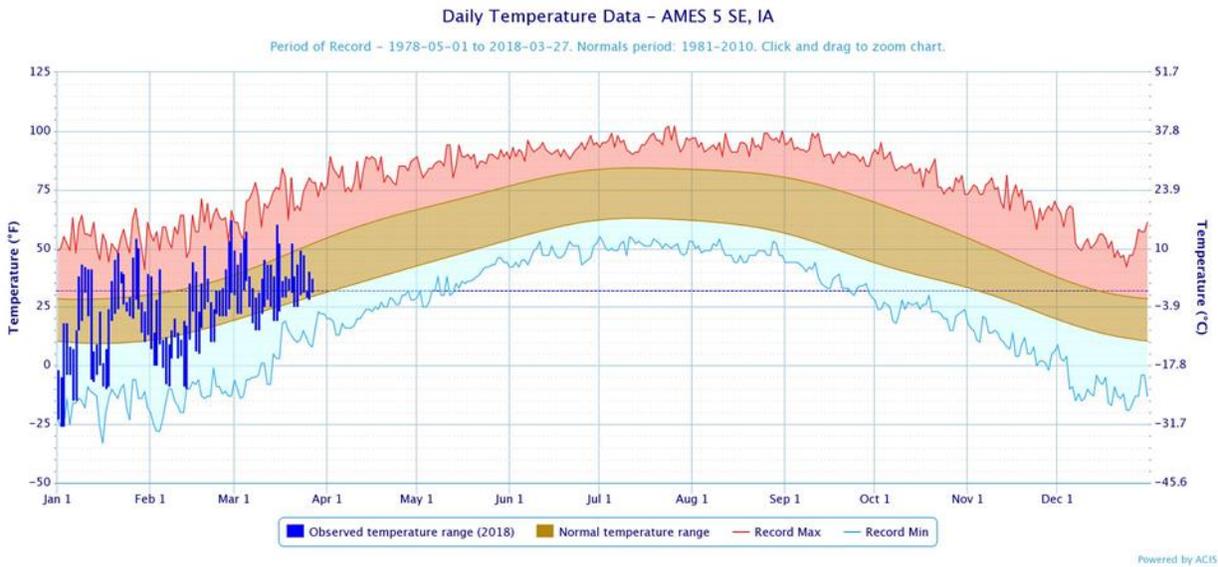
According to data from High Plains RCC, from 1996 to 2017, there were 88 days with temperatures 94 degrees Fahrenheit or above (at least 10 degrees above normal). When looking at only those events with a high temperature of 94 degrees Fahrenheit and higher that lasted for 3 consecutive days or more, there were nine occurrences during the 20-year period from 1996 through 2017.

The following summarizes the National Weather Service Advisories, Watches, and Warnings for Heat or Excessive Heat in Story County from 1996 through 2017 (22 years of data).

- 25 Advisories
- 6 Watches
- 5 Warnings

Figure 4-11 provides the daily temperature averages and extremes at the Ames, Iowa weather station for the period from 1981 to 2010 along with actual observed temperatures for the year to date in 2018 from the High Plains Regional Climate Center.

Figure 4-11: Daily Temperature Averages and Extremes, Ames, Iowa (1981 – 2010)



Source: High Plains Regional Climate Center, <http://climod.unl.edu/>

The National Climatic Data Center reported one regional heat event and two regional excessive heat events in and around the Story County planning area:

August 5, 2001 – Regional Heat Event – Very warm and humid conditions that began in the last part of July continued into August. Temperatures during the day warmed into the 90s, with overnight lows remaining in the 70s. Dew point temperatures held in the mid-70s to low 80s through most of the time. An elderly woman passed away in Des Moines on the 5th. She was found in her home with the windows closed and temperatures in the house in excess of 100 degrees F. She had succumbed to the heat.

July 15-28, 2011 – Regional Excessive Heat Event – A large area of high pressure developed in the upper atmosphere by the middle of July. Heat built up over Iowa, aided by the severe drought to the south across Kansas, Oklahoma, and Texas. Temperatures rose into the 90s each day through the period. Though most days did not see 100-degree heat, the dewpoint and overnight lows were very significant. Low temperatures during most of the nights were in the 70s, with many of the nights in the mid to upper 70s. Dewpoint temperatures failed to fall below 70 through most of the period, with frequent excursions in the upper 70s to low 80s. These conditions caused considerable stress on livestock. Reports indicated that at least 4000 head of cattle and thousands of turkeys were killed by the suffocating heat. Livestock losses were estimated in the \$5 to \$10 million-dollar range.

July 20-23, 2016 – Regional Excessive Heat Event – A warm front lifted through the state on the 20th, allowing southerly winds to bring about high temperatures in the low 90s along with dew points in the upper 70s to 80 at times. As a result, heat index values easily eclipsed the 100-105-degree range and at times exceeded 110. Additionally, overnight lows did not provide much in the way of relief with many areas seeing lows in the mid and even upper 70s.

According to the USDA’s Risk Management Agency, insured payments in Story County for damages to crops as a result of heat and hot wind from 2007-2016 were limited to one hot wind event in 2016 which totaled \$32,902 in insurance paid.

Probability of Future Occurrence

Based on 11 National Weather Service Heat/Excessive Heat Warnings and Watches from 1996 to 2017 (22 years), the probability of occurrence is 50.0 percent. This translates to a probability rating of “**Likely**”.

Magnitude/Severity

Extreme heat is considered to have **critical** magnitude and severity. This means that multiple severe injuries, shutdown of facilities for at least 2 weeks and less than 25% of property is severely damaged. However, it should be noted that it is still possible for extreme heat to cause physical damage to property in the future. Extreme heat events typically occur with ample warning time. Weather forecasters predict heat events several days before they will occur.

Climate Change Considerations

The following climate change impacts relative to Extreme Heat were included in the 2010 Climate Change Impacts on Iowa report developed by the Iowa Climate Change Impacts Committee.

- Nighttime temperatures have increased more than daytime temperatures since 1970.
- Iowa’s humidity has risen substantially, especially in summer, which now has 13 percent more atmospheric moisture than 35 years ago as indicated by a 3 – 5 degree F rise in dew-point temperature. This fuels convective thunderstorms that provide more summer precipitation.

Both of these impacts could increase the number of extreme heat events in the planning area as well as the potential for negative impacts on people and agriculture.

Vulnerability

People

Exposure to extreme heat will increase as Story County’s population increases. People living in urban areas may experience higher vulnerability as impervious surface traps heat and creates an Urban Heat Island effect. As the largest city in the County and the city experiencing the most overall growth, Ames is likely to experience increases in extreme heat exposure and vulnerability.

Those at greatest risk for heat-related illness and deaths include people 65 years of age and older, young children, people who are obese, and people who are ill or on certain medications. To determine jurisdictions within the planning area with populations that may be more vulnerable to extreme heat, demographic data was obtained from the U.S. Census Bureau on numbers of people in each jurisdiction that are over the age of 65 as seen in Table 4-19. Data was not available on rates of obesity or those on certain medications.

Overall, Iowa is already older than the country as a whole. About 17.1% of its population is over 65 years, compared with 16% nationally. Story County’s population over 65 years is smaller than the national and state average at 12.2%. However, people aged 65 and older likely make up a smaller proportion of the county’s population due to the presence of Iowa State University, which contributes to a higher proportion of persons aged 20 to 24 years in the county. It should still be noted that overall, there are approximately 11,858 persons over the age of 65 who may face increased vulnerability to extreme heat events.

The jurisdictions with the highest percent of adults 65 and over in descending order are the cities of Story City, Collins, Zearing, and Colo.

Table 4-19: Story County Population 65 years and Over, 2016-2020 American Community Survey 5-Year Estimates

Jurisdiction	Total Population	Population 65 yrs. and over	Percent 65 yrs. and over
Story County, Iowa (total)	97,355	11,858	12.2
City of Ames	66,361	6,765	10.2
City of Cambridge	941	66	7.0
City of Collins	444	98	22.1
City of Colo	764	151	19.8
City of Gilbert	1,088	93	8.5
City of Huxley	3,912	232	5.9
City of Kelley	369	21	5.7
City of Maxwell	739	121	16.4
City of McCallsburg	479	29	6.1
City of Nevada	6,737	1,162	17.2
City of Roland	1,374	152	11.1
City of Sheldahl*	337	44	13.1
City of Slater	1,463	231	15.8
City of Story City	3,362	819	24.4
City of Zearing	547	110	20.1

Source: U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates

* – City boundaries are within multiple counties

Property

Recent research indicates that the impact of extreme heat has been historically under-represented. The risks of extreme temperatures are often profiled as part of larger hazards, such as drought. However, as temperature variances may occur outside of larger hazards or outside of the expected seasons but still incur large costs, it is important to examine them as stand-alone hazards. Extreme heat may overload demands for electricity to run air conditioners in homes and businesses during prolonged periods of exposure and presents health concerns to individuals outside in the temperatures.

Critical Facilities and Infrastructure

Prolonged heat exposure can have significant impacts on infrastructure. Another type of infrastructure damage that can occur as a result of extreme heat is road damage. Prolonged high heat exposure increases the potential of pavement deterioration, as well as railroad warping or buckling. As mentioned above, high heat also puts a strain on energy systems and consumption, as air conditioners are run at a higher rate and for longer. Extreme heat can also reduce transmission capacity over electric systems.

Economy

According to the USDA’s Risk Management Agency, during the ten-year period from 2007-2016, the sum of claims paid for crop damages as a result of heat and hot wind was \$32,902.00. According to the 2016 Iowa Crop Insurance Profile Report issued by the USDA’s Risk Management Agency, 89 percent of Iowa insurable crops were insured. To factor in estimated losses to insurable crops that are not insured, the 89 percent crop insurance coverage was factored in to provide an adjusted estimate of losses. According to this calculation, estimated annualized losses total \$3,697 (see Table 4-20).

Considering the value of crops from the 2012 Census of Agriculture as baseline crop exposure, the estimated annual losses from heat and hot wind was determined to be negligible (less than 0.00%) compared to the value of the insurable crops.

Table 4-20: Estimated Insurable Annual Crops Lost Resulting from Heat

10-Year Extreme Heat Insurance Paid	Adjusted 10-Year Heat Losses (considering 89% insured)	Estimated Annualized Losses	2012 Value of Crops	Annualized Crop Loss Ratio (Losses/Value)
\$32,902	\$36,969	\$3,697	\$233,151,000	<0.00%

Source: Crop value is from USDA 2012 Census of Agriculture; Crop Insurance Paid is from the USDA's Risk Management Agency for 2007-2016; Crop Insurance Coverage is from USDA's 2016 State Crop Insurance Profile for Iowa

Extreme heat can also cause a strain on electricity delivery infrastructure which can be overloaded during peak use of electricity to power air conditioning during extreme heat events. Another type of infrastructure damage that can occur as a result of extreme heat is road damage. When asphalt is exposed to prolonged extreme heat, it can cause buckling of asphalt-paved roads, driveways, and parking lots. According to Iowa DOT, repairs and replacement of pavement due to heat-caused buckling and rupture costs an average of \$400,000 annually across the State.

Environment and Cultural Resources

Extreme heat may cause temporary drought-like conditions. For example, several weeks of extreme heat increases evapotranspiration and reduces moisture content in vegetation, leading to higher wildfire vulnerability for that time period even if the rest of the season is relatively moist.

Development Trends

Story County has experienced growth and development, with the population increasing nearly 10% from 2010 to 2020. Therefore, the number of people vulnerable to extreme heat is not necessarily increasing. Structures are not usually directly impacted by extreme heat; therefore, continued development is less impacted by this hazard than others in the plan. Public education efforts should continue to help the population understand the risks and vulnerabilities of outdoor activities, property maintenance, and regular exposures during periods of extreme heat.

4.3.4 Flooding (Flash & Riverine)

Future Probability	Magnitude/Severity	Location	Hazard Ranking
Likely	Catastrophic	Significant	High

Risk Summary

- The overall significance of flooding is **High**. However, there is significant variation between communities.
- Ames, Cambridge, Collins, Gilbert, Huxley, Maxwell, Nevada, Roland, Slater, Story City, and the unincorporated County all have properties in the floodplain.
- Flash flooding that occurs with little or no warning will continue to impact the planning area.
- Flooding may be exacerbated by other hazards, such as wildfires.
- Flooding frequently causes other related hazards, such as erosion and mudflows.
- There is \$596 million worth of property values in the 1% and 0.2% floodplain, with potential losses estimated at \$149 million.
- There is an estimated population of 1,712 in the 1% and 0.2% floodplain.
- Related hazards: Drought, Levee/Dam Failure, Wildfire.

Description

Flooding can be broken into two main categories: River Flooding and Flash Flooding.

Riverine flooding is defined as the overflow of rivers, streams, drains, and lakes due to excessive rainfall, rapid snowmelt, or ice melt. The areas adjacent to rivers and stream banks that carry excess floodwater during rapid runoff are called floodplains. A floodplain is defined as the lowland and relatively flat area adjoining a river or stream. The terms “base flood” and “100-year flood” refer to the area in the floodplain that is subject to a one percent or greater chance of flooding in any given year. Floodplains are part of a larger entity called a basin, which is defined as all the land drained by a river and its branches.

Gauges along streams and rain gages throughout the state provide for an early flood warning system. River flooding usually develops over the course of several hours or even days depending on the basin characteristics and the position of the particular reach of the stream. The NWS provides flood forecasts for Iowa. Flood warnings are issued over emergency radio and television messages as well as the NOAA Weather Radio. People in the paths of river floods may have time to take appropriate actions to limit harm to themselves and their property.

A **flash flood** is an event that occurs when water levels rise at an extremely fast rate as a result of intense rainfall over a brief period, sometimes combined with rapid snowmelt, ice jam release, frozen ground, saturated soil or impermeable surfaces.

Ice jam flooding is a form of flash flooding that occurs when ice breaks up in moving waterways, and then stacks on itself where channels narrow. This creates a natural dam, often causing flooding within minutes of the dam formation.

Most flash flooding is caused by slow-moving thunderstorms or thunderstorms repeatedly moving over the same area. Flash flooding is an extremely dangerous form of flooding which can reach full peak in only a few minutes and allows little or no time for protective measures to be taken by those in its path. Flash flood waters move at very fast speeds and can move boulders, tear out trees, scour channels, destroy buildings, and obliterate bridges. Flash flooding often results in higher loss of life, both human and animal, than slower developing river and stream flooding.

In some cases, flooding may not be directly attributable to a river, stream, or lake overflowing its banks. Rather, it may simply be the combination of excessive rainfall or snowmelt, saturated ground, and inadequate drainage. With no place to go, the water will find the lowest elevations—areas that are often not in a floodplain. This type of flooding, often referred to as sheet flooding, is becoming increasingly prevalent as development outstrips the ability of the drainage infrastructure to properly carry and disburse the water flow.

In certain areas, aging storm sewer systems are not designed to carry the capacity currently needed to handle the increased storm runoff. Typically, the result is water backing into basements, which damages mechanical systems and can create serious public health and safety concerns. This combined with rainfall trends and rainfall extremes all demonstrate the high probability, yet generally unpredictable nature of flash flooding in the planning area.

Although flash floods are somewhat unpredictable, there are factors that can point to the likelihood of flash floods occurring. Weather surveillance radar is being used to improve monitoring capabilities of intense rainfall. This, along with knowledge of the watershed characteristics, modeling techniques, monitoring, and advanced warning systems increases the warning time for flash floods.

With the East Indian Creek and the South Skunk River running through the county flooding from these waterways and their tributaries has been a significant problem for many of the communities in Story County. Many of the communities were settled and developed largely because of their proximity to water resources. A flood is partial or complete inundation of normally dry land areas. Heavy precipitation can cause flooding either in the region of precipitation or in areas downstream. Heavy accumulations of ice or snow can also cause flooding during the melting stage. These events are complicated by the freeze/thaw cycles characterized by moisture thawing during the day and freezing at night.

Location

With the history of flooding in many areas across Story County, the location of flooding of various levels is considered **significant**. Story County crosses six HUC-8 watersheds, as follows (see Figure 4-12):

- South Skunk (07080105)—this watershed encompasses most of the county, covering it from northwest to southeast.
- North Skunk (07080106)—this watershed touches the east/southeast corner of the county very minimally.
- Upper Iowa (07080207)—this watershed crosses the county on the northeast corner, right above the South Skunk watershed.
- Middle Iowa (07080208)—this watershed barely touches the east-central boundary of the county, falling in between the Upper Iowa and the North Skunk watersheds.
- Middle Des Moines (07100004)—this watershed brushes the southwest corner of the corner very minimally, next to the South Skunk and Lake Red Rock watersheds.
- Lake Red Rock (07100008)— the southwest corner of Story County is crossed slightly by this watershed, which falls in between the Middle Des Moines and the South Skunk watersheds.

Figure 4-12: Story County, Iowa Watersheds (Story County is the red square)



Source: Environmental Protection Agency, [https:// cfpub.epa.gov/surf/county.cfm?fips_code=19169](https://cfpub.epa.gov/surf/county.cfm?fips_code=19169)



For purposes of this hazard profile and vulnerability analysis, the geographic locations/coverages for river flooding will be considered as those areas at risk to a 1-percent annual chance flood (also known as a 100 year flood). The 1-percent annual chance flood has been adopted by FEMA as the base flood for floodplain management purposes.

Jurisdictional Flood Hazard Maps

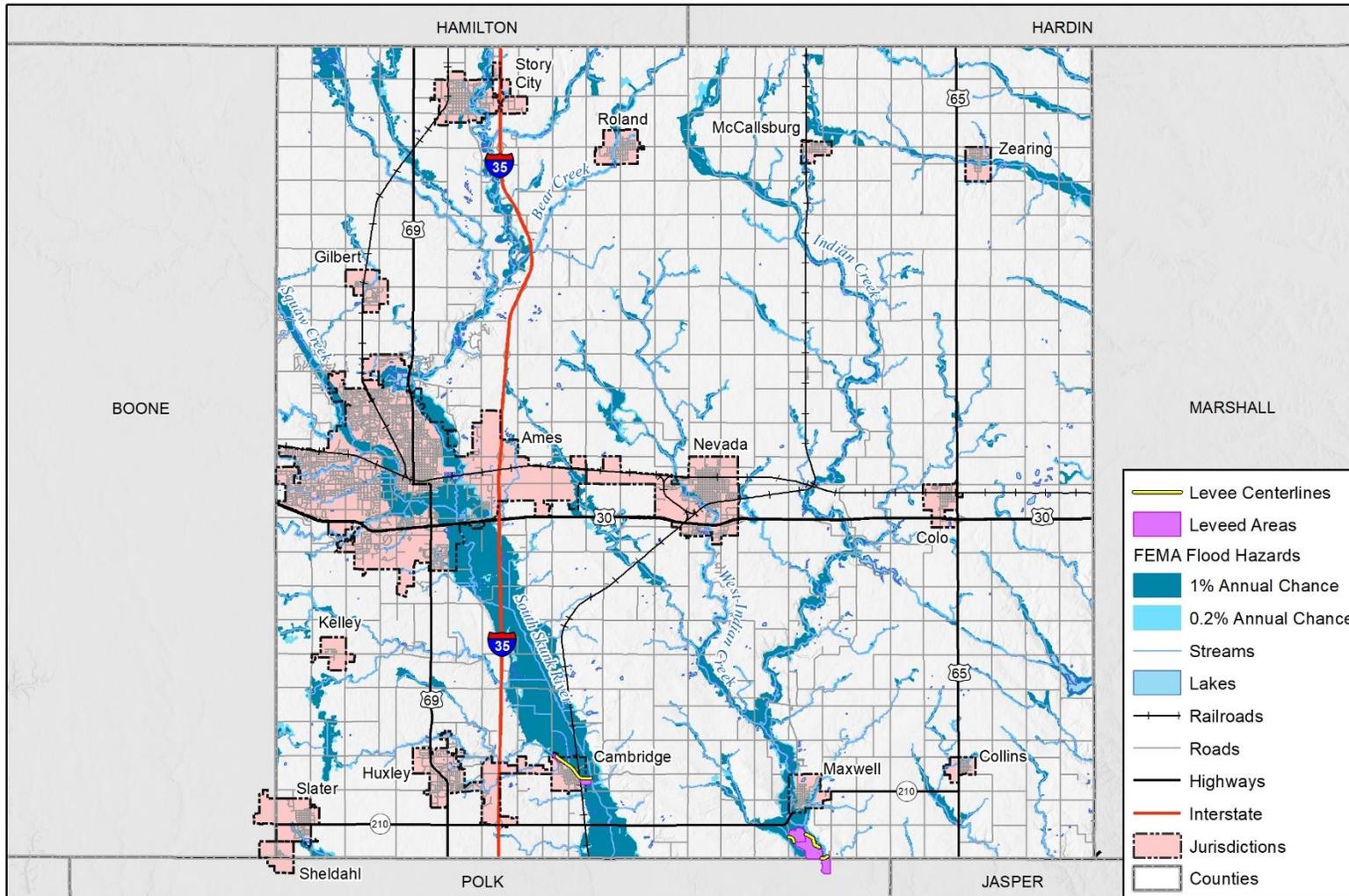
FEMA Special Flood Hazard Areas (SFHAs) in Story County were first mapped in June 1983. The most recent Flood Insurance Rate Maps (FIRMs) are dated January 15, 2021. The FIRMs delineate areas at-risk within the 1-percent annual floodplain (i.e., 100-year floodplain) and the 0.2-percent annual chance floodplain (the 500-year floodplain). Because of its size and location on the South Skunk River, Ames is the most heavily affected by flood. All other jurisdictions except Kelley, Colo, and Sheldahl are at risk of flooding from the 1-percent annual chance flood as well, but to lower degrees.

Figure 4-13 to Figure 4-28 provide the 1-percent annual floodplains for all jurisdictions in the planning area affected by this hazard. The county-level map is provided first for context, and city/town maps are next, in alphabetical order. The School Districts Figure 4-29 is provided last. Preceding each map is a general description of the flooding sources applying to each jurisdiction. These figures also include levees and leveed areas where available from the National Levee Database (NLD). A levee is a man-made structure constructed with engineering methods to contain, control, or divert the flow of water to reduce risk from temporary flooding. Story County's NLD levees can be found within the City of Cambridge Figure 4-15 and south of the City of Maxwell Figure 4-21.

Story County

The main flooding sources in Story County include the South Skunk River, West Indian Creek, Bear Creek, Indian Creek, Squaw Creek, Rock Creek, and other smaller (less influencing) streams and tributaries throughout the county.

Figure 4-13: Story County 1- and 0.2-Percent Annual Chance Floodplains and Levees

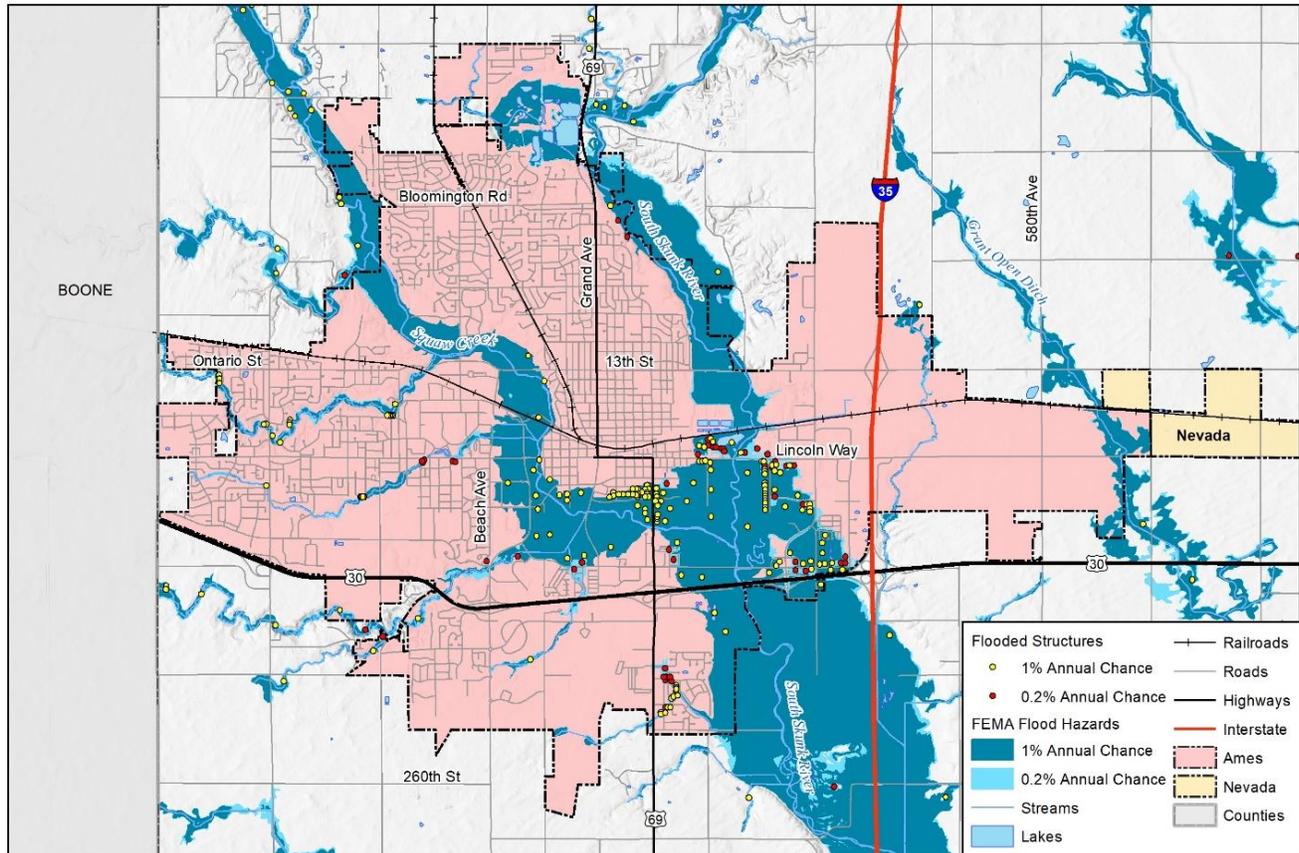


WSP Map compiled 6/2023;
intended for planning purposes only.
Data Source: Story County, NHD,
FEMA NFHL Effective 1/15/2021,
National Levee Database

Ames

The City of Ames is located adjacent to Nevada, to its west. It is on the edge of Story County, right about the middle-left boundary. Both the 1-percent and 0.2-percent annual chance floodplains affect the city, with the South Skunk River and Squaw Creek posing as the primary sources for flooding in the area. The South Skunk River crosses the city from the north to the southeast, while Squaw Creek feeds into the South Skunk River from the northwest, crossing through the middle of the city.

Figure 4-14: City of Ames 1- and 0.2-Percent Annual Chance Floodplains



wsp Map compiled 6/2023;
intended for planning purposes only.
Data Source: Story County, NHD,
FEMA NFHL Effective 1/15/2021

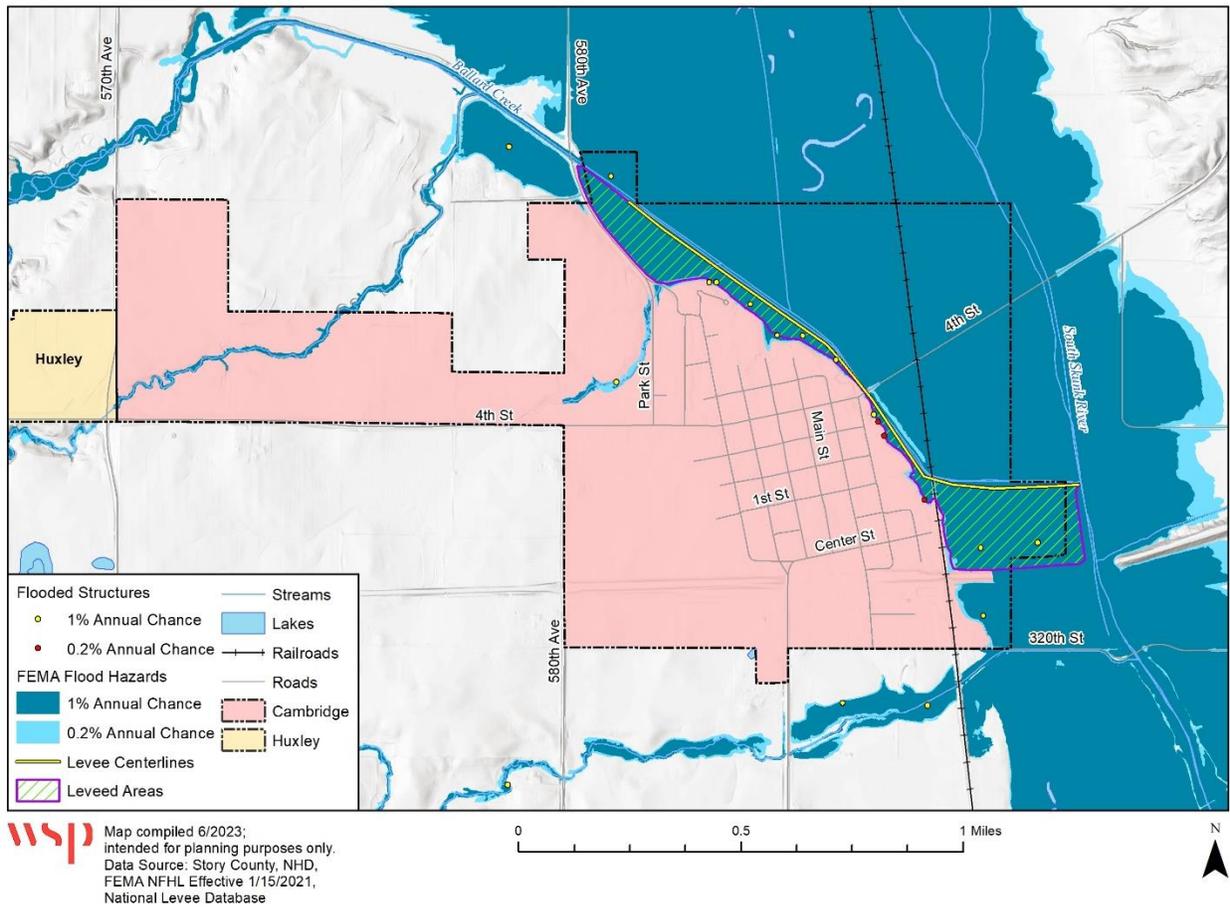
0 2.5 5 Miles



Cambridge

The City of Cambridge is adjacent to Huxley, touching on its east-side boundaries. Cambridge is located close the edge with Polk County, towards the southwest of Story County, and about half a mile east of Interstate 35. Cambridge’s main sources of flooding come from the South Skunk River to the northeast of the city, and Ballard Creek, which crosses it from northwest to southeast, meeting the South Skunk River just south of 4th Street. A small tributary from Ballard Creek also poses a risk to flooding, as it meets Ballard Creek by crossing city boundaries on the west portion of the jurisdiction. According to the National Levee Database, the city has a levee and areas protected by levee to help protect from high water levels and flooding from Ballard Creek and the South Skunk River.

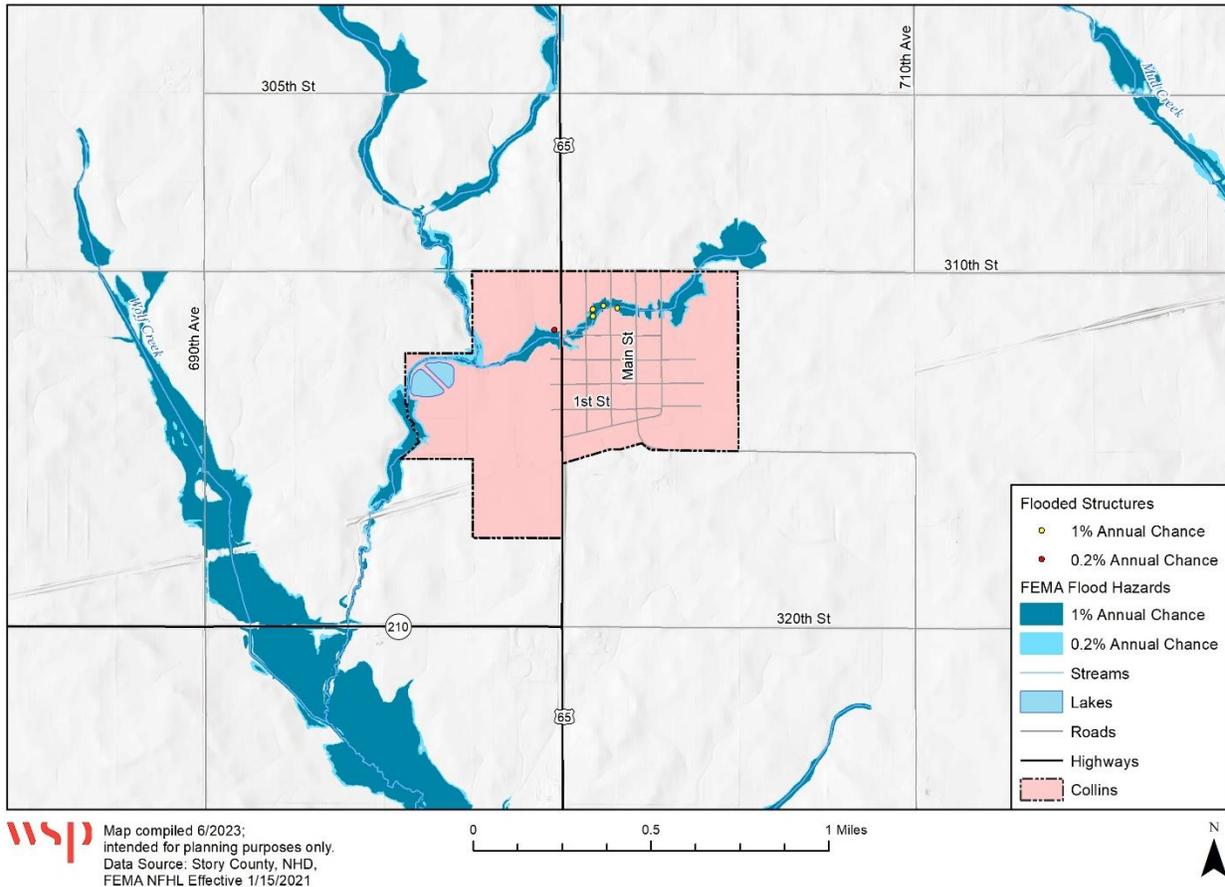
Figure 4-15: City of Cambridge 1- and 0.2-Percent Annual Chance Floodplains and Levee



Collins

The City of Collins is at risk of flooding from a tributary stemming from Wolf Creek. This small stream would affect the City in an almost diagonal fashion, crossing from southwest to northeast through the center-north portion.

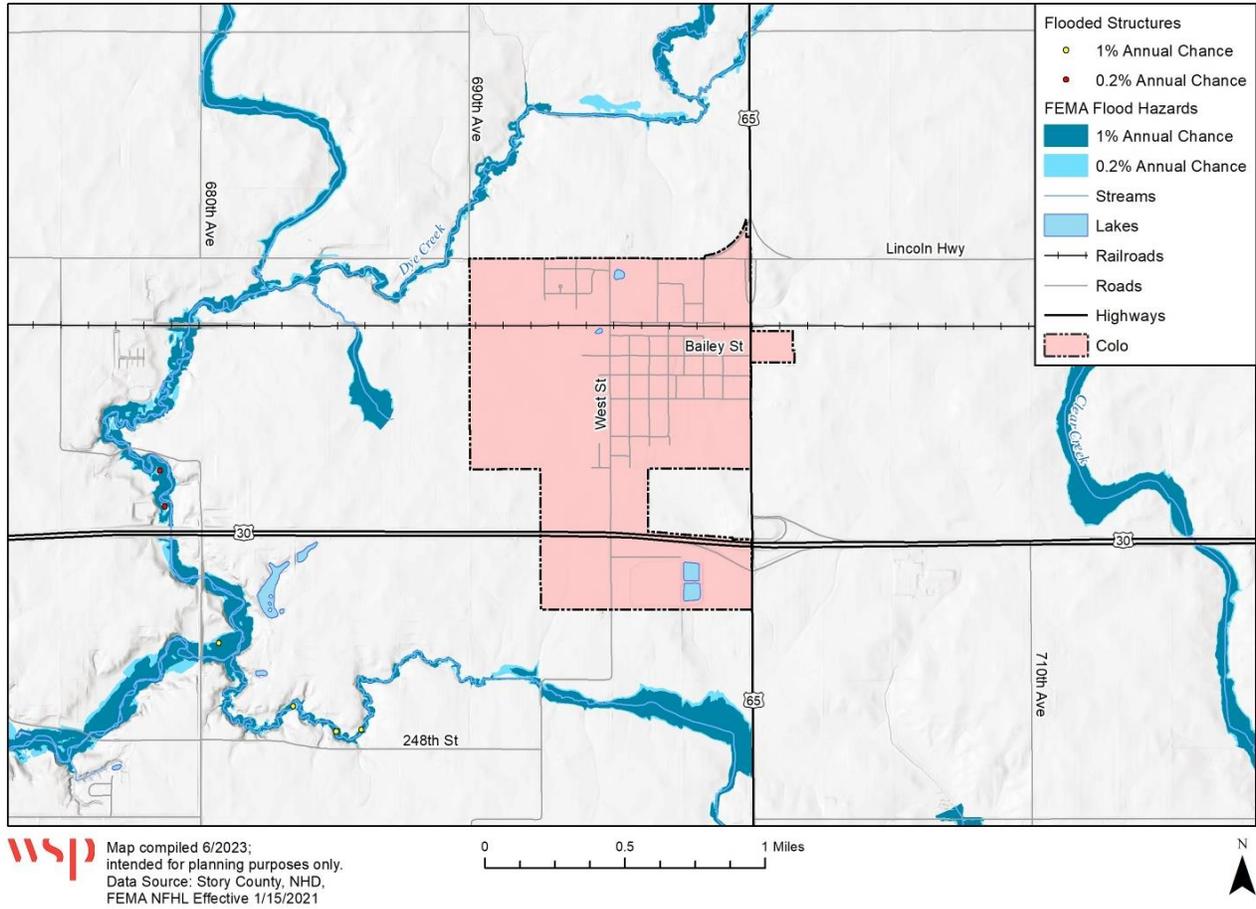
Figure 4-16: City of Collins 1- and 0.2-Percent Annual Chance Floodplains



Colo

Colo is one of the only jurisdictions without any clear risk of flooding. However, Dye Creek flows close to its northwestern corner, and could impact the City in the future if it were to expand in that direction.

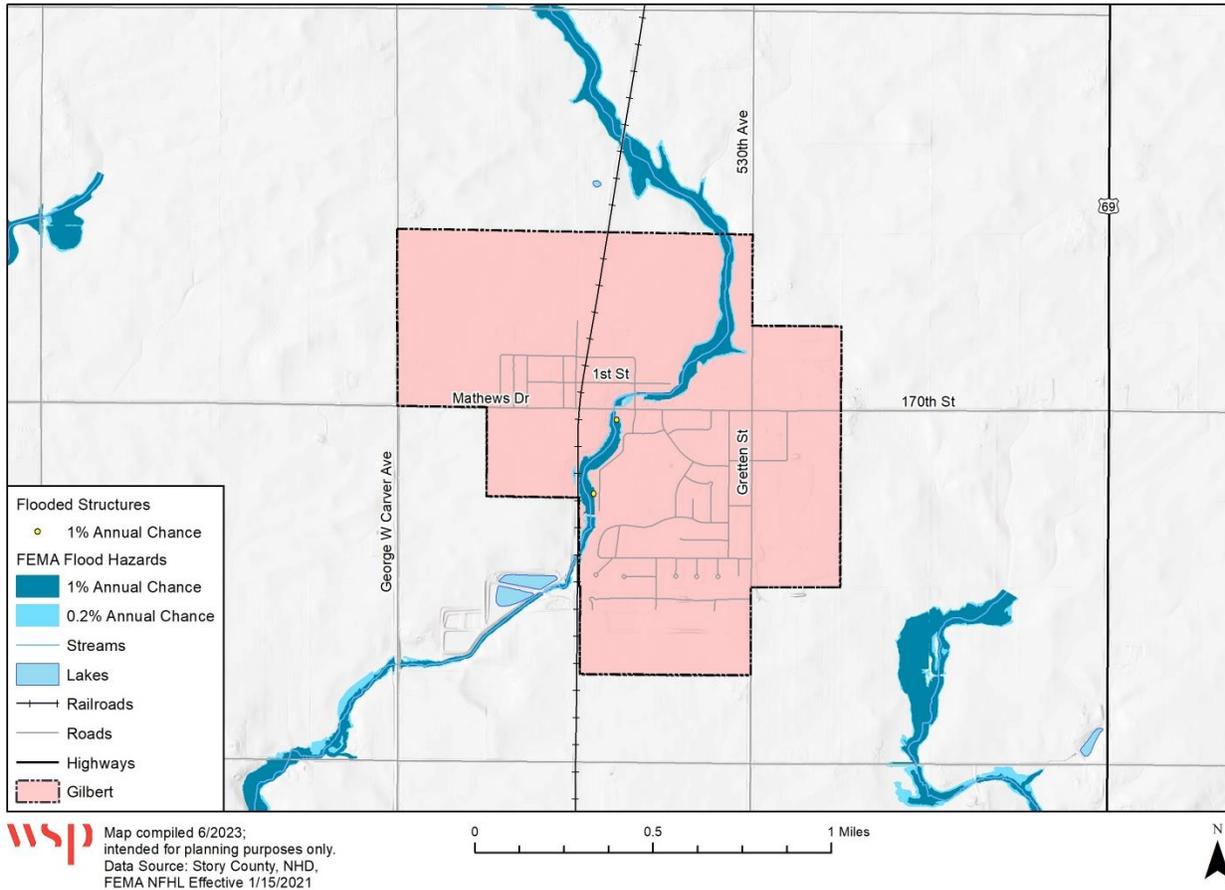
Figure 4-17: City of Colo 1- and 0.2-Percent Annual Chance Floodplains



Gilbert

Gilbert is located approximately one and a half miles north of Ames. A small degree of flooding can occur from a tributary of the Squaw Creek, which crosses the city in a northeast-southwest fashion through the middle of the jurisdiction.

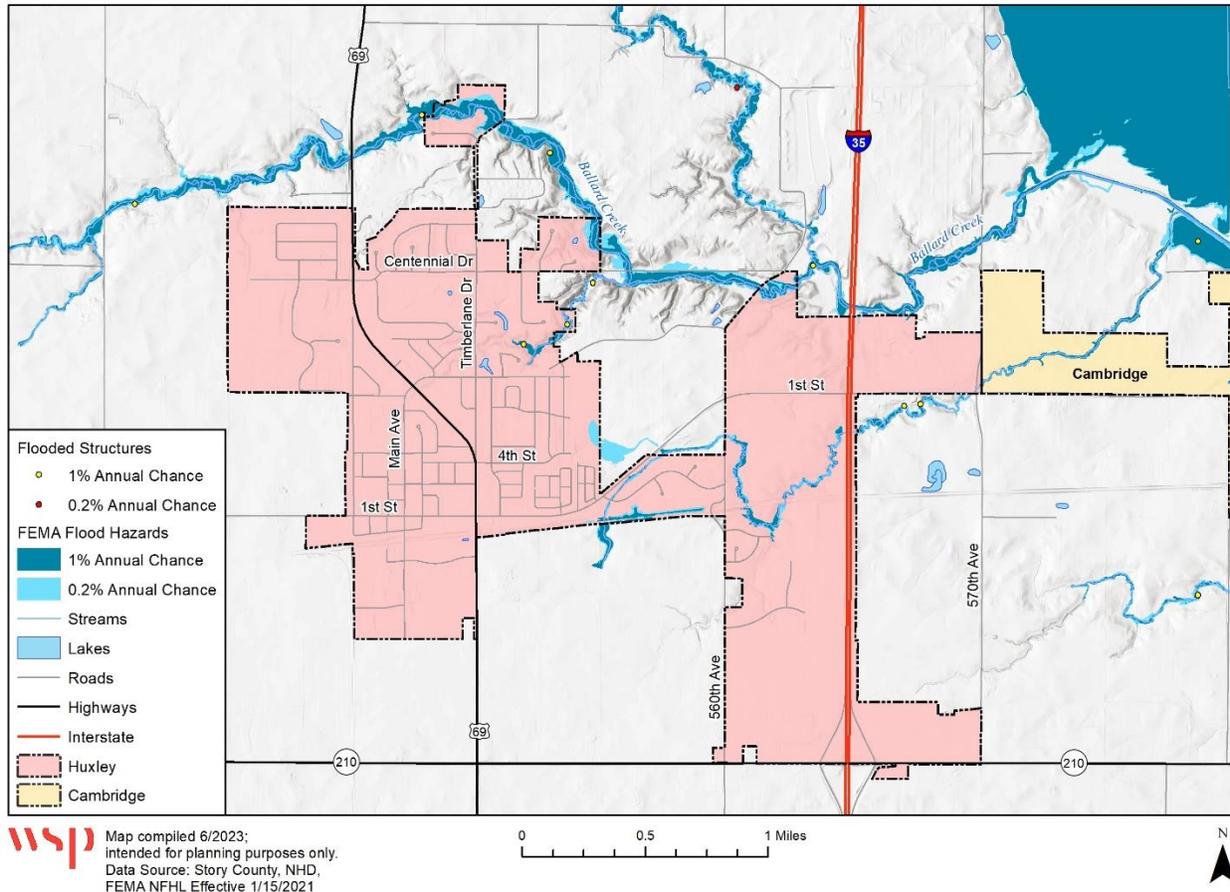
Figure 4-18: City of Gilbert 1- and 0.2-Percent Annual Chance Floodplains



Huxley

The City of Huxley is located on the southwest part of Story County, adjacent to Cambridge, connecting to the east. Interstate 35 crosses it in a north-south fashion. Ballard Creek is the main source of flooding in the city, including a small tributary which connects to Ballard after crossing Cambridge. However, the degree of flooding in the city is very minimal, only affecting a northern tip of the jurisdiction (at the end of Timberlane Drive), and on edges in the northeast and central parts.

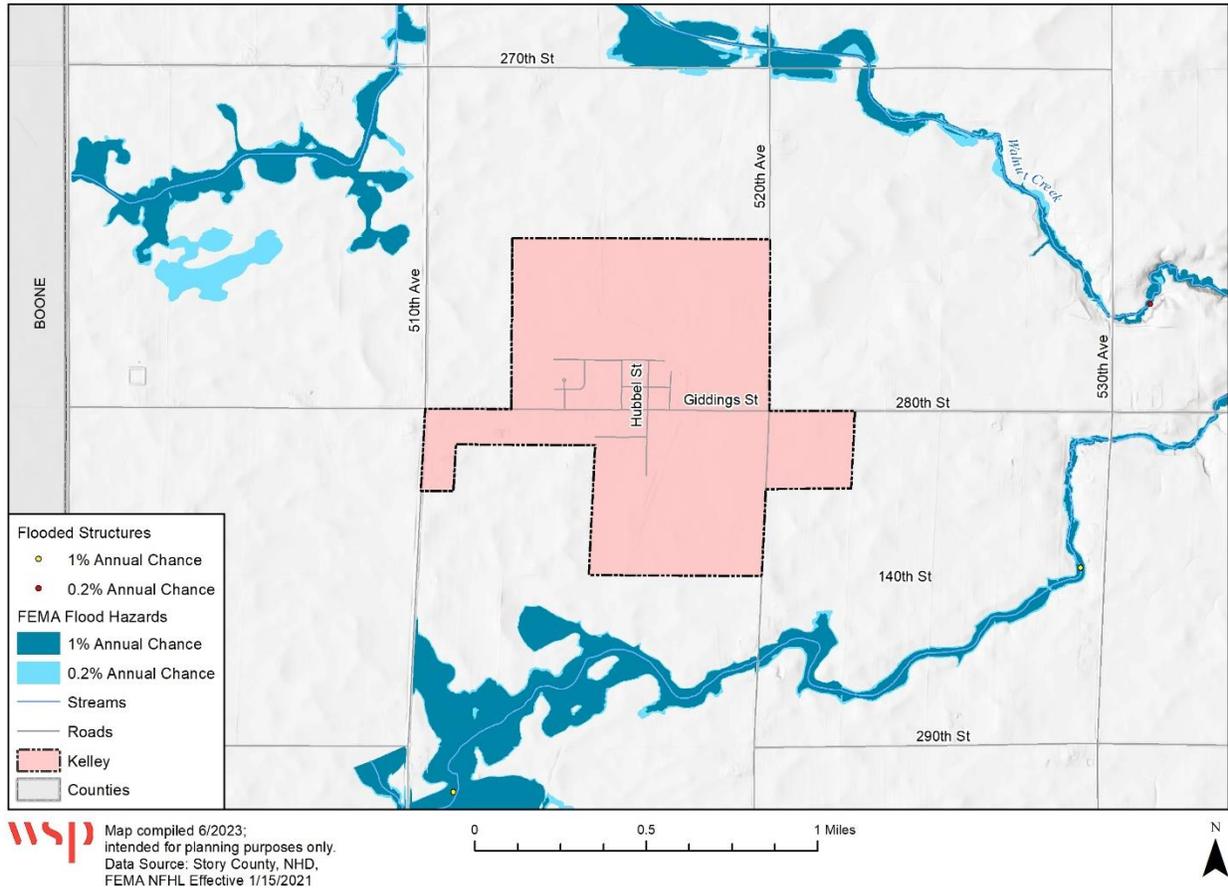
Figure 4-19: City of Huxley 1- and 0.2-Percent Annual Chance Floodplains



Kelley

The City of Kelley is found approximately one mile east of Boone County, and about four miles northeast of Slater. While there is not a floodplain crossing the city to pose a threat, parts of Walnut Creek surround its boundaries, falling about a quarter to a half a mile away from its northeast, northwest, and southern borders.

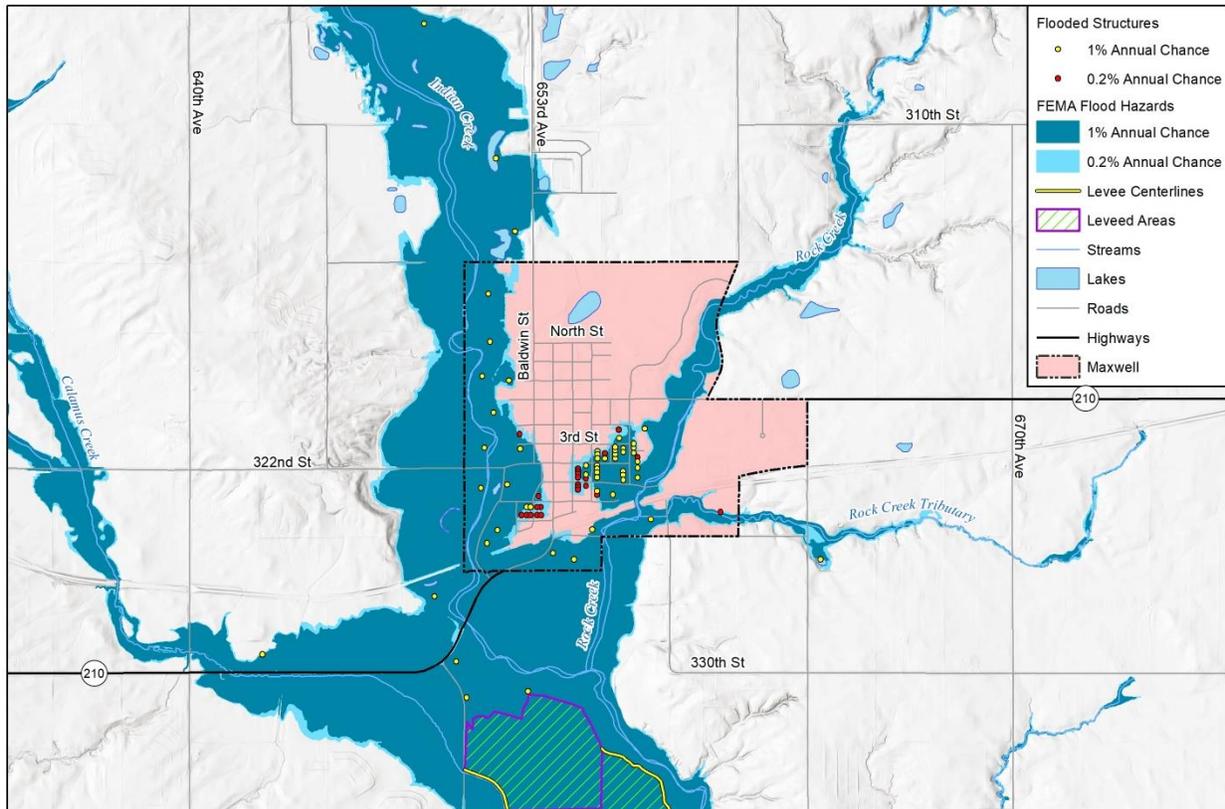
Figure 4-20: City of Kelley 1- and 0.2-Percent Annual Chance Floodplains



Maxwell

The City of Maxwell is found within the paths of the Rock Creek River and Indian Creek. These two are its primary sources for flooding, with Rock Creek affecting the south, east, and northeast portions of the city, and Indian Creek feeding in a north-south fashion, flooding the entire eastern boundary. According to the National Levee Database, there are levees and areas protected by levee south of the city to help protect from high water levels and flooding from Calamus Creek, Indian Creek, and Rock Creek. There is no protection from these levees for the City of Maxwell.

Figure 4-21: City of Maxwell 1- and 0.2-Percent Annual Chance Floodplains and Levees

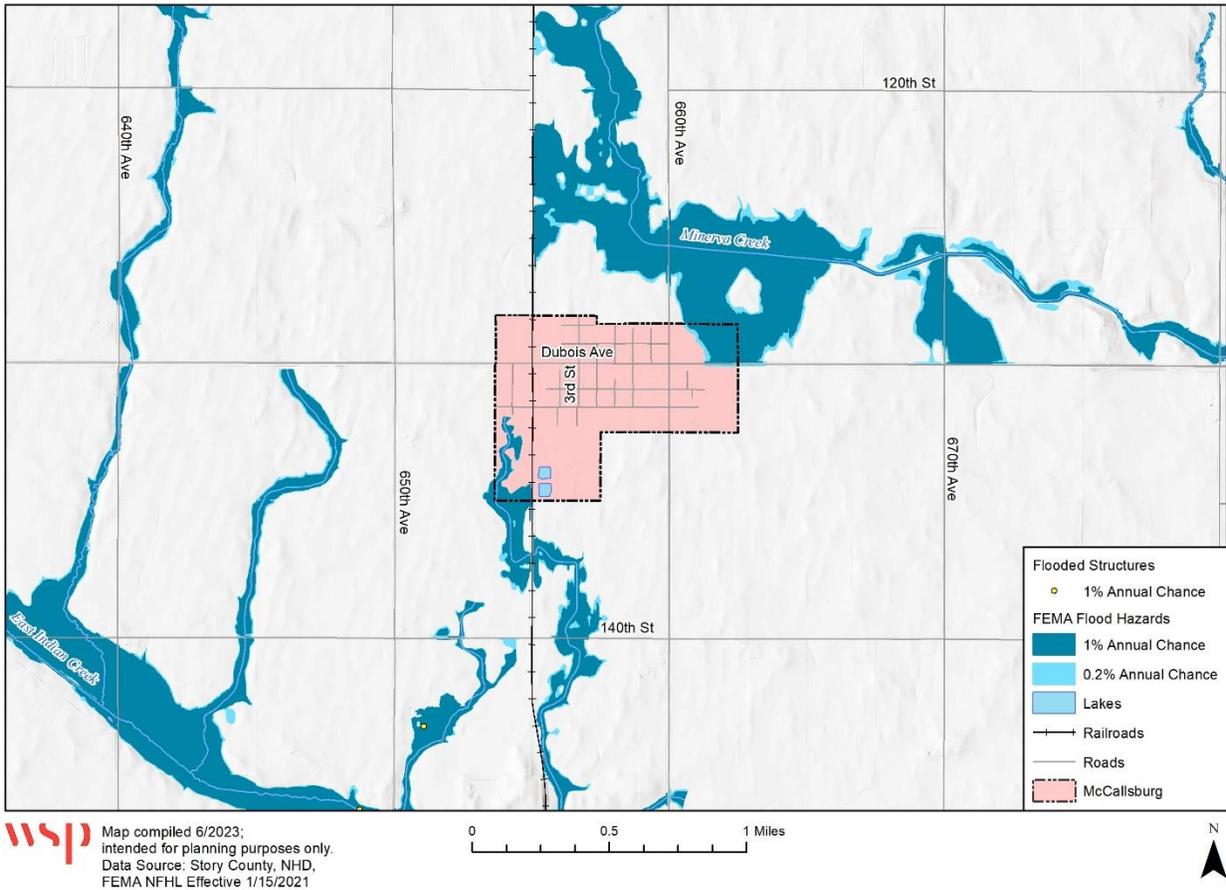


wsp Map compiled 6/2023;
intended for planning purposes only.
Data Source: Story County, NHD,
FEMA NFHL Effective 1/15/2021,
National Levee Database

McCallsburg

The City of McCallsburg is flooded slightly by Minerva Creek, right on the City's northeastern corner, then by a small tributary of East Indian Creek, on the City's southwestern corner.

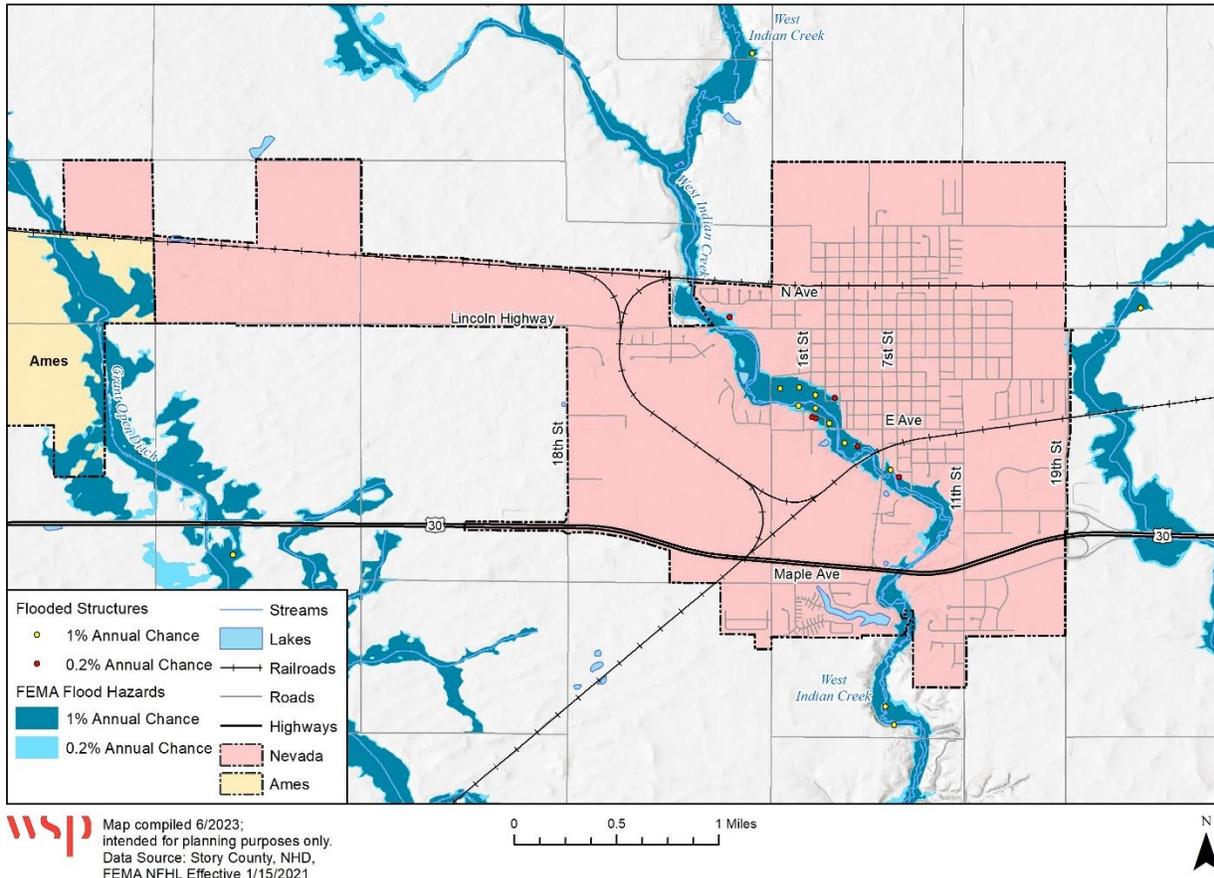
Figure 4-22: City of McCallsburg 1- and 0.2-Percent Annual Chance Floodplains



Nevada

Nevada is located to the east of Ames, about two miles east of Interstate 35, near the middle of Story County. West Indian Creek is the main source of flooding in the city, as it crosses the boundaries in a north to south fashion. The floodplain does not have a large footprint in the city. A small portion of the floodplain of a tributary from Indian Creek also touches city boundaries on its eastern edge.

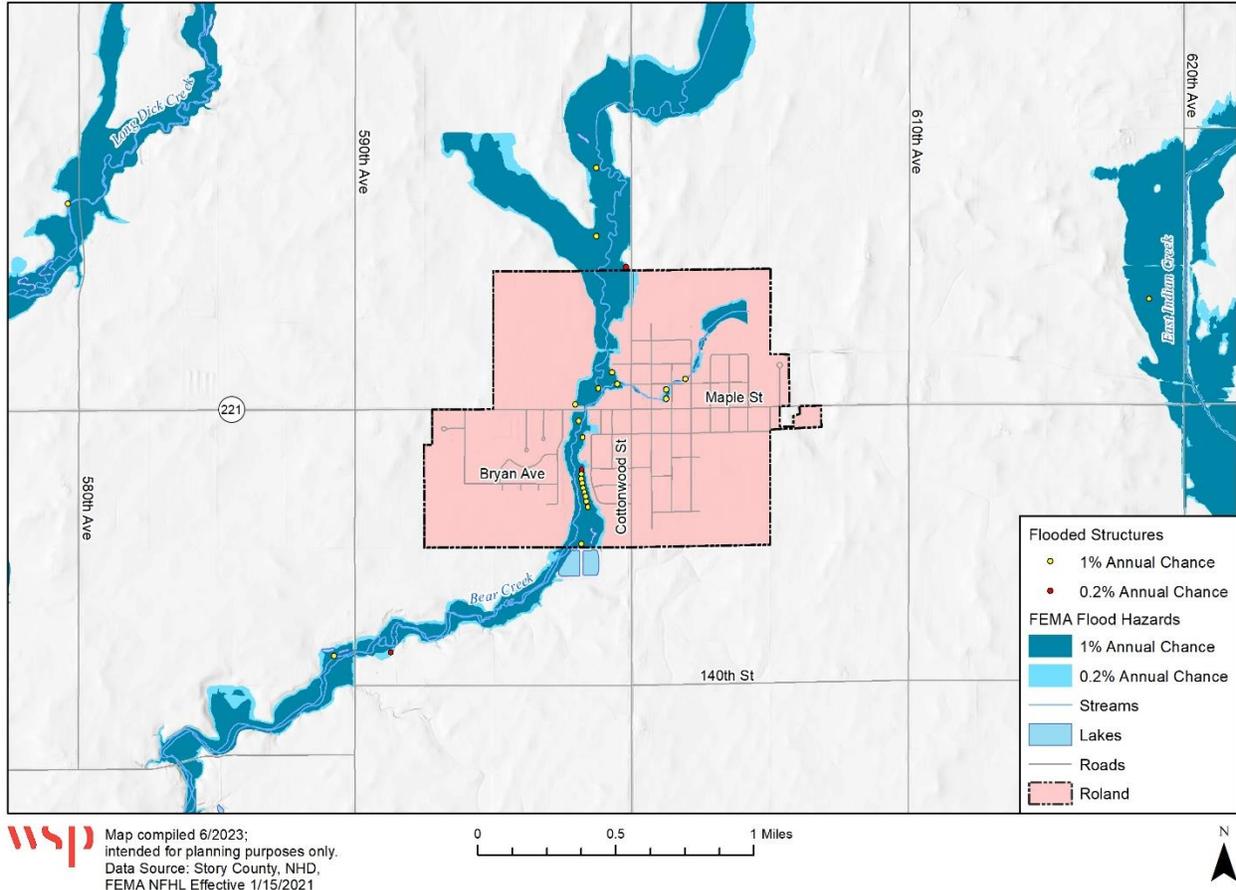
Figure 4-23: City of Nevada 1- and 0.2-Percent Annual Chance Floodplains



Roland

Roland is at risk of flooding from Bear Creek. The stream crosses city boundaries in a north-south fashion, with a small tributary branching off near the center of the city and causing small flooding towards the northeast.

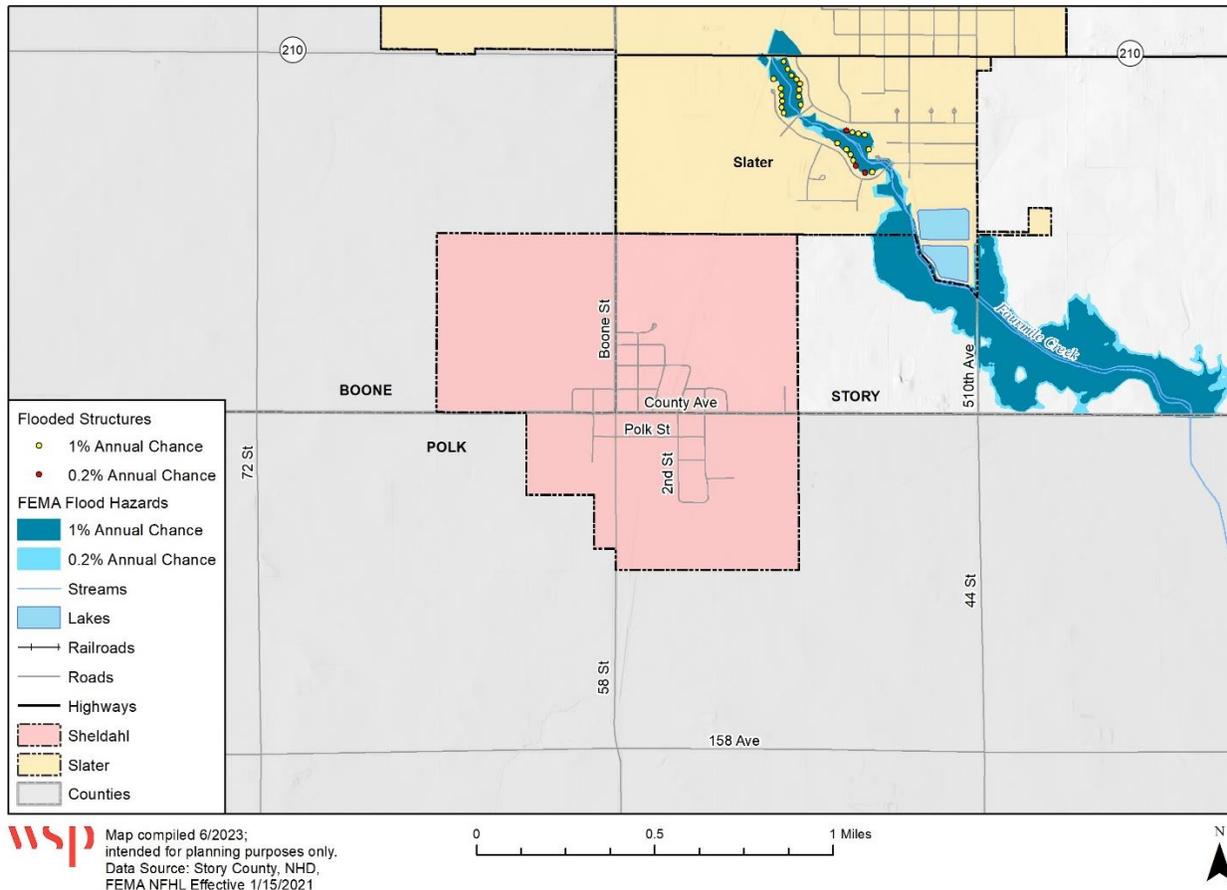
Figure 4-24: City of Roland 1- and 0.2-Percent Annual Chance Floodplains



Sheldahl

The City of Sheldahl falls right on the borders between the counties of Story, Polk, and Boone, with about one third of the city within each county. The city shares a boundary with Slater as well, towards its northeast. While there are no floodplains crossing Sheldahl, Fourmile Creek is located about two miles to the northeast of the city corner, on the side of Story County. As such, there is no direct risk of flooding from the 100-year or 500-year floodplains.

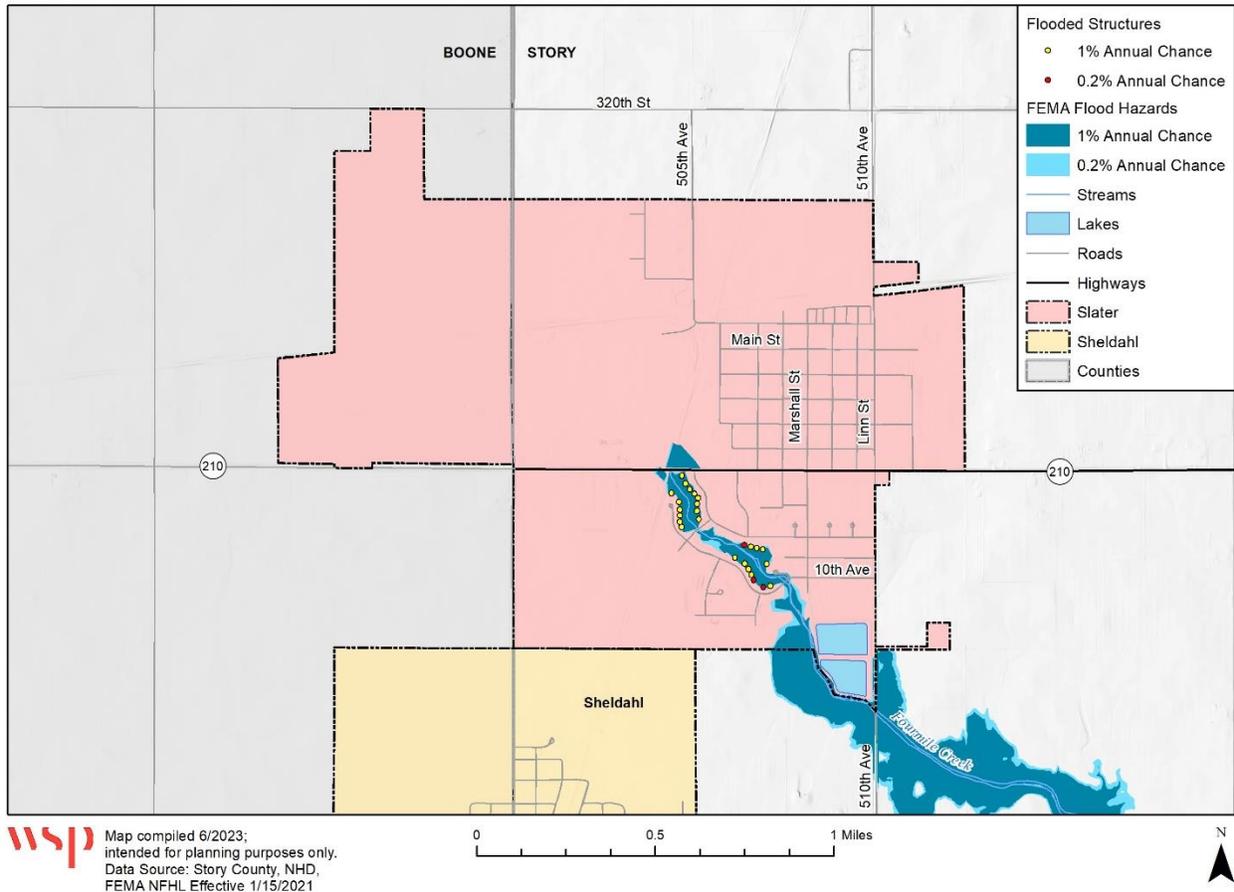
Figure 4-25: City of Sheldahl 1- and 0.2-Percent Annual Chance Floodplains



Slater

Slater shares its southwestern border with the City of Sheldahl, on the southwest corner of Story County, and also crosses into Boone County on the west. Fourmile Creek is Slater's only source of flooding, as the 100-year floodplain extends from the southeast corner, through to the middle of the city past Highway 210. While the floodplain intrusion into the city is not major, flooding is still very likely to occur in parts of the jurisdiction.

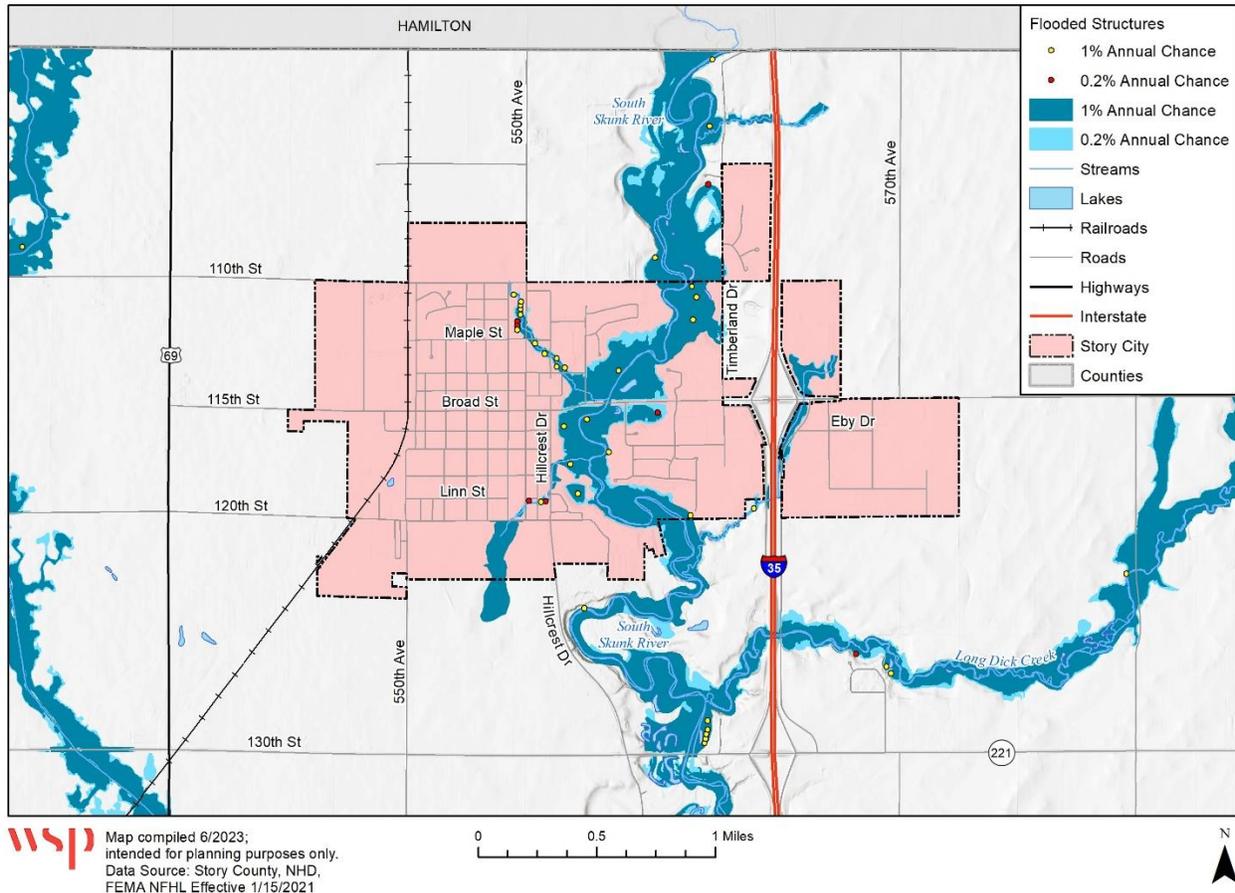
Figure 4-26: City of Slater 1- and 0.2-Percent Annual Chance Floodplains



Story City

Story City is located at the northwest part of Story County, near Hamilton County, and is crossed by Interstate 35 on the right portion of the city. The main source of flooding comes from the South Skunk River, which crosses the city in a north-south fashion through the middle, posing a risk to infrastructure and private property.

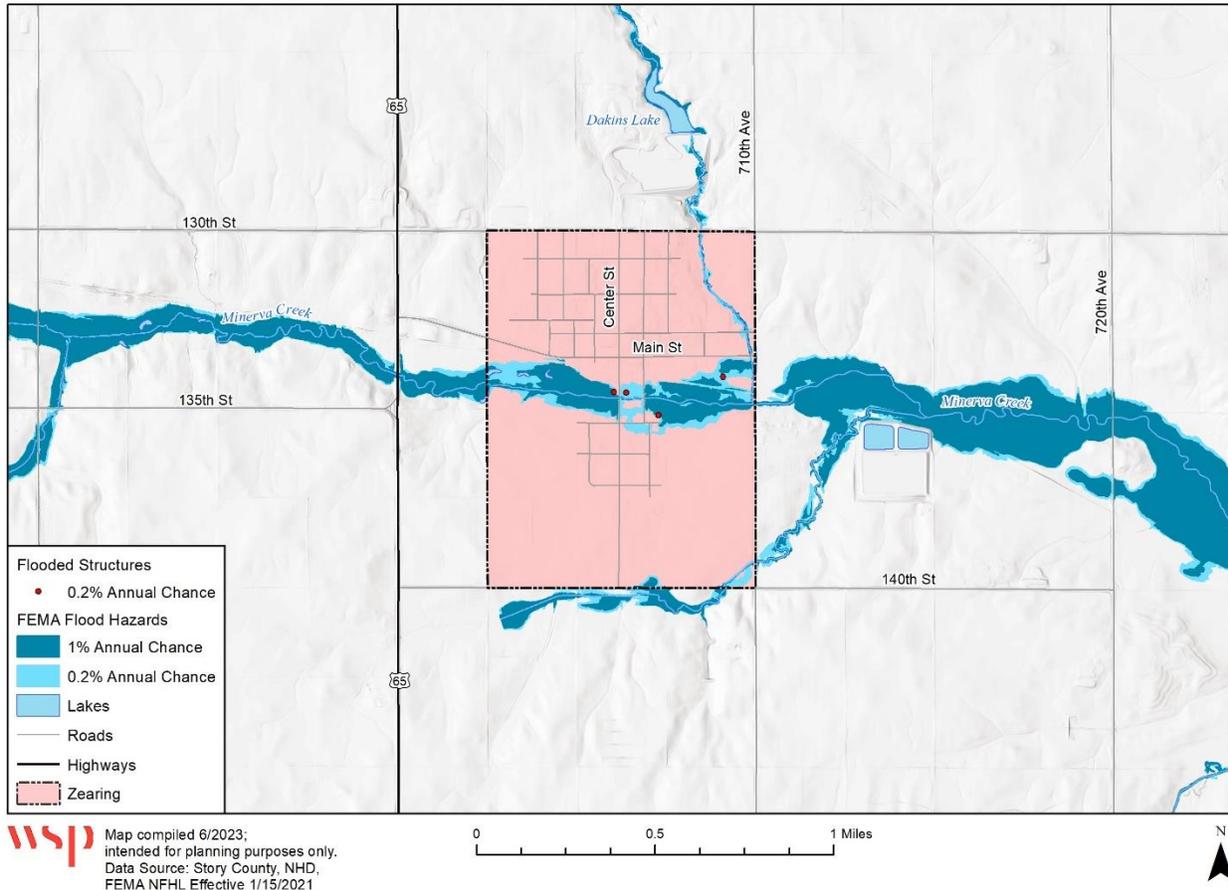
Figure 4-27: Story City 1- and 0.2-Percent Annual Chance Floodplains



Zearing

The City of Zearing is located near the northeastern boundary of Story County, near the Hardin and Marshall County edges. The city is crossed primarily by Minerva Creek, in an east-west fashion, with the Creek's floodplain covering about a fifth of the jurisdiction. In addition, a couple small tributaries from Minerva Creek connect to the main stream from the northeast and southeast, slightly crossing city boundaries as well, though is a minor way.

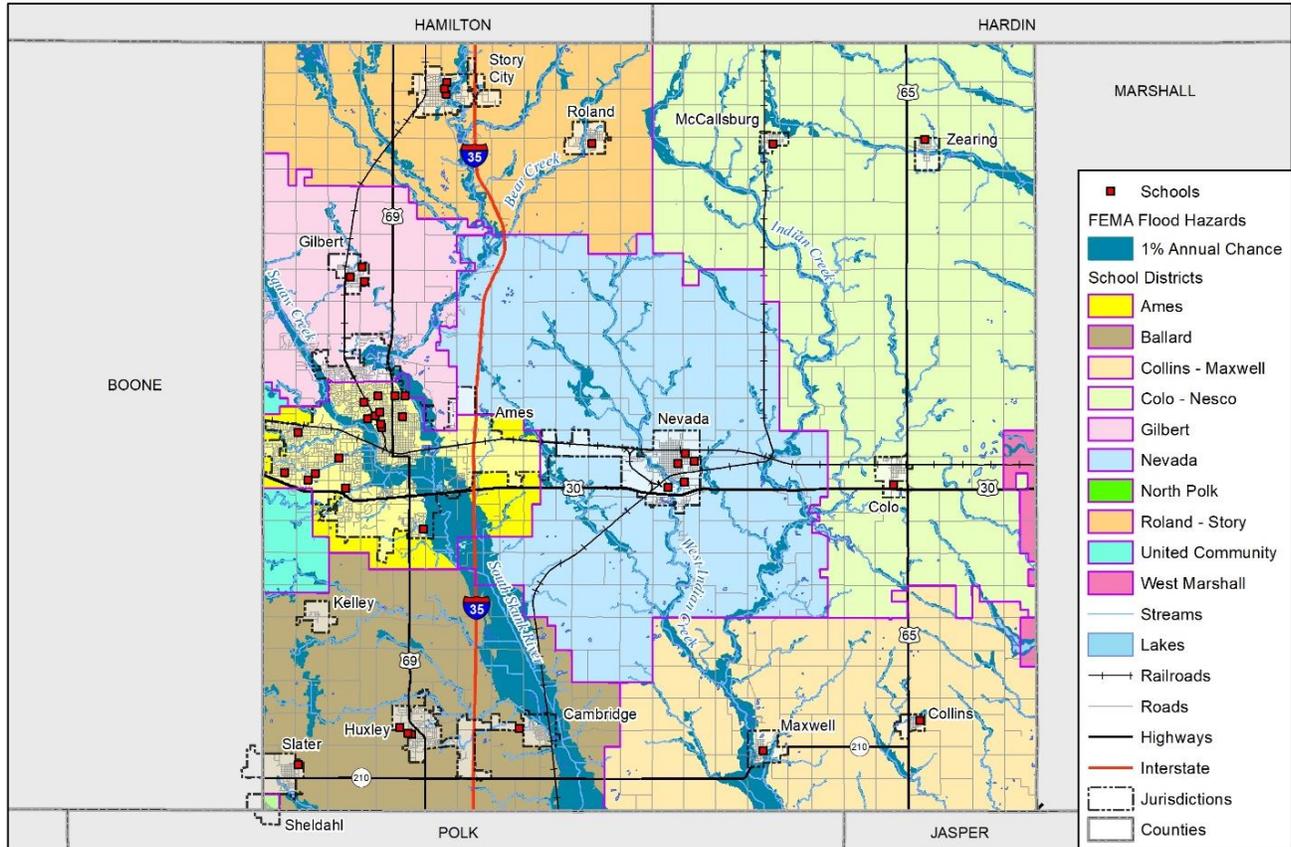
Figure 4-28: City of Zearing 1- and 0.2-Percent Annual Chance Floodplains



Story County School Districts

All ten school districts are affected by flooding from the 1-percent annual chance floodplains, though to varying degrees. Districts such as Ames, Ballard, Colo–NESCO, Collins–Maxwell, and Roland–Story appear to be most at-risk based, on having large areas covered by said floodplains.

Figure 4-29: Story County School Districts and the 1-Percent Annual Chance Floodplain



Map compiled 5/2023,
intended for planning purposes only.
Data Source: Story County, NHD,
FEMA NFHL Effective 2/1/2019,
Iowa Department of Education

Past Occurrences

Story County and its jurisdictions have witnessed several major floods. To date there has been seven federally declared disasters in Story County due to flooding since 1965. Some of the more noteworthy floods and recent floods are profiled in this section.

According to the NCEI, 75 reported flood events have taken place from 1996-2023 in Story County. While no human deaths or injuries were caused from the recorded events during these years, flooding still occurs fairly frequently, and can prove costly with regards to property damages. Details are provided below in Table 4-21.

Table 4-21: NCEI Flood Events in Story County, 1996-2023

Year of Flooding	Number of Events	Deaths	Injuries	Property Damages	Crop Damages
1996	3	0	0	\$2,500,000	\$600,000
1997	2	0	0	\$0	\$0
1998	4	0	0	\$670,000	\$145,000
1999	5	0	0	\$317,000	\$110,000
2000	3	0	0	\$95,000	\$100,000
2001	5	0	0	\$512,500	\$60,000
2003	2	0	0	\$10,000	\$0
2004	2	0	0	\$410,000	\$353,039
2005	2	0	0	\$84,070	\$80,000
2006	1	0	0	\$10,000	\$10,000
2007	2	0	0	\$650,000	\$0
2008	8	0	0	\$1,191,000	\$415,000
2009	1	0	0	\$5,000	\$0
2010	9	0	0	\$52,675,000	\$20,755,000
2013	4	0	0	\$935,000	\$0
2014	2	0	0	\$60,000	\$0
2015	4	0	0	\$1,040,000	\$100,000
2016	2	0	0	\$120,000	\$0
2018	4	0	0	\$555,000	\$375,000
2019	7	0	0	\$225,000	\$0
2021	1	0	0	\$0	\$0
2022	2	0	0	\$0	\$0
Grand Total	75	0	0	\$62,064,570	\$23,103,039

Source: NCEI

The following section provides previous occurrences in the jurisdictions and unincorporated places within the planning area. First, historical events for the county are described, followed by reported events for each city/town/location.

Story County

While there have been many flooding events county-wide of varying scales, the most damaging one caused around 1 million dollars in property damages, and about half a million dollars in crop damages. This event took place mid-June of 1996, lasting three days. It began due to heavy rainfall around the Skunk River, which crested almost a foot over the all-time record stage. Overall, however, the county has suffered from flooding for over 46 days, 41 of which were subjected to property damages, and 23 to crop damages.

Ames

The City of Ames has been subject to 25 river flooding events since 1998. From August 9 to 11 of 2010 the two costliest flooding events took place, with a combined property damage cost of 51 million dollars, along with about \$5,000 in crop damages. The cause was heavy raining that hit record flooding over not just Ames in Story County, but other counties as well. These events turned into a Presidentially Declared Disaster. Major damage occurred along the Skunk Basin, and portions of US Highway 30 were covered with water from the South Skunk River. This event did take one life in central Iowa, but outside of the County boundaries. Many had to be evacuated during these floods, as cars and homes were heavily inundated, and infrastructure such as roads and even a water treatment facility being destroyed. The second costliest event affecting the City incurred around \$500,000 in property damages, and was caused by heavy thunderstorms



and rainfall. This event began on April 25, 2007, and flooding occurred over a 2-day period. Many basements were flooded and parts of the city washed out.

Cambridge

One major event is noted affecting the City of Cambridge, which took place August 9, 2010. The flood incurred \$250,000 in property damages and resulted in power outages. The event was caused by heavy rains, which introduced 2 to 5 inches of added water in the area.

Gilbert

Gilbert suffered from three reported events, all taking place in 2015 due to heavy rains. The first two began on August 29, causing combined property damage losses of \$300,000. A rescue crew was sent to help a car that was pushed down Squaw Creek, stranding one person. The third event began mid-December, causing about \$50,000 in property damages. 1 to 3 inches fell across the area during a 2-day cycle. This flood caused many roads to close due to unsafe structural conditions.

Kelley

One large flood event began around the City of Kelley towards the end of May 2008. A hail storm coupled with tornado events turned into heavy rain, which caused widespread flooding. Property damages from this flooding amount to \$250,000, while about \$50,000 in crop damages were incurred.

Nevada

There are two main events on record, with a combined property loss of \$70,000. The first began around the historical Nevada Municipal Airport on May 30, 2008, caused by heavy rains carrying moisture from the previous days' tornadoes. The other flooding occurrence began a week later, on June 6, also sparked by heavy rains from tornado events. Indian Creek significantly flooded, inundating areas of a city park in Nevada.

Story City

Story City suffered from two recorded events. The first began mid-June of 2010, due to heavy rainfall. About \$20,000 in crop damages were suffered. The next event took place late August of 2015, when flooding occurred on the South Skunk River due to heavy rains. Around \$50,000 in property damages were incurred. Story County's Emergency Manager reported standing water over Forest Ave, between Broad St. and 8th St.

Unincorporated Areas

27 flood events have been reported in unincorporated areas across the county, totaling over \$2,418,000 in property damages, and over \$1,178,000 in crop damages. Two of these floods took place near Ontario St., west of the City of Ames. These two events incurred \$300,000 in property damages. The first flood took place towards the end of August 2015, caused by heavy rainfall which in turn inundated central Iowa rivers to rise above flood stage levels. Squaw Creek crested at 10.69 feet. During the second flood west of the City of Ames, which began December 15 of that same year, Squaw Creek rose to 10.36 feet.

Probability of Future Occurrence

With the history of flooding in many areas across Story County, it is **likely** that flooding of various levels will continue to occur. According to the NCEI, 75 reported flood events have taken place in the 27-year period from 1996 to 2023, or approximately 2.8 events per year on average. Therefore, the probability rating for Story County to suffer from riverine flooding in the future is "Highly Likely".

Magnitude/Severity

The HMPC estimates that the potential magnitude for a flood event in Story County is **catastrophic**. Magnitude and severity can be described or evaluated in terms of a combination of the different levels of impact that a community sustains from a hazard event. Specific examples of negative impacts from flooding on Story County span a comprehensive range and are summarized as follows:

- Floods cause damage to private property that often creates financial hardship for individuals and families.
- Floods cause damage to public infrastructure resulting in increased public expenditures and demand for tax dollars.
- Floods cause loss of personal income for agricultural producers that experience flood damages.
- Floods cause loss of income to businesses relying on recreational uses of County waterways.
- Floods cause emotional distress on individuals and families.
- Floods can cause injury and death.

The magnitude and severity of the flood hazard is usually determined by not only the extent of impact it has on the overall geographic area, but also by identifying the most catastrophic event in the previous flood history. Sometimes it is referred to as the “event of record.” The flood of record is almost always correlated to a peak discharge at a gauge, but that event may not have caused the worst historic flood impact in terms of property damage, loss of life, etc.

The impact of a flood event can vary based on geographic location to waterways, soil content and ground cover, and construction. The extent of the damage of flooding ranges from very narrow to widespread based on the type of flooding and other circumstances such as previous rainfall, rate of precipitation accumulation, and the time of year.

An event of catastrophic magnitude could result in multiple severe injuries, complete shutdown of critical facilities and services for at least two weeks, and severe damage to more than 25% of property in the planning area. Roads closed due to floods can result in serious transportation disruptions due to the limited number of roads in the County. Mud and debris flow also often accompany floods.

Climate Change Considerations

Use of historical hydrologic data has long been the standard of practice for designing and operating water supply and flood protection projects. For example, historical data are used for flood forecasting models and to forecast snowmelt runoff for water supply. This method of forecasting assumes that the climate of the future will be similar to that of the period of historical record. However, the hydrologic record cannot be used to predict changes in frequency and severity of extreme climate events such as floods. Climate change is already impacting water resources, and resource managers have observed the following:

- Historical hydrologic patterns can no longer be solely relied upon to forecast the water future.
- Precipitation and runoff patterns are changing, increasing the uncertainty for water supply and quality, flood management, and ecosystem functions.
- Extreme climatic events will become more frequent, necessitating improvement in flood protection, drought preparedness, and emergency response.

The amount of snow is critical for water supply and environmental needs, but so is the timing of snowmelt runoff into rivers and streams. Rising snowlines caused by climate change will allow more mountain area to contribute to peak storm runoff. High frequency flood events (e.g., 10-year floods) in particular will likely increase with a changing climate. Along with reductions in the amount of the snowpack and accelerated

snowmelt, scientists project greater storm intensity, resulting in more direct runoff and flooding. Changes in watershed vegetation and soil moisture conditions will likewise change runoff and recharge patterns. As stream flows and velocities change, erosion patterns will also change, altering channel shapes and depths, possibly increasing sedimentation behind dams, and affecting habitat and water quality. With potential increases in the frequency and intensity of wildfires due to climate change, there is potential for more floods following fire, which increase sediment loads and water quality impacts.

Vulnerability

A flood vulnerability assessment was performed for Story County using Geographic Information Systems (GIS) using the following GIS methodology. The County’s parcel layer and associated assessor’s building improvement valuation data were provided by the County and were used as the basis for the inventory. GIS was used to convert the parcels into centroids to represent structures for analysis. Only parcels with improvement values greater than zero were used in the analysis except for Exempt properties with government structures which aren’t typically valued. This method assumes that improved parcels have a structure of some type.

The FEMA National Flood Hazard Layer (NFHL) was then overlaid in GIS on the parcel centroid layer to identify structures that would likely be inundated during a 1% annual chance and 0.2% annual chance flood event. Building improvement values for those points were then extracted from the parcel/assessor’s data and summed for each jurisdiction in the study area. Content values were estimated for the buildings based on their occupancy type, based on FEMA methodology. This includes 100% of the structure value for agriculture, commercial, exempt, and mixed-use structures, 50% for agriculture dwelling, multi-family and residential structures, and 150% for industrial structures. Building and contents values were totaled, and a 25% loss factor was applied to the totals, also based on FEMA depth damage functions, assuming a two-foot-deep flood.

People

The flood analysis estimated that the exposed population for the entire county is 1,262 people within the 100-year floodplain. For the unincorporated portions of the county, it is estimated that the exposed population consist of 328 people within the 100-year floodplain. The City of Ames has the highest population at risk to flooding with an estimated population of 662. Table 4-22 summarizes the total populations in the 100-year floodplains by municipality.

Table 4-22 Story County Population at Risk to 1% Annual Chance of Flooding

Jurisdiction	Population
Ames	662
Cambridge	22
Collins	10
Gilbert	2
Huxley	6
Maxwell	87
Nevada	9
Roland	40
Slater	58
Story City	38
Unincorporated	328



Jurisdiction	Population
Total	1,262

Sources: Story County Assessor’s Office, Population - U.S. Census Bureau reported by Iowa State University of Science and Technology, FEMA NFHL, WSP Analysis

The 0.2% annual chance of flooding in Story County has a total of 450 people at risk to the 500-year floodplain. The City of Ames has the highest population at risk to flooding with an estimated population of 314. These areas are not regulated but subject to lower premiums for flood insurance. Table 4-23 summarizes the total population in the 500-year annual chance of flooding flood zone by jurisdiction. These structures within the Special Flood Hazard Area directly reflect the people at risk due to flooding hazards.

Table 4-23 Story County Population at Risk to 0.2% Annual Chance of Flooding

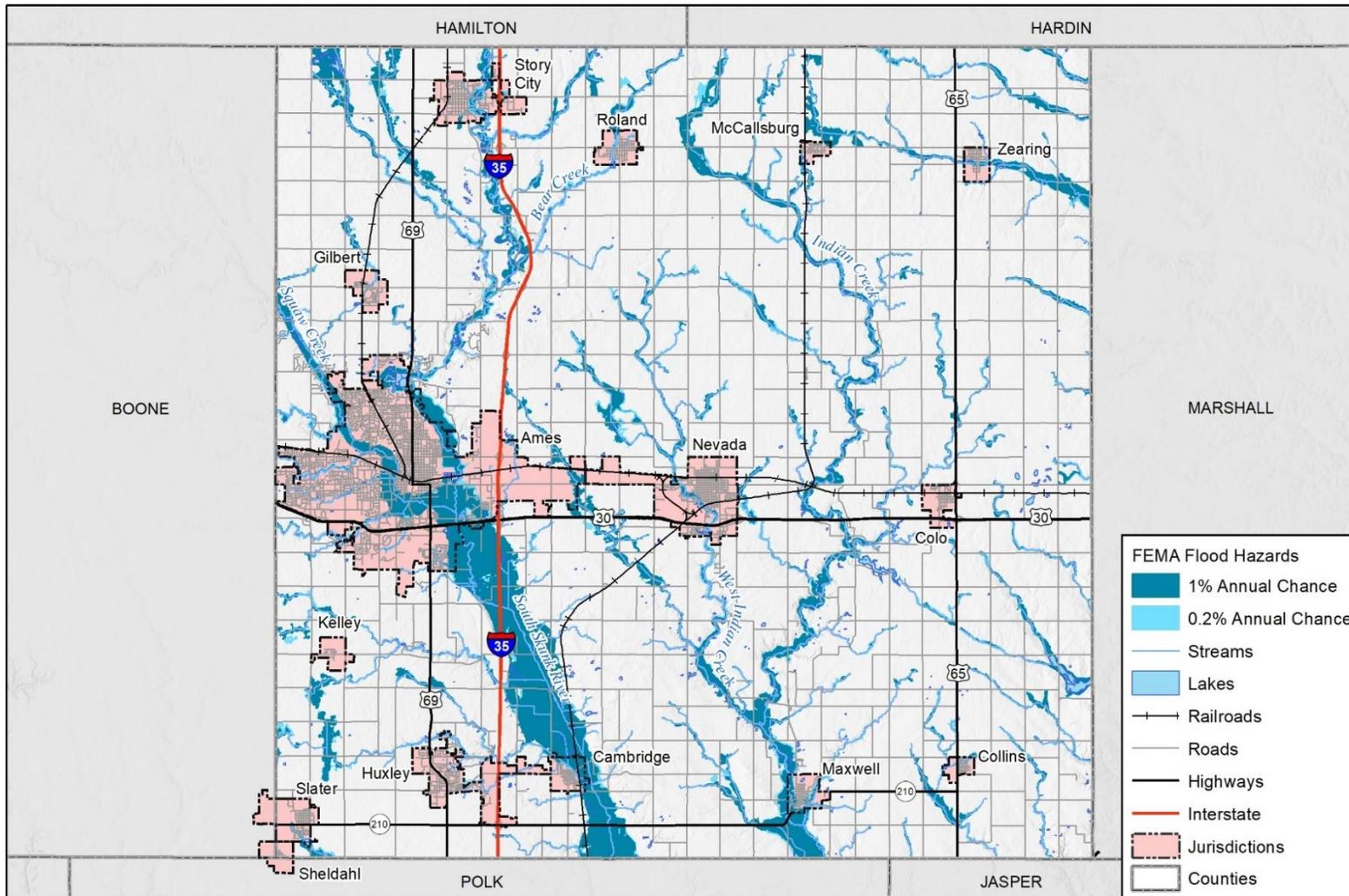
Jurisdiction	Population
Ames	314
Cambridge	2
Collins	2
Maxwell	51
Nevada	11
Roland	2
Slater	8
Story City	9
Zearing	0
Unincorporated	50
Total	450

Sources: Story County Assessor’s Office, Population - U.S. Census Bureau reported by Iowa State University of Science and Technology, FEMA NFHL, WSP Analysis

Property

As noted in Figure 4-30 and Table 4-24 below, there is a substantial amount of property value within Story County’s flood hazard areas. There is a total of \$493,341,850 in total property value with the largest amount being located in the commercial and residential sectors within Story County’s 1% floodplain. The City of Ames possesses the highest amounts of total values with \$386 million with the highest amount being in the commercial sectors within the 1% floodplain. Ames also has the highest loss estimations amounting to \$96.6 million total.

Figure 4-30: Story County 1- and 0.2-Percent Annual Chance Floodplains



Map compiled 6/2023;
intended for planning purposes only.
Data Source: Story County, NHD,
FEMA NFHL Effective 1/15/2021

0 5 10 Miles





Table 4-24: Story County Properties at Risk to FEMA 1% Annual Chance of Flooding

Jurisdiction	Property Type	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value	Loss Estimate
Ames	Agriculture	1	\$6,200	\$6,200	\$12,400	\$3,100
	Agriculture Dwelling	2	\$1,487,500	\$743,750	\$2,231,250	\$557,813
	Commercial	77	\$118,548,400	\$118,548,400	\$237,096,800	\$59,274,200
	Exempt	20	\$860,400	\$860,400	\$1,720,800	\$430,200
	Industrial	1	\$531,400	\$797,100	\$1,328,500	\$332,125
	Mixed Use	2	\$363,200	\$363,200	\$726,400	\$181,600
	Multi-Family	19	\$54,157,700	\$27,078,850	\$81,236,550	\$20,309,138
	Residential	253	\$41,254,900	\$20,627,450	\$61,882,350	\$15,470,588
	Total	375	\$217,209,700	\$169,025,350	\$386,235,050	\$96,558,763
Cambridge	Agriculture Dwelling	1	\$198,000	\$99,000	\$297,000	\$74,250
	Commercial	3	\$1,889,400	\$1,889,400	\$3,778,800	\$944,700
	Residential	8	\$909,100	\$454,550	\$1,363,650	\$340,913
	Total	12	\$2,996,500	\$2,442,950	\$5,439,450	\$1,359,863
Collins	Residential	4	\$290,200	\$145,100	\$435,300	\$108,825
	Total	4	\$290,200	\$145,100	\$435,300	\$108,825
Gilbert	Commercial	1	\$55,600	\$55,600	\$111,200	\$27,800
	Residential	1	\$200,900	\$100,450	\$301,350	\$75,338
	Total	2	\$256,500	\$156,050	\$412,550	\$103,138
Huxley	Residential	2	\$607,100	\$303,550	\$910,650	\$227,663
	Total	2	\$607,100	\$303,550	\$910,650	\$227,663
Maxwell	Agriculture	1	\$1,200	\$1,200	\$2,400	\$600
	Agriculture Dwelling	1	\$161,800	\$80,900	\$242,700	\$60,675
	Commercial	9	\$1,069,800	\$1,069,800	\$2,139,600	\$534,900
	Residential	35	\$4,087,300	\$2,043,650	\$6,130,950	\$1,532,738
	Total	46	\$5,320,100	\$3,195,550	\$8,515,650	\$2,128,913
Nevada	Commercial	4	\$688,200	\$688,200	\$1,376,400	\$344,100
	Residential	4	\$673,800	\$336,900	\$1,010,700	\$252,675
	Total	8	\$1,362,000	\$1,025,100	\$2,387,100	\$596,775
Roland	Commercial	1	\$32,100	\$32,100	\$64,200	\$16,050
	Residential	17	\$2,760,000	\$1,380,000	\$4,140,000	\$1,035,000
	Total	18	\$2,792,100	\$1,412,100	\$4,204,200	\$1,051,050
Slater	Residential	23	\$7,408,100	\$3,704,050	\$11,112,150	\$2,778,038
	Total	23	\$7,408,100	\$3,704,050	\$11,112,150	\$2,778,038
Story City	Commercial	5	\$1,707,000	\$1,707,000	\$3,414,000	\$853,500
	Mixed Use	1	\$189,400	\$189,400	\$378,800	\$94,700



Jurisdiction	Property Type	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value	Loss Estimate
	Residential	16	\$3,388,800	\$1,694,400	\$5,083,200	\$1,270,800
	Total	22	\$5,285,200	\$3,590,800	\$8,876,000	\$2,219,000
Unincorporated	Agriculture	26	\$326,900	\$326,900	\$653,800	\$163,450
	Agriculture Dwelling	67	\$23,008,300	\$11,504,150	\$34,512,450	\$8,628,113
	Commercial	4	\$462,200	\$462,200	\$924,400	\$231,100
	Industrial	1	\$846,200	\$1,269,300	\$2,115,500	\$528,875
	Residential	64	\$17,738,400	\$8,869,200	\$26,607,600	\$6,651,900
	Total	162	\$42,382,000	\$22,431,750	\$64,813,750	\$16,203,438
	Grand Total	674	\$285,909,500	\$207,432,350	\$493,341,850	\$123,335,463

Sources: Story County Assessor's Office, Population - U.S. Census Bureau reported by Iowa State University of Science and Technology, FEMA NFHL, WSP Analysis

Similar to the 100-year floodplain, Story County has a substantial amount of property values within the 0.2% Annual Chance floodplain. There is a total of \$103,111,650 in property value with the commercial and residential sectors having the largest amounts. The City of Ames has the largest property values at risk with \$82 million to the 0.2% floodplain. Followed by unincorporated Story County having \$9 million in potential losses due to the 500-year chance of flooding as well and is shown in below. Ames also has the highest loss estimations amounting to \$20.5 million total within the 500-year floodplain shown in Table 4-25 below.

Table 4-25: Story County Properties at Risk to FEMA 0.2% Annual Chance of Flooding

Jurisdiction	Property Type	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value	Loss Estimate
Ames	Agriculture	1	\$1,300	\$1,300	\$2,600	\$650
	Commercial	33	\$32,174,800	\$32,174,800	\$64,349,600	\$16,087,400
	Exempt	2	\$0	\$0	\$0	\$0
	Multi-Family	3	\$1,078,400	\$539,200	\$1,617,600	\$404,400
	Residential	128	\$10,902,500	\$5,451,250	\$16,353,750	\$4,088,438
	Total	167	\$44,157,000	\$38,166,550	\$82,323,550	\$20,580,888
Cambridge	Commercial	2	\$392,700	\$392,700	\$785,400	\$196,350
	Residential	1	\$122,300	\$61,150	\$183,450	\$45,863
	Total	3	\$515,000	\$453,850	\$968,850	\$242,213
Collins	Residential	1	\$111,500	\$55,750	\$167,250	\$41,813
	Total	1	\$111,500	\$55,750	\$167,250	\$41,813
Maxwell	Commercial	2	\$24,100	\$24,100	\$48,200	\$12,050
	Residential	21	\$2,465,600	\$1,232,800	\$3,698,400	\$924,600
	Total	23	\$2,489,700	\$1,256,900	\$3,746,600	\$936,650
Nevada	Commercial	1	\$1,071,900	\$1,071,900	\$2,143,800	\$535,950
	Mixed Use	1	\$287,400	\$287,400	\$574,800	\$143,700
	Residential	4	\$774,300	\$387,150	\$1,161,450	\$290,363
	Total	6	\$2,133,600	\$1,746,450	\$3,880,050	\$970,013



Jurisdiction	Property Type	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value	Loss Estimate
Roland	Residential	1	\$187,700	\$93,850	\$281,550	\$70,388
	Total	1	\$187,700	\$93,850	\$281,550	\$70,388
Slater	Residential	3	\$829,900	\$414,950	\$1,244,850	\$311,213
	Total	3	\$829,900	\$414,950	\$1,244,850	\$311,213
Story City	Commercial	1	\$27,500	\$27,500	\$55,000	\$13,750
	Residential	4	\$496,000	\$248,000	\$744,000	\$186,000
	Total	5	\$523,500	\$275,500	\$799,000	\$199,750
Zearing	Commercial	4	\$143,100	\$143,100	\$286,200	\$71,550
	Total	4	\$143,100	\$143,100	\$286,200	\$71,550
Unincorporated	Agriculture	1	\$9,400	\$9,400	\$18,800	\$4,700
	Agriculture Dwelling	10	\$3,363,400	\$1,681,700	\$5,045,100	\$1,261,275
	Residential	10	\$2,899,900	\$1,449,950	\$4,349,850	\$1,087,463
	Total	21	\$6,272,700	\$3,141,050	\$9,413,750	\$2,353,438
Grand Total		234	\$57,363,700	\$45,747,950	\$103,111,650	\$25,777,913

Sources: Story County Assessor's Office, Population - U.S. Census Bureau reported by Iowa State University of Science and Technology, FEMA NFHL, WSP Analysis

National Flood Insurance Program (NFIP) Participation

Table 4-26 provides details on NFIP participation for the communities in the planning area as well as the number of policies in force, amount of insurance in force, number of closed losses, and total payments for each jurisdiction, where applicable. The claims information is for the period from January 1, 1978 to September 30, 2023.



Table 4-26: NFIP Participation, Policies, and Claim Statistics for Story County

Community Name	NFIP Participant	Current Effective Map Date	Reg Emer Date	Policies In-force	Insurance In-force	Claims Since 1978	Total Payments Since 1978
Story County	Yes	1/15/2021	06/01/83	13	\$4,878,000	14	\$180,994
Ames	Yes	1/15/2021	01/02/81	104	\$42,927,000	194	\$12,148,454
Cambridge	Yes	1/15/2021	06/15/81	0	\$0	8	\$29,034
Collins	Yes	1/15/2021	12/12/07	0	\$0	2	\$16,130
Colo	No	NSFHA	N/A	N/A	N/A	N/A	N/A
Gilbert	Yes	1/15/2021	01/01/87	0	\$0	2	\$51,811
Huxley	Yes	1/15/2021	05/05/08	0	\$0	0	\$0
Kelley	Yes	NSFHA	10/14/10	1	\$350,000	0	\$0
Maxwell	Yes	1/15/2021	02/15/84	8	\$1,980,000	16	\$142,554
McCallsburg	Yes	1/15/2021	09/06/13	0	\$0	0	\$0
Nevada	Yes	1/15/2021	08/03/81	4	\$921,000	16	\$245,711
Roland	Yes	1/15/2021	04/02/90	3	\$756,000	9	\$35,850
Sheldahl	No	Never Mapped	N/A	N/A	N/A	N/A	N/A
Slater	Yes	1/15/2021	02/15/08	1	\$350,000	1	\$3,387
Story City	Yes	1/15/2021	01/16/81	4	\$926,000	9	\$99,920
Zearing	Yes	1/15/2021	05/01/87	1	\$350,000	9	\$13,993

Source: FEMA Community Information System; M= No elevation determined – all Zone A, C, and X; NSFHA = No Special Flood Hazard Area; E=Emergency Program; Loss Statistics from BureauNet, <https://bsa.nfipstat.fema.gov/reports/1040.htm> *Closed Losses are those flood insurance claims that resulted in payment. Loss statistics are for the period from January 1, 1978 to September 30, 2023

Repetitive Loss/Severe Repetitive Loss Properties

Repetitive Loss: Repetitive Loss Properties are those properties with at least two flood insurance payments of \$5,000 or more in a 10-year period.

Severe Repetitive Loss (SRL): SRL properties are defined as “a single family property” (consisting of one-to-four residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which four or more separate claims payments have been paid under flood insurance coverage with the amount of each claim payment exceeding \$5,000 and with cumulative amounts of such claims payments exceeding \$20,000; or for which at least two separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

There is one repetitive loss property and no severe repetitive loss properties in Story County.

Critical Facilities and Infrastructure

Key support facilities and structures most necessary to withstand the impacts of, and respond to, natural disasters are referred to as critical facilities. Examples of these critical facility types include utilities, transportation infrastructure, and emergency response and services facilities. Failures of components along major lifelines or even closures or inaccessibility to key emergency facilities could limit if not completely cut off transmission of commodities, essential services, and lead to other potentially catastrophic repercussions.

This analysis determined of the 882 total facilities that there are 146 critical facilities/infrastructure in the 1% annual chance floodplain, and 21 critical facilities/infrastructure in the 0.2% annual chance floodplain. The Transportation sector has the highest critical facilities total located with the Special Flood Hazard Areas. There are 111 in the 100-year floodplain and 18 in the 500-year hazard. Road and bridge infrastructure are vital to Story County and there are a limited number of highways and local roads in the County. When these roads are rendered impassable by an event such as a flood, ingress or egress can be severely limited. These bridges have been impacted by previous flooding in the past. Table 4-27 and Table 4-28 provide a summary of the critical facilities in the 1-percent and 0.2-percent annual chance floodplains broken out by FEMA Lifeline.

Table 4-27: Critical Facilities at risk to 1-percent Annual Chance Flood

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Ames	-	-	18	-	1	-	9	28
Cambridge	-	-	-	-	-	1	-	1
Collins	-	-	-	-	-	-	-	0
Colo	-	-	-	-	-	-	-	0
Gilbert	-	-	-	-	-	-	-	0
Huxley	-	-	-	-	-	-	1	1
Kelley	-	-	-	-	-	-	-	0
Maxwell	-	-	1	-	-	-	5	6

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
McCallsburg	-	-	-	-	-	-	-	0
Nevada	-	-	-	-	-	-	3	3
Roland	-	-	-	-	-	-	-	0
Sheldahl	-	-	-	-	-	-	-	0
Slater	-	-	-	-	-	-	-	0
Story City	-	-	-	-	-	-	-	0
Zearing	-	-	-	-	-	-	-	0
Unincorporated	2	1	11	-	-	-	93	107
Total	2	1	30	0	1	1	111	146

Sources: Story County, DNR, HIFLD, National Bridge Inventory, Iowa Geological Survey, FEMA NFHL, WSP Analysis

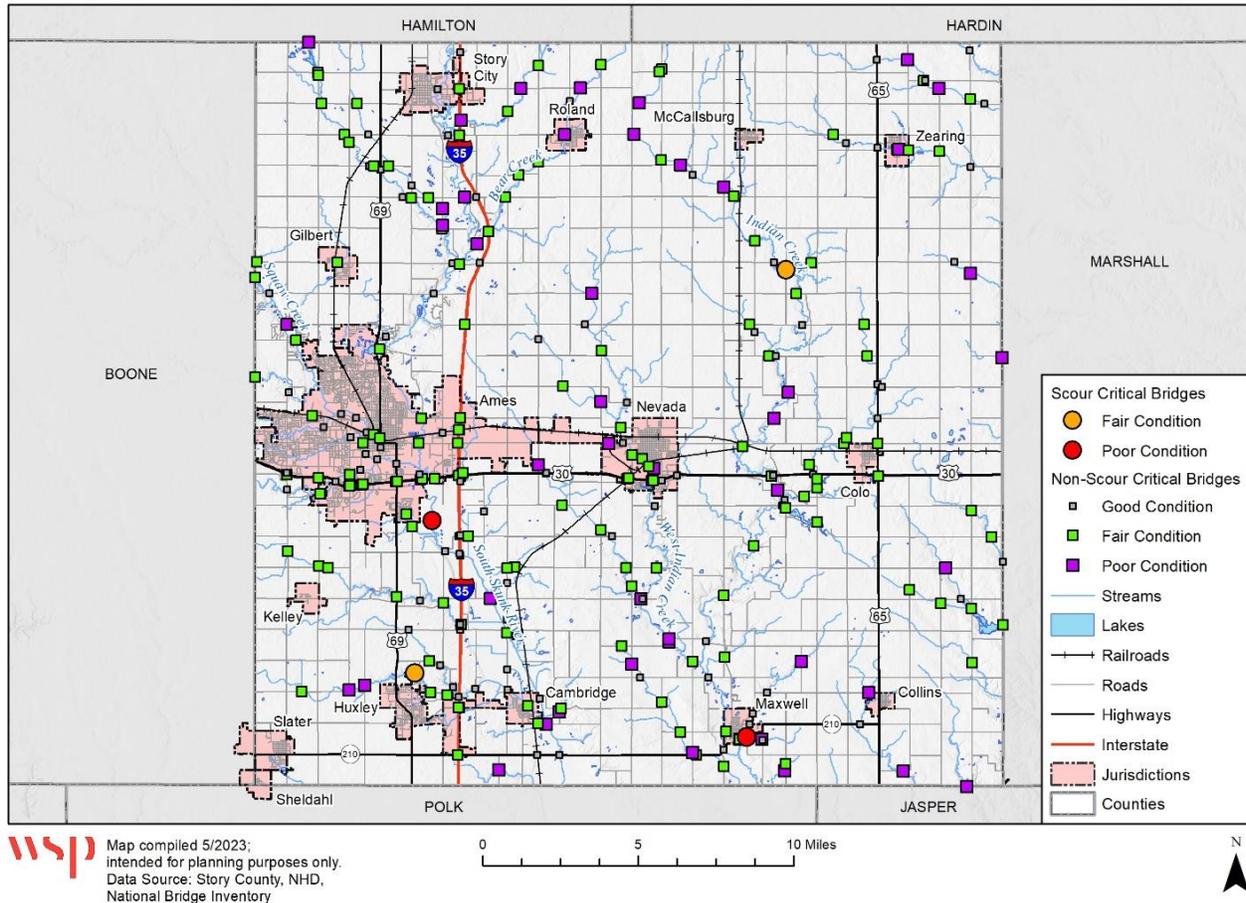
Table 4-28: Critical Facilities at risk to 0.2-percent Annual Chance Flood

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Ames	-	-	1	-	-	2	1	4
Unincorporated	-	-	-	-	-	-	17	17
Total	0	0	1	0	0	2	18	21

Sources: Story County, DNR, HIFLD, National Bridge Inventory, Iowa Geological Survey, FEMA NFHL, WSP Analysis

According to the National Bridge Inventory, there is a total of 294 bridges in the County. 290 are non-scour critical bridges with 46 in poor condition and four are scour critical with 2 in poor condition. These bridges are depicted in Figure 4-31. Note that not every bridge infrastructure displayed on the map will be at risk of the 1-percent annual chance flood.

Figure 4-31: Story County Bridges with Scour Critical Bridges Identified



Economy

Economic damages related to flooding include crop loss, building damage, and recovery efforts after flood events. Flood insurance can help mitigate some of the costs of flood damages. Participation in the NFIP helps flood-prone communities reduce their economic risk to flooding.

Environment and Cultural Resources

Next to people and property, natural resources impact from flooding could be severe. Flooding events are common and naturally occurring phenomenon in forested areas and can benefit forest health in many respects. Yet the trend for more flooding can make it more difficult for the environment to recover, and lead to even more increased flood hazards. This can severely impact water quality and watershed health for years following.

Development Trends

Any future development in floodplains would increase risk in those areas. For those communities that participate in the National Flood Insurance Program, enforcement of the floodplain management regulations will ensure mitigation of future construction in those areas.

4.3.5 Grass/Wildland Fire

Future Probability	Magnitude/Severity	Extent/ Location	Hazard Ranking
Likely	Limited	Significant	Medium

Risk Summary

Overall, grass/wildland hazard is ranked as medium for the County.

- The greatest risk to homes and highest likelihood in the County is spread throughout. Ames, Cambridge, and Maxwell have the highest areas of moderate risk of the jurisdictions.
- Less than half of the area in the County is vulnerable to grass/wildland fires; therefore, extent is rated as **significant**.
- Magnitude and severity of this hazard is considered **limited**, as large-scale, destructive wildland fires are rarely seen in Iowa and most fires are contained to singular buildings or areas smaller than a few acres.
- Fires do commonly occur in the county, albeit of limited magnitude, and an occurrence can be expected at least once every few years. Therefore, the probability of future events is considered **likely**.
- Smoke and air pollution from wildfires can be a severe health hazard, especially for sensitive populations, including children, the elderly, and those with respiratory and cardiovascular diseases.
- Power lines in the unincorporated areas of the county are the most at risk from wildfire because most poles are made of wood and susceptible to burning. Fires can create conditions that block or prevent access and can isolate residents and emergency service providers.
- Fire suppression may result in increased costs to local and state government for water acquisition and delivery.
- Environmental impacts from wildfire include soil erosion, destroyed habitats, and soil sterilization.
- Related hazards: Drought, Extreme Heat, Infrastructure Failure, Lightning, Windstorm

Description

Iowa's urban/rural interface (areas where development occurs within or immediately adjacent to wildland, near fire-prone trees, brush, and/or other vegetation), is growing as metro areas expand into natural forest, prairies, and agricultural areas that are in permanent vegetative cover through the Conservation Reserve Program (CRP). The State has the largest number of CRP contracts in the nation, totaling over 1.5 million acres. Most of this land is located near cool and warm season grass plantings, tree plantings, and riparian buffer strips. There are an additional 230,000 acres in federal ownership and conservation easements.

Wildfires are frequently associated with lightning and periods of drought, as dry conditions make vegetation more flammable. As new development encroaches into the wildland/urban interface, furthermore, an increasing number of structures and people are at risk. On occasion, ranchers and farmers intentionally set fire to vegetation to restore soil nutrients or alter the existing vegetation growth. Also, individuals in rural areas frequently burn trash, leaves and other vegetation debris. These fires have the potential to get out of control and turn into wildfires.

The risk of wildfires is a real threat to landowners across the State. The National Weather Service monitors the conditions supportive of wildfires in the State on a daily basis, so that wildfires can be predicted, if not prevented.



Major wildfire risk factors considered are:

- High temperature
- High wind speed
- Fuel moisture (greenness of vegetation)
- Low humidity
- Little or no cloud cover

Grass and wildland fire can occur when conditions are favorable, such as during periods of drought when natural vegetation would be drier and more combustible. Most communities in Story County are surrounded by agricultural land. Parcels located on the outskirts of incorporated areas and parcels in unincorporated Story County are most likely to experience effects from this hazard.

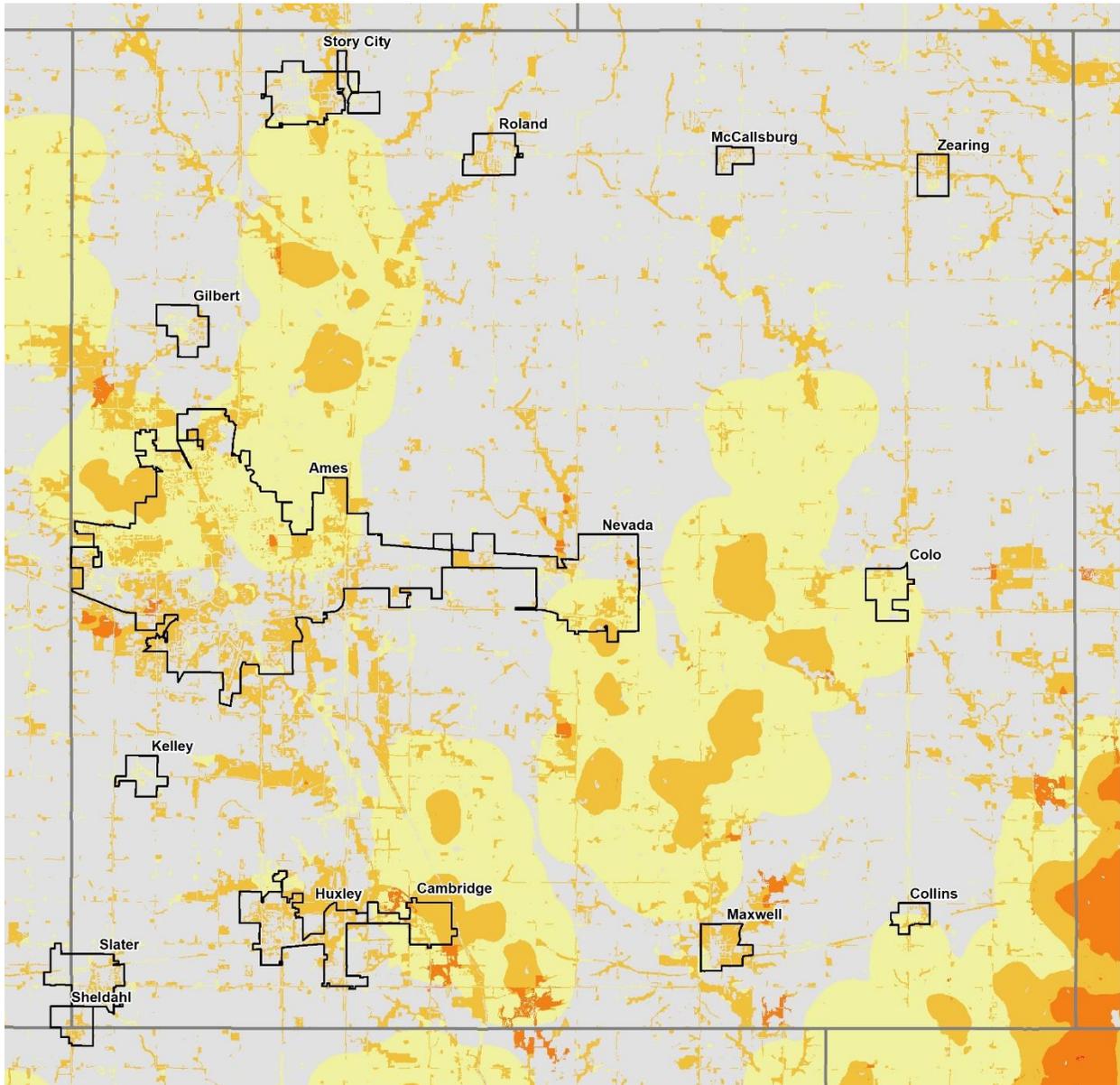
Location

The location of grass or wildland fires in Story County is considered **significant**, as large areas of the county such as croplands, roadsides and medians, and open grass or forest lands may see fires. The USDA Forest Service, under the direction of Congress in the 2018 Consolidated Appropriations Act (H.R. 1625, Section 210), developed a nationwide wildfire risk assessment. The Wildfire Risk to Communities study results were used to assess risk to Wildfire in Story County. Wildfire Risk to Communities uses the best available science data to identify risk and provide resources for communities to manage and mitigate risk. This is a national analysis for comparing risk that varies across a state, region, or county to help prioritize actions to mitigate risk.

The Wildfire Risk to Homes wildfire analysis categories were reviewed to represent risk. Figure 4-32 shows the Risk to Homes within Story County and Figure 4-33 displays the legend, which represents where the planning area falls in relation to the other counties in Iowa. The size of the circles in the legend is a proportional representation of the county's population compared to other counties in the state. Story County has a Low Risk to wildfire, lower than 91% of other counties within the State. The greatest risk to homes in the County is scattered throughout the County with Moderate to Less Risk in all of the jurisdictions and large areas in the unincorporated county. Ames, Cambridge, and Maxwell have the highest areas of moderate risk of the jurisdictions.

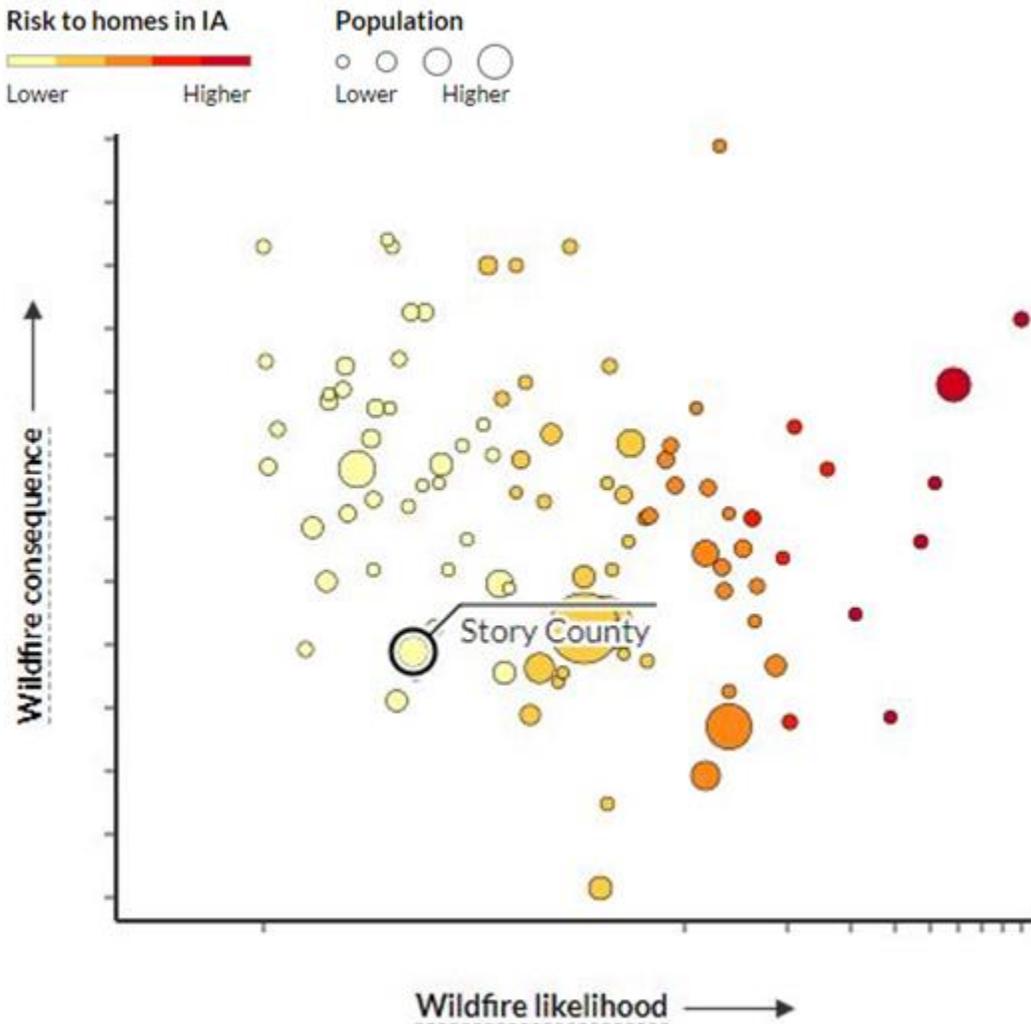
Risk to Homes combines wildfire likelihood and intensity with generalized results to a home within the planning area. The Risk to Homes data integrates wildfire likelihood and wildfire intensity from simulation modeling to represent wildfire hazard. Wildfire Risk to Communities uses a generalized concept of susceptibility that all homes that encounter wildfire will be damaged and the degree of damage is directly related to the fire's intensity.

Figure 4-32: Story County Wildfire Risk to Homes



Source: Wildfire Risk to Communities, <https://wildfirerisk.org>

Figure 4-33 Story County Wildfire Risk to Homes Relative to Other Iowa Counties



Source: *Wildfire Risk to Communities*, <https://wildfirerisk.org>

Past Occurrences

Data was requested from the Iowa Department of Public Safety, State Fire Marshal Division, to provide information on the latest occurrences of grass/wildland fires in the planning area. Through the National Fire Incident Reporting System (NFIRS), the Iowa State Fire Marshal’s Office collects and reports fire incidents throughout the State. NFIRS is a repository of statistical data reported by participating fire departments. However, this data is not available to the public and was not included in this plan update. According to the Iowa Department of Public Safety, there have been 25 fire related fatalities in Iowa so far in 2023. Additionally, the Iowa Forest Action Plan notes that there have been 5,473 reported wildland fires statewide over the 10-year period from 2009-2018, burning a total of 86,192 acres. This is summarized in Table 4-29 below.

Table 4-29 Reported Wildfires in Iowa 2009-2018

Year	Number of Wildland Fires Reported	Acres of Wildland Fires Reported
2009	844	9,303
2010	375	4,835
2011	745	11,548
2012	720	7,969
2013	285	2,548
2014	718	13,789
2015	594	16,210
2016	182	1,557
2017	588	10,501
2018	422	7,932
Total	5,473	86,192

Source: Iowa Forest Action Plan, 2020

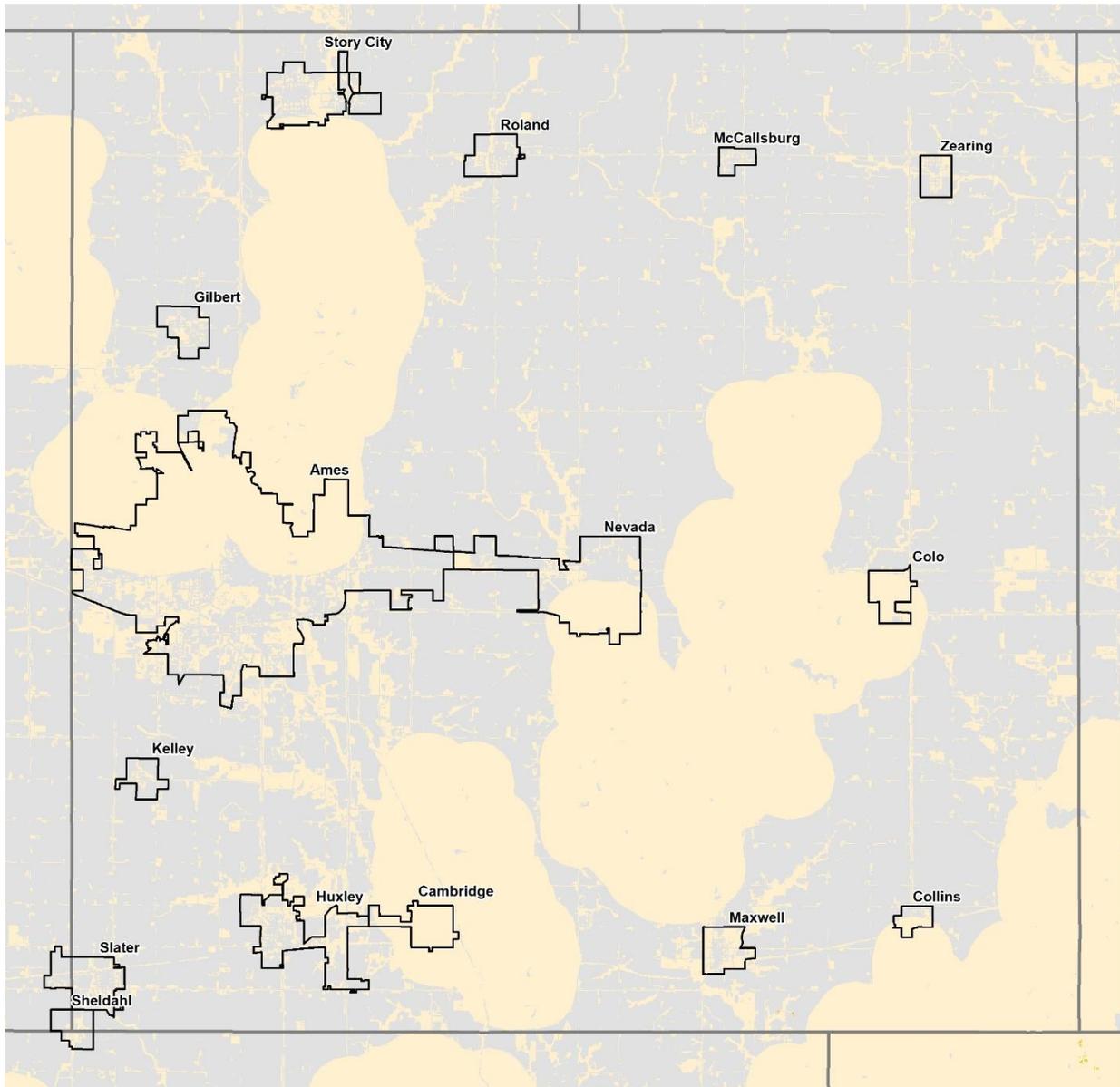
While the State Fire Marshal’s Division was unable to provide the historical grass/wildland fire data at this time, information from previous instances of wildfire were obtained from the Iowa Department of Natural Resources Forestry Bureau. According to the DNR system, there were 173 wildland or grass fires reported from 2005 to 2012 in Story County alone. Although only one person was injured during the fires taking place in the seven-year period, 1,753 acres were burned in total. The HMPC reported that several notable fires have occurred in recent years, each burning around 40-60 acres. Updated data since 2012 is not readily available, however this data range helps establish a baseline for the average size and frequency of fires in the county.

Probability of Future Occurrence

The probability rating for grass or wildland fire events of this nature is “**Likely.**” Updated historical data was not available to document the wildland/grass fires in late years, or information related to the events (e.g., losses incurred, population affected). Since updated statistical data was unavailable to determine a quantitative probability, a qualitative probability is based on the anecdotal descriptions from the HMPC. The planning committee determined that, although damaging fires do not take place frequently, wildfires still occur on an annual basis. In addition, based on the reported fires from 2005 to 2012 mentioned in the subsection above, it can be estimated that there is an average of about 24 fires per year in the planning region.

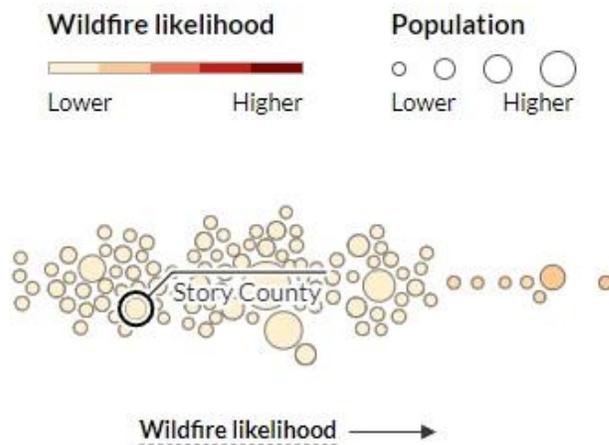
To supplement the qualitative probability, the Wildfire Risk to Communities study mentioned above was also used. Wildfire Likelihood is the annual probability based on fire behavior modeling across thousands of simulations of possible fire seasons. Each simulation factor contributes to the probability of a fire occurring through weather, topography, and ignitions. These models do not reflect current wildfire foresting or conditions but can be used for prevention efforts through fuel and ignition prevention projects. Figure 4-34 shows the Wildfire Likelihood in Story County and Figure 4-35 displays the legend, which represents where the planning area is in relation to the other counties in Iowa. Like the Wildfire Risk maps, the size of the circles in the legend is a proportional representation of the county’s population compared to other counties in the state. Story County has a likelihood of 8% for wildfire within the US and a 25% likelihood within the State. Like wildfire risk, the greatest likelihood to wildfire in the County is scattered throughout the County with a Lower Risk to all of the jurisdictions and large areas in the unincorporated county. A significant portion of the county is at lower risk.

Figure 4-34 Story County Wildfire Likelihood



Source: Wildfire Risk to Communities, <https://wildfirerisk.org>

Figure 4-35 Story County Wildfire Likelihood Relative to Other Iowa Counties



Source: *Wildfire Risk to Communities*, <https://wildfirerisk.org>

Magnitude/Severity

Grass and wildland fire is considered to have **limited** magnitude and severity. Most grass fires burn only grasses, crops, or other low land cover. Injuries and deaths from fighting the fire most often occur by natural causes such as heart attack or stroke. Property damage is usually limited to grass, small trees, and other vegetative matter. Occasionally, a house or outbuilding can be damaged or destroyed, but widespread or large-scale losses of structures is very rare in Iowa.

Grass and wildland fire events often occur with minimal or no warning (up to 6 hours warning). Certain conditions could be the right mix for a grass or wildland fire to occur, but often these incidents cannot be predicted ahead of time. The rate at which fires can travel depends upon conditions at the time such as moisture, wind, and land cover.

Climate Change Considerations

Iowa is already experiencing the effects of climate change. The Iowa Climate Change Impacts Committee's Report to the Governor and the Iowa General Assembly has highlighted many expected effects, many of which may impact the severity and frequency of grass or wildland fires in the coming years:

- Long-term winter temperatures have increased six times more than summer temperatures.
- Nighttime temperatures have increased more than daytime temperatures since 1970.
- Iowa's humidity has risen substantially, especially in summer, which now has 13 percent more atmospheric moisture than 35 years ago as indicated by a 3-5°F rise in dew-point temperature. This fuels convective thunderstorms that provide more summer precipitation.

The impacts of higher temperatures listed above could also impact the frequency and severity of drought, which in turn could help fuel more severe wildland fires. The complexities of the impacts of climate change related to wildland fires in Iowa will likely lead to many cascading hazards, such as increased erosion and flooding following fires.



Vulnerability

Most vulnerable to wildfire are agricultural areas where land is burned, rural areas where trash and debris are burned, and the wildland-urban interface/intermix areas. The HMPC noted that corn stover fires are a major issue in the County, and that areas along the river are particularly vulnerable to fire.

Most grass fires are contained to highway right-of-way and rail right-of-way ditches and are less than a few acres in size. High winds can turn a small flame into a multi-acre grass fire within a matter of minutes, but the extent is dependent upon conditions such as land use/land cover, moisture, and wind. Grass fires are equally likely to affect Story County communities where there is dense or high vegetation. Rural areas are much more likely to experience grass or wildland fires. Grass fires are often more easily contained and extinguished before there is damage to people or developed property. Fires often burn large portions of field crops in the fall when the crops are dry, and the harvesting equipment overheats or throws sparks. It should be noted that all communities stressed that their vulnerability to damage from grass or wildland fires is extremely low due to the ability of fire departments throughout the county to respond to and put out fires before they are able to spread.

People

Smoke and air pollution from wildfires can be a severe health hazard, especially for sensitive populations, including children, the elderly, and those with respiratory and cardiovascular diseases. Smoke generated by wildfire consists of visible and invisible emissions that contain particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, nitrogen oxides), and toxics (formaldehyde, benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Public health impacts associated with wildfire include difficulty in breathing, odor, and reduction in visibility.

Wildfire may also threaten the health and safety of those fighting the fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

Property

Direct property damage and losses of buildings due to wildland fire is a rare occurrence in Story County. According to the USDA Forest Service wildfire risk tool referenced above, populated areas in Story County have, on average, a greater risk to homes than 9% of counties in Iowa.

Critical Facilities and Infrastructure

Critical facilities of wood frame construction are especially vulnerable during grass or wildland fire events. Power lines in the unincorporated areas of the county are the most at risk from wildfire because most poles are made of wood and susceptible to burning. Fires can create conditions that block or prevent access and can isolate residents and emergency service providers.

Some jurisdictions in Story County are more vulnerable to grass or wildland fires than others due to the large amount of cropland in the surrounding areas. The Cities of Ames and Nevada has the highest concentration of critical facilities and infrastructure but is less likely to experience a wildland or grassland fire than Gilbert or Kelley. A list of critical infrastructure by City and lifeline or facility type can be found above in Table 4-8 and Table 4-9.

Economy

Fire suppression may result in increased costs to local and state government for water acquisition and delivery, especially during periods of drought when water resources are scarce. Fires can also cause direct

economic losses in the destruction of buildings and their contents, or indirectly through the forced closures of businesses.

Environment and Cultural Resources

Fire is a natural and critical ecosystem process in most terrestrial ecosystems, dictating in part the types, structure, and spatial extent of native vegetation. However, severe wildfires can cause negative environmental impacts:

- **Soil Erosion**—The protective covering provided by foliage and dead organic matter is removed, leaving the soil fully exposed to wind and water erosion. Accelerated soil erosion occurs, causing landslides and threatening aquatic habitats.
- **Spread of Invasive Plant Species**—Non-native woody plant species frequently invade burned areas. When weeds become established, they can dominate the plant cover over broad landscapes, and become difficult and costly to control.
- **Disease and Insect Infestations**—Unless diseased or insect-infested trees are swiftly removed, infestations and disease can spread to healthy forests and private lands. Timely active management actions are needed to remove diseased or infested trees.
- **Destroyed Endangered Species Habitat**—Catastrophic fires can have devastating consequences for endangered species.
- **Soil Sterilization**—Topsoil exposed to extreme heat can become water repellent, and soil nutrients may be lost. It can take decades or even centuries for ecosystems to recover from a fire. Some fires burn so hot that they can sterilize the soil.

Many ecosystems are adapted to historical patterns of fire occurrence. These patterns, called “fire regimes,” include temporal attributes (e.g., frequency and seasonality), spatial attributes (e.g., size and spatial complexity), and magnitude attributes (e.g., intensity and severity), each of which have ranges of natural variability. Ecosystem stability is threatened when any of the attributes for a given fire regime diverge from its range of natural variability.

Development Trends

Iowa’s urban/rural interface is generally growing, however specific to Story County the overall population is decreasing in recent years. Any future development in the wildland-urban interface/intermix areas could increase the planning areas vulnerability to this hazard, but not by a significant degree.

4.3.6 Hazardous Materials

Future Probability	Magnitude/Severity	Location	Hazard Ranking
Likely	Limited	Significant	Medium

Risk Summary

The overall significance of hazardous materials incidents in Story County is **Medium**.

- Transportation Hazardous Materials Incidents can occur in all jurisdictions in Story County, specifically those with major highways or railways. There are 83 sites in Story County that because of the volume or toxicity of the materials on site were designated as Tier II or EHS Facilities, and numerous pipelines traverse the planning area. Therefore, the location is considered **significant**.
- According to Iowa DNR, there have been 469 reported spills of the last 23 years, an average of about 20 incidents per year. While this indicates multiple occurrences of hazardous materials

incidents per year, incidents with casualties or property damage occur much less frequently. Therefore, the overall future probability is considered **likely**.

- The overall magnitude is considered **limited**, as these incidents most commonly result in very minimal, localized impacts, despite there being the possibility for a more severe incident.
- About 40% of recorded incidents were at fixed facility sites.
- There are 26 Tier II facilities in the county, mostly located in Ames.
- Related Hazards: Transportation Incidents, Flood, Severe Summer Weather, Grass/Wildland Fire.

Description

A hazmat incident is an unintentional hazardous materials release from a fixed site, pipeline, or in transportation. This can include the accidental release of flammable or combustible, explosive, toxic, noxious, corrosive, oxidizable, irritant, or radioactive substances or mixtures that can pose a risk to life, health, or property possibly requiring evacuation. A hazardous substance is one that may cause damage to persons, property, or the environment when released to soil, water, or air. Chemicals are manufactured and used in increasing types and quantities. Hazardous substances are categorized as toxic, corrosive, flammable, irritant, or explosive. Hazardous material incidents generally affect a localized area. Hazardous materials incidents can arise through a number of different mechanisms, such as:

Fixed Hazardous Materials Incident

A fixed hazardous materials incident is the accidental release of chemical substances or mixtures during production or handling at a fixed facility.

Transportation Hazardous Materials Incident

A transportation hazardous materials incident is the accidental release of chemical substances or mixtures during transport. Transportation Hazardous Materials Incidents in Story County can occur during highway or air transport. Highway accidents involving hazardous materials pose a great potential for public exposures. Both nearby populations and motorists can be impacted and become exposed by accidents and releases. If airplanes carrying hazardous cargo crash, or otherwise leak contaminated cargo, populations and the environment in the impacted area can become exposed.

Pipeline Incident

A pipeline transportation incident occurs when a break in a pipeline creates the potential for an explosion or leak of a dangerous substance (oil, gas, etc.) possibly requiring evacuation. An underground pipeline incident can be caused by environmental disruption, accidental damage, or sabotage. Incidents can range from a small, slow leak to a large rupture where an explosion is possible. Inspection and maintenance of the pipeline system along with marked gas line locations and an early warning and response procedure can lessen the risk to those near the pipelines.

Location

The geographic extent of hazmat incidents is **significant**. A hazardous materials incident in the more population dense areas of Story County, such as Ames, could have severe consequences. It is more likely that an event would occur in the areas located near Interstate 35, or U.S. Highways 30, 65, or 69, where the potential for trucking accidents is higher. This section provides geographic locations within Story County impacted by each type of potential hazardous materials incident.

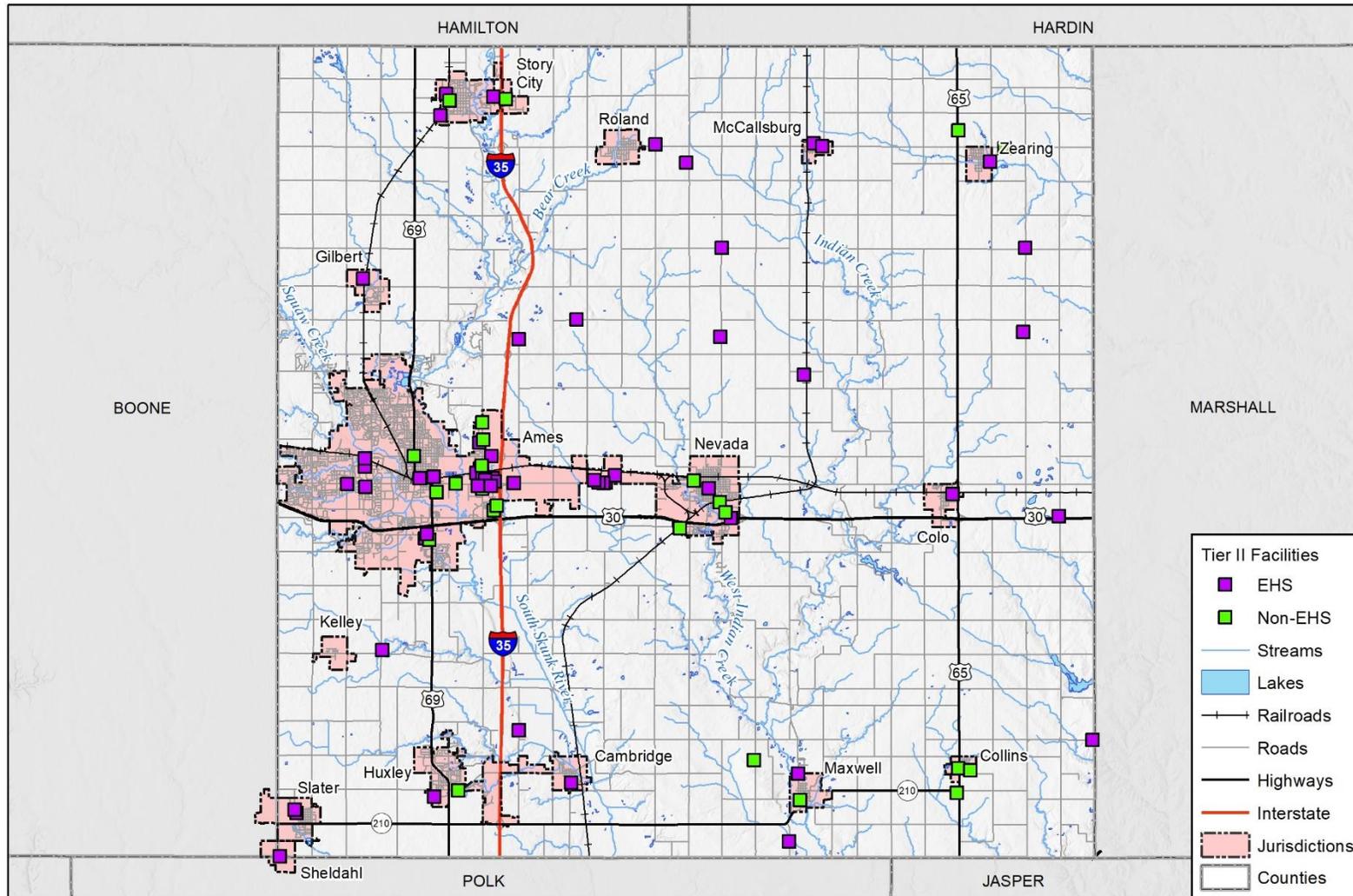


Fixed Hazardous Materials Incident

According to the Iowa Department of Natural Resources, there are 83 sites in Story County that because of the volume or toxicity of the materials on site were designated as Tier II or EHS Facilities under the Superfund Amendments and Reauthorization Act.

Table 4-30 provides the number of Tier II and EHS Facilities for each jurisdiction in the planning area; the jurisdiction is assigned from the address. Some facilities do fall within the unincorporated areas of the county and are noted in the table. Figure 4-36 below is a map showing the locations of these facilities.

Figure 4-36: Tier II Facilities in Story County



wsp Map compiled 6/2023;
intended for planning purposes only.
Data Source: Story County, NHD, DNR

Table 4-30: Number of Tier II Facilities by Jurisdiction

Jurisdiction	# of Tier II Facilities	EHS Facilities
Ames	12	22
Cambridge	-	1
Collins	2	-
Colo	-	-
Gilbert	-	1
Huxley	1	1
Kelley	-	-
Maxwell	1	1
McCallsburg	-	2
Nevada	3	7
Roland	-	-
Sheldahl	-	1
Slater	-	2
Story City	2	3
Zearing	-	1
Unincorporated	5	15
Total	26	57

Source: Story County, WSP Analysis

Transportation Hazardous Materials Incident

In 2001, the *Story County Hazardous Commodity Flow Analysis* looked at both highway and rail transport of hazardous materials in Story County. The highways analyzed included Highway 30 and Interstate 35 and the railroad line analyzed is the Union Pacific Railroad. The highway analysis included four locations that were selected for observation of the number of hazardous materials being transported in a 4-hour period. The collected data was then extrapolated to a 24-hour time-frame. The following was revealed from the analysis:

- 2,061,000 combined gallons of the following classes of hazardous materials:
 - Corrosives
 - Cryogenic gases
 - Elevated Temperature Liquids
 - Explosives
 - Flammable and Combustible Liquids
 - Flammable Gas
 - Flammable Liquids
 - Non-flammable Gas

- 115,000 combined pounds of the following classes of hazardous materials
 - Corrosives
 - Dangerous Mixed Loads
 - Flammable Liquids
 - Flammable solids
 - Non-flammable Gas
 - Poison



The Commodity Flow Analysis also reported on the Transport of Hazardous Materials via Railroad in Story County for an 11-month period from January 1, 2000 to December 1, 2000. According to the 2007 Ames/ISU Hazard Mitigation Plan, approximately 80 trains a day pass through the community of Ames on the east-west Union Pacific Railroad. For the 2014 Story County Hazard Mitigation Plan, Union Pacific supplied data on quantities of hazardous materials transported for 5 Departure/Destination rail routes that pass through the County.

The following classes of hazardous materials pass through Story County via railroad:

- Flammable and Combustible Liquids
- Explosives
- Corrosive Liquids
- Non-Flammable Gases
- Flammable Gases
- Flammable Solids
- Oxidizers
- Poison Gases
- Liquid and Solid Poisons
- Radioactive
- Hazardous Waste

A track is being added west of Highway 30 to transport hazardous materials, which will further increase the County's vulnerability.

Air Freight

Ames Municipal Airport is a publicly owned airport located 1 mile south of the city of Ames.

Figure 4-37: Ames Municipal Airport



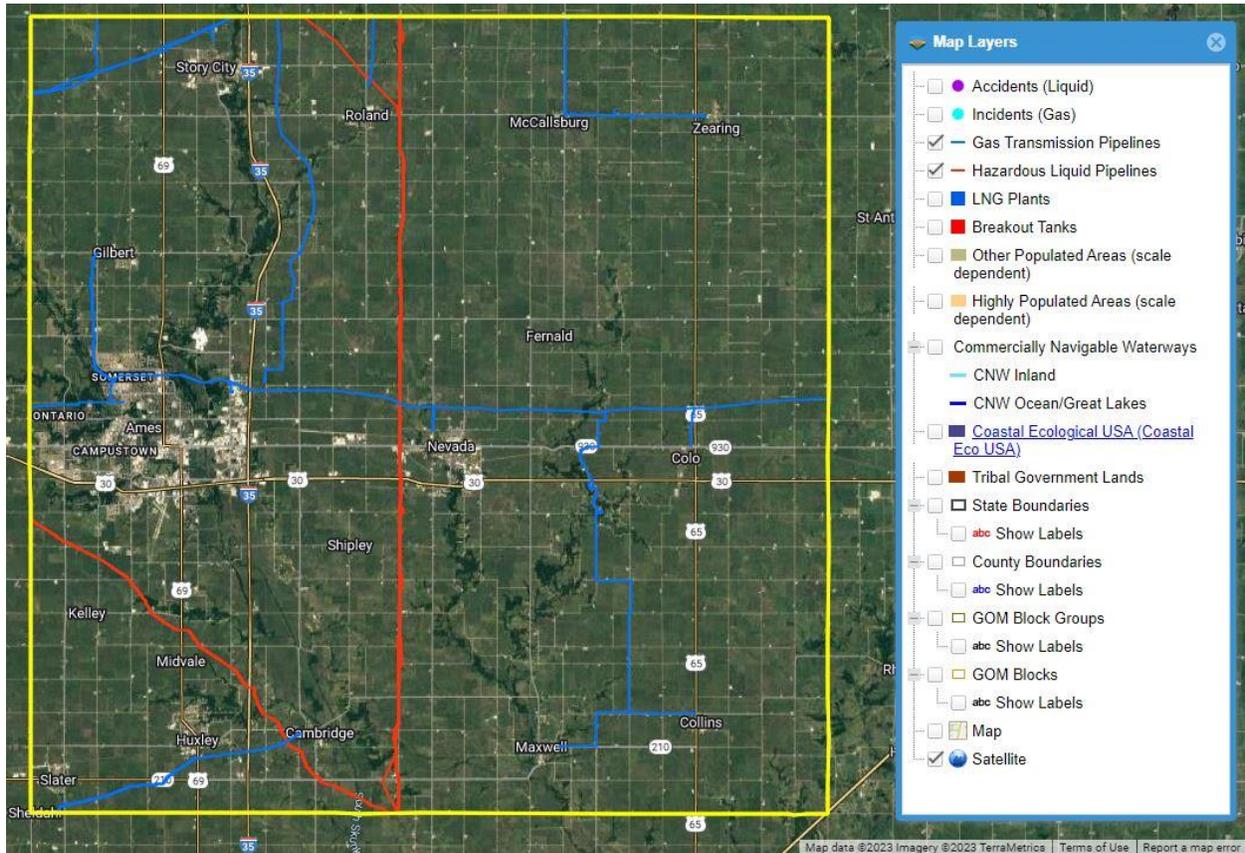
Source: Google Maps

Pipeline Incident

According to the National Pipeline Mapping System (NPMS), there are 92 miles of gas pipelines and 81 miles of liquid pipelines in Story County. Pipeline operators include: Alliant Energy/Interstate Power and Light Company, Koch Pipeline Company, L.P., Magellan Pipeline Company, L.P., Northern Natural Gas Company, Poet Biorefining-Jewell, and Sunoco Logistics Partners, which operates the Dakota Access Pipeline (not currently shown in NPMS). Approximately 7 miles to the east of the City of Ames, along the western edge of the City of Nevada, a major gas pipeline runs north and south that breaks off to supply most parts of Story County.

Figure 4-38 provides the locations of pipelines in Story County. The data for this map consists of gas transmission pipelines and hazardous liquid trunklines. It does not contain gathering or distribution pipelines, such as lines which deliver gas to a customer's home. Therefore, not all pipelines in the County will be visible, including the Dakota Access Pipeline.

Figure 4-38: Pipelines in Story County



Source: Pipeline and Hazardous Materials Safety Administration, National Pipeline Mapping System

Any type of hazardous materials incident within a city that includes a large release of hazardous materials could affect large areas of the city in the right conditions, possibly even the entire city. This could necessitate evacuation of large areas. In the rural unincorporated areas where population densities are low, even in the event of a large release the number of homes that may need to be evacuated would be significantly lower than in an urban environment.

Immediate dangers from hazardous materials include fires and explosions. The release of some toxic gases may cause immediate death, disablement, or sickness if absorbed through the skin, injected, ingested, or inhaled. Contaminated water resources may be unsafe and unusable, depending on the amount of contaminant. Some chemicals cause painful and damaging burns if they come in direct contact with skin. Contamination of air, ground, or water may result in harm to fish, wildlife, livestock, and crops. The release of hazardous materials into the environment may cause debilitation, disease, or birth defects over a long period of time. Loss of livestock and crops may lead to economic hardships within the community. The occurrence of a hazmat incident many times shuts down transportation corridors for hours at a time while the scene is stabilized, the product is off-loaded, and reloaded on a replacement container.

Past Occurrences

In Iowa, hazardous materials spills are reported to the Department of Natural Resources. According to Iowa Administrative Code Chapter 131, Notification of Hazardous Conditions, any person manufacturing, storing, handling, transporting, or disposing of a hazardous substance must notify the Department of Natural Resources and the local police department or the office of the sheriff of the affected county of the



occurrence of a hazardous condition as soon as possible but not later than six hours after the onset of the hazardous condition or the discovery of the hazardous condition. The Department of Natural Resources maintains a database of reported spills.

According to the DNR database, from 2000 to August 2023, there have been 469 hazardous materials spills reported in Story County. Table 4-31 provides a summary of the reported spills during this time period in the database by the mode of the spill. According to this data, the most spills occurred through handling and storage accidents, followed closely by transportation. Table 4-32 that follows summarizes the spills by material type. Petroleum is by far the most common material type spilled with 255 spills of this type.

Table 4-31: Story County Hazardous Materials Spills by Mode Reported to Iowa DNR, 2000-2023

Cause/Mode	Number of Incidents
Dumping	5
Fire	4
Handling and Storage	189
Manure	5
Other	10
Pipeline	3
Railroad	7
RR Incident	3
Theft	5
Transformer	76
Transportation	159
Unknown	2
Vandalism	1
Grand Total	469

Source: Iowa Department of Natural Resources, <https://programs.iowadnr.gov/hazardousspills/Introductory.aspx#&&BasicPageIndex=0>

Table 4-32: Story County Hazardous Materials Spills Reported to Iowa DNR, 2000-2023 by Material Type

Material Type	Number of Incidents
Acids/Bases	9
Ammonia (Anhydrous)	5
Ammonia/Ag-related	1
Animal/Vegetable Products	8
Chlorine	2
Fertilizer/Pesticide	42
Inorganic Chemical	9
Manure	5
Organic Chemical	51
Other Chemical	2



Material Type	Number of Incidents
Paints/Dyes/Organic Solv	5
Petroleum	255
Propane/LPG/Natural Gas	1
Transformer Oil/PCB	73
Unknown	1
Grand Total	469

Source: Iowa Department of Natural Resources, <http://www.iowadnr.gov/InsideDNR/RegulatoryLand/EmergencyPlanningEPCRA/SpillReporting.aspx>

The Environmental Protection Agency's Toxics Release Inventory (TRI) tracks the management of over 650 toxic chemicals that pose a threat to human health and the environment. Facilities in the U.S. that manufacture, process, or otherwise use these chemicals in amounts above established levels must report how each chemical is managed through recycling, energy recovery, treatment, and releases to the environment. A "release" of a chemical means that it is emitted to the air or water or placed in some type of land disposal. The information submitted by facilities to the EPA and states is compiled annually as the Toxics Release Inventory or TRI and is stored in a publicly accessible database in Envirofacts.

TRI data reflects releases and other waste management activities of chemicals, not whether (or to what degree) the public has been exposed to those chemicals. Release estimates alone are not sufficient to determine exposure or to calculate potential adverse effects on human health or the environment. TRI data, in conjunction with other information can be used to begin to evaluate exposures that may result from releases and other waste management activities that involve toxic chemicals. The determination of potential risk is dependent on several factors including, toxicity of the chemical, the fate of the chemical, and the amount of and duration of human exposure after the chemical is released.

Specific Hazardous Materials Incidents reported by the planning committee are provided below:

- January 29, 2003
- January 25, 2001
- September 21, 1999
- November 10, 1999
- June 1997
- March 19, 1996

Probability of Future Occurrence

The probability of future occurrence of hazardous materials incidents is determined to be "**Likely**". From 2000 to 2023 (23 years), there have been 469 spills reported to Iowa DNR. This computes to an annual average of over 20.4 hazardous materials spills per year. However, incidents which result in significant property damages, extended shutdown of critical facilities, injuries, or deaths are much less common.

Magnitude/Severity

Hazmat incidents have **limited** magnitude in Story County. This means that 10% to 25% of property is severely damaged, shutdown of facilities and services for more than a week, and/or injuries/illnesses that do not result in permanent disability. Although DNR and Story County Emergency Management did report the number of hazmat incidents, there have been relatively limited economic losses or casualties associated with the hazard impacting Story County when compared to other hazards.



Hazmat incidents often occur with minimal or no warning (up to 6 hours warning). You can prepare and practice how to respond to a hazmat incident, but there is often no warning time when an incident occurs.

Climate Change Considerations

There are not expected to be climate change impacts on human-caused hazards such as hazardous materials incidents.

Vulnerability

People

A hazardous materials incident can occur almost anywhere. So, all jurisdictions are considered to have at least some vulnerability to this hazard. People, pets, livestock, and vegetation in close proximity to facilities producing, storing, or transporting hazardous substances are at higher risk. Populations downstream, downwind, and downhill of a released substance are particularly vulnerable. Depending on the characteristics of the substance released, more people, in a larger area may be in danger from explosion, absorption, injection, ingestion, or inhalation.

Property

The impact of a fixed hazardous facility, such as a chemical processing facility is typically localized to the property where the incident occurs. The impact of a small spill (i.e. liquid spill) may also be limited to the extent of the spill and remediated if needed. A blanket answer for potential impacts is hard to quantify, as different chemicals may present different impacts and issues. Property within a half mile in either direction of designated hazardous materials routes is at increased risk of impacts. While cleanup costs from major spills can be significant, they do not typically cause significant long-term impacts to property. However, some larger incidents involving pipelines, railroads, or explosive materials may cause significant and overwhelming damage to the surrounding communities.

Critical Facilities and Infrastructure

Impacts of hazardous material incidents on critical facilities are most often limited to the area or facility where they occurred, such as at a transit station, airport, fire station, hospital, or railroad. These impacts could involve physical damages and loss of usage impacts at the storage facilities themselves or impacts cascading from a facility or transportation hazmat incident. For example, a transportation incident resulting in a hazmat spill could temporarily close roads and railways, damaged transportation infrastructure, or potentially require evacuations of the area depending on the severity of the incident.

A Tier II facility is one that has greater than or equal to 10,000 pounds of any hazardous chemical as defined by OSHA criteria. An EHS Facility stands for Environment, Health, and Safety. It's a general term used to refer to laws, rules, regulations, professions, programs, and workplace efforts to protect the health and safety of employees and the public as well as the environment from hazards associated with the workplace. There is a total of 26 Tier II Facilities and 57 EHS Facilities within Story County as within Story County as showcased in Table 4-33 below. Twelve of these Tier II facilities are located in Ames, along with 22 EHS facilities.

Table 4-33: Number of Tier II Facilities by Jurisdiction

Jurisdiction	# of Tier II Facilities	EHS Facilities
Ames	12	22



Jurisdiction	# of Tier II Facilities	EHS Facilities
Cambridge	-	1
Collins	2	-
Colo	-	-
Gilbert	-	1
Huxley	1	1
Kelley	-	-
Maxwell	1	1
McCallsburg	-	2
Nevada	3	7
Roland	-	-
Sheldahl	-	1
Slater	-	2
Story City	2	3
Zearing	-	1
Unincorporated	5	15
Total	26	57

Source: Story County, WSP Analysis

Economy

Hazardous materials incidents can also interrupt transportation and delivery services, potentially resulting in economic losses.

Environment and Cultural Resources

Impacts to the environment from hazmat incidents can be severe. Widespread effects occur when the product contaminates the municipal water supply or water system such as river, lake, or aquifer. Spills can be costly to clean up due to the specialized equipment and training, and disposal sites that are necessary. Air and water quality may be reduced for extended periods of time depending on the scale of the event. The majority of spills in the county are small and quickly maintained within existing capabilities, but due to the presence of the pipelines and rail transport, the possibility of more serious events exists.

Development Trends

The number and types of hazardous chemicals stored and transported through Story County will likely continue to increase. As populations grow, this also increases the number of people vulnerable to the impacts of hazardous materials spills. Population and business growth along major transportation corridors increases the vulnerability to transportation hazardous materials spills.

4.3.7 Human Disease

Future Probability	Magnitude/Severity	Location	Hazard Ranking
Occasional	Limited	Significant	Medium

Risk Summary

- Human Disease is ranked as an overall medium-significance hazard.

- Given the history of epidemics in Iowa and pandemics in the United States, the probability of a future disease outbreak is **occasional**.
- Advances in sanitation practices and medicine have decreased the likely severity of human disease – however, it is impossible to predict with certainty the severity of future outbreaks.
- While human disease tends to have the most severe effect on the old and young, recent outbreaks have shown that human disease can have detrimental effects on all people. The overall magnitude and severity of human disease is considered **limited**.
- The duration of a human disease epidemic will last more than one week and can take a significant amount of time to manage and stop the disease. Additionally, disease outbreaks can rapidly spread and be present in populations across large geographic regions. Therefore, the location is considered **significant**.
- Disease will spread more quickly in high-density areas, posing a more significant threat to the cities of Ames, Huxley, Nevada, Story City, and the local school districts. Populations of less than 2,000 are likely at lower risk.

Description

A human disease outbreak is a medical, health or sanitation threat to the general public (such as contamination, epidemic, plague and insect infestation). The outbreak may be spread by direct contact with an infected person or animal, ingesting contaminated food or water, vectors such as mosquitoes or ticks, contact with contaminated surroundings such as animal droppings, infected droplets, or by aerosolization.

Iowa's public health and health care communities work to protect Iowans from infectious diseases and preserve the health and safety of Iowans by rapidly identifying and containing a wide range of biological agents. Local public health departments and the Iowa Department of Public Health, Center for Acute Epidemiology investigate disease "outbreaks" of routine illnesses. There are a number of biological diseases/agents that are of concern to the State of Iowa such as vaccine preventable disease, foodborne disease and community associated infections having significant impact on the morbidity of Iowans. The following descriptions are general and it should be noted that individuals may experience more or less severe consequences.

Vaccine Preventable Disease

In the U.S., there are common infectious diseases that include polio, measles, diphtheria, pertussis, rubella, mumps, tetanus and Haemophilus influenzae type b that are now rare because of widespread use of vaccines. Routine childhood immunizations have helped protect both individuals and communities each year saving nearly \$14 billion in direct medical costs and \$69 billion in costs to society according to the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention.

The immunization rates in Iowa are consistent with national average (see Table 4-37). Vaccine preventable diseases continue to threaten the health of Iowans when children, adolescents and adults are un-immunized or under-immunized.

Influenza

Influenza (flu) is a viral infection of the nose, throat, bronchial tubes, and lungs. There are two main types of virus: A and B. Each type includes many different strains, which tend to change each year. In Iowa, influenza occurs most often in the winter months. Illnesses resembling influenza may occur in the summer months, but these are usually the result of other viruses that exhibit symptoms commonly referred to as influenza-like illness or ILI.



Influenza is highly contagious and is easily transmitted through contact with droplets from the nose and throat of an infected person during coughing and sneezing. Typical symptoms include headache, fever, chills, cough, and body aches. Although most people are ill for only a few days, some may have secondary infections such as pneumonia and may need to be hospitalized. Anyone can get influenza, but it is typically more serious in the elderly and people with chronic illnesses such as cancer, emphysema, diabetes, or weak immune systems. It is estimated that thousands of people die each year in the United States from flu or related complications.

Pandemic Influenza

A pandemic is a global disease outbreak. A pandemic flu is a human flu that causes a global outbreak, or pandemic, of serious illness. A flu pandemic occurs when a new influenza virus emerges for which people have little or no immunity, and for which there is no vaccine.

This disease spreads easily person-to-person, causing serious illness, and can sweep across the country and around the world in a very short time. The Centers for Disease Control and Prevention (CDC) has been working closely with other countries and the World Health Organization (WHO) to strengthen systems to detect outbreaks of influenza that might cause a pandemic and to assist with pandemic planning and preparation.

An especially severe influenza pandemic could lead to high levels of illness, death, social disruption, and economic loss. Impacts could range from school and business closings to the interruption of basic services such as public transportation, health care, and the delivery of food and essential medicines.

Pandemics are generally thought to be the result of novel strains of viruses. Because of the process utilized to prepare vaccines, it is impossible to have vaccine pre-prepared to combat pandemics. A portion of the human and financial cost of a pandemic is related to lag time to prepare a vaccine to prevent future spread of the novel virus. In some cases, current vaccines may have limited activity against novel strains.

Foodborne Disease

There are several agents that can cause illness when consuming contaminated food, beverages, or water. Foodborne illness (food poisoning) can also be spread person-to-person as well as from contact with animals. Table 4-34 is a list of common foodborne diseases.

Table 4-34: Common Foodborne Diseases

Organism	Onset of Symptoms	Associated Food(s)
Botulism	12 – 36 hours	Canned fruits and vegetables
Campylobacter	2 – 5 days, range 1 – 10 days	Undercooked chicken or pork, unpasteurized milk
Cholera	12 – 72 hours	Undercooked or raw seafood, especially oysters
Cryptosporidium	7 days, range 1 – 12 days	Unpasteurized beverages, contaminated food or water, person-to-person
E. coli (shiga-toxin)	3 – 4 days, range 2 – 10 days	Undercooked ground meats, unpasteurized milk, contaminated fruits or vegetables, person-to-person
Giardia	7 – 10 days, range 3 – 25 days	Contaminated water, person-to-person
Hepatitis A	28 – 30 days, range 15 – 50 days	Raw produce, undercooked foods, person-to-person
Listeria	3 weeks, range 3 – 70 days	Soft cheeses, unpasteurized milk, ready-to-eat deli meats, hot dogs, undercooked poultry, unwashed raw vegetables



Organism	Onset of Symptoms	Associated Food(s)
Norovirus	24 – 48 hours, range 10 – 50 hours	Contaminated ready-to-eat food, undercooked shellfish, person-to-person
Salmonella	12 – 36 hours, range 6 – 72 hours	Contaminated eggs, poultry, beef, raw fruits and vegetables, unpasteurized milk or juice, cheese
Shigella	1 – 3 days, range 12 – 96 hours	Contaminated food or water, person-to-person
Trichinosis	8 – 15 days, range 5 – 45 days	Raw or undercooked pork or wild game meat

Source: Iowa Department of Public Health, Center for Acute Disease Epidemiology <http://www.idph.state.ia.us/Cade/Foodborne.aspx>.

Location

The location of human disease is considered **significant**. A human disease outbreak has no geographic boundaries. Because of our highly mobile society, disease can move rapidly across the nation within days, weeks or months. Many of the infectious diseases that are designated as notifiable at the national level result in serious illness, if not death. Some are treatable, for others only the symptoms are treatable.

Past Occurrences

The WHO tracks and reports on epidemics and other public health emergencies through the Global Alert and Response (see historic epidemics at www.who.int/en/). There have been five acknowledged pandemics in the past century:

2019 COVID-19 Pandemic —The COVID-19 pandemic, caused by the novel coronavirus SARS-CoV-2, has had a profound impact on global public health since its emergence in late 2019. The pandemic has gone through several phases, including introduction, local transmission, community spread, and mitigation efforts. Governments worldwide implemented various measures, such as lockdowns, social distancing, mask mandates, and vaccination campaigns, to control transmission. Several vaccines have been developed and distributed globally to combat the virus. Vaccination campaigns have played a crucial role in reducing severe illness and death, though challenges like vaccine hesitancy and supply issues persist.

2009 H1N1 Influenza —The 2009 H1N1 Pandemic Influenza caused 659 confirmed hospitalizations and 41 fatalities. The CDC estimated that 80% of H1N1 deaths were in people younger than 65 years of age, which differs from the typical season influenza epidemics during which 80-90% of deaths are estimated to occur in people 65 years of age and older.¹

1968–69 Hong Kong flu (H3N2) —This strain caused approximately 34,000 deaths in the United States and more than 700,000 deaths worldwide. It was first detected in Hong Kong in early 1968 and spread to the United States later that year. Those over age 65 were most likely to suffer fatal consequences. This virus returned in 1970 and 1972 and still circulates today.

1957–58 Asian flu (H2N2) —This virus was quickly identified because of advances in technology, and a vaccine was produced. Infection rates were highest among school children, young adults, and pregnant women. The elderly had the highest rates of death. A second wave developed in 1958. In total, there were about 70,000 deaths in the United States. Worldwide deaths were estimated between one and two million.

1918–19 Spanish flu (H1N1) —This flu is estimated to have sickened 20-40 percent of the world’s population. Over 20 million people lost their lives. Between September 1918 and April 1919, 500,000 Americans died.

¹ <https://www.cdc.gov/flu/spotlights/pandemic-global-estimates.htm>



The flu spread rapidly; many died within a few days of infection, others from secondary complications. The attack and mortality rates were highest among adults 20-50 years old; the reasons for this are uncertain.

Other Reportable Diseases

In 2021, influenza and pneumonia combined was the 10th leading causes of death in Iowa with 361 deaths, followed by all infective and parasitic diseases with 148 deaths. In 2008, there were over 800 influenza/pneumonia deaths in Iowa. Table 4-35 shows the historical reported deaths in Story County and throughout Iowa from Influenza and Pneumonia as well as Infective and Parasitic Disease.

Table 4-35: Deaths by Year 2007-2021, Influenza and Pneumonia and Infective and Parasitic Disease, Story County and State of Iowa

Year	Influenza/Pneumonia Deaths, Story County	Influenza/Pneumonia Deaths, Iowa	Infective/Parasitic Disease Deaths, Story County	Infective/Parasitic Disease Deaths, Iowa
2021	9	361	*	578
2020	8	536	7	600
2019	*	583	18	630
2018	13	688	19	526
2017	10	567	*	554
2016	8	483	10	429
2015	8	592	11	488
2014	6	549	8	448
2013	12	755	*	511
2012	12	656	*	511
2011	10	657	0	464
2010	9	557	0	441
2009	4	633	0	457
2008	13	825	9	493
2007	15	748	*	427

Source: Iowa Department of Public Health, Bureau of Health Statistics-Vital Statistics of Iowa in Brief, <https://hhs.iowa.gov/health-statistics/data>

* Counts are suppressed to protect confidentiality.

Table 4-36 lists the number of common reportable diseases in the State of Iowa from 2018 to 2023 (Updated July 24, 2023) from the Iowa Department of Public Health, Center for Acute Epidemiology.

Table 4-36: Iowa Common Reportable Diseases Case Counts

	2018	2019	2020	2021	2022	2023
Anaplasmosis/Ehrlichiosis	13	16	4	16	9	13
Campylobacteriosis	727	614	502	548	511	555
Cryptosporidiosis	303	244	182	155	227	185
Cyclosporidiosis	139	28	230	48	13	18
Dengue	0	1	1	0	1	2
E.coli (STEC)	241	250	159	230	229	194
Enteric-HUS	2	4	0	8	1	1
Giardia	121	108	51	84	99	93
Haemophilus influenzae type b	0	0	1	2	1	0
Hansens disease	1	0	1	0	2	2
HepB	0	0	0	0	0	1
Hepatitis A	5	4	5	3	6	8



	2018	2019	2020	2021	2022	2023
Hepatitis D	2	1	3	5	3	4
Hepatitis E	0	1	0	1	0	1
Legionellosis	21	16	16	20	22	13
Listeria	4	5	4	3	1	2
Lyme	158	158	131	195	83	83
M COVID-19	0	0	5	21	10	1
Malaria	13	9	2	12	4	13
Measles	0	2	0	0	0	0
Mpoxvirus	0	0	0	0	2	1
Mumps	12	6	5	5	2	7
N. meningitidis	1	1	1	0	2	9
Pertussis	57	115	21	6	16	31
Q fever acute and chronic	6	8	3	2	3	3
Rocky Mountain spotted fever	11	4	2	1	3	1
Salmonellosis	681	406	219	310	301	326
Shigellosis	48	41	39	40	64	56
West Nile virus	2	2	1	2	0	1

Source: Iowa Department of Public Health, Center for Acute Disease Epidemiology
<http://idph.iowa.gov/CADE>

Probability of Future Occurrence

The possibility of a human disease outbreak causing a threat to the general public has been determined to be “**Occasional.**” For purposes of determining probability of future occurrence, the HMPC defined “occurrence” of human disease outbreak as a medical, health or sanitation threat to the general public (such as contamination, epidemic, or plague). Within the last century, there have been five pandemic events, and with the H1N1 outbreak and the covid-19 pandemic both occurring within the same decade, the possibility of a human disease outbreak causing a threat to the general public has been determined to be occasional.

Magnitude/Severity

Human disease is considered to have **limited** magnitude and severity.

The magnitude of a public health emergency will range significantly depending on the aggressiveness of the virus in question and the ease of transmission. Pandemic influenza is more easily transmitted from person-to-person but advances in medical technologies have greatly reduced the number of deaths caused by influenza over time.

Improvements in sanitation and hygiene, the discovery of antibiotics, and the implementation of universal childhood vaccination programs have decreased the number and severity of human diseases. IDPH also provides consultation to county and local health agencies on diseases requiring public health intervention, collaborates with Centers for Diseases Control and Prevention by weekly reporting of nationally reportable diseases, and offers health education opportunities. Programs guide community-based prevention planning, monitor current infectious disease trends, prevent transmission of infectious disease, provide early detection and treatment for infected persons, and ensure access to health care for refugees in Iowa. These safeguards work to limit the severity of impact of human disease.

Climate Change Considerations

As the Earth’s climate continues to warm, researchers predict wild animals will be forced to relocate their habitats — likely to regions with large human populations — dramatically increasing the risk of a viral jump to humans that could lead to the next pandemic. In addition, rising temperatures caused by climate change



will impact bats, which account for the majority of novel viral sharing. Bats' ability to fly will allow them to travel long distances and share viruses in geographically dispersed places.

Vulnerability

People

Several populations in Story County are at specific risk to infectious diseases. Communicable diseases are most likely to spread quickly in institutional settings such as prisons, dormitories, long-term care facilities, daycare facilities and schools. According to the critical facilities inventory provided by Story County GIS, there are 21 nursing homes, and 110 school facilities (including college/university, school, and daycares) in the county.

According to the Iowa Department of Public Health 2022-2023 Immunization Program Audit Report, Story County had 94.9 percent with immunization certificates in kindergarten through 12th grade. The County Immunization Assessment for 2-year-old and 13-15-year old coverage from the 2022 Annual Report is provided in Table 4-37. The percent of up-to-date children is over the State average of 70.1 percent, while the percent of adolescents up-to-date is below the state average of 71.3 percent.

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Table 4-37: 2022 Vaccination Coverage Percent of Individual Vaccines and Selected Vaccination Series in Story County (2-year old coverage and 13-15 year old coverage)

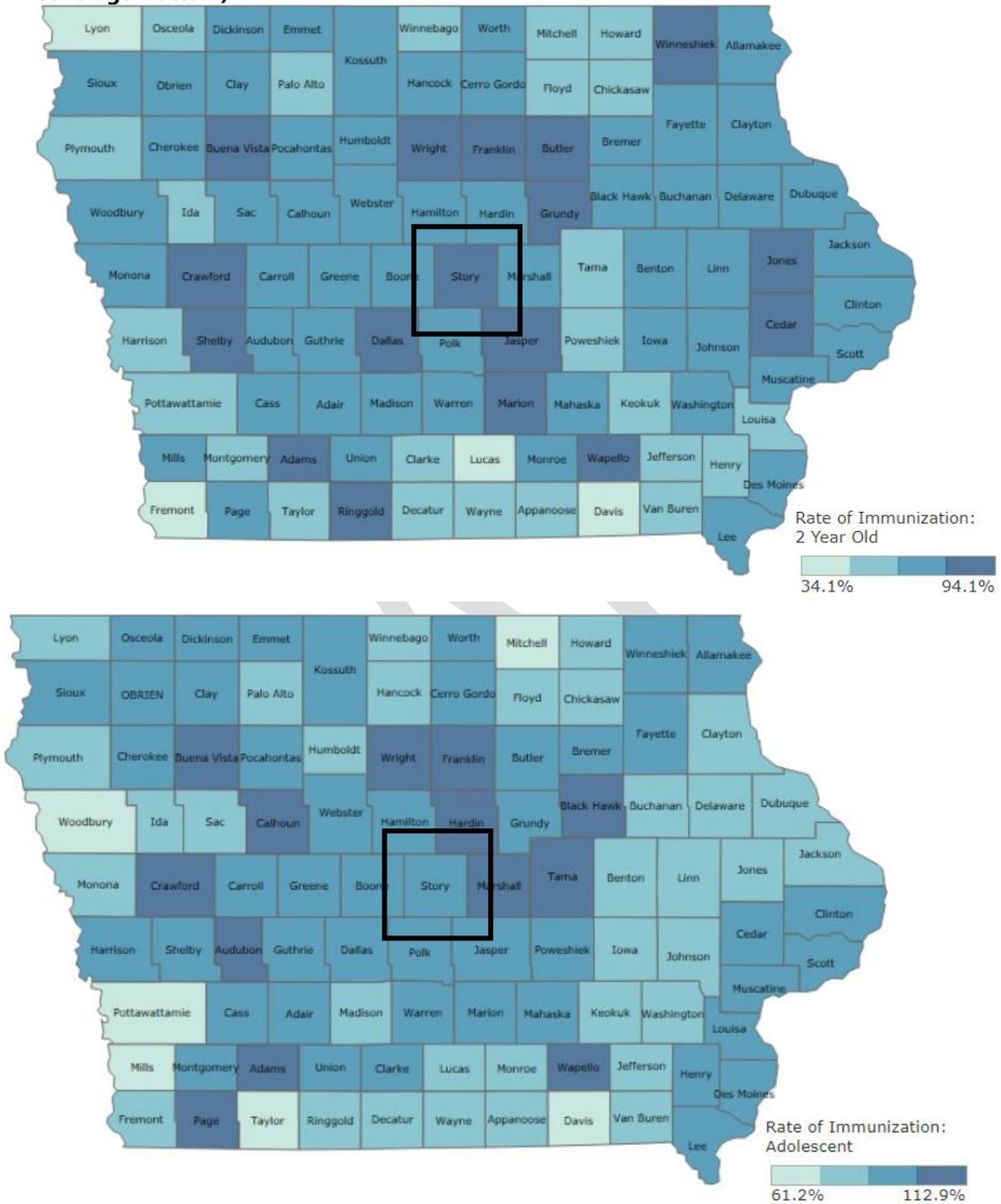
	County Population Born 2020 Estimate	Total Records Analyzed from IRIS	Percent of Population in IRIS	4 DTaP Coverage Percent	3 Polio Coverage Percent	1 MMR Coverage Percent	3 Hib Coverage Percent	3 Hep B Coverage Percent	1 Varicella Coverage Percent	4 PCV Coverage Percent	Up-To-Date 4-3-1-3-3-1-4 Coverage Percent
2-Year Old Coverage	832	847	101.8	82.5	91.4	87.6	91.3	89.0	87.2	83.2	83.2
	County Population 2022 Estimate	Total Records Analyzed from IRIS	Percent of Population in IRIS	3 Hep B Coverage Percent	1 Meningitis Coverage Percent	2 MMR Coverage Percent	1 Td/Tdap Coverage Percent	2 Varicella Coverage Percent	Up-to-Date 3-1-2-1-2 Coverage Percent	3 HPV Female Coverage Percent	3 HPV Male Coverage Percent
13-15 Year Old Coverage	2,693	3,824	142.0	91.9	72.5	84.1	73.8	82.8	69.0	63.5	54.9

Source: Iowa Department of Public Health, Iowa Immunization Program 2022 Annual Report, 2022 County Immunization Assessment, <https://tracking.idph.iowa.gov/Health/Immunization>

* Note: Up-to-date are 2-year old children who have completed the 4 DTaP, 3 Polio, 1 MMR, 3 Hib, 3 Hep B, 1 Varicella, 4 PCV by 24 months of age or adolescents 13- to 15-year-olds who have completed the 3 Hep B, 1 Meng, 2 MMR, 1 Td or Tdap, 2 Varicella series.



Figure 4-39: County Immunization Assessment Maps (2-year Old Coverage-Top, 13-15-year Old Coverage-Bottom)



Source: Iowa Department of Public Health, Iowa Immunization Program Annual Report 2022 County Immunization Assessment, <https://tracking.idph.iowa.gov/Health/Immunization>

Note: Story County is outlined in black



Property

There is no historical data for previous structural losses due to human disease epidemics. Therefore, a loss estimate was not completed for this hazard. This hazard was also not spatially analyzed because it does not typically cause structural damage.

Critical Facilities and Infrastructure

Health care facilities and emergency service personnel would likely be affected in the event of a human disease epidemic. While buildings, infrastructure, and critical facilities are not considered vulnerable to this hazard, access to facilities and infrastructure in the area of the incident may be denied until decontamination is complete. Workplace closures due to social distancing and quarantine requirements can make facility operation more difficult.

Economy

Local economy and finances may be adversely affected, possibly for an extended period of time. Unscheduled sick leave from a large portion of the workforce could result in millions of dollars lost in productivity. Business restrictions due to social distancing requirements can also be significant. In a normal year, lost productivity due to illness costs U.S. employers an estimated \$530 billion. During a pandemic, that figure would likely be considerably high and could trigger a recession or even a depression. Some indirect consequences may be the diversion of resources that may be otherwise available.

Based upon 2011 research on foodborne pathogens, the CDC estimates that 48 million people suffer foodborne illnesses each year in the United States, accounting for 128,000 hospitalizations and 3,000 deaths. Salmonella and norovirus cause the most illnesses and hospitalizations. Foodborne disease is extremely costly. According to 2018 estimates from the USDA's Economic Research Service, the 15 major pathogens that cause over 95 percent of the illnesses and deaths from foodborne illnesses in the U.S. cost over \$17 billion per year in direct medical expenses and lost productivity. Infections with the bacteria Salmonella alone account for over \$4 billion yearly in direct and indirect medical costs.

The impact of the COVID-19 pandemic and associated closures has been significant, triggering a recession and high unemployment. The national unemployment rate jumped from 4.4% in March of 2020 to 14.7% in April and stayed in the double-digits through most of the summer. Some studies estimate that 1 in 5 renters are at risk of eviction. The stock market suffered major losses in the early days of the pandemic. The restaurant, retail, and oil and gas industries have been particularly hard hit, with numerous businesses closing or filing for bankruptcy. Among household with children, food insecurity – defined as when a household does not have sufficient food for its members to maintain healthy and active lives and lacks the resources to obtain more food – more than doubled from 14% in 2018 to 32% in July 2020.

Environment and Cultural Resources

Impacts to these resources are typically minimal. However, reduced tourism during outbreaks could lead to additional economic impacts.

Development Trends

Spread of disease in Story County is high due to the population density of 172.1 people per square mile of land area, which is above the national average of 93.8 people per square mile. During the school year the population increases due to the Iowa State University campus in the City of Ames. With students living in close proximity to one another the opportunity for disease to spread from person to person in the County is high.



The pandemic predictions for Iowa from the *Iowa Pandemic Influenza Annex* are that 15-35 percent of the population may be affected with a “medium level” case scenario with no vaccine and no antiviral drugs, which could cause 900-2,000 deaths and 3,000-7,000 hospitalizations statewide. Using pandemic influenza as the worst-case scenario for estimating projected numbers of people affected, the Story County *Pandemic Influenza Response Plan 2009* states that 30 percent of the overall population could be ill in this scenario. Table 4-38 lists the number of persons affected by jurisdiction in Story County based on the 2020 census population.

Table 4-38: Pandemic Influenza Worst Case Scenario Projected Numbers of People Affected

Jurisdiction	2020 Population	30% of Population Affected
Ames	66,427	19,928
Cambridge	827	248
Collins	495	149
Colo	845	254
Gilbert	1,211	363
Huxley	4,244	1,273
Kelley	304	91
McCallsburg	353	106
Maxwell	859	258
Nevada	6,925	2,078
Roland	1,362	409
Sheldahl	297	89
Slater	1,543	463
Story	3,352	1,006
Zearing	528	158
Story County	98,537	29,561

Source: U.S. Census, 2020 <https://data.census.gov/>

As populations increase in Story County and cities such as Ames, Huxley, Maxwell, Nevada, and Slater continue to experience growth and development while the costs of health care increases, it is expected the potential loss to human disease is expected to rise.

4.3.8 Infrastructure Failure

Future Probability	Magnitude/Severity	Location	Hazard Ranking
Likely	Critical	Extensive	Medium

Risk Summary

Overall, Infrastructure Failure is ranked as **medium** for the County.

- The entire County is vulnerable to communication and energy failure; therefore, the geographic area is **extensive**. Other types of infrastructure failures, such as a dam and bridge failures, typically impact a more localized area.
- It is **likely** that infrastructure failures will happen again in the future.
- Historically the vast majority of infrastructure failures in Story County have had negligible impacts. However, the potential magnitude of infrastructure failure can be catastrophic. Communication failures can prevent emergency responders from assisting the community and spreading warning messages to residents. Power failures can jeopardize the health and safety of residents who

depend on electricity to survive. Road and bridge failures can injure commuters. Overall, the magnitude is considered to be **critical**.

- Property, particularly vehicles, can be damaged due to road and bridge failure. Significant damages to buildings can occur as a result of structure fire.
- Infrastructure failure can create loss of revenue from halted business. FEMA found that loss of electricity costs, on average, \$126 per person per day.
- Environmental impacts from infrastructure failure include erosion and sedimentation (dam failure and water main break), as well as polluting the environment with debris (dam failure, bridge failure, and structure fire)
- Related hazards: All hazards

Description

Critical infrastructure involves several different types of facilities and systems including electric power, transportation routes, natural gas and oil pipelines, water and sewer systems, storage networks and internet/telecommunications systems. Failure of utilities or other components of the infrastructure in the planning area can seriously impact public health, functioning of communities and the economy. Disruption of any of these services could result from the majority of the natural, technological, and manmade hazards described in this plan. In addition to a secondary or cascading impact from another primary hazard, utilities and infrastructure can fail as a result of faulty equipment, lack of maintenance, degradation over time, or accidental damage such as damage to buried lines or pipes during excavation.

Communications Failure

Communications failure is the widespread breakdown or disruption of normal communication capabilities. This could include major telephone outages, internet interruption, loss of cellular telephone service, loss of local government radio facilities, long-term interruption of electronic broadcast services, or emergency 911. Law enforcement, fire, emergency medical services, public works, and emergency warning systems are just a few of the vital services which rely on communications systems to effectively protect citizens. In addition, business and industry rely heavily on various modes of communication. Mechanical failure, traffic accidents, power failure, line severance, and weather can all affect communications systems and disrupt service. Disruptions and failures can range from localized and temporary to widespread and long-term.

The types of hazards and impacts to internet and telecommunications infrastructure are very similar to electric power supply. Land line phone lines often utilize the same poles as electric lines. So, when weather events such as windstorm or winter weather cause lines to break, both electricity and telephone services experience outages. With the increasing utilization of cellular phones, hazard events such as tornado that can damage cellular repeaters can cause outages. In addition, during any hazard event, internet and telecommunications systems can become overwhelmed due to the surge in call/usage volume. The HMPC also noted the potential for hacking to disrupt or damage communications networks.

Energy Failure

Energy failure includes interruption of service to electric, petroleum, or natural gas. Disruption of electric power supply can be a cascading impact of several other hazards. Electric power is the type of energy failure that is most often a secondary impact of other hazard events. The most common hazards analyzed in this plan that disrupt power supply are flood, tornado, windstorm, and winter weather as these hazards can cause major damage to power infrastructure. To a lesser extent, extreme temperatures, lightning, and terrorism can disrupt power. Extreme heat can disrupt power supply when air conditioning use spikes during heat waves which can cause brownouts. Dam failure is similar to flood in that infrastructure can be damaged or made inaccessible by water. Lightning strikes can damage substations and transformers but is usually



isolated to small areas of outage. Many forms of terrorism could impact power supply either by direct damage to infrastructure or through cyber-terrorism targeting power supply networks.

Primary hazards that can impact natural gas and oil pipelines are earthquake, expansive soils, land subsidence, landslide, and terrorism.

Structural Failure/Structure Fire

The collapse (partial or total) of any structure including roads, bridges, towers, and buildings is considered a structural failure. A road, bridge, or building may collapse due to the failure of the structural components or because the structure was overloaded. Natural events such as heavy snow may also cause the roof of a building to collapse (under the weight of snow). In 1983 a KWWL television tower collapsed due to ice buildup. Heavy rains and flooding can undercut and washout a road or bridge. This occurred twice in 2008 when railway bridges failed in Waterloo and Cedar Rapids due to flooding. The age of the structure is sometimes independent of the cause of the failure. Adoption and enforcement of building codes can better guarantee that structures are designed to hold-up under normal conditions. Routine inspection of older structures may alert inspectors to weak points. The level of damage and severity of the failure is dependent on factors such as the size of the building or bridge, the number of occupants of the building, the time of day, day of week, amount of traffic on the road or bridge, and the type and number of products stored in the structure. There have been structural failures across the state in the past as mentioned above. They have included homes, commercial structures, and communications towers. There is no central collection point for this information, but news articles document infrastructure failure.

A structural fire is an uncontrolled fire in a populated area that threatens life and property and is beyond normal day-to-day response capability. Structural fires present a far greater threat to life and property and the potential for much larger economic losses. Modern fire codes and fire suppression requirements in new construction and building renovations, coupled with improved fire-fighting equipment, training, and techniques lessen the chance and impact of a major urban fire. Most structural fires occur in residential structures, but the occurrence of a fire in a commercial or industrial facility could affect more people and pose a greater threat to those near the fire or fighting the fire because of the volume or type of the material involved. Less severe structural fires are almost a common occurrence in some communities.

Other Utility Failure

Interruption of other utilities such as water and sewer systems can be a devastating, costly impact. The primary hazards that can impact water supply systems are drought, flood, hazardous materials, and terrorism. Winter storm can also impact water supply if low temperatures cause failure/breakage of water infrastructure. The primary hazard that impacts sewer systems is flood.

Location

The location of infrastructure failure is considered **extensive**. The entire planning area is at risk to all types of infrastructure failure included in the hazard description section, either from primary failure due to malfunction, degradation, or accidental or intentional damage or as a result of a secondary impact related to another hazard event. Power outages can occur in outlying areas with more frequency than in more developed areas. A loss of electric power can also interrupt your supply of water from a well. You may also lose food in freezers or refrigerators and power outages can cause problems with computers as well.

Table 4-39 provides the names of electric and natural gas providers for each jurisdiction in Story County. Figure 4-40, which follows, provides a map of critical facilities throughout the county, displayed by the FEMA Community Lifeline to which they belong.

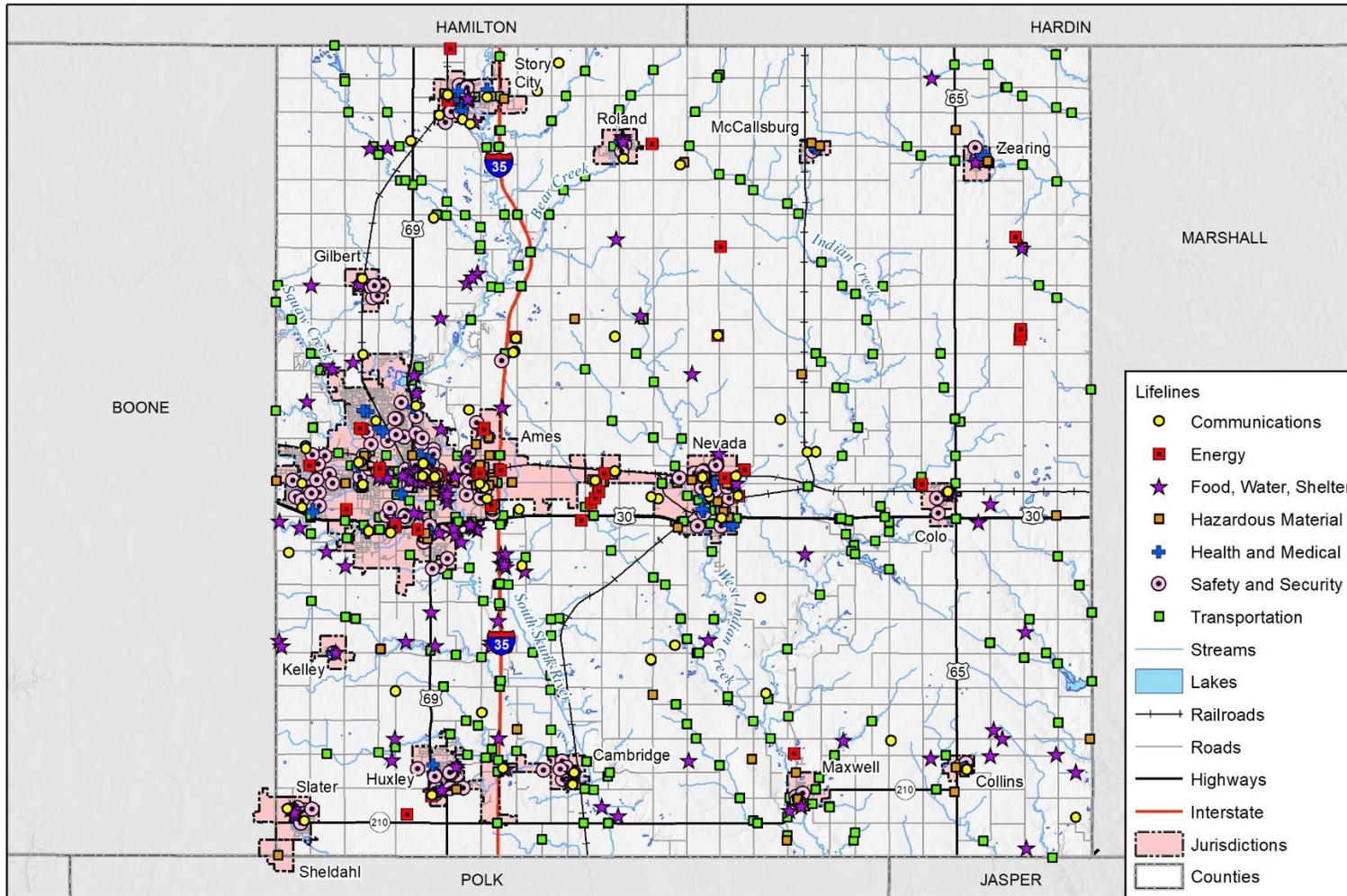


Table 4-39: Electric and Natural Gas Providers

Jurisdiction	Electric Service Providers	Natural Gas Providers
Uninc. County	Consumer's Energy Midland Power Cooperative	Alliant/Interstate Power and Light
Ames	Ames Municipal Alliant/Interstate Power and Light Consumer's Energy	Alliant/Interstate Power and Light
Cambridge	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
Collins	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
Colo	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
Gilbert	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
Huxley	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
Kelley	Alliant/Interstate Power and Light	-
Maxwell	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
McCallsburg	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
Nevada	Alliant/Interstate Power and Light Consumes Energy	Alliant/Interstate Power and Light
Roland	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
Sheldahl	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
Slater	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light
Story City	Story City Municipal	Black Hills Energy
Zearing	Alliant/Interstate Power and Light	Alliant/Interstate Power and Light

Source: Iowa Utilities Board <https://iub.iowa.gov/sites/default/files/files/misc/town-provider-list.pdf>

Figure 4-40 Story County Critical Facilities



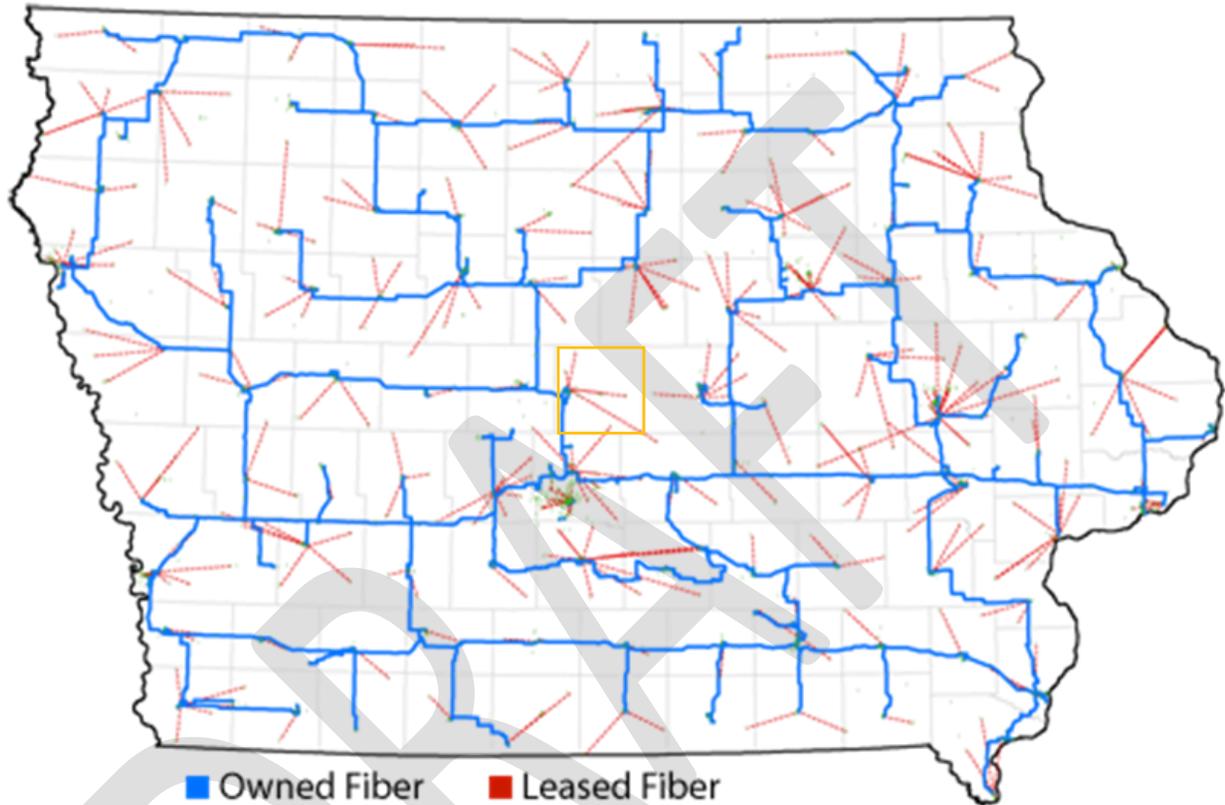
Map compiled 6/2023;
intended for planning purposes only.
Data Source: Story County, NHD, DNR,
HIFLD, National Bridge Inventory



Figure 4-40 above shows the distribution of critical facilities across the County. Most of the energy facilities in the County are concentrated in and around the cities of Ames and Nevada.

Figure 4-41 shows the Iowa Communications Network (ICN) that administers Iowa's statewide fiber optic telecommunications network.

Figure 4-41: Map of Iowa Communication Network



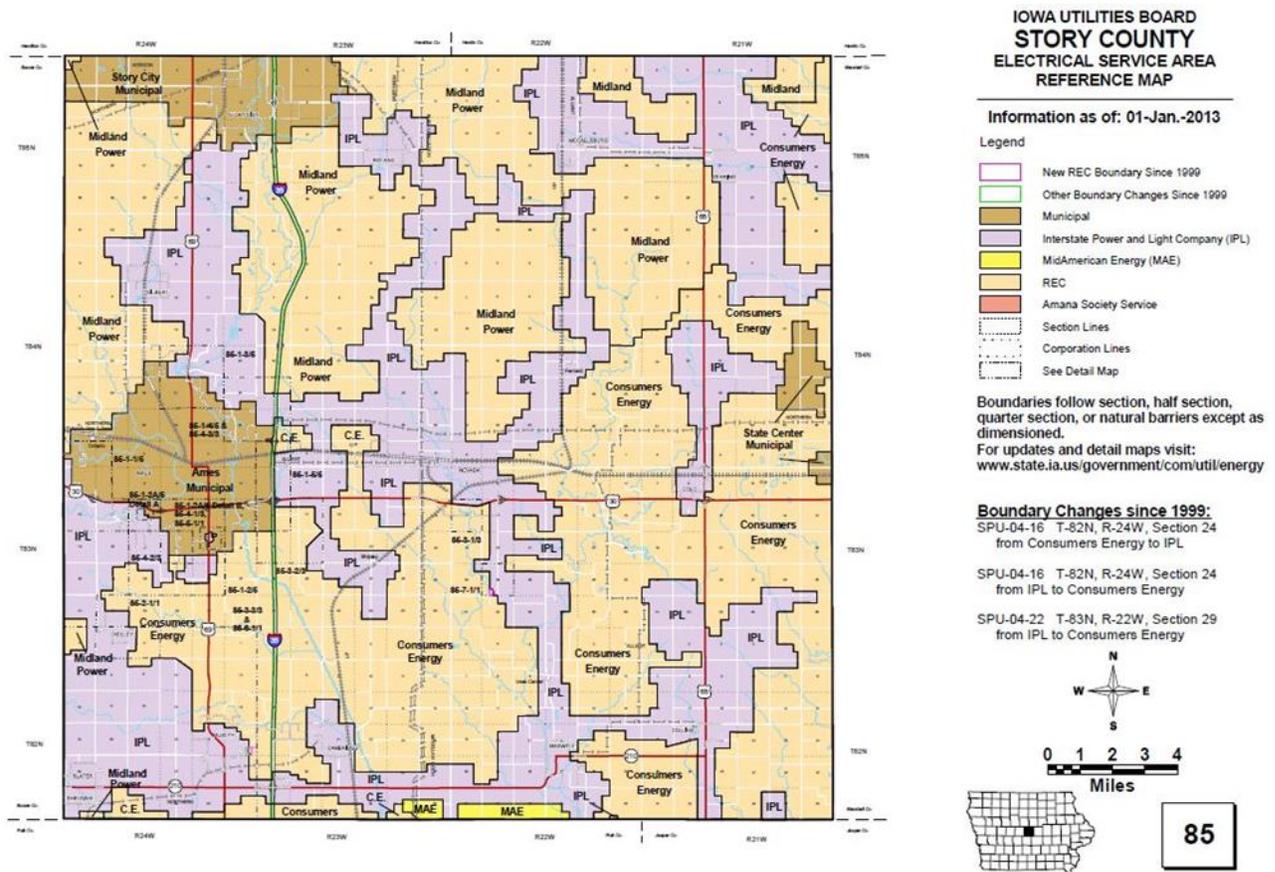
Source: <http://icn.iowa.gov/about-icn/agency-information-icn-story>

Note: Orange box outlines Story County.

Power outages can occur in outlying areas with more frequency than in more developed areas. A loss of electric power can also interrupt supply of water from a well. Food in freezers or refrigerators may also be lost. Power outages can cause problems with computers and other devices as well.

Figure 4-42 shows the electrical service area map for Story County.

Figure 4-42: Electrical Service Areas in Story County



Source: Iowa DOT, https://iowadot.gov/maps/msp/electrical/story_85.pdf

Other Utilities (Water/Sewer)

Water

There are 19 Water Supply Systems in Story County, as shown in Table 4-40.

Table 4-40: Water Supply Systems in Story County

Water Supplier	Jurisdiction	Number of people served
Ames Water Treatment Plant	Ames	41,795
Iowa State University	Ames	28,178
Xenia Rural Water District	Ames	1,183
Squaw Valley South Subdivision	Ames	163
Crestview Mobile Home Park	Ames	95
Cambridge Water Supply	Cambridge	819
Central Iowa Rural Water Assoc.	Collins; McCallsburg; Colo	Unreported
Colo Water Supply	Colo	868
Collins Water Supply	Collins	499
Gilbert Water Supply	Gilbert	987
Huxley Waterworks Dept.	Huxley	2,959
Deer Creek HOA of Story County	Huxley	106
Kelley Water Supply	Kelley	300



Water Supplier	Jurisdiction	Number of people served
Maxwell Water Department	Maxwell	807
McCallsburg Water Supply	McCallsburg	318
Nevada Water Supply	Nevada	6,658
Roland Water Supply	Roland	1,324
Slater Muni Water Dept.	Slater	1,306
Story City Water Dept.	Story City	3,228
Zearing Water Department	Zearing	617

Source: <https://www.nytimes.com/interactive/projects/toxic-waters/contaminants/ia/story/index.html>

Sewer

There are 28 permitted wastewater treatment discharge sites in Story County according to the Iowa Department of Natural Resources, as detailed in Table 4-41.

Table 4-41: Permitted Wastewater Sites in Story County

Facility Name	Facility City	Permit Type	Class	Sic Code	Treatment Type
Ames Water Pollution Control Facility	Ames	Municipal	Major	4952	Trickling Filter
Ames, City of MS4	Ames	Stormwater	Minor	4952	No Treatment
Arctic Glacier, Inc.	Ames	Industrial	Minor	2097	No Treatment
Cambridge City of STP	Cambridge	Municipal	Minor	4952	Aerated Lagoon
City of Ames Steam Electric Plant	Ames	Industrial	Minor	4911	Other
Collins City of STP	Collins	Municipal	Minor	4952	Waste Stabilization Lagoon
Colo City of STP	Colo	Municipal	Minor	4952	Waste Stabilization Lagoon
Country Living Court, LLC	Colo	Semi-Public	Minor	6515	Waste Stabilization Lagoon
Couser Cattle Company	Nevada	Agricultural	Minor	0211	Other
Dupont Celluloic Ethanol	Nevada	Industrial	Minor	2869	Other
Gilbert City of STP	Gilbert	Municipal	Minor	4952	Waste Stabilization Lagoon
Hickory Grove Court, LLC	Ames	Semi-Public	Minor	6515	Septic Tank Sand Filter
Homestead Colony Mobile Home Park	Ames	Semi-Public	Minor	6515	Waste Stabilization Lagoon
Huxley, City of STP	Huxley	Municipal	Minor	4952	Activated Sludge
Iowa DOT Rest Area #19 I35	Story City	Semi-Public	Minor	4959	Waste Stabilization Lagoon
Iowa DOT Rest Area #20 I35	Story City	Semi-Public	Minor	4959	Waste Stabilization Lagoon
Iowa State University MS4	Ames	Stormwater	Minor	4952	No Treatment
Iowa State University Power Plant	Ames	Industrial	Minor	8221	Other
Lincolnway Energy, LLC	Nevada	Industrial	Minor	2869	No Treatment
Maxwell, City of STP	Maxwell	Municipal	Minor	4952	Aerated Lagoon
McCallsburg, City of STP	McCallsburg	Municipal	Minor	4952	Waste Stabilization Lagoon



Facility Name	Facility City	Permit Type	Class	Sic Code	Treatment Type
Nevada, City of STP	Nevada	Municipal	Major	4952	Trickling Filter
Roland, City of STP	Roland	Municipal	Minor	4952	Aerated Lagoon
Rolling Hills Mobile Home Park	Maxwell	Semi-public	Minor	6515	Waste Stabilization Lagoon
Slater, City of STP	Slater	Municipal	Minor	4952	Aerated Lagoon
South Squaw Valley Association	Ames	Semi-public	Minor	4952	Activated Sludge
Story City, City of STP	Story City	Municipal	Minor	4952	Sequencing Batch Reactor
Zearing, City of STP	Zearing	Municipal	Minor	4952	Waste Stabilization Lagoon

Source: Iowa Department of Natural Resources, <http://www.iowadnr.gov/Environmental-Protection/Water-Quality/NPDES-Wastewater-Permitting/Current-NPDES-Permits>

Past Occurrences

As indicated in the Description Section, Infrastructure Failure often occurs as a secondary impact to other hazard events. For specific descriptions, please see the Previous Occurrences section of the other hazards included in this plan. In addition to failure/impacts as a result of other hazard events, Infrastructure Failure can also occur as a result of lack of maintenance, human error, and age deterioration.

The infrastructure failure events provided below are some notable events in the planning area including some events where failure occurred as the primary event, not related to another hazard.

- *August 2020 – numerous jurisdictions reported widespread infrastructure failures during the August 2020 Derecho which impacted Iowa. Long-lasting power outages and damaged buildings and facilities were almost universal.*
- **April 12, 2012**—(primary) Xenia Rural Water Main Break. A water main break in Boone County affected rural residents in Story County. The break caused a loss of pressure in the Xenia system resulting in a 2-day boil order.
- **January 2011**—(primary) Xenia Rural Water Main Break. A water main break in Boone County affected rural residents in Story County. The break caused a loss of pressure in the Xenia system resulting in a 2-day boil order.
- **August 10, 2010**—(secondary from river flood) Ames Water Main Break. Three to five inches of rain fell on saturated ground, resulting in a very widespread flash flood event. Very intense rainfall in the Ames area resulted in a record crest on Squaw Creek. The creek crested 1.5 to 2.5 feet above the record high stage. Major flooding took place. A water main break resulted in the draining of the City of Ames water tower at State Ave and Mortensen Rd. This water main break and multiple smaller water main breaks caused a loss of pressure in the distribution system which ultimately resulted in the City of Ames issuance of a boil water advisory that lasted four days.

The HMPC noted several other infrastructure failure occurrences, including a damaged bridge in unincorporated Story County that restricted access to the wastewater treatment plant and a downed tree near Iowa State University which caused power loss for several hours. While there are no known previous occurrences, the HMPC also noted the possibility for cyber-attacks and hacking to cause infrastructure failure.



Probability of Future Occurrences

The HMPC determined the probability of future occurrence of this hazard to be “**Likely**”. As discussed in other hazard sections in this plan, infrastructure failure occurs as a secondary or cascading impact from several primary hazards such as winter storm, windstorm, and tornado as well as lack of maintenance and age deterioration and other human-caused incidents such as human error, and various forms of terrorism. Structure fire events also occur annually.

Magnitude/Severity

The overall magnitude and severity of infrastructure failure is “**Critical**”. Severity of impact is dependent on the event. Infrastructure failure cannot be predicted. There would be minimal or no warning time if an infrastructure failure occurred. Energy disruptions and communications failures generally do not result in injuries or illnesses, have a limited impact on property damage, and results in a brief interruption of essential facilities or services. Structural fires, bridge failures, and dam failures could potentially cause serious injury and major property damage that threatens structural stability.

Climate Change Considerations

As mentioned throughout, since this hazard typically is a result of other hazard events, with changes in the expected frequency and severity of various hazards as a result of climate change, impacts to frequency of infrastructure failures may occur as well. Please refer to the Climate Change Considerations sections of other profiled hazards that often cause a cascading or secondary impact of infrastructure failure, such as Flooding, Tornado/Windstorm, Severe Summer Weather, Severe Winter Storms, Grass/Wildland Fire, and Extreme Heat.

Vulnerability

Iowa is almost entirely dependent on out-of-state resources for energy. Iowans purchase oil, coal, and natural gas from outside sources. As a result, world and regional fuel disruptions are felt in Iowa.

Every community in the planning area is at risk to some type of utility/infrastructure failure. Business and industry in the urban areas are reliant on electricity to power servers, computers, automated systems, etc. Rural areas of the County are vulnerable as well, as modern agricultural practices are reliant on energy, such as electric milking machines and irrigation pivots.

Generally, the smaller utility suppliers such as small electrical suppliers have limited resources for mitigation. This could mean greater vulnerability in the event of a major, widespread disaster, such as a major flood, severe winter storm or ice storm. The municipal utilities that exist in the County purchase power on the wholesale market for resale to their customers. This may make them more vulnerable to regional shortages as well, although they do vary their portfolios to avoid reliance on a sole provider.

In the event of a large-scale event impacting water supply or wastewater treatment, homes and businesses with well-supplied water and septic systems for waste treatment would be largely unaffected. However, these systems may be prone to individual failure and do not have back-up systems in place in the event of failure, as larger systems might.

People

People can be impacted by critical infrastructure in many ways. In the case of road or bridge failure, transportation routes can be closed or altered, preventing people from easily leaving an area. Additionally, supply chain issues can occur during road closures, preventing the transportation of goods in and out of



the County. Communication infrastructure failures can result in delayed first responders and public warning messages. Damages to energy infrastructure jeopardize individuals who are dependent on electricity to survive.

Property

Damaged critical infrastructure can cause damage to property in some situations. For instance, poor roadway or railway conditions can cause damage to the vehicles. Structural fires can completely destroy homes and buildings. Water main breaks can result in local flooding.

Critical Facilities and Infrastructure

As mentioned above, critical infrastructure failure can result from a hazard or on its own. One infrastructure failure can result in other infrastructure failures. A power failure could impact police stations and emergency service personnel's ability to respond to emergencies. Failure of bridges or other road infrastructure could increase response times or limit transportation options or affect delivery of emergency supplies for all residents. Power losses and sewer backups can affect businesses and recreational facilities. Redundancies within these systems can prevent losses during period of damaged critical infrastructure.

The Iowa Department of Transportation has conducted inspections of bridges in the state. Table 4-42 provides a summary of the condition of the 294 bridges in Story County.

Table 4-42: Story County Bridge Condition, SDFO Ratings, Weight Restrictions

Condition Index Rating—All Bridges in Story County		
Good	Fair	Poor
100	150	44
Structurally Deficient/Functionally Obsolete (SDFO) Rating—All Bridges in Story County		
Not Deficient	Structurally Deficient	Functionally Obsolete
250	44	N/A
Weight Restrictions—All Bridges in Story County		
Unrestricted	Restricted	Closed
201	86	7

Source: Iowa Department of Transportation,
<http://iowadot.maps.arcgis.com/apps/MapSeries/index.html?appid=db6cb43313354a4f85505089ab317e7a>

Economy

Since utility/infrastructure failure is generally a secondary or cascading impact of other hazards, it is not possible to quantify estimated potential losses specific to this hazard due to the variables associated with affected population, duration of outages, etc.

Although the variables make it difficult to estimate specific future losses, FEMA has developed standard loss of use estimates in conjunction with their Benefit-Cost Analysis methodologies to estimate the cost of lost utilities on a per-person, per-use basis (See Table 4-43).

Table 4-43: FEMA Standard Values for Loss of Service for Utilities and Roads/Bridges

Power Loss	Cost of Complete Loss of Service
Loss of Electric Power	
Total Economic Impact	\$126 per person per day
Loss of Potable Water Service	
Total Economic Impact	\$93 per person per day
Loss of Wastewater Service	



Power Loss	Cost of Complete Loss of Service
Total Economic Impact	\$41 per person per day
Loss of Road/Bridge Service	
Vehicle Delay Detour Time	\$38.15 per vehicle per hour
Vehicle Delay Mileage	\$0.55 per mile (or current federal mileage rate)

Source: FEMA BCA Reference Guide, June 2009, Appendix C

Environment and Cultural Resources

Some critical infrastructure failures can have significant impacts on the environment. For instance, sewer backups and water main breaks can pollute the environment, while dam failures can result in erosion, sedimentation, threaten local fish populations, and impact the local fishing economy.

Development Trends

Increases in development and population growth would increase the demand for utilities and use of infrastructure as well as the level of impacts when the utilities or infrastructure fail. Story County and the jurisdictions within the county have seen the population grow over the last 5 years. As technological advances are made and systems become more and more automated and dependent on power and communications infrastructure, the impacts of infrastructure failure could increase even though population is decreasing slightly.

4.3.9 Severe Summer Weather (Thunderstorm/Lightning/Hail)

Future Probability	Magnitude/Severity	Location	Hazard Ranking
Highly Likely	Critical	Extensive	High

Risk Summary

Severe Summer Weather has an overall significance rating of **High** for Story County and its jurisdictions.

- There have been 668 recorded hail, lightning, and thunderstorm wind events in the county since 1996, according to the NCEI. The actual number of events is likely much higher, with an average of 16 Severe Thunderstorm Watches or Warnings issued by the NWS each year. This indicates that Story County can expect to have numerous events occur each year, giving a future probability of **Highly Likely**.
- The potential magnitude and severity of Severe Summer Weather is **Critical**.
- Winter storms occur on a regional scale, and most occurrences would impact all of Story County at once. Therefore, the location is considered **extensive**.
- These events have cumulatively caused \$9,726,000 in reported property damages and at least 11 injuries in the county since 1996.
- 3.1% of Medicare beneficiaries in the County rely on electricity-dependent medical equipment to live independently in their own homes making them vulnerable to lightning and severe wind events that may result in power outages.
- Related hazards: flooding, grass/wildland fire, infrastructure failure, tornado/windstorm.



Description

For this plan, severe summer weather in Story County includes thunderstorms, hail, heavy rain, and lightning. A brief description of these weather phenomena is presented below. More information on thunderstorm winds, high winds, and tornadoes, which typically are associated with summer weather, can be found in the Tornadoes and Windstorms section of the plan.

A thunderstorm is defined as a storm that contains lightning and thunder which is caused by unstable atmospheric conditions. When the upper air which is cold sinks and the warm moist air rises, storm clouds or 'thunderheads' develop resulting in thunderstorms. This can occur singularly, in clusters or in lines. Severe thunderstorms most often occur in Iowa in the spring and summer, during the afternoon and evenings, but can occur at any time. Thunderstorms can result in heavy rains, high winds, tornadoes, and hail. All thunderstorms are dangerous, according to FEMA. Associated dangers of thunderstorms include tornados, strong winds, hail, and flash flooding. Flash flooding is responsible for the most deaths. Dry thunderstorms that do not produce rain that reaches the ground are most prevalent in the western United States. Falling raindrops evaporate, but lightning can still reach the ground and can start wildfires.

Thunderstorms are created from a combination of moisture, rapidly raising warm air, and the lifting mechanism such as that caused when warm and cold air masses collide. Thunderstorms are hazards unto themselves, but can cause other hazards such as flash flooding, river flooding, and tornadoes/windstorms. Hailstorms are a product of a severe thunderstorm in which pellets or lumps of ice (of most concern when greater than 1 inch in diameter) fall with rain.

The National Weather Service considers a thunderstorm severe if it produces hail at least $\frac{3}{4}$ inch in diameter, wind 58 mph or higher, or tornadoes. High straight-line winds, which can often exceed 60 mph, are common occurrences and are often mistaken for tornadoes. Hail is produced by many strong thunderstorms. Strong rising currents of air within a storm will carry water droplets to a height where freezing occurs. The size of hail ranges from 0.75 inches in diameter to 2.75 inches. Ice particles grow in size until they are too heavy to be supported by the updraft. Hail can be smaller than a pea or as large as a softball and can be very destructive to plants and crops. Pets and livestock are particularly vulnerable to hail. The onset of severe summer weather is generally rapid. However, advancements in meteorological forecasting allow for some advance warning.

Lightning

All thunderstorms produce lightning which often strikes outside of the area where it is raining and is known to strike more than 10 miles away from the rainfall area. Thunder is simply the sound that lightning makes. Lightning is an electrical discharge that results from the buildup of positive and negative charges within a thunderstorm. When the buildup becomes strong enough, lightning appears as a "bolt." This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning reaches temperatures approaching 50,000 degrees Fahrenheit in a split second. This rapid heating, expansion, and cooling of air near the lightning creates thunder. According to the National Weather Service, lightning kills on average 49 people per year in the United States. Lightning strikes can also start building fires, wildland fires, and damage electrical systems and equipment.

Hail

According to the National Oceanic and Atmospheric Administration (NOAA), hail is precipitation that is formed when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere causing them to freeze. The raindrops form into small frozen droplets and then continue to grow as they come into contact with super-cooled water which will freeze on contact with the frozen rain

droplet. This frozen rain droplet can continue to grow and form hail. As long as the updraft forces can support or suspend the weight of the hailstone, hail can continue to grow.

At the time when the updraft can no longer support the hailstone, it will fall down to the earth. For example, a ¼" diameter or pea sized hail requires updrafts of 24 mph, while a 2 ¾" diameter or baseball sized hail requires an updraft of 81 mph. The largest hailstone recorded in the United States was found in Vivian, South Dakota on July 23, 2010, measuring eight inches in diameter, almost the size of a soccer ball. Soccer-ball-sized hail is the exception, but even small pea sized hail can do damage.

Hailstorms in Iowa cause damage to property, crops, and the environment, and kill and injure livestock. In the United States, hail causes more than \$1 billion in damage to property and crops each year. Much of the damage inflicted by hail is to crops. Even relatively small hail can shred plants to ribbons in a matter of minutes. Vehicles, roofs of buildings and homes, and landscaping are the other things most commonly damaged by hail. Hail has been known to cause injury to humans; occasionally, these injuries can be fatal.

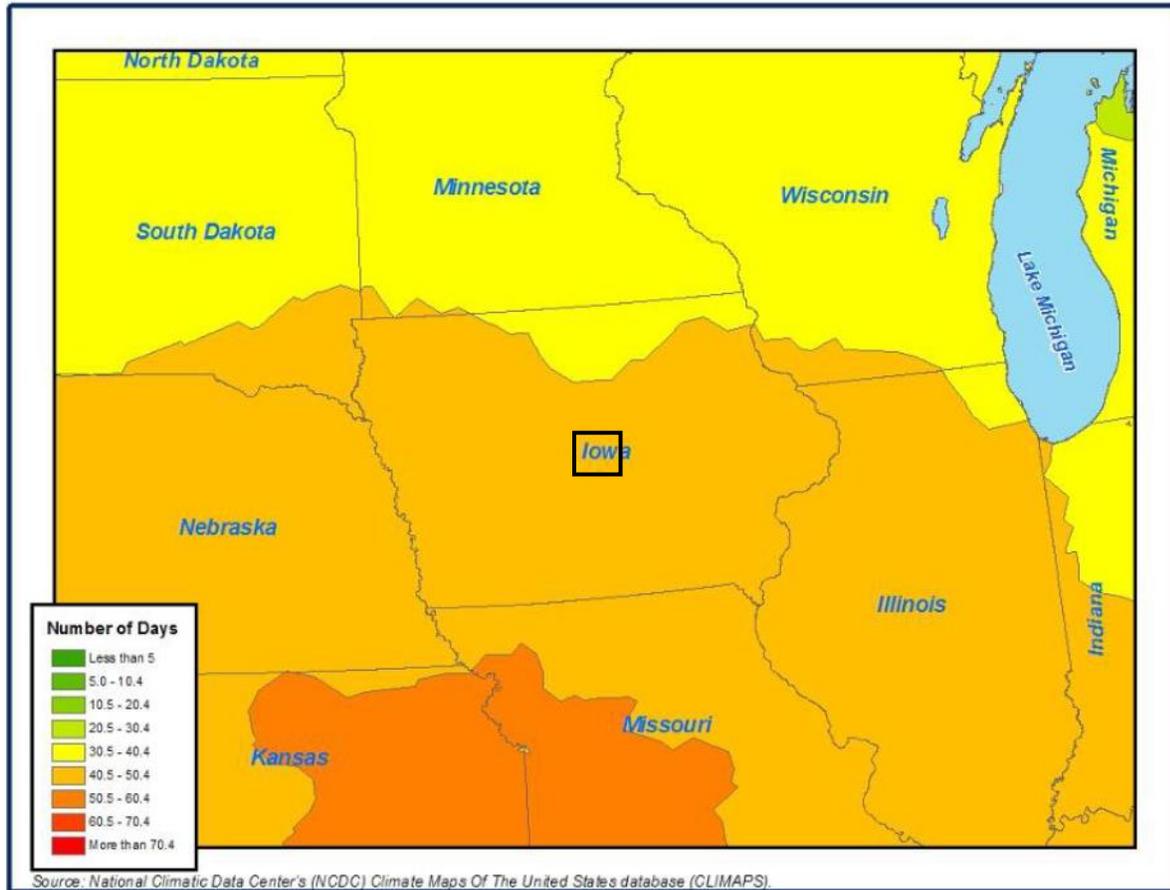
Heavy Rain

Heavy rain is typically associated with thunderstorm conditions and can result in flash flooding. On occasion, heavy rains and melting snow have been reported to cause ice jams and further the accumulation of flash flooding. This sudden and generally localized flooding can block transportation routes, create dangerous stream crossings, flood basements and buildings, and sweep away vehicles and people.

Location

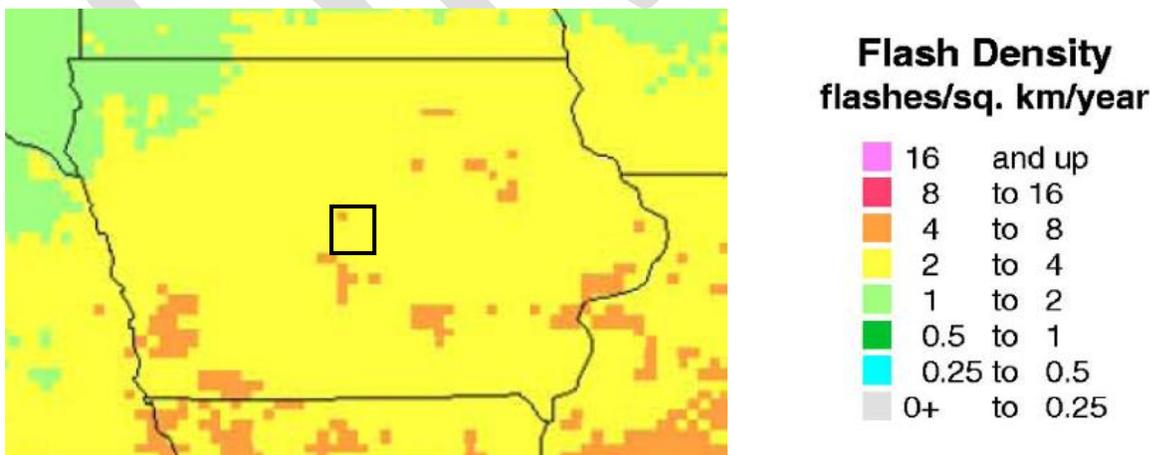
Location is considered "**extensive**" for severe summer weather, as it is very likely that individual instances of severe summer weather will be impacting 50% of the county or more at a time. Severe summer weather events impact the entire County with relatively similar frequency. Although these events occur similarly throughout the planning area, they are more frequently reported in more urbanized areas. In addition, damages are more likely to occur in more densely developed urban areas, as well as cropland. Figure 4-43 displays the average number of days with thunder experienced throughout different areas of the county each year, showing the County experiences between 40.5 to 50.4 days with thunder per year. Figure 4-44 shows 2 to 4 lightning strikes per square kilometer per year throughout the County, with 4-8 strikes per square kilometer per year in isolated areas (the orange areas).

Figure 4-43: Distribution and Frequency of Thunderstorms



Note: Black Square indicates approximate location of Story County

Figure 4-44: Location and Frequency of Lightning in Iowa



Source: National Weather Service, www.lightningsafety.noaa.gov/lightning_map.htm

Note: Black Square indicates approximate location of Story County



Past Occurrences

Since 1965, Story County has been included in seven Presidential Disaster declarations that included severe summer storms/weather (see Table 4-2 in the Hazard Identification Section). Some of the damages that resulted in the declarations were from tornadoes and flooding that accompanied the severe weather.

The NCEI reported 668 total thunderstorm events for the Story County planning area from January 1996 through June 2023. Together these reported events resulted in \$9,726,000 in total property damage, \$2,828,500 in crop damage, 11 injuries, and no fatalities. This information is summarized in Table 4-44 below. Additionally, from 1986 to August 2023 the Iowa State Environmental Mesonet Database reported 600 Severe Thunderstorm Watches and Warnings from the National Weather Service issued for Story County.

Table 4-44: Thunderstorm Summary for Story County (1996-2023)

Hazard type	Total Events	Crop Damage	Property Damage	Injuries	Fatalities
Hail	280	\$1,655,000	\$2,658,000	0	0
Lightning	13	\$0	\$1,232,000	4	0
Thunderstorm Wind	375	\$1,173,500	\$5,836,000	7	0
Totals	668	\$2,828,500	\$9,726,000	11	0

Source: NCEI

Thunderstorm Winds

Although NCEI provides estimates of crop losses, crop insurance payment statistics are considered a more accurate resource for this data. According to the USDA Risk Management Agency, insured crop losses in Story County from 2007 to 2021 as a result of hail totaled \$274,828,959, for an average of \$18.3M per year (see Table 4-45). Damage from windstorms during the same period totaled \$99,599,240, for an average of \$6.6M per year. There was no crop damage reported from lightning.

Table 4-45: Crop Insurance Claims Paid in Story County from Hailstorms and Windstorms, 2007-2021

Year	Hail	Wind/Excess Wind	Total Insurance Paid
2007	\$8,373,150	\$9,599,962	\$17,973,112
2008	\$29,008,058	\$7,618,755	\$36,626,813
2009	\$77,495,505	\$992,887	\$78,488,392
2010	\$5,622,225	\$986,632	\$6,608,857
2011	\$39,438,679	\$26,819,731	\$66,258,410
2012	\$6,402,785	\$10,475,134	\$16,877,919
2013	\$9,487,633	\$4,217,003	\$13,704,636
2014	\$90,247,363	\$11,484,015	\$101,731,378
2015	\$3,139,914	\$2,714,320	\$5,854,234
2016	\$5,058,539	\$3,322,207	\$8,380,746
2017	\$78,434	\$71	\$78,505
2018	\$10,2801	\$195,086	\$297,887
2019	-	-	\$0
2020	\$350,402	\$21,173,437	\$21,523,839
2021	\$23,471	-	\$23,471
Grand Total	\$274,828,959	\$99,599,240	\$374,428,199

Source: USDA Risk Management Agency



Probability of Future Occurrence

Severe summer weather is considered **“highly likely”** for Story County. Based on the number of Severe Thunderstorm Watches and Warnings issued since 1986, the county can expect to see an average of approximately 16 severe thunderstorms per year, meaning there is essentially a 100% chance for severe summer weather to occur on an annual basis.

Magnitude/Severity

The magnitude and severity of severe summer weather is **“critical”**. It is possible for the entire county to be affected by a large thunderstorm and lightning event that moves across the entire county, but effects are often localized. Thunderstorms can bring large hail that can damage homes and businesses, break glass, destroy vehicles, and cause bodily injury to people, pets, and livestock. One or more severe thunderstorms occurring over a short period can lead to flooding and cause extensive damage, power and communication outages, and agricultural damage.

In extreme or isolated circumstances, severe thunderstorms can bring straight-line winds in excess of 100 mph. Straight-line winds are responsible for most thunderstorm damage. High winds can damage trees, homes (especially mobile homes), and businesses and can knock vehicles off of the road. The power of lightning’s electrical charge and intense heat can electrocute people and livestock on contact, split trees, ignite fires, and cause electrical failures.

The National Weather Service (NWS) will issue a Severe Thunderstorm Warning whenever a thunderstorm is forecasted to produce wind gusts to 58 miles per hour (50 knots) or greater and/or hail size one-inch (quarter-size) diameter which can produce significant damage. Based on information provided by the Tornado and Storm Research Organization, Table 4-46 below describes typical damage impacts of the various sizes of hail.

Table 4-46: Tornado and Storm Research Organization Hailstorm Intensity Scale

Intensity Category	Diameter (mm)	Diameter (inches)	Size Description	Typical Damage Impacts
Hard Hail	5-9	0.2-0.4	Pea	No damage
Potentially Damaging	10-15	0.4-0.6	Mothball	Slight general damage to plants, crops
Significant	16-20	0.6-0.8	Marble, grape	Significant damage to fruit, crops, vegetation
Severe	21-30	0.8-1.2	Walnut	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
Severe	31-40	1.2-1.6	Pigeon’s egg > squash ball	Widespread glass damage, vehicle bodywork damage
Destructive	41-50	1.6-2.0	Golf ball > Pullet’s egg	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
Destructive	51-60	2.0-2.4	Hen’s egg	Bodywork of grounded aircraft dented, brick walls pitted
Destructive	61-75	2.4-3.0	Tennis ball > cricket ball	Severe roof damage, risk of serious injuries
Destructive	76-90	3.0-3.5	Large orange > Soft ball	Severe damage to aircraft bodywork
Super Hailstorms	91-100	3.6-3.9	Grapefruit	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
Super Hailstorms	>100	4.0+	Melon	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Source: Tornado and Storm Research Organization (TORRO), Department of Geography, Oxford Brookes University

Notes: In addition to hail diameter, factors including number and density of hailstones, hail fall speed and surface wind speeds affect severity.



Climate Change Considerations

Climate change presents a significant challenge for risk management associated with severe weather. The frequency of severe weather events has increased steadily over the last century. The number of weather-related disasters during the 1990s was four times higher than in the 1950s, and cost 14 times as much in economic losses. Historical data shows that the probability for severe weather events increases in a warmer climate. The changing hydrograph caused by climate change could have a significant impact on the intensity, duration, and frequency of storm events. All of these impacts could have significant economic consequences.

Vulnerability

In general, assets in the County are vulnerable to severe summer weather including people, crops, livestock, vehicles, and built structures. Although this hazard results in high annual losses, generally private property insurance and crop insurance cover the majority of losses. Considering insurance coverage as a recovery capability and therefore mitigation of devastating impacts to the economy, the overall impact on jurisdictions is reduced.

Hail can also do considerable damage to vehicles and buildings. Hail only rarely results in loss of life directly, although injuries can occur.

Effects of this hazard could range from minimal and localized property damage to widespread or significant property damage affects a large portion of a jurisdiction. In addition to routine damage, several jurisdictions in the county do not currently have safe rooms available for their residents. These factors could affect each community' vulnerability to thunderstorm, lightning, and hail events.

People

People in unprotected areas, mobile homes, or automobiles during a storm are especially at risk of thunderstorm, lightning, and hailstorms. Sudden strong winds often accompany a severe thunderstorm and may blow down trees across roads and power lines. Lightning presents the greatest immediate danger to people and livestock during a thunderstorm. It is the second most frequent weather-related killer in the U.S. with nearly 100 deaths and 500 injuries each year. Hail only rarely results in loss of life directly, although injuries can occur.

Livestock and people who are outdoors, especially under a tree or other natural lightning rods, in or on water, or on or near hilltops are at risk from lightning. Hail can be very dangerous to people, pets, and livestock if shelter is not available. Flash floods and tornadoes can develop during thunderstorms as well. People who are in automobiles or along low-lying areas when flash flooding occurs and people who are in mobile homes are vulnerable to the impacts of thunderstorms.

Property

Hail can also do considerable damage to vehicles and buildings. According to the NCEI Storm Events Database, between 1996 and 2023 approximately \$9,726,000 in total property damage and \$2,828,500 in crop damages occurred in Story County from thunderstorms, hail, and lightning. As mentioned throughout this section, these damages are often insured.

Critical Facilities and Infrastructure

Hail can lead to the temporary incapacitation of roads when small hail stones build up so deep, they block roads. Hail has also been observed to block storm drains and prevent proper runoff, potentially resulting in flooding as a secondary hazard. Most structures, including the County's critical facilities, should be able to provide adequate protection from hail but the structures could suffer broken windows and dented exteriors. Those facilities with back-up generators are better equipped to handle a severe weather situation should



the power go out. Critical facilities and infrastructure can potentially be damaged by a direct lightning strike. The effect of wind, combined with lightning, rain and hail, on power delivery is a significant factor when assessing current development exposure.

Economy

The economic impact of a severe thunderstorm is typically short term. Lightning and high wind events can cause power outages and fires. Generally, long-term economic impacts center more around hazards that cascade from a severe thunderstorm, including wildfires ignited by lightning. Similarly, with the previous sections, lightning can cause structural damage or damage to electrical systems to private buildings as well as critical infrastructure. Hail and high wind damage can also force the temporary closure of businesses, resulting in lost income and wages in addition to the recovery costs of repairing damage.

Environment and Cultural Resources

While hail and lightning are natural environmental processes, it can cause significant environmental damage, breaking tree limbs, damaging trees and other plants in bloom, and destroying crops. Some cultural and historic properties may also potentially be at risk of damage from hail.

Development Trends

Any additional future development in Story County will result in more property being vulnerable to damages from severe thunderstorms, lightning and hail. To minimize vulnerability, protective measures could be implemented such as wind-resistant construction, lightning rods, surge protection, and use of materials less prone to hail/wind damage. Land use policies should be identified in master plans and enforced through zoning code and the permitting process as well to address the secondary impacts of this hazard. With these tools, the planning partnership will be well equipped to deal with future growth and the associated impacts of severe weather.

4.3.10 Severe Winter Storm

Future Probability	Magnitude/Severity	Location	Overall Significance
Highly Likely	Limited	Extensive	High

Risk Summary

- The overall significance of winter storms is **high**.
- Winter storms of varying severity can be expected to impact the planning area multiple times each year, resulting in a rating of **highly likely** for future probability.
- Winter storms have not historically caused significant damage or casualties in Story County, however the potential for these issues exists. Therefore, the magnitude is considered to be **limited**.
- Winter storms occur on a regional scale, and most occurrences would impact all of Story County at once. Therefore, the location is considered **extensive**.
- There is a significant risk for vehicle accidents and stranded motorists, who may be unprepared to protect themselves from exposure, during winter storms.
- The largest impacts typically involve utility and transportation disruptions.
- Related hazards: Infrastructure Failure, Flooding, Transportation Incident, Windstorm.



Description

Severe winter storms are an annual occurrence in Iowa. A major winter storm can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall, cold temperatures and drifting snow creating blizzards. The National Weather Service describes different types of winter storm events as follows:

- **Blizzard**—Winds of 35 mph or more with snow and blowing snow reducing visibility to less than ¼ mile for at least three hours.
- **Blowing Snow**—Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.
- **Snow Squalls**—Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant.
- **Snow Showers**—Snow falling at varying intensities for brief periods of time. Some accumulation is possible.
- **Freezing Rain**—Measurable rain that falls onto a surface with a temperature below freezing. This causes it to freeze to surfaces, such as trees, cars, and roads, forming a coating or glaze of ice. Most freezing-rain events are short lived and occur near sunrise between the months of December and March.
- **Sleet**—Rain drops that freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects.

Heavy accumulations of ice, often the result of freezing rain, can bring down trees, utility poles, and communications towers and disrupt communications and power for days. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians.

Severe winter storms include extreme cold, heavy snowfall, ice, and strong winds which can push the wind chill well below zero degrees in the planning area. Heavy snow can bring a community to a standstill by inhibiting transportation (in whiteout conditions), weighing down utility lines, and causing structural collapse in buildings not designed to withstand the weight of the snow. Repair and snow removal costs can be significant. Ice buildup can collapse utility lines and communication towers, as well as make transportation difficult and hazardous. Ice can also become a problem on roadways if the air temperature is high enough so that precipitation falls as freezing rain rather than snow.

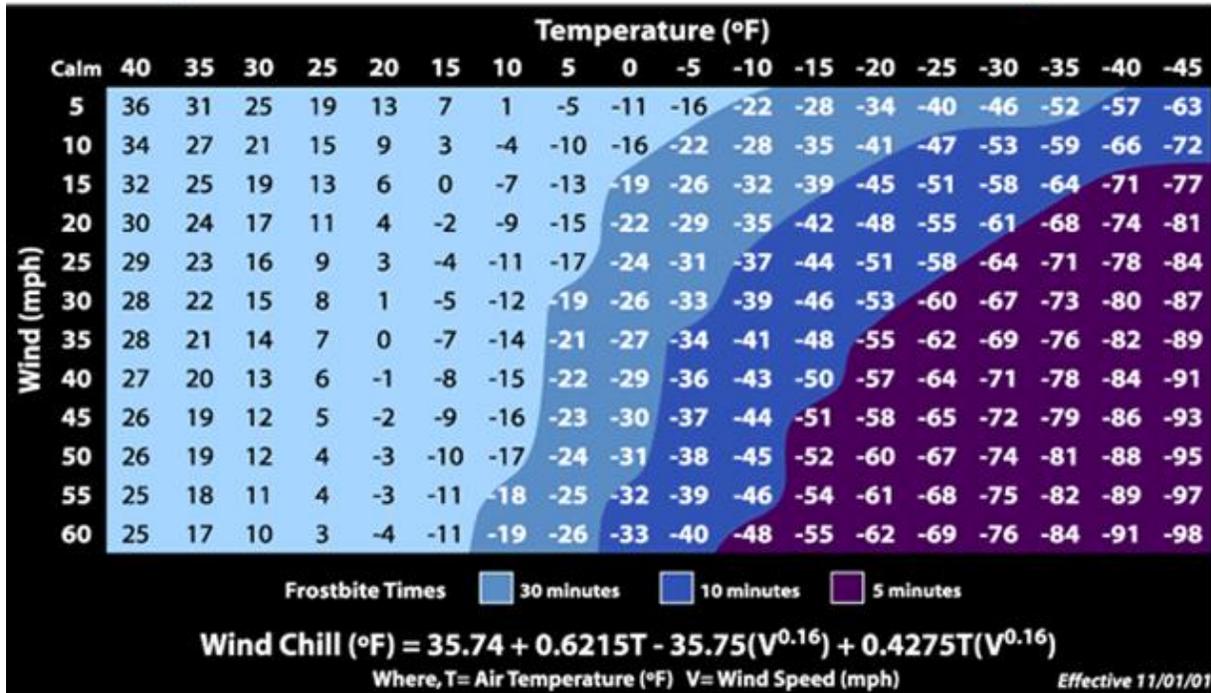
Extreme cold often accompanies severe winter storms and can lead to hypothermia and frostbite in people who are exposed to the weather without adequate clothing protection. Cold can cause fuel to congeal in storage tanks and supply lines, stopping electric generators. Cold temperatures can also overpower a building's heating system and cause water and sewer pipes to freeze and rupture. When combined with high winds from winter storms, extreme cold becomes extreme wind chill, which is extremely hazardous to health and safety.

The National Institute on Aging estimates that more than 2.5 million Americans are especially vulnerable to hypothermia, with the isolated elderly being most at risk. About 10 percent of people over the age of 65 have some kind of temperature-regulating defect, and 3-4 percent of all hospital patients over 65 are hypothermic.

Also at risk are those without shelter or who are stranded, or who live in a home that is poorly insulated or without heat. Other impacts of extreme cold include asphyxiation (unconsciousness or death from a lack of oxygen) from toxic fumes from emergency heaters, from household fires, which can be caused by fireplaces and emergency heaters, and from frozen/burst pipes.

Wind can greatly amplify the impact of cold ambient air temperatures. Provided by the National Weather Service, Figure 4-45 below shows the relationship of wind speed to apparent temperature and typical time periods for the onset of frostbite.

Figure 4-45: Wind Chill Chart



Source: National Weather Service

Location

The location is considered **extensive**, as it is likely that the entirety of Story County will experience severe winter weather at once. The High Plains Regional Climate Center reports the following temperature statistics for the planning area:

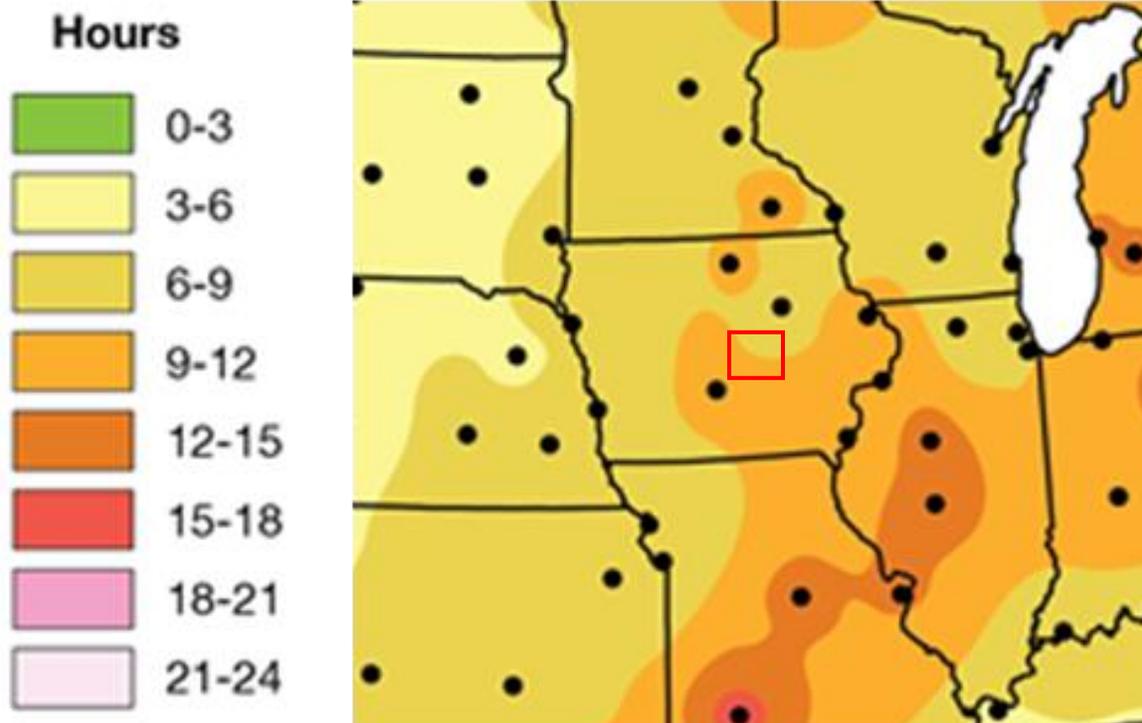
Month	Average Maximum Temperature	Average Minimum Temperature
December	31.14 °F	13.84 °F
January	27.89 °F	9.52 °F
February	32.75 °F	14.13 °F

Source: HPRCC CLIMOD Monthly Climate Normals

Average snowfall is highest in December, January, and February with an annual average of 31 inches. The entire State of Iowa is vulnerable to heavy snow, extreme cold temperatures and freezing rain. Generally, winter storms occur between the months of November and March, but can occur as early as October and as late as April.

Figure 4-46 shows that the planning area (approximated within the red square) is in the light-orange shaded area that receives 9-12 hours of freezing rain per year.

Figure 4-46: Average Number of Hours per Year with Freezing Rain



Source: Midwestern Regional Climate Center; http://mc.sws.uiuc.edu/living_wx/icestorms/index.html
 Note: Red square provides approximate location of planning area.

Past Occurrences

Historically, there have been two Presidential Disaster Declarations for Severe Winter Storms that included Story County since 1965; a winter storm in 2007 and an ice storm in 2010 (See Table 4-2 in the Hazard Identification Section).

From 1996 thru 2023, the National Climatic Data Center reports the following 100 severe winter weather events:

- 18 – Blizzard
- 7 – Cold/Wind Chill
- 10 – Extreme Cold/Wind Chill
- 23 – Heavy Snow
- 12 – Ice Storm
- 29 – Winter Storm
- 1 – Winter Weather

During this 27-year period, 48 of the events caused property or crop damage. This translates to roughly two damaging winter storm/cold temperature events each year. The total property damage for these 48 events was \$2,575,680 with another \$2,894,118 in crop damage. The most damaging event occurred on October 26, 1997, causing \$640,000 in property damage and \$2,600,000 in crop damage resulting from an early winter storm that dumped up to 11" of snow across parts of the State.



NOAA's National Weather Service has issued 351 Advisories, Watches, and/or Warnings concerning winter weather phenomena affecting the planning area between 2005 and December 2022 (see Table 4-47). The data is kept with Iowa Environmental Mesonet, Iowa State University Department of Agronomy website, (<http://mesonet.agron.iastate.edu/vtec/search.php>).

Table 4-47: National Weather Service Issuances for Winter Weather in Story County, IA

Phenomenon/Significance	Advisory	Warning	Watch	Total
Blizzard		18	11	29
Blowing Snow	1			1
Freeze		16	3	19
Freezing Fog	2			2
Freezing Rain	5			5
Frost	25			25
Heavy Snow			1	1
Ice Storm			2	2
Snow	17			17
Snow and Blowing Snow	1			1
Wind Chill	112	15	4	131
Winter Storm	153	32	43	228
Winter Weather				0
Grand Total	316	81	64	461

Source: Environmental Mesonet, Iowa State University Department of Agronomy website, <http://mesonet.agron.iastate.edu/vtec/search.php>

Agricultural Impacts

Winter storms, cold, frost and freeze take a toll on crop production in the planning area. According to the USDA's Risk Management Agency, payments for insured crop losses in the planning area as a result of winter weather from 2007-2021 totaled \$1.2 million (see Table 4-48).

Table 4-48: Crop Insurance Claims Paid in Story County as a Result of Cold Conditions and Snow (2007-2021)

Year	Cold Wet Weather	Cold Winter Weather	Freeze	Total Insurance Claims Paid
2007	\$2,599			\$2,599
2008	\$29,677			\$29,677
2009	\$74,992	\$2,496	\$2,197	\$79,685
2010	\$7,214		\$2,745	\$9,959
2011	\$61,868			\$61,868
2012	\$979	\$31		\$1,010
2013	\$75,061	\$221		\$75,282
2014	\$670,136	\$11,826		\$681,962
2015	\$315	\$1,025		\$1,340
2016	\$1,221			\$1,221
2017	\$1,912			\$1,912
2018	\$98,401			\$98,401
2019	\$94,766			\$94,766
2020				\$0
2021	\$14,506		\$5,943	\$20,449
Total	\$1,133,647	\$15,599	\$10,885	\$1,160,131

Source: USDA Risk Management Agency

Probability of Future Occurrence

The probability rating of severe winter weather is “**Highly Likely**”. According to NCEI, during the 27-year period from 1996 thru 2023, the planning area experienced a total of 48 damaging blizzards, winter storms, ice storms frost/freeze, and extreme cold events. This translates to an annual probability of about two blizzards, winter/ice storms, or extreme cold events per year.

Magnitude/Severity

The overall magnitude and severity of severe winter storm is considered “**limited**”. Certain areas may experience local variations in storm intensity and quantity of snow or ice. The Iowa Department of Transportation, county road departments, and local public works agencies are responsible for the removal of snow and treatment of snow and ice with sand and salt on the hundreds of miles of streets and highways in the area. Poor road conditions, immobilized transportation, and downed trees and electrical wire can impair snow removal on roads and road treatment.

Building and communication tower collapse and bodily injury or death are just a few of the impacts of a severe winter storm. Vehicle batteries and diesel engines are stressed, and the fuel often gels in extreme cold weather. This impacts transportation, trucking, and rail traffic. Rivers and lakes freeze, and subsequent ice jams threaten bridges and can close major highways. Ice jams can also create flooding problems when temperatures begin to rise.

An ice coating at least ¼ inch in thickness is heavy enough to damage trees, overhead wires, and similar objects and to produce widespread power outages. Buried water pipes can burst causing massive ice problems, loss of water, and subsequent evacuations during sub-zero temperatures.

Fire during winter storms presents a great danger because water supplies may freeze, and firefighting equipment may not function effectively, or personnel and equipment may be unable to get to the fire. If power is out, interiors of homes become very cold, causing pipes to freeze and possibly burst.

Cold temperature impacts on agriculture are frequently discussed in terms of frost and freeze impacts early or late in growing seasons and on unprotected livestock. The cost of snow removal, repairing damage, and loss of business can have large economic impacts on a community.

Climate Change Considerations

Climate change has the potential to exacerbate the severity and intensity of winter storms, including potential heavy amounts of snow. A warming climate may also result in warmer winters, the benefits of which may include lower winter heating demand, less cold stress on humans and animals, and a longer growing season. However, these benefits are expected to be offset by the negative consequences of warmer summer temperatures.

According to the 2010 report on Climate Change Impacts on Iowa, Iowa has experienced a long-term upward trend in temperature.

- Long-term winter temperatures have increased six times more than summer temperatures.
- Nighttime temperatures have increased more than daytime temperatures since 1970.
- Since 1970, daily minimum temperatures have increased in summer and winter; daily maximum temperatures have risen in winter but declined substantially in summer.



If this trend continues, future occurrences of the extreme cold/wind chill aspects of winter storms should decrease. In addition, higher winter temperatures bring higher probability of rain, rather than snow. As a result, the amount of precipitation falling as snow should decrease.

Vulnerability

The entire planning area is vulnerable to the effects of winter storm. Hazardous driving conditions due to snow and ice on highways and bridges lead to many traffic accidents and can impact the response of emergency vehicles. The leading cause of death during winter storms is transportation accidents. About 70 percent of winter-related deaths occur in automobiles due to traffic accidents and about 25 percent are from people caught outside in a storm. Emergency services such as police, fire, and ambulance may be unable to respond due to road conditions. Emergency needs of remote or isolated residents for food or fuel, as well as for feed, water and shelter for livestock are unable to be met. The probability of utility and infrastructure failure increases during winter storms due to freezing rain accumulation on utility poles and power lines. People, pets, and livestock are also susceptible to frostbite and hypothermia during winter storms. Those at risk are primarily either engaged in outdoor activity (shoveling snow, digging out vehicles, or assisting stranded motorists), or are the elderly. Schools often close during extreme cold or heavy snow conditions to protect the safety of children and bus drivers. Citizens' use of kerosene heaters and other alternative forms of heating may create other hazards such as structural fires and carbon monoxide poisoning.

People

The threat to public safety is typically the greatest concern when it comes to impacts of winter storms. The highest risk will be to travelers that attempt to drive during adverse conditions. People can also become isolated from essential services in their homes and vehicles. While virtually all aspects of the population are vulnerable to the potential indirect impacts of a winter storm, others may be more vulnerable, such as individuals with access and functional needs, who may become isolated to essential services.

Elderly populations are considered to be at increased risk to Winter Storms and associated extreme cold events. According to the 2019 US Census Bureau American Community Survey estimates, approximately 12.2% of Story County's population is over the age of 65. Additionally, the US Department of Health and Human Services estimates that there are 487 electricity-dependent Medicare beneficiaries in the county. These individuals are extremely vulnerable during power outages, which commonly accompany severe winter storm events.

Property

The total property loss reported by the NCDL for a total of 48 winter events that impacted the planning area during the 27-year time-period from 1996 thru 2023 was \$2,575,680. However, damages for winter and ice storms are reported for all weather zones impacted. So, it is extremely difficult to determine the damages from these events that apply specifically to Story County.

USDA crop insurance claims for cold and winter conditions from 2007-2021 totaled \$1,160,131, or \$82,867 in estimated annualized losses.

Considering the \$293 million market value of Story County crops from the 2012 Census of Agriculture as baseline crop exposure, the estimated annual losses from cold conditions and snow was determined minimal compared to the value of the insurable crops.



Critical Facilities and Infrastructure

Buildings with overhanging tree limbs are more vulnerable to damage during winter storms. Businesses experience loss of income as a result of closure during power outages. In general, heavy winter storms increase wear and tear on roadways though the cost of such damages is difficult to determine. Businesses can experience loss of income as a result of closure during winter storms.

Roads are especially susceptible to the effects of a severe winter storm, which can temporarily hinder transportation and require resources for snow removal. As noted under the people section, heavy snow accumulation may also lead to downed power lines not only causing disruption to customers but also have potentially negative impacts on critical facilities in the county which may have cascading impacts on the local governments' ability to operate. Potential losses would include cost of repair or replacement of damaged facilities and lost economic opportunities for businesses. Secondary effects from loss of power could include burst water pipes in homes without electricity during winter storms. Public safety hazards include risk of electrocution from downed power lines. Specific amounts of estimated losses are not available due to the complexity and multiple variables associated with this hazard.

Economy

According to the 2013 Iowa Hazard Mitigation Plan, of the 8 hazards for which data was available to estimate annualized losses, severe winter storm ranked 6th with \$2.2 million in annualized losses based on data spanning a 13-year period. Closure of major transportation routes during severe winter storms could temporarily isolate communities in Story County and further isolate the more remote areas of the County. Depending on the length of the closure, it could also hinder the local economy by disrupting tourism and out of county visitors. There would also be the potential impacts to shipping delays from a closure of any of the highways that traverse the county. Snow removal costs can also impact budgets significantly. Power outages may lead to business closures as well, with impacts possibly lasting for multiple days. According to FEMA standard values for loss of service for utilities reported in the 2009 Benefit Cost Analysis Reference Guide, the economic impact as a result of loss of power is \$126 per person per day of lost service.

Overhead power lines and infrastructure are also vulnerable to damages from winter storms. In particular, ice accumulation during winter storm events can cause damages to power lines due to the ice weight on the lines and equipment, as well as damage caused to lines and equipment from falling trees and tree limbs weighted down by ice. Potential losses would include cost of repair or replacement of damaged facilities, and lost economic opportunities for businesses. Secondary effects from loss of power could include burst water pipes in homes without electricity during winter storms. Public safety hazards include risk of electrocution from downed power lines. Specific amounts of estimated losses are not available due to the complexity and multiple variables associated with this hazard.

The electric power loss of use estimates provided in Table 4-49 below were calculated using FEMA's Standard Values for Loss of Service for Utilities published in the June 2009 *BCA Reference Guide*. These figures are used to provide estimated costs associated with the loss of power in relation to the populations in Story County's jurisdictions. The loss of use estimates for power failure associated with winter storms is provided as the loss of use cost per person, per day of loss. The estimated loss of use provided for each jurisdiction represents the loss of service of the indicated utility for one day for 10 percent of the population. It is understood that in rural areas, the typical loss of use may be for a larger percentage of the population for a longer time during weather extremes. These figures do not take into account physical damages to utility equipment and infrastructure.

Table 4-49: Loss of Use Estimates for Power Failure (One Day)

Jurisdiction	2016 Population Estimate	Estimated Affected Population 10%	Electric Loss of Use Estimate (\$126 per person per day)
Ames	66,265	6,627	\$834,939
Cambridge	885	89	\$11,151
Collins	483	48	\$6,086
Colo	838	84	\$10,559
Gilbert	1,185	119	\$14,931
Huxley	4,331	433	\$54,571
Kelley	401	40	\$5,053
Maxwell	776	78	\$9,778
McCallsburg	484	48	\$6,098
Nevada	6,933	693	\$87,356
Roland	1,472	147	\$18,547
Sheldahl	382	38	\$4,813
Slater	1,546	155	\$19,480
Story City	3,352	335	\$42,235
Zearing	655	66	\$8,253
Unincorporated Story County	8,585	859	\$108,171
County Total	98,573	9,857	\$1,242,020

Source: Loss of Use Estimates from FEMA BCA Reference Guide, 2009; Population Estimates, U.S. Census Bureau, 5-year American Community Survey

Environment and Cultural Resources

Natural resources may be damaged by the severe winter weather, including broken trees and death of wildlife and livestock. Unseasonable storms may damage or kill plants and wildlife, which may impact natural food chains until the next growing seasons. Most of these impacts would be short-term. As noted previously, older, historic buildings could potentially be more vulnerable to roof and structural damage from heavy snow. Cultural facilities in Story County can shut down as a result of severe winter weather. Cultural facilities include restaurants, parks, community centers, museums, and businesses

Development Trends

Future development could potentially increase vulnerability to this hazard by increasing demand on the utilities and increasing the exposure of infrastructure networks.

4.3.11 Sinkholes

Future Probability	Magnitude/Severity	Location	Hazard Ranking
Unlikely	Negligible	Limited	Low

Risk Summary

- There are relatively extensive areas of potential karst bedrock in Story County, which may be more susceptible to sinkholes. Additionally, it is possible for sinkholes to occur due to abandon mines and local watermain breaks; therefore, geographic area is rated as **limited**.
- There is no history of sinkholes occurring in Story County; therefore, the probability of future occurrence is rated as **unlikely**.

- The magnitude of sinkholes in the County is **negligible**. Damages are typically localized to a single area.
- Sinkholes can displace homeowners and disrupt roadway travel. Injury and death due to sinkholes is uncommon but is possible if a person falls into a sinkhole.
- In severe cases that result in very large sinkholes, whole buildings and cars can be swallowed. However, this is very rare and unlikely.
- The USGS reported that over the last 15 years, sinkholes have caused an estimated \$300 million in damages annually in the United States.
- Related hazards: Flooding, Infrastructure failure, Severe Summer Weather

Description

Generally speaking, sinkholes can be defined as the loss of surface elevation due to the removal of subsurface support defines a sinkhole. Sinkholes range from broad, regional lowering of the land surface to localized collapse. Sinkholes are common where the rock below the land surface is limestone, carbonate rock, salt beds, or rocks that can naturally be dissolved by ground water circulating through them. As the rock dissolves, void spaces and caverns develop underground. This type of “soluble” rock is called karst. The sudden collapse of the land surface can be dramatic and range in size from broad, regional lowering of the land surface to localized collapse. Although subsidence can be a naturally occurring hazard from a karst landscape, the primary causes of most incidents of subsidence are human activities: underground mining of coal, groundwater or petroleum withdraw, and drainage of organic soils. Land subsidence occurs slowly and continuously over time or on occasion abruptly, as in the sudden formation of sinkholes. Sinkholes can be aggravated by flooding.

Location

Sinkholes are considered to have a **limited** location in Story County. There are three areas in Iowa where large numbers of sinkholes exist: 1) within the outcrop belt of the Ordovician Galena Group carbonates in Allamakee, Clayton, and Winneshiek Counties; 2) in Devonian carbonates in Bremer, Butler, Chickasaw and particularly Floyd and Mitchell Counties; and 3) along the erosional edge of Silurian carbonates in Dubuque and Clayton Counties. Pockets of karst terrain occur in isolated areas of central Iowa; parts of Story County have been identified as having potential for karst terrain.

Figure 4-47 shows the areas with karst terrain and potential for sinkholes in Story County, and Figure 4-48 shows areas with sinkhole potential in Iowa. Areas identified as green are within 1,000 feet of a known sinkhole and the blue areas show greater than 1,000 feet but less than a mile from a known sinkhole or an area with carbonate bedrock close to the surface.

Figure 4-47 Karst Terrain in Story County (Sinkhole Location and Potential)

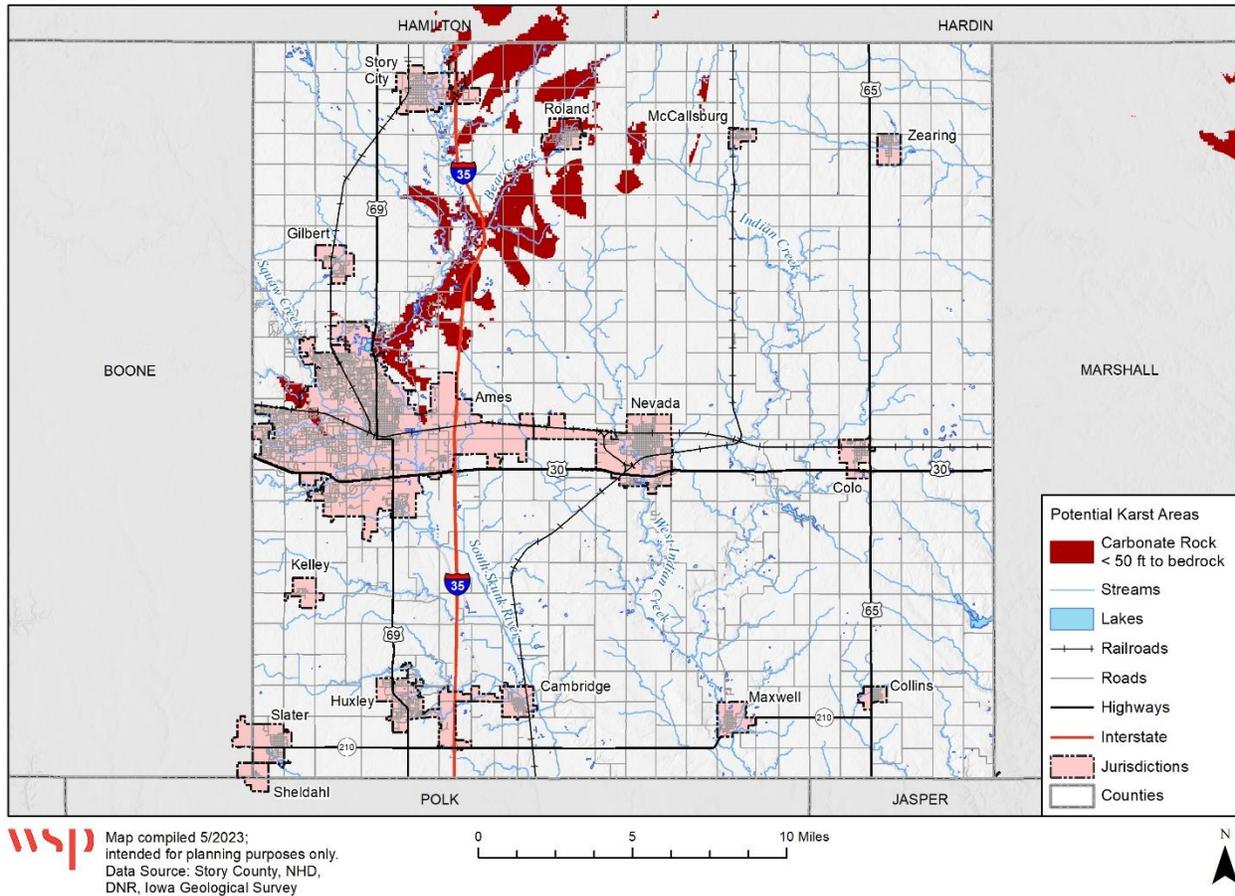
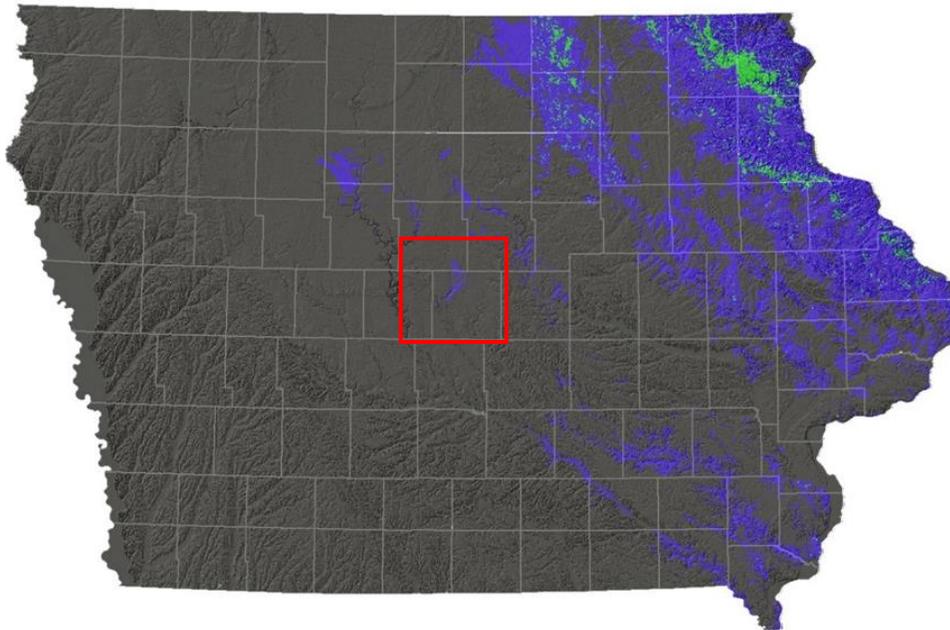


Figure 4-48: Karst Terrain (Sinkhole Location and Potential, Story County)

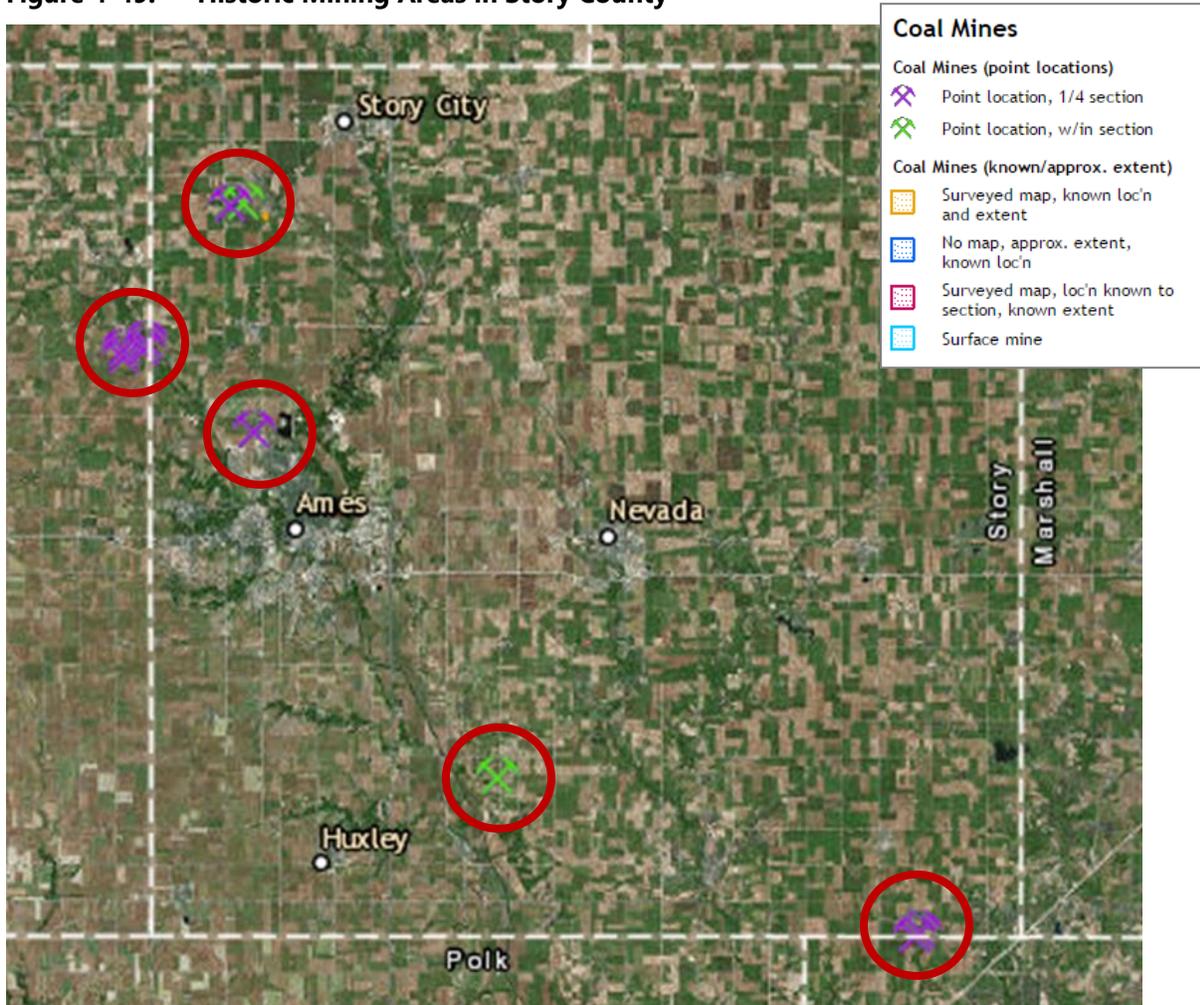


Source: Iowa Department of Natural Resources, <http://iagiservicebureau.blogspot.com/2013/05/caution-karst-below.html>

Per data provided by the Iowa Department of Natural Resources, and verified by the HMPC, potential karst terrain areas in the county exist in and around Ames, Roland, and Story City.

Mining activity can also lead to sinkhole development. Figure 4-49 shows historic coal mining areas in Story County as reported by the Iowa Department of Natural Resources.

Figure 4-49: Historic Mining Areas in Story County



Source: Iowa Department of Natural Resources; identified mines encircled in red

Table 4-50 shows coal mines mapped in Story County, according to the Iowa DNR.

Table 4-50 DNR-Identified Mines in Story County

Owner	Location	Area (acres)	Entrance Type	Shaft Depth	Coal Bed
Marshall & Crow Coal Company	SE Story County	Unknown	Shaft	142	Undetermined
Collins Fuel Company No. 1	SE Story County	Unknown	Shaft	150	Undetermined
No name	NE of Cambridge	Unknown	Unknown	Unknown	Undetermined
North Star Coal & Mining Company	North of Gilbert	Unknown	Shaft	135	Undetermined
Summit Coal Company	North of Gilbert	Unknown	Shaft	Unknown	Undetermined



Owner	Location	Area (acres)	Entrance Type	Shaft Depth	Coal Bed
Johnson Shaft	North of Ames	Unknown	Shaft	Unknown	Undetermined

Source: Iowa Department of Natural Resources

Past Occurrences

The HMPC didn't identify any sinkholes that have previously occurred around the County.

Probability of Future Occurrence

Based on no known past history in Story County, the probability of this hazard is **unlikely**. If current building codes are followed, the occurrence of damages because of known sinkholes should be minimized. During discussions on this hazard, the HMPC identified no known history of sinkhole issues; communities with mapped potential karst terrain areas confirmed no recent history, nor is karst terrain and sinkholes something that these communities plan around.

Magnitude and Severity

Sinkholes are considered to have **negligible** magnitude. If a sinkhole were to form, people and structures located on or near the sinkhole are the most at risk for injury, death, and property damage. Sinkholes can occur with little to no warning, as they are caused by bedrock that is dissolved over time and eventually gives way to the weight on top of it. Less than 10% of property severely damaged, shutdown of facilities and services for less than 24 hours, and/or injuries/illnesses treatable with first aid. There were no injuries, deaths, or property damages due to sinkholes in the County.

Climate Change Considerations

There are no noted trends in climate change that would not have a significant effect on the occurrence of sinkholes.

Vulnerability

People

Sinkholes can kill and injure people who may be caught in an existing sinkhole or when the ground beneath gives way during a sinkhole's collapse. GIS analysis was performed by overlaying property data with karst data to determine the number of potential properties and estimated population counts impacted by sinkholes. Table 4-51 in the Property section displays the results of this analysis in detail. In Story County, based on the average household size of each jurisdiction, there is an estimated 1,309 people at risk to karst and potential karst features.

Property

A GIS analysis was performed by overlaying property data with karst data to determine the number of potential properties and estimated population counts impacted by sinkholes. Table 4-51 shows these analysis results in detail. In Story County, there are a total of 787 improved properties at risk to karst features.



Table 4-51 Story County Improved Properties at Risk to Potential Karst by Jurisdiction and Property Type

Jurisdiction	Property Type	Improved Parcel Count	Population
Ames	Commercial	4	
	Exempt	1	
	Multi-Family	12	29
	Residential	176	
	Total	193	29
Roland	Agriculture Dwelling	1	2
	Commercial	34	
	Exempt	1	
	Industrial	1	
	Mixed Use	2	5
	Multi-Family	2	5
	Residential	220	513
	Total	261	524
Story City	Commercial	8	
	Industrial	2	
	Residential	5	11
	Total	15	11
Unincorporated	Agriculture	14	
	Agriculture Dwelling	42	105
	Commercial	4	
	Industrial	2	
	Multi-Family	1	3
	Residential	255	638
	Total	318	745
Grand Total		787	1,309

Sources: Story County, Population— U.S. Census Bureau reported by Iowa State University of Science and Technology, DNR, Iowa Geological Survey, WSP Analysis

Critical Facilities and Infrastructure

A GIS analysis was done using critical facility data provided by Story County overlaid with karst data for Story County to determine critical facilities at risk to karst and potential karst features. The results of this analysis are shown in Table 4-52. There are a total of 38 critical facilities at risk to damage from sinkholes in Story County, the majority of which are in the Transportation lifeline.

Table 4-52 Story County Critical Facilities at Risk to Potential Karst by Jurisdiction and FEMA Lifeline

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Ames	-	-	1	-	-	-	3	4
Roland	-	-	3	-	1	1	1	6
Story City	-	-	-	1	-	-	-	1
Unincorporated	1	-	2	1	-	1	22	27
Total	1	0	6	2	1	2	26	38

Sources: Story County, DNR, HIFLD, National Bridge Inventory, Iowa Geological Survey, WSP Analysis

Economy

Economic damages from sinkholes would most likely impact structures located on or near the sinkhole. Most of the known sinkholes in the planning area occur in rural areas where their main impact is rendering some land unsuitable for row-crop agriculture.

Environment and Cultural Resources

Sinkholes can post a threat to the environment by reducing water quality and polluting aquifers with sediment.

Development Trends

While sinkholes are not likely to occur in the County, all new infrastructure built in areas of the county with karst potential or abandoned mines may be vulnerable to the damaging effects of sinkholes. Sinkholes caused by watermain breaks may be the most likely cause of sinkholes in the future. The development of new sinkholes has been correlated to land-use practices, most commonly from groundwater pumping related to construction. Future development should avoid areas of known subsurface void spaces such as old coal mines.

4.3.12 Terrorism

Future Probability	Magnitude/Severity	Location	Hazard Ranking
Unlikely	Limited	Extensive	Medium

Risk Summary

The overall significance of this hazard is **medium**.

- Has the potential to occur in a limited area or over the entire county at once. The location is considered **extensive**.
- The overall probability of future events is considered **unlikely**.
- Overall, terrorism is considered to have a **limited** magnitude in Story County.

- Key vulnerabilities include: property damage and personal injuries, disruptions to continuity of operations, economic disruptions, public confidence in government can be affected
- Includes many sub-hazards, perhaps most likely for Story County is an attack involving Iowa State University as a target or an incident of agro-terrorism.
- Related hazards: Radiological incident, hazardous materials incidents, infrastructure failure.

Description

This hazard encompasses the following sub-hazards: enemy attack, biological terrorism, agro-terrorism, chemical terrorism, conventional terrorism, cyber terrorism, radiological terrorism and public disorder. These hazards can occur anywhere and demonstrate unlawful force, violence, and/or threat against persons or property causing intentional harm for purposes of intimidation, coercion or ransom in violation of the criminal laws of the United States. These actions may cause massive destruction and/or extensive casualties. The threat of terrorism, both international and domestic, is ever present, and an attack can occur when least expected.

Enemy attack is an incident that could cause massive destruction and extensive casualties throughout the world. Some areas could experience direct weapons' effects, including blast and heat; others could experience indirect weapons' effect. International political and military activities of other nations are closely monitored by our federal government and the State of Iowa would be notified of any escalating military threats.

The use of biological agents against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion or ransom can be described as biological terrorism. Liquid or solid contaminants can be dispersed using sprayers/aerosol generators or by point of line sources such as munitions, covert deposits and moving sprayers. Biological agents vary in the amount of time they pose a threat. They can be a threat for hours to years depending upon the agent and the conditions in which it exists.

Agro-terrorism consists of acts to intentionally contaminate, ruin, or otherwise make agricultural products unfit or dangerous for consumption or further use. Agriculture is an important industry in Iowa and Story County. The introduction of a biological agent into the population of 15,300 cattle and calves, or the 62,420 hogs and pigs, or the 156,400 acres of corn in Story County would be financially devastating and would have a major impact on the food supply of the state and the nation. A major attack involving the nation's food supply could be launched in a rural area that has little capacity to respond. Potential terrorists' targets for livestock disease introduction would be concentration points, such as the County's licensed feedlots or livestock markets discussed later in the Geographic Location section.

Chemical terrorism involves the use or threat of chemical agents against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion or ransom. Effects of chemical contaminants are similar to biological agents.

Use of conventional weapons and explosives against persons or property in violation of the criminal laws of the United States for purposes of intimidations, coercion, or ransom is conventional terrorism. Hazard affects are instantaneous; additional secondary devices may be used, lengthening the time duration of the hazard until the attack site is determined to be clear. The extent of damage is determined by the type and quantity of explosive. Effects are generally static other than cascading consequences and incremental structural failures. Conventional terrorism can also include tactical assault or sniping from remote locations.



Electronic attack using one computer system against another in order to intimidate people or disrupt other systems is a cyber-attack. All governments, businesses and citizens that conduct business utilizing computers face these threats. Cyber-security and critical infrastructure protection are among the most important national security issues facing our country today. As such, the Iowa Division of Criminal Investigation has a Cyber Crime Unit tasked with analysis and retrieval of digital information for investigations.

Radiological terrorism is the use of radiological materials against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion or ransom. Radioactive contaminants can be dispersed using sprayers/aerosol generators, or by point of line sources such as munitions, covert deposits and moving sprayers or by the detonation of a nuclear device underground, at the surface, in the air or at high altitude.

Mass demonstrations, or direct conflict by large groups of citizens, as in marches, protest rallies, riots, and non-peaceful strikes are examples of public disorder. These are assembling of people together in a manner to substantially interfere with public peace to constitute a threat, and with use of unlawful force or violence against another person, or causing property damage or attempting to interfere with, disrupting, or destroying the government, political subdivision, or group of people. Labor strikes and work stoppages are not considered in this hazard unless they escalate into a threat to the community. Vandalism is usually initiated by a small number of individuals and limited to a small target or institution. Most events are within the capacity of local law enforcement.

The Southern Poverty Law Center reports four active hate groups in Iowa: National Socialist Movement (Neo-Nazi, National Socialist); Gallows Tree Wotansvolk Alliance (Neo-Nazi); the Daily Stormer (Neo Nazi); and ACT for America (Anti-Muslim).

Location

The potential location of terrorism is considered **extensive**. According to the FBI, the most common targets of terrorist attacks in the US are:

- Businesses: 27%
- Government: 17%
- Private Citizens & Property: 13%
- Abortion-related: 9%
- Military: 6%
- Police: 6%
- Religious: 5%

The entire planning area has a low potential for terrorist activity. However, any venue with a large gathering of people could be a potential target for terrorists. The most likely targets of a conventional terrorism attack in Story County include public school system facilities, the County Justice Center, and law enforcement centers within the County. The presence of Iowa State University in Ames could also present an inviting target for terrorist activity.

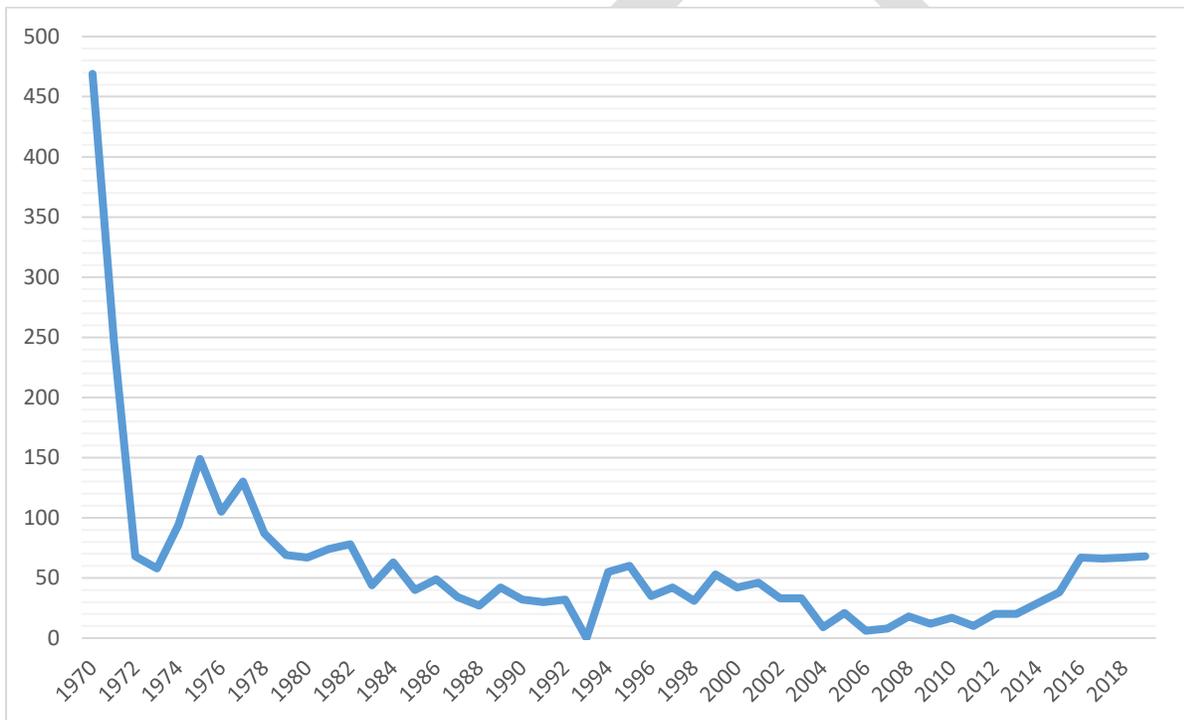
In terms of cyber-terrorism, our society is highly networked and interconnected. An attack could be launched from anywhere on earth and could range in impacts from small and localized to a far-reaching global scale. Depending on the attack vector and parameters, a cyber-attack could impact all of Story County and its associated municipal jurisdictions.

Past Occurrences

The Global Terrorism Database (GTD) catalogs more than 200,000 terrorist attacks dating back to 1970. As shown in Figure 4-50, GTD data shows that despite public perception the number of terrorist attacks on US soil decreased for most of past 50 years. From an average of 148 incidents per year in the 1970s, the frequency of attacks had declined to less than 23 per year in the 2000s. An increase in attacks starting around 2014 has brought that average back-up to 43 incidents per year for 2011 through 2019 (the most recent year the GTD has analyzed), the highest since the 1980s.

In most years, the number of people killed or injured by terrorists on American soil is fairly low, with a median of 25 casualties per year. (The average is significantly higher due to a handful of high-casualty incidents such as the 9-11 attacks.) According to the GTD data, there have only been 11 years since 1970 where 100 or more Americans were killed or injured in terrorist attacks; however, six of those years have been in the last 10 years.

Figure 4-50 Terrorist Attacks in The US 1970-2019



Source: GTD, <https://www.start.umd.edu/gtd/>

The increase in attacks over the last decade has been driven almost entirely by domestic terrorism, not international terrorism. A recent report by the Center for Strategic & International Studies records 980 domestic terrorist attacks in the US since 1994, with sharp growth over the last 10-15 years. Figure 4-51 shows a breakdown of terrorist attacks based on the ideology of the attacker.

Figure 4-51 Domestic Terrorist Attacks in The US 1994-2021



Source: Center for Strategic & International Studies

There have not been any large-scale enemy attacks or acts of radiological terrorism in Iowa. There have been biological and chemical agent threats, animal rights activists' vandalism and many bomb threats. In 2002, pipe bombs were found in 18 states including Iowa and six people were injured in the bombings in Iowa and Illinois. In 2005 and 2006, pipe bombs were used in attempted murder cases in two Iowa cities.

The Iowa Department of Public Safety issued a 2016 Iowa Uniform Crime Report showing 18 hate/bias crimes were reported statewide in 2016.

According to the Southern Poverty Law Center, there were 47 hate incidents reported in Iowa from 2003 to 2016. Four of these incidents reported occurred in Story County.

Probability of Future Occurrence

While difficult to estimate, the probability for a terrorist event is "**Unlikely**" within the next 10 years in Story County.

Magnitude/Severity

Overall, terrorism is considered to have a **limited** magnitude in Story County. The severity of impact varies tremendously depending on the form of terrorism. The HMPC determined that, although some terroristic activity could result in serious injury and major property damage, the most likely terroristic threat that Story County would experience would involve little to no injuries, illness, or property damage, or minor injuries, illness, or property damage.

Terrorism occurs with minimal or no warning. No jurisdiction in Story County would have advanced notice of a terrorism event.

Climate Change Considerations

There are no known climate change impacts relevant to this hazard.



Vulnerability

A terrorism event could occur in either limited areas of a jurisdiction, or over the entire jurisdiction at once. This hazard has the ability to directly cause substantial structural losses and potentially loss of life. Hazard impacts are heavily influenced by the type and parameters of a terrorist attack.

Potential Losses to Existing Development

Potential losses from terrorism include fatalities to people, damage to property, infrastructure, critical facilities, crops, and animals. The degree of impact would be directly related to the type of incident and the target. Potential losses could include cost of repair or replacement of damaged facilities, lost economic opportunities for businesses, loss of human life, injuries to persons, loss of food supplies, disruption of the food supply chain, and immediate damage to the surrounding environment. Secondary effects of infrastructure failure could include public safety hazards, spread of disease, increased morbidity and mortality among the local and distant populations, public panic and long-lasting damage to the environment. Terrorism events are rare occurrences and specific amounts of estimated losses for previous occurrences are not available due to the complexity and multiple variables associated with these types of hazards. In some instances, information about these events is secure and unavailable to the public in order to maintain national security and prevent future attacks.

People

People would be the greatest vulnerability in the event of a terrorism incident in Story County. A terrorism event would inevitably also result in significant property losses. As discussed previously, it is difficult to quantify potential losses in terms of the jurisdictions most threatened by CBRNE (chemical, biological, radiological, nuclear, and high yield explosive) attack events due to the many variables and human element.

Property

A terrorism event would likely also result in significant property losses. The degree of impact would be directly related to the type of incident and the target. Potential losses could include cost of repair or replacement of damaged facilities, lost economic opportunities for businesses, loss of human life, injuries to persons, loss of food supplies, disruption of the food supply chain, and immediate damage to the surrounding environment.

Critical Facilities and Infrastructure

Critical facilities and infrastructure are vulnerable as these assets would be likely targets for a direct attack. Depending on the extent of damages or disruptions in the aftermath of an event, the ability of first responders and medical personnel to respond could be hindered. Secondary effects of infrastructure failure could include public safety hazards, spread of disease, increased morbidity and mortality among the local and distant populations, public panic and long-lasting damage to the environment.

The HMPC noted that Iowa State University and other federal agency assets could be targets of an attack.

Economy

Potential economic losses could fluctuate significantly depending on the scope of the hypothetical terrorist incident. Direct losses in terms of costs for building and infrastructure repairs would occur, as well as losses to businesses from downtime or disruptions in the aftermath of an event.



Environment and Cultural Resources

Agro-terrorism or chemical terrorism could result in significant damage to the environment in Story County. These events can pollute the environment and cause nearby plants and animals to get sick or die. Contaminated material that gets into the air or water supply can affect humans further away from the incident site.

Development Trends

As public events are held at various venues in the County, the potential may exist for these locations to become targets of attack. With human-caused hazards such as this that can have multiple variables involved, increase in development is not always a factor in determining risk.

4.3.13 Tornado/Windstorm

Future Probability	Magnitude/Severity	Location	Overall Significance
Highly Likely	Critical	Significant	High

Risk Summary

The overall significance of tornados/windstorms is **High**.

- Based on Iowa’s location in Tornado Alley and the record of past events, the future probability of tornadoes and windstorms in Story County has been determined to be **highly likely**.
- The August 2020 Derecho is just one example of the scale of damage and disruption that could occur in Story County as a result of this hazard. Widespread damage and infrastructure/utility outages impacted all of Story County for multiple days. Therefore, the potential magnitude and severity is **critical**.
- The extent is considered **significant**, as tornadoes and windstorms have the potential to occur anywhere in Story County and could impact large portions of the county in a single event.
- According to NCEI, there have been 62 tornado events recorded in Story County from 1950 to 2023.
- The strongest tornado recorded in the county has been an F5 in magnitude which occurred in 1976. This is one of several EF5 tornadoes that have occurred in the State of Iowa and are possible in the planning area.
- Related hazards: Flooding, Wildfire, Thunderstorm/Lightning/Hail

Description

This section discusses both tornado and windstorm hazards.

Tornado: The NWS defines a tornado as “a violently rotating column of air extending from a thunderstorm to the ground.” It is usually spawned by a thunderstorm and produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. Often, vortices remain suspended in the atmosphere as funnel clouds. When the lower tip of a vortex touches the ground, it becomes a tornado and a force of destruction.

Tornadoes are the most violent of all atmospheric storms and are capable of tremendous destruction. Wind speeds can exceed 250 miles per hour, and damage paths can be more than one mile wide and 50 miles long. Tornadoes have been known to lift and move objects weighing more than 300 tons a distance of 30 feet, toss homes more than 300 feet from their foundations, and siphon millions of tons of water from water bodies. Tornadoes also generate a tremendous amount of flying debris or “missiles,” which often become airborne shrapnel that causes additional damage. If wind speeds are high enough, missiles can be thrown



at a building with enough force to penetrate windows, roofs, and walls. However, the less spectacular damage is much more common.

Windstorm: For purposes of this plan, windstorms refer to any non-tornadic damaging winds of thunderstorms including downbursts, microbursts, and straight-line winds. Downbursts are localized currents of air blasting down from a thunderstorm, which induce an outward burst of damaging wind on or near the ground. Microbursts are minimized downbursts covering an area of less than 2.5 miles across. They include a strong wind shear (a rapid change in the direction of wind over a short distance) near the surface. Microbursts may or may not include precipitation and can produce winds at speeds of more than 150 miles per hour. Straight-line winds are generally any thunderstorm wind that is not associated with rotation. It is these winds, which can exceed 100 mph, which 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 (and multiple) counties. Objects like trees, barns, outbuildings, high-profile vehicles, and power lines/poles can be toppled or destroyed, and roofs, windows, and homes can be damaged as wind speeds increase.

Strong winds can occur year-round in Iowa. These winds typically develop with strong pressure gradients and gusty frontal passages. The closer and stronger two systems are, (one high pressure, one low pressure) the stronger the pressure gradient and, therefore, the stronger the winds are. Downbursts can be particularly dangerous to aviation.

The NWS issues High Wind Watch, High Wind Warning, and Wind Advisory to the public. The following are the definitions of these issuances:

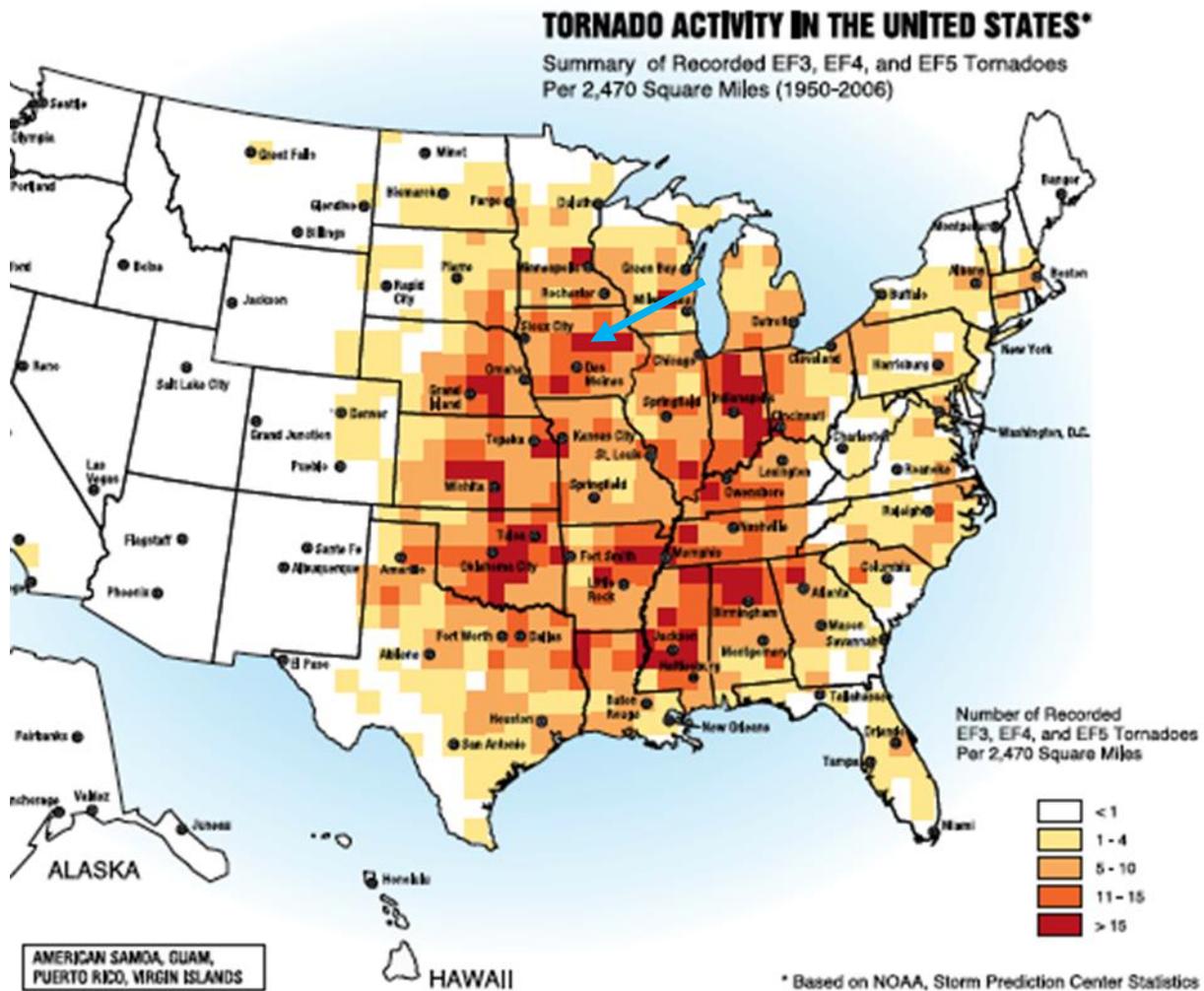
- **High Wind Watch**—This is issued when there is the potential of high wind speeds developing that may pose a hazard or are life-threatening.
- **High Wind Warning**—The 1-minute surface winds of 35 knots (40 mph) or greater lasting for one hour or longer, or winds gusting to 50 knots (58 mph) or greater, regardless of duration, that are either expected or observed over land.
- **High Wind Advisory**—This is issued when high wind speeds may pose a hazard. Sustained winds 25 to 39 mph and/or gusts to 57 mph.

Location

The location of Tornadoes and Windstorms is **significant**. Iowa is located in a part of the United States where tornadoes are a common occurrence. According to NCEI, Story County, Iowa has experienced 105 tornado/high wind events from 1950 through 2023 (73-year period). Six F5 rated tornados have occurred in Iowa during this timeframe, one of which affected Story County. Since 1950, there have been on average 48 tornadoes per year in Iowa. Most tornadoes occurred in May and June but can occur during any month. Also, mid-afternoon until around sunset is the peak time of day for tornado activity.

Tornadoes can occur in the entire planning area. Figure 4-52 illustrates the number of F3, F4, and F5 tornadoes recorded in the United States per 3,700 square miles between 1950 and 2006. Story County is in the section with orange and red shading, indicating 5 to 10, or even more than 15 tornadoes of this magnitude occurring during this 57-year period.

Figure 4-52: Tornado Activity in the United States

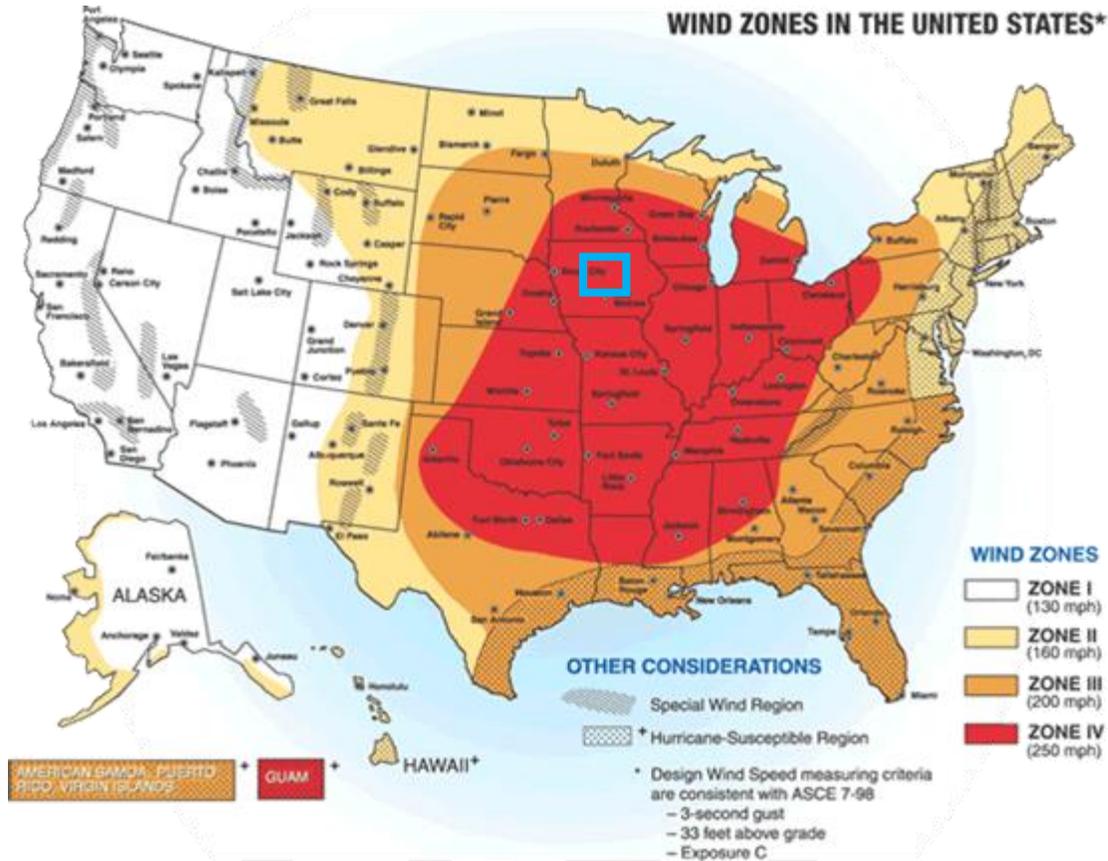


Source: FEMA 320, Taking Shelter from the Storm, 3rd edition
Note: Blue arrow is approximate location of Story County

The wind speeds for the EF scale and damage descriptions are based on information on the NOAA Storm Prediction Center as listed in Table 4-56. The damage descriptions are summaries. For the actual EF scale, it is necessary to look up the damage indicator (type of structure damaged) and refer to the degrees of damage associated with that indicator. Information on the Enhanced Fujita Scale's damage indicators and degrees of damage is located online (www.spc.noaa.gov/efscale/ef-scale.html).

All of Story County is susceptible to high wind events. The County is located in Wind Zone IV, which is susceptible to winds up to 250 mph. All of the participating jurisdictions are vulnerable to this hazard. Figure 4-53 shows the wind zones of the United States based on maximum wind speeds; the entire state of Iowa is located within wind zone IV, the highest inland category.

Figure 4-53: Wind Zones in the United States



Source: FEMA: http://www.fema.gov/plan/prevent/saferoom/tsfs02_wind_zones.shtm

Note: Blue square indicates approximate location of Story County

The advancement in weather forecasting has provided for the ability to predict severe weather that is likely to produce tornadoes days in advance. Tornado watches can be delivered to those in the path of these storms several hours in advance. Lead time for actual tornado warnings is about 30 minutes. Tornadoes have been known to change paths very rapidly, thus limiting the time in which to take shelter. Tornadoes may not be visible on the ground if they occur after sundown or due to blowing dust or driving rain and hail.

Past Occurrences

Tornadoes

NOAA statistics record 62 tornado events in Story County from 1950 to 2023. Of these, one was an F5, one was an F4, four were an F3; ten were rated F2; 16 were rated F1/EF1; 27 were rated F0/EF0; and three received no rating. These tornadoes caused one fatality and 19 injuries, over \$34 million in property damages and \$40,900 in damage to crops. Historically, tornadoes in the county have occurred in undeveloped areas and had relatively little impact. Table 4-53 summarizes these events.

Table 4-53: Recorded Tornadoes in Story County, 1950 – 2023

Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage	Length (miles)	Width (yards)
6/15/1950	F3	0	5	\$-	\$-	5.6	300



Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage	Length (miles)	Width (yards)
5/20/1953	F3	1	0	\$-	\$-	22.7	400
5/30/1957		0	0	\$25,000	\$-	0	33
5/31/1959	F2	0	0	\$250,000	\$-	17	440
6/28/1959	F0	0	0	\$25,000	\$-	2	300
5/7/1962	F2	0	0	\$250,000	\$-	0	150
7/4/1965		0	0	\$250	\$-	0	33
8/26/1965	F2	0	2	\$25,000	\$-	1.9	100
9/16/1965	F2	0	0	\$25,000	\$-	0.5	100
6/11/1966	F1	0	0	\$25,000	\$-	2	150
6/7/1967	F2	0	0	\$25,000	\$-	1	100
6/8/1967	F1	0	0	\$25,000	\$-	2.3	100
6/8/1967	F2	0	0	\$250,000	\$-	14.4	100
6/29/1969	F1	0	0	\$250,000	\$-	0	200
5/10/1970		0	0	\$-	\$-	0	33
5/12/1970	F1	0	0	\$30	\$-	0	33
5/12/1970	F1	0	0	\$25,000	\$-	0	33
5/7/1973	F0	0	0	\$-	\$-	0.5	60
7/1/1973	F1	0	0	\$25,000	\$-	0	33
6/18/1974	F2	0	0	\$250,000	\$-	2	200
6/12/1976	F1	0	0	\$25,000	\$-	0	33
6/13/1976	F5	0	0	\$250	\$-	7.3	880
6/13/1976	F2	0	0	\$25,000	\$-	1.3	200
8/28/1979	F0	0	0	\$-	\$-	1.3	60
6/12/1984	F0	0	0	\$-	\$-	0	33
6/22/1984	F0	0	0	\$-	\$-	0	33
5/24/1989	F4	0	0	\$25,000,000	\$-	13	150
3/13/1990	F2	0	0	\$2,500,000	\$-	3	60
3/13/1990	F3	0	1	\$250,000	\$-	9	100
3/22/1991	F3	0	0	\$2,500,000	\$-	27	70
3/22/1991	F0	0	0	\$250	\$-	0.1	20
6/19/1994	F1	0	0	\$50,000	\$500	7	60
6/5/1995	F0	0	0	\$15,000	\$1,000	5	20
5/30/1998	F1	0	0	\$5,000	\$1,000	14	45
4/8/1999	F1	0	2	\$800,000	\$-	2	75
5/16/1999	F0	0	0	\$5,000	\$-	0.2	30
6/6/1999	F1	0	0	\$2,000	\$-	0.7	30
5/10/2001	F0	0	0	\$5,000	\$-	0.3	30
5/22/2004	F0	0	0	\$2,000	\$2,000	1.4	50
8/3/2004	F1	0	0	\$75,000	\$15,000	3	100
8/26/2004	F0	0	0	\$-	\$2,000	0.5	50
8/26/2004	F0	0	0	\$10,000	\$2,000	0.5	50

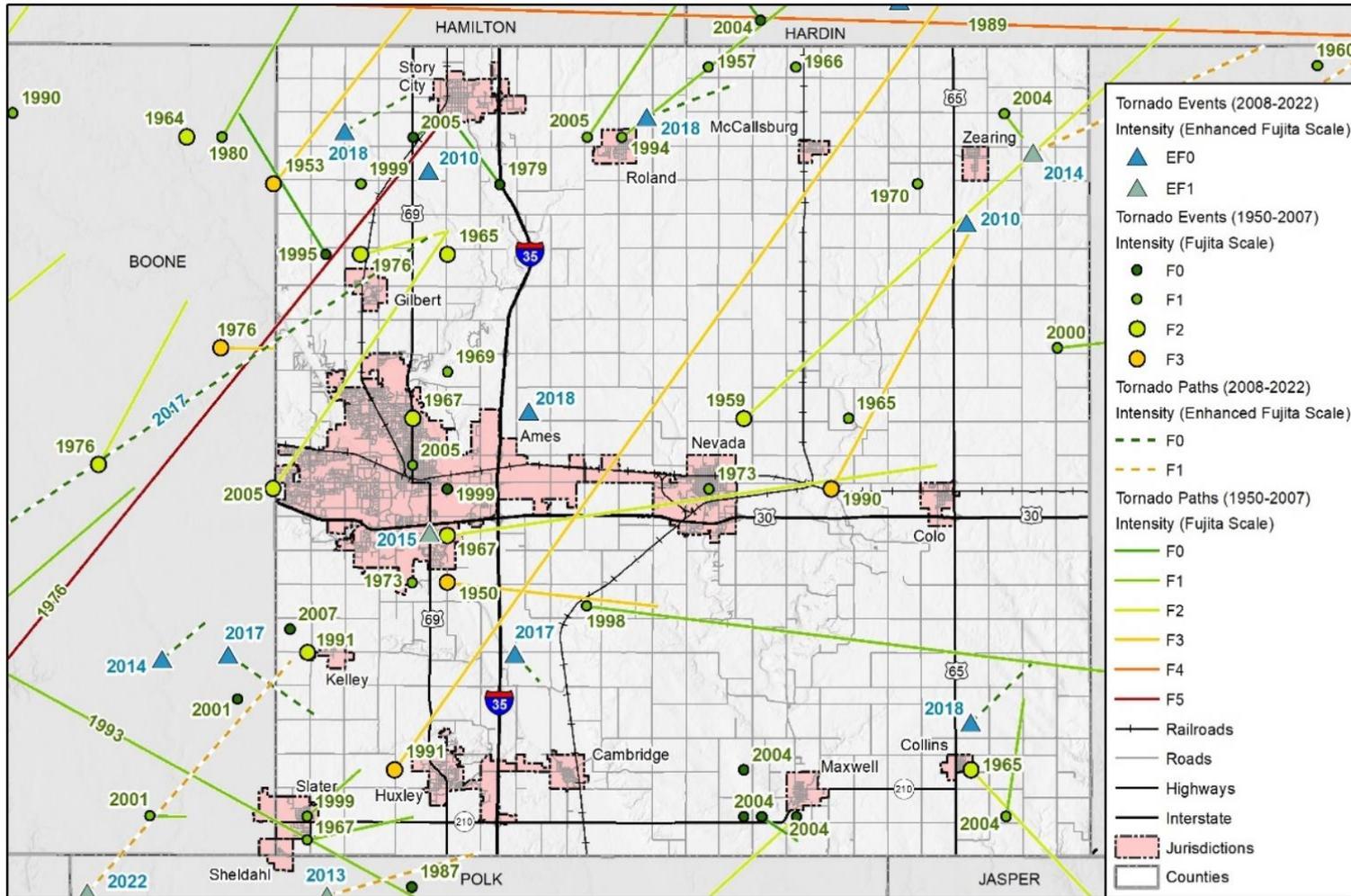


Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage	Length (miles)	Width (yards)
9/5/2004	F1	0	0	\$30,000	\$2,000	2.7	40
9/8/2005	F1	0	8	\$150,000	\$-	0.7	75
11/12/2005	F0	0	0	\$2,000	\$-	0.2	30
11/12/2005	F2	0	1	\$250,000	\$-	9	100
11/12/2005	F0	0	0	\$50,000	\$-	1.6	50
11/12/2005	F1	0	0	\$580,000	\$-	4	75
6/21/2007	EFO	0	0	\$-	\$2,000	0.1	30
6/8/2010	EFO	0	0	\$-	\$-	0.44	20
6/8/2010	EFO	0	0	\$-	\$-	0.24	20
5/19/2013	EFO	0	0	\$15,000	\$-	0.46	100
6/30/2014	EFO	0	0	\$20,000	\$5,000	2.01	90
6/7/2015	EF1	0	0	\$90,000	\$-	0.92	35
03/06/2017	EFO	0	0	\$75,000	\$-	5.34	85
08/21/2017	EFO	0	0	\$-	\$4,000	1.37	80
08/21/2017	EFO	0	0	\$-	\$3,000	1.08	10
5/29/2018	EFO	0	0	0	\$100	0.3	30
7/19/2018	EFO	0	0	0	\$500	2.07	40
7/19/2018	EFO	0	0	0	\$-	2.79	60
7/19/2018	EFO	0	0	0	\$800	2.48	40
4/23/2022	EFO	0	0	1\$,000	\$-	0.68	60
TOTAL		1	19	\$34,007,780	\$40,900		

Source: NOAA

The map in Figure 4-54 shows the paths of the previous events in Story County. Note, not all events had available latitude and longitude coordinates. As a result, only those events with geographic information are displayed.

Figure 4-54: Story County Tornado Events, 1950-2022



Map compiled 6/2023;
intended for planning purposes only.
Data Source: Story County, DNR,
NOAA, National Weather Service SVRGIS 2022

0 5 10 Miles





Story County has been included in five Presidential Disaster Declarations that involved tornadoes since 1998. See Table 4-2 in the Hazard Identification Section for additional details. Descriptions of notable previous tornado events are provided below:

March 13, 1990 – Wind damage was reported at several locations. Buildings were damaged at Zearing. A semi-truck was upended into a ditch with the driver sustaining minor injuries. About \$60,000 in damage was sustained on one farm where four buildings were destroyed and six others were damaged. This tornado was the remnants of an EF4 tornado that caused approximately \$2,500,00 in damage in Ankeny in Polk County previously and had a total path of 22 miles.

April 8, 1999 – At the beginning of the event, the main weather feature was in the form of hail. There were numerous reports of hail three quarters to one and three quarters inch in diameter. The largest hail fell in Guthrie and Dallas Counties with reports of golf ball size hail. One of the storms in the initial wave of afternoon activity became stronger as it moved into southern Story County. Initially, high winds of 60 MPH or more swept through the Sheldahl area of Boone County. Greene County was also affected by high winds from the storms. A tornado dropped out of the storm as it moved into the Slater area and was on the ground for about 2 miles. Initial estimates showed 44 homes and businesses damaged in Story County, one was destroyed with major damage to another. Thirty-six homes and four businesses were damaged in the town of Slater. Two people were injured during the passage of the tornado. One of the injuries involved a 70-year-old man who was picked up by the tornado's winds and thrown about 10 feet before he latched on to something. His shoulder was dislocated and he required 6 stitches due to his injuries in his hand. High winds northeast of Slater knocked several cars of a Burlington Northern freight train off the tracks after they were blown more than one quarter mile down the track. It was not possible to determine if the cars were knocked off by the tornado or high winds however. This band of storms continued to race and develop northeast through the afternoon. Damage became more sporadic, however high winds occurred as far northeast as Hardin County, with 70 MPH winds reported near New Providence. As the storms moved north, high winds were produced over Story County east of Story City. High winds toppled a tractor semi-trailer truck east of Story City on Interstate 35, injuring the driver. Twenty counties in Iowa experienced serious damage from the storms of the day. Iowa Governor Vilsack declared several counties in Iowa State disaster areas.

November 12, 2005—A long-lived tornado tracked through several counties across central Iowa during the late afternoon hours of November 12, 2005. This tornado occurred just prior to an ISU home football game. Many fans were evacuated to adjacent facilities for shelter. The tornado path across all counties involved is estimated at 27.5 miles long and between 100 and 150 yards wide along the damage path. The path in Story County, was around 15 miles long and 100 yards wide. Initially the storms produce quarter to golf ball size hail, with 2 1/2 inch diameter hail falling in Dallas County. Hail up to baseball size fell in Greene County as well. The system transitioned into a tornadic system within an hour with several tornadoes touching down in the central sections of the state. At least 9 communities were hit by tornadoes and 65 homes damaged or destroyed in all. An 82 year old woman was killed in Stratford when the tornado demolished her home. In a 2 or 3 block area of downtown Woodward, at least 12 houses were totally destroyed. There was one minor injury in Ames, two serious injuries in the Woodward area, and three injuries in Stratford. Due to the extensive damage to property caused by the tornadoes, Iowa Governor Vilsack declared Boone, Story, Webster, Dallas and Hamilton Counties state disaster areas. In all, 11 separate tornadoes were described as part of this system.



Roland reported no property damage while Story City reported only minor damage to roofs and foundation skirting on a few mobile homes near the south edge of town. In west Ames, numerous homes received damage, some substantial with one home destroyed. There was also heavy tree damage and many out buildings damaged or destroyed in the rural area along the tornado's path.

Heavy debris and power line destruction forced the closure of 170th street from HWY 69 east and 530th Ave north from 180th Street into Gilbert. Story County Sheriff deputies and Iowa State Patrol officers established a perimeter and conducted traffic control around Gilbert. 170th Street remained closed until Tuesday while power crews worked to restore service.

Windstorms

According to the NCEI database, there were 43 high wind events in Story County from 1996 to 2023. During this time period, there were no reported deaths, but two injuries did occur. There were an estimated \$1.477 million in property damages, and nearly \$30,100 in crop damages recorded. Recorded wind gusts ranged from a high of 60 knots (70.19 mph) to a low of 35 knots (40.28 mph). Table 4-54 provides a summary of the wind speeds reported for the wind events.

Table 4-54: Reported Wind Speeds (knots), NCEI Events from 1996 to 2023

Wind Speed	# of Events
35-40	12
41-45	0
46-50	6
51-55	15
56-60	7
60+	1
N/A	2
TOTAL	43

Source: NCEI; N/A – data not available

The August 2020 Derecho was another notable event that significantly impacted all of Story County. In addition to these events, the HMPC noted that the City of Sheldahl incurred substantial damages from a straight-line wind event in July 2011 that brought down many trees.

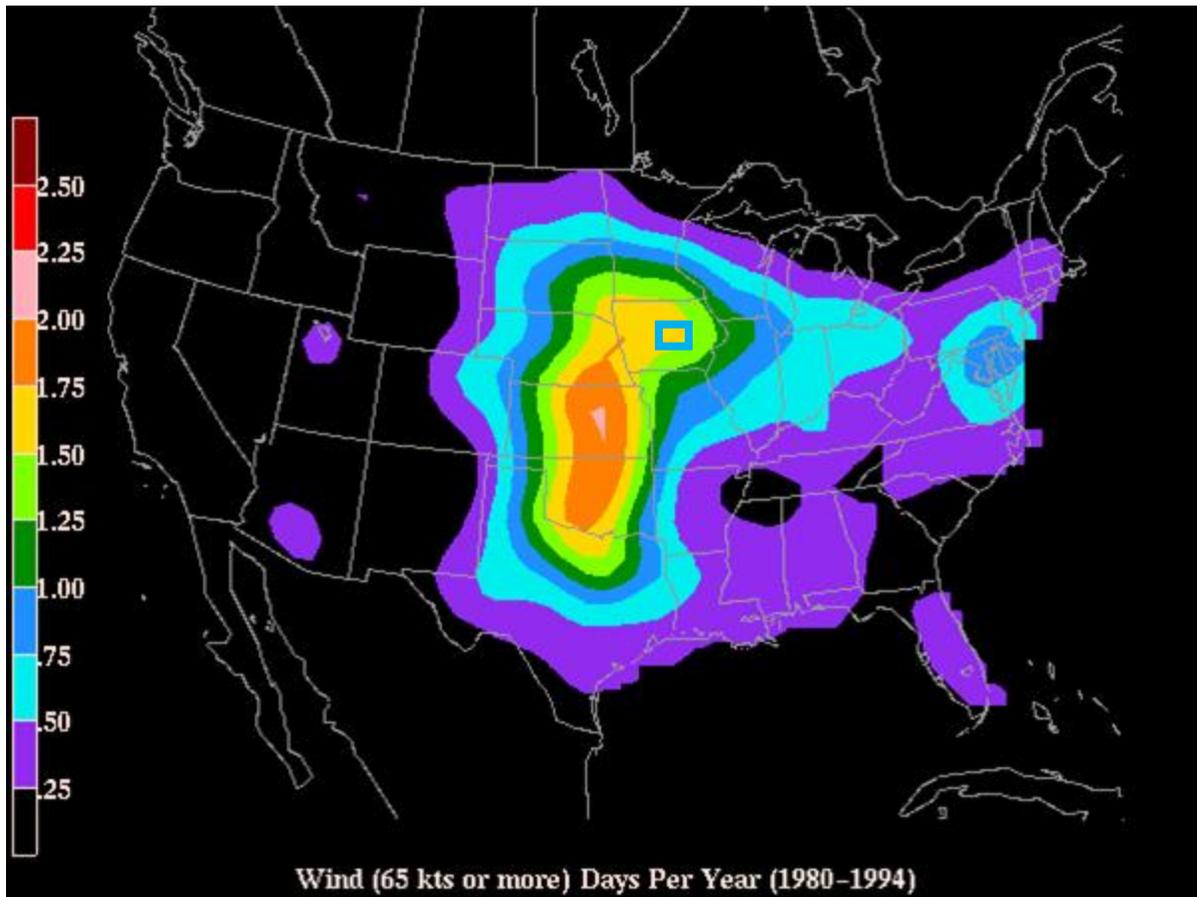
Probability of Future Occurrence

The probability rating of tornadoes and windstorms is "**Highly Likely**". NOAA reported 62 tornadoes in Story County in a 73-year time period. Therefore, it is a high probability that some portion of Story County will experience tornado activity in any given year.

According to NCEI, there were 43 separate high wind events from 1996 to 2023 (27-year period) in Story County. Based on this data there is an over 100-percent annual probability of high wind events in any given year.

Figure 4-55 shows the probability of a windstorm event (65 knots or greater) in the U.S. The Story County planning area is colored yellow, showing that 65+ knot winds are probable to occur 1.50 to 1.75 times a year. Wind speeds of 65 knots converts to approximately 75 mph.

Figure 4-55: Annual Windstorm Probability (65+ knots/75+ mph), United States 1980-1994



Source: NSSL, http://www.nssl.noaa.gov/users/brooks/public_html/bigwind.gif;
 Note: Blue square indicates approximate location of Story County

Magnitude/Severity

Historically, tornadoes and windstorms in Story County have been of **critical** magnitude. However larger and more damaging tornadoes and windstorms have occurred within Iowa, and remain possible in the planning area.

Tornadoes are classified according to the EF- Scale (the original F – Scale was developed by Dr. Theodore Fujita, a renowned severe storm researcher). The Enhanced Fujita Scale (see Table 4-56) attempts to rank tornadoes according to wind speed based on the damage caused. This update to the original F scale was implemented in the U.S. on February 1, 2007. Tornadoes up through EF 5 are possible in the planning area.

Table 4-55: Enhanced F Scale for Tornado Damage

FUJITA SCALE			DERIVED EF SCALE		OPERATIONAL EF SCALE	
F Number	Fastest 1/4-mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165



FUJITA SCALE		DERIVED EF SCALE		OPERATIONAL EF SCALE	
4	208-260	210-261	4	168-199	4
5	261-318	262-317	5	200-234	5
					Over 200

Source: The National Weather Service, www.spc.noaa.gov/faq/tornado/ef-scale.html

The wind speeds for the EF scale and damage descriptions are based on information on the NOAA Storm Prediction Center as listed in Table 4-56. The damage descriptions are summaries. For the actual EF scale, it is necessary to look up the damage indicator (type of structure damaged) and refer to the degrees of damage associated with that indicator. Information on the Enhanced Fujita Scale's damage indicators and degrees of damage is located online at www.spc.noaa.gov/efscale/ef-scale.html.

Table 4-56 Enhanced Fujita Scale and Damage Indicators

EF-Scale	Wind Speed	Classification	Type of Damage Done
EF-0	65-85 mph (105-137 km/h)	Light damage	Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF-1	86-110 mph (138-178 km/h)	Potential damage	Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF-2	111-135 mph (179-218 km/h)	Considerable damage	Roofs torn off houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF-3	136-165 mph (219-266 km/h)	Severe damage	Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF-4	166-200 mph (267-322 km/h)	Devastating damage	Well-constructed houses and whole frame houses completely leveled; cars thrown, and small missiles generated.
EF-5	200 mph + (322 km +)	Total destruction	Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (109 yd); steel reinforced concrete structure badly damaged; high-rise buildings have significant structural deformation; incredible phenomena will occur.

Source: Tornado EF Scale.com

Since the Enhanced Fujita Scale was introduced on February 1, 2007, there have only been two EF5 tornados recorded in the United States. The most recent one occurred in Parkersburg, Iowa on May 25, 2008 and leveled half the city.

Damage from windstorms can be difficult to quantify. Wind, by itself, has not historically caused high insured dollar losses. For the insurance industry to track a weather event, it must be a large enough storm that insurance companies may declare it a catastrophe, and then damage estimates for auto and homeowner claims are collected and published. This generally equates to damages in excess of \$25 million, though significant events impacting small communities are also tracked occasionally.

Similar to tornados, there are various scales to measure and convey the intensity of windstorms. The NWS can issue High Wind Watch, High Wind Warning, and Wind Advisory to the public. The following are the definitions of these issuances:

- High Wind Watch—This is issued when there is the potential of high wind speeds developing that may pose a hazard or are life-threatening.



- High Wind Warning—The 1-minute surface winds of 35 knots (40 mph) or greater lasting for one hour or longer, or winds gusting to 50 knots (58 mph) or greater, regardless of duration, that are either expected or observed over land.
- High Wind Advisory—This is issued when high wind speeds may pose a hazard. Sustained winds 25 to 39 mph and/or gusts to 57 mph.

Table 4-57 shows The Beaufort Wind Scale used to measure windstorm strength.

Table 4-57 The Beaufort Wind Scale

Force	Wind (Knots)	WMO Classification	Appearance of Wind Effects	
			On the Water	On Land
0	Less than 1	Calm	Sea surface smooth & mirror-like	Calm, smoke rises vertically
1	1-3	Light Air	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes
2	4-6	Light Breeze	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move
3	7-10	Gentle Breeze	Large wavelets, crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate Breeze	Small waves 1-4 ft. becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted, small branches move
5	17-21	Fresh Breeze	Moderate waves 4-8 ft taking longer form, many whitecaps, some spray	Small trees in leaf begin to sway
6	22-27	Strong Breeze	Larger waves 8-13 ft, whitecaps common, more spray	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Sea heaps up, waves 13-20 ft, white foam streaks off breakers	Whole trees moving, resistance felt walking against wind
8	34-40	Gale	Moderately high (13-20 ft) waves of greater length, crests begin to break into spindrift, foam blown in streaks	Whole trees in motion, resistance felt walking against wind
9	41-47	Strong Gale	High waves (20 ft), sea begins to roll, dense streaks of foam, spray may reduce visibility	Slight structural damage occurs, slate blows off roofs
10	48-55	Storm	Very high waves (20-30 ft) with overhanging crests, densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees broken or uprooted, considerable structural damage
11	56-63	Violent Storm	Exceptionally high (30-45 ft) waves, foam patches cover sea, visibility more reduced	
12	64+	Hurricane	Air filled with foam, waves over 45 ft, sea completely white with driving spray, visibility greatly reduced	

Source: Storm Prediction Center & NOAA

Climate Change Considerations

According to the 2010 Climate Change Impacts on Iowa report, growing evidence points to stronger summer storm systems in the Midwest. Studies have not been done to conclusively say that severe storms,

including tornadoes, are increasing. However, with summer temperatures becoming warmer and humidity levels increasing, an increase in the likelihood of tornadic activity is plausible.

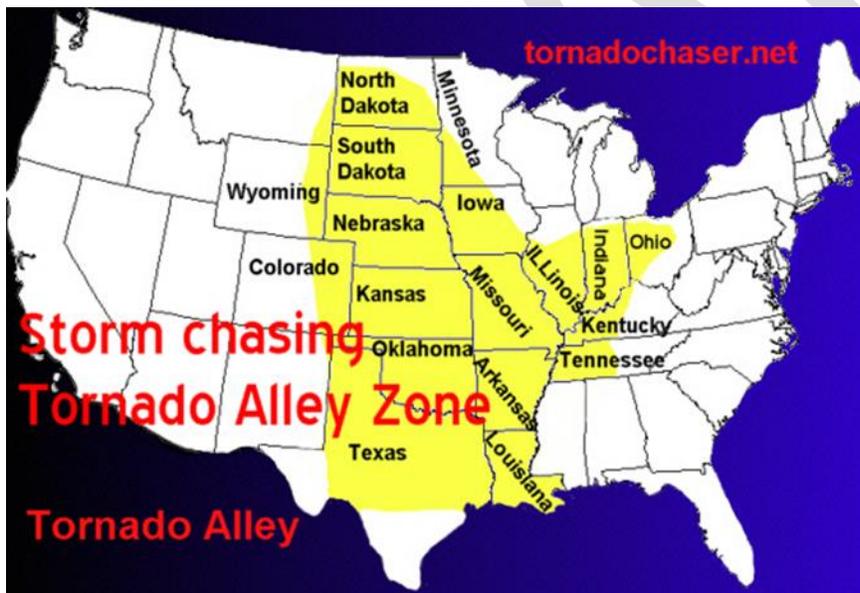
Climate change impacts on the frequency and severity of tornadoes are unclear at this time due to the events occur over a much shorter time periods and tend to impact smaller areas compared to other extreme events such as heat waves and droughts (U.S. Global Change Research Program 2018). NASA's Earth Observatory has conducted studies in 2013, which aim to understand the interaction between climate change and tornadoes. Based on these studies meteorologists are unsure why some thunderstorms generate tornadoes and others don't, beyond knowing that they require a certain type of wind shear. Tornadoes spawn from approximately one percent of thunderstorms, usually supercell thunderstorms that are in a wind shear environment that promotes rotation. Some studies show a potential for a decrease in wind shear in mid-latitude areas. The level of significance of this hazard should be revisited over time.

The influence of climate change on wind is not fully understood at this time. While there have been several significant wind events in recent years, there is not enough observations to determine if there are any long-term trends in frequency of severity of events (US Global Change Research Program 2018).

Vulnerability

Story County is located within a region of the U.S. with high frequency of dangerous and destructive tornadoes and is referred to as "Tornado Alley". Figure 4-56 is based on areas where dangerous tornadoes are most likely to take place.

Figure 4-56: Tornado Alley in the U.S.



Source: <http://www.tornadochaser.net/tornalley.html>

Light frame structures, such as mobile homes, outbuildings and sheds are considered especially vulnerable to damage from tornadoes. Those most at risk from tornadoes include people living in mobile homes, campgrounds, and other dwellings without secure foundations or basements. People in automobiles are also very vulnerable to tornados. According to the US Census Bureau American Community Survey results



for 2022, 3.4% of homes in Story County are considered mobile homes, or 1,333 housing units are mobile homes. In Story County, there are seventeen mobile home parks – eight in Ames, three in Nevada, two in Huxley, and Slater, Maxwell, Colo and Story City each have one. (Note that some of these mobile home parks may actually be located in the unincorporated County despite having addresses in a particular city.)

The elderly (65 and older), young (less than 18 years old), and the physically and mentally handicapped are most vulnerable to tornadoes and wind due to lack of mobility to escape the path of destruction. People who may not understand watches and warnings due to language barriers are also at risk.

Due to the potential for damaging tornadoes in the planning area, the magnitude was determined to be potentially catastrophic.

People

It can be assumed that the entire planning area is exposed to some extent to tornadoes. Certain areas are more exposed due to geographic location and local weather patterns. Likelihood of injuries and fatalities would increase if warning time was limited before the event or if residents were unable to find adequate shelter.

Vulnerable populations are the elderly, low income or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life-threatening to those dependent on electricity for life support. Isolation of these populations is a significant concern. These populations face isolation and exposure after tornado events and could suffer more secondary effects of the hazard. According to the U.S. Health and Human Services emPOWER database, 8% of Medicare Beneficiaries in the County rely on electricity-dependent medical equipment to be able to live independently in their homes. These populations face isolation and exposure after tornado events and could suffer more secondary effects of the hazard. These populations face isolation and exposure after tornado events and could suffer more secondary effects of the hazard.

Individuals caught in the path of a tornado who are unable to seek appropriate shelter are especially vulnerable. This may include individuals who are out in the open, in cars, or who do not have access to basements, cellars, or safe rooms.

Property

All property is vulnerable during tornado and high wind events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. Generally, damage is minimal and goes unreported. Property located at higher elevations may be more prone to wind damage. Property located under or near overhead lines or near large trees may be damaged in the event of a collapse. Wind pressure can create a direct and frontal assault on a structure, pushing walls, doors, and windows inward. Conversely, passing currents can create lift and suction forces that act to pull building components and surfaces outward. The effects of winds are magnified in the upper levels of multi-story structures. As positive and negative forces impact the building's protective envelope (doors, windows, and walls), the result can be roof or building component failures and considerable structural damage.

Mobile homes are more vulnerable to the impacts of a tornado event compared to housing types due to methods of construction. Statewide, mobile homes represent about 3.6% of total housing (U.S. Census). Story fares better than the state average, with 2.3% of total housing units being mobile homes. These still represent a vulnerability in the county to be addressed.



In Story County, the NCDC estimate for past property damages resulting from tornadoes from 1950 – 2023 (73 years) was \$34,007,780. This translates to an annualized loss of nearly \$465,860. For windstorms, NCDC loss estimates were \$1,477,110 from 1996 to 2023 (21 years). This translates to an annualized loss of over \$70,339.

Critical Facilities and Infrastructure

All critical facilities and infrastructure are likely exposed to tornadoes and windstorms, though the likelihood of damage to any critical facilities or infrastructures from this hazard is extremely limited. The most common problems associated with this hazard are utility losses. Downed power lines can cause blackouts, leaving large areas isolated. Phone, water, and sewer systems may not function. Roads may become impassable due to downed trees or other debris.

Tornadoes and windstorms can cause significant damage to trees and power lines, blocking roads with debris, incapacitating transportation, isolating population, and disrupting ingress and egress. Of particular concern are roads providing access to isolated areas and to the elderly. Loss of electricity and phone connection would leave certain populations isolated because residents would be unable to call for assistance. Any facility that is in the path of a tornado is likely to sustain damage.

Additionally, fires may result from damages to natural gas infrastructure. Hazardous materials may be released if a structure is damaged that houses such materials or if such a material is in transport.

Overhead power lines and infrastructure are also vulnerable to damages from windstorms. Potential losses would include cost of repair or replacement of damaged facilities and lost economic opportunities for businesses. Public safety hazards include risk of electrocution from downed power lines. Specific amounts of estimated losses are not available due to the complexity and multiple variables associated with this hazard. Refer to the electric power loss of use estimates provided in Table 4-49 in the Winter Storm hazard section.

Economy

As mentioned above, tornadoes and windstorms can impact exposed critical infrastructure; depending on the impact and the function, this could cause a short-term economic disruption. The most common problems associated with tornadoes and damaging winds are loss of utilities. Downed power lines can cause power outages, leaving large parts of the County isolated, and without electricity, water, and communication. Damage may also limit timely emergency response and the number of evacuation routes.

Based on reported losses from NCEI and the USDA RMA detailed in the property section above, tornadoes and windstorms result in a combined annualized loss of approximately \$35,555,890 in crop and property damages.

Environmental and Cultural Resources

Environmental features are exposed to tornado risk, although damages are generally localized to the path of the tornado however, if tornadoes impact facilities that store HAZMAT areas impacted by material releases may be especially vulnerable. Historic buildings built prior to modern building codes would be more prone to damage. Cultural facilities could also be temporarily shut down until debris is cleaned and residents are accounted for. Some cultural facilities such as community centers, parks, or gas stations may be turned into impromptu emergency centers where emergency supplies can be distributed, and emergency personnel can organize.



Development Trends

Story County has seen an estimated population growth of 10% between 2010 and 2020. With population growth comes new development; this new development increases the County’s vulnerability to a tornado and its impacts. Future development that does occur in growing cities should consider tornado hazards at the planning, engineering and architectural design stages. Public buildings such as schools, government offices, as well as other buildings with a high occupancy and mobile home parks, should consider inclusion of a tornado saferoom to shelter occupants in the event of a tornado.

Windstorms are primarily a public safety and economic concern, and the planning area is located in a region with very high frequency of occurrence. Windstorms can cause damage to structures and power lines which in turn create hazardous conditions for people. Debris flying from high wind events can shatter windows in structures and vehicles and can harm people that are not adequately sheltered.

Although windstorms occur frequently in the planning area and damages to property occur, much of the damage is generally covered by private insurance. This results in less impact to individuals and the community since recovery is facilitated by insurance.

4.3.14 Transportation Incident

Future Probability	Magnitude/Severity	Location	Overall Significance
Highly Likely	Negligible	Limited	Low

Risk Summary

Overall, transportation incident hazard is ranked as **Low** for the County.

- There are hundreds of road transportation accidents in the County every year, therefore, probability of future occurrence is ranked as **highly likely**.
- While airplane incidents can occur anywhere in the County, most transportation accidents are most likely to occur along roadways and railways; therefore, geographic area is ranked as **limited**.
- Most transportation incidents in Story County have been of **negligible** magnitude. However larger and more serious incidents have occurred within Iowa and remain possible in the county.
- The vast majority of deaths from transportation accidents in the County are due to roadway accidents.
- Transportation incidents can disrupt the distribution of goods and delay first responders.
- Significant economic impacts can result from transportation incidents. The U.S. Department of Transportation Federal Highway Administration estimated the cost of a fatality from a transportation incident totaled \$5,694,057.
- Related hazards: Infrastructure Failure, Severe Winter Weather, Hazmat Incident

Description

This hazard encompasses the following: air transportation, highway transportation, and rail transportation. The transportation incidents can involve any mode of transportation that directly threatens life and which



results in property damage and/or death(s)/injury(s) and/or adversely impact a community's capabilities to provide emergency services. Incidents involving buses and other high occupancy vehicles could trigger a response that exceeds the normal day-to-day capabilities of response agencies.

An air transportation incident may involve a military, commercial or private aircraft. Air transportation is playing a more prominent role in transportation as a whole. Airplanes and helicopters are used to transport passengers for business and recreation as well as thousands of tons of cargo. A variety of circumstances can result in an air transportation incident; mechanical failure, pilot error, enemy attack, terrorism, weather conditions and on-board fire can all lead to an air transportation incident.

Highway transportation incidents are very complex. Contributing factors can include a roadway's design and/or pavement conditions (e.g. rain, snow and ice), a vehicle's mechanical condition (e.g. tires, brakes, lights), a driver's behavior (e.g. speeding, inattentiveness and seat belt usage), the driver's condition (e.g. alcohol use, age-related conditions, physical impairment) and driver inattention by using a wireless device. In fact, the driver's behavior and condition factors are the primary cause in an estimated 67 percent of highway crashes and a contributing factor in an estimated 95 percent of all crashes.

A railway transportation incident is a train accident that directly threatens life and/or property, or adversely impacts a community's capabilities to provide emergency services. Railway incidents may include derailments, collisions and highway/rail crossing accidents. Train incidents can result from a variety of causes; human error, mechanical failure, faulty signals, and/or problems with the track. Results of an incident can range from minor "track hops" to catastrophic hazardous material incidents and even human/animal casualties. With so many miles of track in Iowa, vehicles must cross the railroad tracks at numerous at-grade crossings.

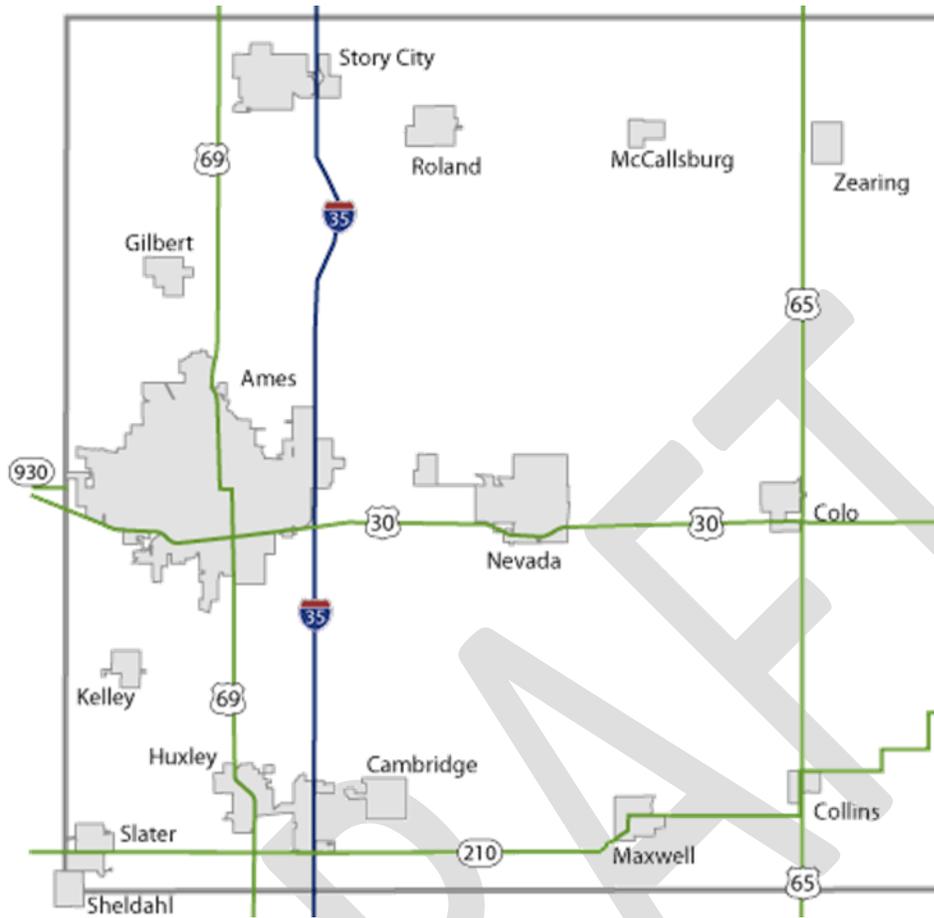
Location

The overall location rating for transportation incidents is **limited**, as this hazard can occur anywhere there are roadways, railways, or air travel infrastructure, but the effects of an incident are most often very localized to the immediate vicinity.

Highways/Roads

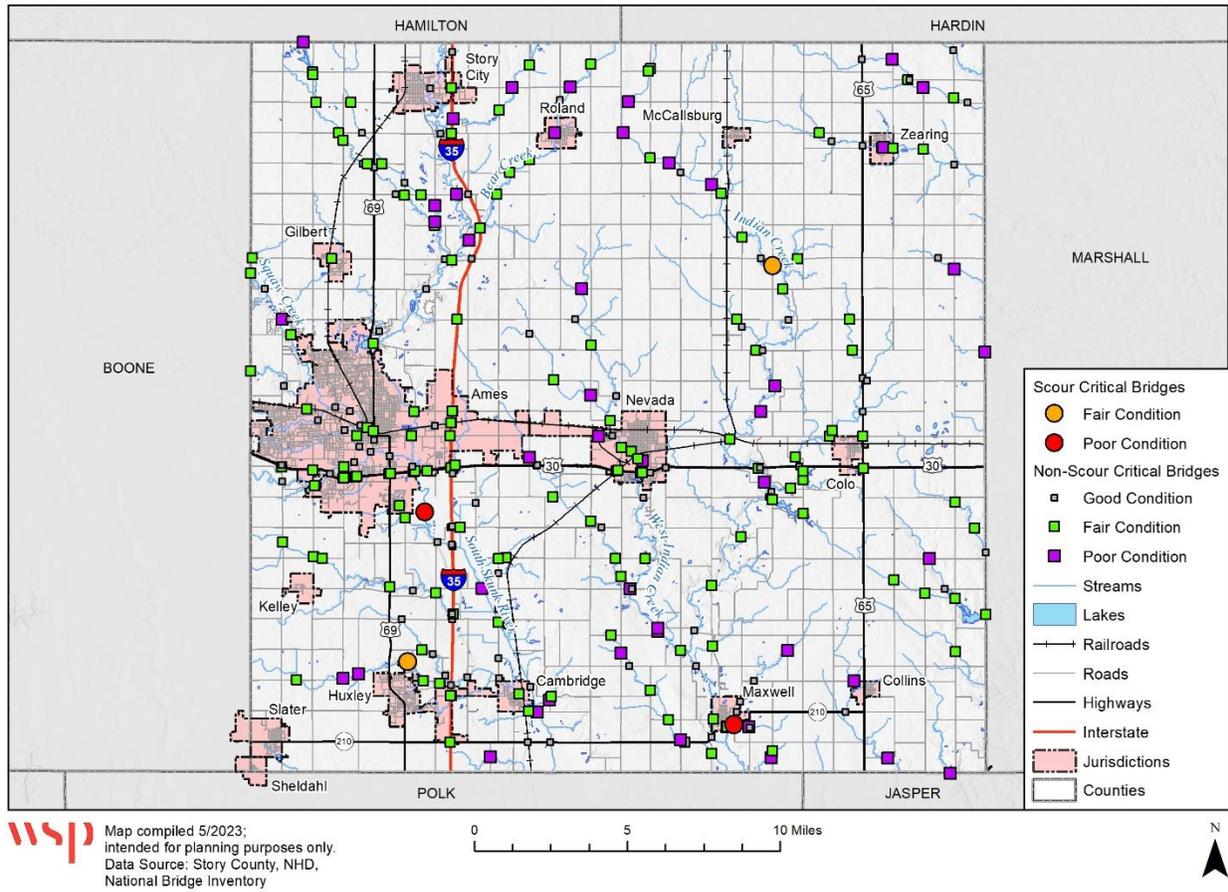
The entire planning area and all participating jurisdictions are subject to transportation incidents. The transportation routes include Interstate 35 running north/south bisecting the County, U.S. Highways 30, 65 and 69, Iowa Highways 210 and 330 and 15 county highways. Numerous paved county roads connect the incorporated cities and unincorporated towns throughout the county. Figure 4-57 below shows the highway network in Story County, while Figure 4-58 below shows all bridges in the county organized by their condition rating.

Figure 4-57: Story County Highway Map



Source: Iowa Department of Transportation, <http://www.iowadot.gov/maps/msp/pdfview/counties.html>

Figure 4-58 Story County Bridges



According to the Iowa Department of Transportation, the total daily traffic across all Story County bridges is 944,247 and the total daily truck traffic is 116,727. (Source: <http://iowadot.maps.arcgis.com/apps/MapSeries/index.html?appid=db6cb43313354a4f85505089ab317e7a>)

Rail Transport

Story County has three railway lines owned and operated by the Union Pacific Railroad Company. The line commonly referred to by Union Pacific as the Overland Route runs east to west through Story County on its route from Chicago, Illinois to Oakland, California. The Overland Route travels through the incorporated communities of Colo, Nevada and Ames. The line commonly referred to by Union Pacific as the Spine Line runs north to south through Story County on its route through the incorporated communities of McCallsburg, Nevada and Cambridge. The third line in Story County, whose origin is in Ames, routes through the incorporated communities of Gilbert and Story City.

In Ames, the railroad that travels east/west/north in the community is a vulnerability issue, as most of the rail crossings in the community are at-grade. Stopped or derailed trains have the potential to severely limit the ability of emergency responders to arrive at locations on the other side of those tracks. Figure 4-59 shows the railroads that operate in Story County.

Figure 4-59: Railroad Lines in Story County



Source: Iowa Department of Transportation, <http://www.iowadot.gov/iowarail/railroads/maps/maphome.htm> Note. UP represents Union Pacific

Air Transport

There is one airport in Story County, the Ames Municipal Airport, which is located on the south side of Ames, just south of U.S. Highway 30. It is mainly used for private and hobby pilots. The Des Moines International Airport is located south of Des Moines and is 30 to 60 miles away from Story County depending on where you are traveling from. The third airport nearby is the Ankeny Regional Airport, which provides commercial and general aviation services, is operated by the Polk County Aviation Authority Board, and is accessible off I-35 exit 90.

The Mary Greeley Medical Center in Ames does not maintain a helipad at the medical facility but utilizes the Ames Airport when there is a need for a medical helicopter landing. The Story County Hospital in Nevada maintains a helipad at its facility for medical helicopters. There are no military installations in Story County but Camp Dodge in Johnston, Iowa is the closest active military installation, although the Department of Defense classifies it as a major training center.

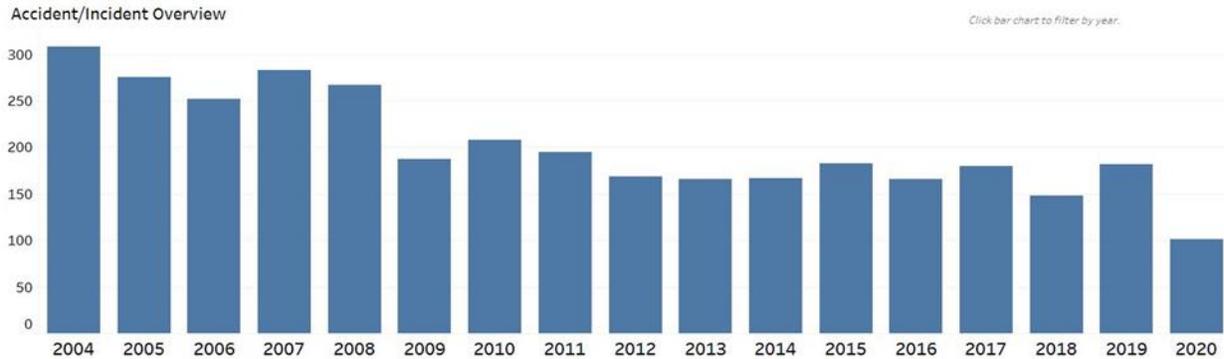
Past Occurrences

Rail Transportation Incidents

Railway transportation incidents involving derailments have become a more common, and dangerous, occurrence with the increased shipment of oil and oil products. The Federal Railway Administration reported 22 railway accidents from 2001-2021 statewide in Iowa. Of these accidents, 18 were highway-rail incidents. From 2018-2021 railway incidents in Iowa led to 1 death, 9 injuries, and \$19,715,043 in reportable damages.

Throughout Iowa, rail car traffic has increased but the number of derailments in relationship to the traffic is trending downward according to the Iowa Department of Transportation (see Figure 4-60). Iowa has 5,157 public highway-rail crossings in the State on state, city, and county highways.

Figure 4-60 Iowa Railway Accidents/Incidents, 2004-2020



Source: U.S. Department of Transportation Federal Railroad Administration, Overview Reports

Air Transportation Incidents

There has been one aviation incident in Story County that has been reported to the National Transportation Safety Board (NTSB) during the ten-year period from January 1, 2002 to December 31, 2012.

January 30, 2003 in Ames – A private plane was coming into land at the Ames Airport under moderate snowfall. The NTSB determined that the pilot failed to maintain the proper glide path during the final approach and struck a power pole and went through electric wires, causing the plane to crash in a field ¼ mile short of the runway. There were no injuries. The plane wing and tail section were damaged.

Highway Transportation Incidents

The Iowa Department of Transportation’s Office of Traffic and Safety maintains traffic crash statistics and location maps by county and city in Iowa. According to this data, there were 8,302 roadway crashes in Story County from 2018-2023, cumulatively resulting in 25 fatalities, 137 serious injuries, and 808 minor injuries. Table 4-58 below shows the reportable interstate crash history for the state from 2008 to 2022.

Table 4-58: Iowa Interstate Crash History, 2008-2022

Year	Total Crashes	Crash Severity					Total Injuries	Injury Severity				
		Fatal	Major	Minor	Possible/Unknown	Damage Only		Fatalities	Major	Minor	Possible	Unknown
2022	5,604	36	105	487	700	4,276	1,695	38	132	597	783	145
2021	5,470	28	95	499	689	4,159	1,686	30	113	649	774	120
2020	4,575	28	88	378	611	3,470	1,437	33	103	479	723	99
2019	6,224	35	111	538	817	4,723	1,975	38	140	671	1,009	117
2018	5,831	28	97	460	778	4,468	1,873	34	117	610	990	122
2017	5,227	25	89	423	688	4,002	1,603	26	112	533	852	80
2016	5,276	38	72	407	712	4,047	1,661	46	97	530	909	79
2015	6,032	29	105	441	815	4,642	1,940	35	143	604	1,074	84
2014	5,704	26	122	452	745	4,359	1,822	30	148	613	985	46
2013	5,194	35	99	419	702	3,939	1,716	39	131	550	953	43
2012	4,544	28	107	414	594	3,401	1,598	34	130	579	817	38
2011	4,639	37	102	376	629	3,495	1,575	42	129	524	833	47
2010	5,535	48	124	454	787	4,122	1,976	58	152	617	1,108	41
2009	5,331	42	111	442	760	3,976	1,905	47	142	604	1,068	44
2008	5,886	58	160	553	849	4,266	2,268	66	196	776	1,189	41

Source: Iowa Department of Transportation’s Office of Traffic and Safety



Probability of Future Occurrence

Based on the available information, the probability of air transportation or highway incident that directly threatens life and which results in property damage and/or death(s)/injury(s) and/or adversely impact a community's capabilities to provide emergency services is "**Highly Likely**" with greater than 33 percent likelihood to occur in any given year.

A major transportation incident can occur at any time. Even though traffic engineering, inspection of traffic facilities and land use management of areas adjacent to roads and highways has increased, incidents continue to occur as the volume of traffic in the county increases. The combination of cars and trucks, farm equipment, wildlife, unpredictable weather conditions, potential mechanical problems and human error always leaves the potential for a transportation accident.

Magnitude/Severity

Historically, most transportation incidents in Story County have been of at most **negligible** magnitude. However larger and more serious incidents have occurred within Iowa and remain possible in the planning area.

Highway incidents threaten the health and lives of people in the vehicles and pedestrians, as well as the wider vicinity if hazardous materials are involved. Mass casualty events can occur if mass transit vehicles are involved. Community bus and school buses have a good safety record, but accidents can and do occur. Numerous injuries are a realistic possibility in situations involving mass transit vehicles. Property damage would be limited to vehicles and cargo involved; roads, bridges, and other infrastructure; utilities such as light and power poles; and third-party property adjacent to the accident scene such as buildings and yards.

Railway incidents can result in death, injury, and property damage. Deaths and injuries can range from those directly involved, to citizens in the community affected by hazardous materials.

Depending on the materials involved, evacuations may occur, moving residents away from dangerous products and the possibility of explosion. Gases, liquids, and solids can contaminate air, soil, and water in and near the incident scene. If a railway incident occurred in an urban area, the health and welfare of thousands of people could be put in jeopardy. Damage may be limited to the train, railcars, and cargo involved, but it can also include loss of production, business disruption due to evacuations, and business disruptions of those served by the railroad. Business and traffic disruptions could last several days until the clean-up efforts are complete.

Climate Change Considerations

If projections regarding milder winters come to fruition, climate change impacts may reduce the number of transportation incidents associated with some severe weather. However, if ice occurs, rather than snow, this could result in higher incidents of weather-related accidents.

Vulnerability

Transportation incidents can almost always be expected to occur in specific areas, on or near airports, roadways or other transportation infrastructure. The exception is air transportation incidents, which can occur anywhere. However, it is difficult to predict the magnitude of any specific event because these types of events are generally accidental and the circumstances surrounding these events will impact the extent of damage or injuries that occur.



People

Those who use the roadway transportation system are most vulnerable. Travelers, truckers, delivery personnel, and commuters are at risk the entire time they are on the road. During high traffic hours and holidays the number of people on the road in Story County is higher. This is also true before and after major gatherings such as sporting events, concerts, conventions, and major events around Iowa State University, such as the start and end of semesters. Pedestrians and citizens of the community are less vulnerable but still not immune from the impacts of a highway incident.

For railway transportation incidents, people, and property near the railway lines, crossing, sidings, switching stations, and loading/unloading points are most at risk. Those away from railroad tracks and facilities are vulnerable only to large-scale incidents including those in which hazardous materials are involved.

Property

No countywide or jurisdictional loss estimate were calculated due to lack of data. Generally, private property involved in such an event is likely to be insured, while impacts would be smaller, localized, and unlikely to last for a long period of time.

Critical Facilities and Infrastructure

Incidents involving highway accidents could result in injuries, fatalities, closed roads, rerouted traffic, and a strain on the capacity of emergency service personnel who must respond to the incident. In general, all critical facilities in all jurisdictions could be vulnerable to transportation incident. Highway accidents could affect the flow of traffic and ability of residents to travel within and out of the jurisdiction. For those cities vulnerable to railway transportation incidents, large areas of the city could be affected by a train derailment.

Economy

The U.S. Department of Transportation Federal Highway Administration issued a technical advisory in 1994 providing suggested estimates of the cost of traffic crashes to be used for planning purposes. These figures were converted from 1994 dollars to 2023 dollars using U.S. Bureau of Labor Statistics Consumer Price Index Inflation Calculator. The costs are listed below in Table 4-59.

Table 4-59: Costs of a Traffic Crash

Severity	Cost per injury (in 2023 dollars)
Fatal	\$5,694,057
Evident Injury	\$78,838
Possible Injury	\$41,612
Property Damage Only	\$4,381

Source: U.S. Department of Transportation Federal Highway Administration Technical Advisory T 7570.2, 1994. Adjusted to 2023 dollars.

Estimated losses as a result of railway transportation and air transportation are not available for this analysis.

Environment and Cultural Resources

Most likely environmental vulnerabilities to transportation incidents would be related to pollution and hazardous materials spills resulting from crashes.

Development Trends

The Iowa Department of Transportation, Office of Aviation, has an Aviation System Plan 2010-2030 that makes recommendations for future development of the air transportation system until 2030. The plan describes the role of air transportation for Iowans for moving people and goods. A 2009 Iowa Department



of Transportation study determined that the Iowa air transportation system contributes about \$5.4 billion a year to Iowa's economy and supports an estimated 47,034 jobs. (source: <http://www.iowadot.gov/aviation/studiesreports/systemplanreports.html>)

According to the Iowa Department of Transportation, there are no major federal interstate or state highway projects scheduled in Story County at the time of this planning effort.

The Ames Area Metropolitan Planning Organization has a 2035 Ames Area Long Range Transportation Plan to address its growing population and employment that are supplemented with increased transportation needs. This plan includes roadways, pedestrian, bicycle and transit system of the Ames area and makes recommendations for future transportation needs in the Ames area. The County's 5-year Plan and Capital Improvements Program also address future road development.

DRAFT



4.4 Hazard Analysis Summary

This table below provides a tabular summary of the hazard ranking for each jurisdiction in the planning area.

Table 4-60 Hazard Ranking Summary by Jurisdiction

Jurisdiction	Animal / Plant / Crop Disease	Drought	Extreme Heat	Flooding	Grass/Wildland Fire	Hazardous Materials	Human Disease	Infrastructure Failure	Severe Summer Weather	Severe Winter Storm	Sinkholes	Terrorism	Tornado/Windstorm	Transportation Incident
Story County, Iowa	L	M	M	H	M	M	M	M	H	H	L	M	H	L
City of Ames	L	M	M	H	M	H	M	M	H	H	L	M	H	M
City of Cambridge	L	M	M	H	M	M	M	M	H	H	N/A	M	H	L
City of Collins	L	M	M	M	M	M	M	M	H	H	N/A	M	H	L
City of Colo	L	M	M	N/A	M	M	M	M	H	H	N/A	M	H	L
City of Gilbert	L	M	M	M	M	M	M	M	H	H	N/A	M	H	L
City of Huxley	L	M	M	M	M	H	M	M	H	H	N/A	M	H	L
City of Kelley	L	M	M	N/A	M	M	M	M	H	H	N/A	M	H	L
City of Maxwell	L	M	M	H	M	M	M	M	H	H	N/A	M	H	L
City of McCallsburg	L	M	M	N/A	M	M	M	M	H	H	N/A	M	H	L
City of Nevada	L	M	M	H	M	H	M	M	H	H	N/A	M	H	L
City of Roland	L	M	M	H	M	M	M	M	H	H	L	M	H	L
City of Sheldahl	L	M	M	N/A	M	M	M	M	H	H	N/A	M	H	L
City of Slater	L	M	M	M	M	M	M	M	H	H	N/A	M	H	L
City of Story City	L	M	M	H	M	H	M	M	H	H	L	M	H	L
City of Zearing	L	M	M	M	M	M	M	M	H	H	N/A	M	H	L
Ames Schools	L	M	M	H	M	H	M	M	H	H	N/A	M	H	L
Ballard Schools	L	M	M	H	M	H	M	M	H	H	N/A	M	H	L
Collins-Maxwell Schools	L	M	M	H	M	M	M	M	H	H	N/A	M	H	L
Colo-Nesco Schools	L	M	M	M	M	M	M	M	H	H	N/A	M	H	L
Gilbert Schools	L	M	M	M	M	M	M	M	H	H	N/A	M	H	L
Nevada Schools	L	M	M	H	M	H	M	M	H	H	N/A	M	H	L
Roland-Story Schools	L	M	M	H	M	H	M	M	H	H	N/A	M	H	L
Iowa State University	L	M	M	H	M	H	M	M	H	H	N/A	M	H	L

Note: H = High, M = Medium, L = Low, N/A = Not Applicable

5 Mitigation Strategy

44 CFR Requirement §201.6(c)(3):

[The plan shall include] a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools. This section shall include:

- (i) A description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.*
- (ii) A section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.*
- (iii) An action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.*

This section presents the mitigation strategy updated by the Hazard Mitigation Planning Committee (HMPC) based on the updated risk assessment. The mitigation strategy was developed through a collaborative group process and consists of updated general goal statements to guide the jurisdictions in efforts to lessen disaster impacts, as well as specific mitigation actions that can be put in place to directly reduce vulnerability to hazards and losses. The following definitions are based upon those found in FEMA's Local Mitigation Planning Handbook:

- **Goals** are general guidelines that explain what the community wants to achieve with the plan. They are usually broad policy-type statements that are long-term, and they represent visions for reducing or avoiding losses from the identified hazards.
Mitigation Actions are specific projects and activities that help achieve goals. They are measures, projects, plans or activities proposed to reduce the current and future vulnerabilities described in the risk assessment.

5.1 Goals

The HMPC reviewed the goals and objectives from the 2018 HMP, and determined they still captured what the jurisdictions want to accomplish. The HMPC participated in a facilitated discussion during their third meeting to review and update the plan goals. To ensure that the goals are comprehensive and support State goals, the 2018 State of Iowa Hazard Mitigation Plan goals were reviewed as well. The HMPC also reviewed common categories of mitigation goals from other plans. Ultimately, the HMPC determined that the goals from 2018 still aligned with the needs of the community and chose to carry them forward for the 2024-2029 update as written.

The goals for the 2024-2029 Story County HMP are:

- Goal 1: Protect lives and reduce injury.
- Goal 2: Minimize or reduce damage to property, especially critical facilities and infrastructure.
- Goal 3: Strengthen communication among agencies and between agencies and the public regarding hazard mitigation.



5.2 Progress on Previous Mitigation Actions

The jurisdictions reviewed and updated the status of each mitigation action identified in the 2018 HMP. Actions were listed as Not Started, In Progress, Continuous Implementation, Completed, or Deleted. As shown in Table 5-1, of the 102 actions in the 2018 HMP, 16 actions have been completed showing that the jurisdictions are making good progress in implementing mitigation activities. An additional seven (7) actions were determined to no longer be relevant and were deleted, with reasoning provided in the table. The remaining 77 actions were continued over into the 2023 HMP, along with 55 new actions.



Table 5-1 Completed and Deleted Actions

Jurisdiction	Action #	Mitigation Action	Hazards Addressed	Comments
Story County	Story-4	Indoor warning systems to be required in all county buildings with public access Story County buildings do not have the capability to warn the public who access the building other than by face to face communication of the event of severe weather or other threats. There are parts of county building where the public may not interact with county staff to warn them of the event.	Animal/Plant/Crop Disease, Drought, Extreme Heat, Grass/Wildland Fire, Hazmat, Human Disease, Infrastructure Failure, Flooding, Winter Storm, Sinkhole, Summer Weather, Tornado/Wind, Transportation Incident	Completed. JC, Admin, and HSC all now have an auxiliary notification system. All County buildings on the network phone system have the ability to use the phone paging.
Story County	Story-5	Promote and construct tornado safe rooms on county owned properties. Currently no county building has a tornado safe room for the public who utilize County facilities daily. County Conservation manages public camp grounds during the summer that only have limited sheltering capabilities which is undersized and inadequate to withstand a significant tornado event.	Tornado	Completed. There are designated areas for each location depending on the structure type. Hickory Grove Park has a storm safe room which can accommodate park visitors.
Story County	Story - 14	Continue participation in HUD Lead Hazard Control Program and encourage communities to consider joining when opportunity arises Story County has an older housing stock, and many of the structures could potentially contain lead-based paints and materials.	Human Disease	Deleted. Story County is no longer participating in the program.
Story County	Story - 17	Develop and implement information regarding public safety to be available at community facilities The County is committed to protecting people and maintaining a high level of communication to ensure County residents remain safe and informed. Safety and communication are vital to the welfare of the Story County residents	Animal/Plant/Crop Disease, Drought, Extreme Heat, Grass/Wildland Fire, Hazmat, Human Disease, Infrastructure Failure, Flooding, Winter Storm, Sinkhole, Summer Weather, Tornado/Wind, Transportation Incident	Deleted. Remove action unless the consultants have some suggested outreach measures and materials.
Colo	Colo-2	Develop and maintain pipeline mapping using GIS.	Tornado/Windstorm	Completed
Colo	Colo-8	Install backup power supplies for outdoor warning sirens.	Flash Flood	Completed
Colo	Colo-11	Place weather radios in all public buildings	Thunderstorm/Lightning/Hail, Tornado/Windstorm	Completed
Gilbert	Gilbert-6	Dutch Elm Disease Study	Animal/Plant/Crop Disease, Infrastructure Failure, Severe Winter Storm, Tornado/Windstorm	Completed



Jurisdiction	Action #	Mitigation Action	Hazards Addressed	Comments
Huxley	Huxley-5	Safe room, continued protection	Tornado/Windstorm	Completed. Continued use with no changes.
Huxley	Huxley-6	Shelter for extreme winter weather	Severe Winter Storm	Completed. Continued use of both saferoom and Fire Department used with no changes.
Nevada	Nevada-1	Install backup power supplies for outdoor warning sirens.	Flash Flood, Thunderstorm/Lightning/Hail, Tornado/Windstorm	Completed.
Nevada	Nevada-2	Purchase and install outdoor warning systems.	Flash Flood, Thunderstorm/Lightning/Hail, Tornado/Windstorm	Completed.
Nevada	Nevada-4	Establish recreational area saferooms.	Extreme Heat, Severe Winter Storm, Thunderstorm/Lightning/Hail, Tornado/Windstorm	Deleted.
Nevada	Nevada-6	Work with Story County Emergency Management to disseminate multi- hazard public information	Extreme Heat, Flash Flood, Hazardous Materials Incident, Flooding, Severe Winter Storm, Thunderstorm/Lightning/Hail, Tornado/Windstorm, Transportation Incident	Completed
Roland	Roland-7	W. Maple Street Bridge Replacement	Infrastructure Failure, Flooding, Transportation Incident	Completed. In 2020.
Story City	Story City-6*	Annually review Floodplain Management Ordinance to ensure it addresses concerns related to development in the floodplain	Flooding	Completed. New ordinance adopted in 2020.
Story City	Story City-9	Wastewater Treatment Plant - Flood Control	Flooding	Deleted. City will be constructing a new Wastewater Treatment Plant in 2024 outside of the flood plain.
USD Ames	USD Ames-4	Assure safe areas are available at school facilities for personnel to seek refuge or protection during severe weather events	Extreme Heat, Severe Winter Storm, Terrorism, Thunderstorm/Lightning/Hail, Tornado/Windstorm	Completed.
USD Gilbert	USD Gilbert-1	Construct a saferoom	Tornado/Windstorm	Deleted. This is no longer a district priority.



Jurisdiction	Action #	Mitigation Action	Hazards Addressed	Comments
Nevada CSD	Nevada CSD-3	Room-level emergency notification help buttons	Terrorism	Completed. Updated goals during 2023: 1.) Eliminate CCTV Blind Spots (additional cameras/lighting); 2.) Automate Door Locks (add crash bar motors; add hardware for emergency access; replace wireless door locks with wired door locks; integrate door locks to CCTV system.); 3.) Signage (Doors and windows numbered and visible from exterior for expedited emergency response.)
Nevada CSD	Nevada CSD-4	Emergency notification system	Extreme Heat, Hazardous Materials Incident, Human Disease, Infrastructure Failure, Severe Winter Storm, Terrorism, Thunderstorm/Lightning/Hail, Tornado/Windstorm, Transportation Incident	Completed. Updated goals for 2023: 1.) Eliminate CCTV Blind Spots (additional cameras/lighting); 2.) Automate Door Locks (add crash bar motors; add hardware for emergency access; replace wireless door locks with wired door locks; integrate door locks to CCTV system.); 3.) Signage (Doors and windows numbered and visible from exterior for expedited emergency response.)
Iowa State University	ISU-4	Purchase and install monitoring equipment for creeks & rivers along with flood monitoring software to increase flood warning time.	River Flood	Deleted. Considered to be an unnecessary duplication of effort. ISU is comfortable with the level of service its National Weather Service partners and their affiliated state and federal agencies provide for flood forecasting.
Iowa State University	F-11	Conduct regular creek maintenance in creeks and floodplain areas. This program clears and removes debris that could contribute to blockage and flooding and may include the removal of silt in areas of high risk to flood damage.	Flash Flood	Deleted. Regular waterway maintenance is primarily a City of Ames responsibility, as Ames has the heavy equipment necessary for clearing major blockages. ISU Facilities Planning & Management will partner with this effort upon request.

5.3 Identification and Analysis of Mitigation Actions

To identify and select mitigation measures to support the mitigation goals, each hazard identified in Chapter 3 was evaluated. The HMPC analyzed a comprehensive set of viable mitigation alternatives for both new and existing buildings and infrastructure that would support identified goals and objectives.

Potential mitigation measures were considered as part of the following six categories:

Prevention: Government administrative or regulatory measures or processes that influence the way land and buildings are developed and built. These measures also include public activities to reduce hazard losses. Examples include:

- Planning and zoning
- Hazard mapping
- Building codes
- Subdivision regulations
- Studies/data collection and analysis to support prevention measures
- Floodplain regulations
- Storm water management regulations
- Multi-jurisdictional agreements that reduce hazard risks
- Other regulatory measures or processes that reduce hazard risks

Property Protection: Measures that involve modifying existing buildings or structures to protect them from a hazard, or removing buildings or structures from the hazard area, or providing insurance to cover potential losses. Examples include:

- Acquisition, elevation, or relocation of hazard-prone property
- Safe room/storm shelter retrofits
- Security retrofits
- Critical facility protection
- Risk reduction retrofits (modifications) to hazard prone properties
- Studies/data collection and analysis to develop property protection measures
- National Flood Insurance Program (NFIP) participation

Structural Projects: Measures that involve the construction and maintenance of structures and infrastructure that will reduce the impact of a hazard or redirect the impact away from people and property. Examples include:

- Channel modification/maintenance
- Dam and reservoir construction/maintenance
- Levee and floodwall construction and maintenance
- Safe room construction
- Infrastructure construction and maintenance – roads and bridges
- Infrastructure construction and maintenance – utility systems
- Infrastructure construction and maintenance – urban and rural drainage systems
- Studies and data collection to develop structural projects

Natural Resource Protection: Measures that, in addition to minimizing hazard losses; preserve or restore the functions of natural systems. Examples include:



- Sediment and erosion control
- Stream corridor restoration, watershed management
- Forest and vegetation management
- Wetland restoration and preservation

Public Education and Awareness: Measures to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them. Examples include:

- Programs to improve awareness of hazard risk
- Programs to improve awareness of hazard risk prevention and reduction
- Education programs directed toward specialized audience, i.e., buildings, developers, and hazard prone neighborhoods.

Emergency Services: Measures taken before, during and after a hazard event to protect people, and property; although these measures are not typically considered "mitigation, they significantly minimize the events impact and preserve the community's health and safety. Examples include:

- Emergency/response facilities and personnel
- Hazard warning systems and equipment
- Health/safety/environmental risk prevention/reduction
- Emergency/response infrastructure
- Emergency/response planning
- Emergency/response training
- Emergency/response vehicles, equipment, and protective gear
- Emergency/response services studies and data collection
- Emergency/response communication systems

The HMPC reviewed the hazards and vulnerabilities covered in Section 5, and looked for ways to reduce losses from those hazards by achieving the four 'A's' of mitigation:

- **Alter** the physical nature of the hazard: wildfire defensible space and fuels treatments, snow fences etc.
- **Avert** the hazard away from people, buildings, and infrastructure: engineered solutions, drainage, and channel improvements, floodproofing, fuel breaks.
- **Adapt** to the hazard: land use planning, building codes and design standards, warning systems etc.
- **Avoid** the hazard: natural systems protection, open space, acquisition, or relocation of properties out of hazardous areas.

To facilitate the brainstorming process, the HMPC referred to a matrix of typical mitigation alternatives organized by CRS category for the hazards identified in the plan, in addition to a handout that explains the categories and provided examples. HMPC members were encouraged to develop mitigation alternatives that would protect future, as well as existing, development from hazards per the DMA 2000 regulations. With an understanding of the alternatives, a brainstorming session was conducted to generate a list of preferred mitigation actions. The result was new and updated project ideas with the intent of meeting the identified goals and mitigating identified hazards.

5.3.1 Prioritization Process

The Planning Team discussed a wide range of possible mitigation actions and employed the STAPLEE methodology (see description below) to evaluate and prioritize each proposed action. For each recommended action, the Planning Team developed a project summary that included a description of the action, the department or agency responsible for implementing it, and an estimated timeframe for

completion. While STAPLEE provided a template for the Planning Team to evaluate a range of specific mitigation actions and projects, the results of the risk assessment were also considered (i.e., probability and severity of impacts for each hazard). Planning Team members also weighed the pros and cons of proposed actions based on their judgement, subject matter expertise and experience with local hazards.

STAPLEE criteria were used as one method for evaluating the effectiveness of each action item. STAPLEE considers social, technical, administrative, political, legal, economic, and environmental constraints and benefits of a proposed activity.

- **Social:** Does the measure treat people fairly?
- **Technical:** Will it work? Does it solve the problem? Is it feasible?
- **Administrative:** Is there capacity to implement and manage the project?
- **Political:** Who are the stakeholders? Did they get to participate? Is there public support? Is political leadership willing to support the project?
- **Legal:** Does your organization have the authority to implement? Is it legal? Are there liability implications?
- **Economic:** Is it cost-beneficial? Is there funding? Does it contribute to the local economy or economic development? Does it reduce direct property losses or indirect economic losses?
- **Environmental:** Does it comply with environmental regulations or have adverse environmental impacts?

In accordance with the DMA requirements, an emphasis was placed on the importance of a benefit-cost analysis in determining project priority (the economic factor of STAPLEE). Other criteria used to recommend what actions might be more important, more effective, or more likely to be implemented than another included:

- Does the action protect lives?
- Does the action address hazards or areas with the highest risk?
- Does the action protect critical facilities, infrastructure, or community assets?
- Does the action meet multiple goals or address multiple hazards?

At the mitigation strategy meeting, the HMPC reviewed and discussed the STAPLEE considerations to determine which of the identified actions were most likely to be implemented and effective. Prioritization of previous mitigation actions identified in the 2018 HMP that are continuing in the updated plan were revisited during a HMPC meeting. New actions identified during 2023 were also prioritized based on discussions and review with the STAPLEE considerations in mind.

5.3.2 Financial Resources

The availability of funding can play a significant role in the formulation, implementation, and proposed project mitigation actions. There are a wide variety of Federal grant programs that can potentially be used to fund local mitigation activities, to include the following FEMA grants:

- **Hazard Mitigation Grant Program (HMGP):** Post-disaster multi-hazard mitigation funding for federally declared disasters. HMGP Post Fire funds are available for FMAG declarations.
- **Building Resilient Infrastructure & Communities (BRIC):** Pre-disaster/annual cycle addressing all natural hazards, with an emphasis on infrastructure & lifelines.
- **Flood Mitigation Assistance (FMA) Program:** Pre-disaster/annual cycle for repetitive flood loss property reduction and projects that mitigate losses to NFIP insured properties.
- **High Hazard Potential Dam Program (HHPD):** Pre-disaster/annual cycle, for non-Federal dams in Unsatisfactory conditions.



5.3.3 Continued Compliance with the National Flood Insurance Program

As described in Section 3.3.4, Story County, and the Cities of Ames, Cambridge, Collins, Gilbert, Huxley, Kelley, Maxwell, McCallsburg, Nevada, Roland, Slater, Story City, and Zearing all participate in the NFIP. Each of these jurisdictions will continue to participate and comply with NFIP standards.

Given the flood hazard and risk in the planning area and recognizing the importance of the NFIP in mitigating flood losses, an emphasis is placed on continued compliance with the NFIP by Story County and all NFIP-participating jurisdictions. As NFIP participants, these communities have and will continue to make every effort to remain in good standing with the NFIP. This includes continuing to comply with the NFIP’s standards for updating and adopting floodplain maps and maintaining and updating the floodplain zoning ordinance. There are several action items identified in that address specifics related to NFIP continued compliance. Other details related to NFIP participation are noted in Chapter 2 under the Jurisdictional Capabilities Section and the flood vulnerability discussion in Section 3.3.4.

5.4 Mitigation Action Plan

This section outlines the development of the updated mitigation action plan. The action plan consists of the specific projects, or actions, designed to meet the plan’s goals. As noted in Section 4.2, a number of mitigation activities have already been completed or are in progress. Over time the implementation of new and continuing projects will be tracked as a measure of demonstrated progress on meeting the plan’s goals.

The total number of actions identified by each jurisdiction is summarized in Table 5-2, as well as those actions completed, deleted, or continued from the 2018 HMP.

Table 5-2 Mitigation Action Plan Summary

Jurisdiction	2018 Actions	Actions Completed	Actions Deleted	Actions Continued	New Actions	Grand Total Moving Forward
Unincorporated Story County	13	2	2	9	6	15
Ames	10	0	0	10	6	16
Cambridge	1	0	0	1	6	7
Collins	6	0	0	6	5	11
Colo	10	3	0	7	1	8
Gilbert	4	1	0	3	1	4
Huxley	4	2	0	2	2	4
Kelley	5	0	0	5	1	6
Maxwell	3	0	0	3	2	5
McCallsburg	2	0	0	2	1	3
Nevada	6	3	1	2	3	5
Roland	3	1	0	2	6	8
Sheldahl	1	0	0	1	2	3
Slater	7	0	0	7	3	10
Story City	5	1	1	3	2	5
Zearing	-	-	-	-	1	1
Ames CSD	2	1	0	1	2	3
Ballard CSD	1	0	0	1	1	2



Jurisdiction	2018 Actions	Actions Completed	Actions Deleted	Actions Continued	New Actions	Grand Total Moving Forward
Collins-Maxwell CSD	1	0	0	0	x	NP
Colo-NESCO CSD	1	0	0	1	1	2
Gilbert CSD	1	0	1	0	1	1
Nevada CSD	3	2	0	1	1	2
Roland-Story CSD	1	0	0	1	1	2
Iowa State University	12	0	2	10	1	11
Grand Total	102	16	7	78	56	134

*The Collins-Maxwell CSD elected not to participate in the planning process during the 2023 update. The City of Zearing is a new participant in the planning process, and as such does not have any previous mitigation actions to report on.

The results of the project identification and prioritization exercise for each participating jurisdiction are summarized in Table 5-3 through Table 5-25 below. These projects detail specific actions for reducing future hazard-related losses within Story County. The projects are organized by jurisdiction and include notes about the department and partners necessary to implement the project, estimated cost, potential funding sources, timeline, which goal(s) that the projects support, and their relative level of priority high, medium, and low.

The Cost Estimate column describes the estimated project costs using the following categories:

- Little to no cost
- Low: Less than \$10,000
- Moderate: \$10,000-\$100,000
- High: \$100,000-\$1,000,000
- Very High: More than \$1,000,000

The Timeline column describes the estimated time of completion for each project using the following categories:

- Short Term: 1-2 years
- Medium Term: 3-5 years
- Long Term: 5+ years
- Ongoing: action is implemented every year

The tables also provide status/implementation notes that describe progress made on the actions so far, using the following categories, and, where applicable, notes if there were changes in the priority level from the previous plan:

- **Not Started:** Work has not begun.
- **In Progress:** Work has begun but not completed.
- **Continuous:** Ongoing annually with no specific end date.
- **Completed:** The action has been finished.
- **Deleted:** The action is no longer relevant due to changing priorities, lack of funds, etc.

The mitigation action summary table presenting the summary of continuing and new mitigation actions for each jurisdiction is provided in Table 5-2. In addition to the 78 actions that were continued from the previous plan, 56 new actions were identified, for a combined total of 134 actions in this updated mitigation strategy. The Action ID for each action is based on jurisdiction and sequential order, with continuing actions numbered first and new actions developed in 2023 numbered last.



Table 5-3 Story County Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Story-1	Increase and support public education in preparedness, response and recovery relating to all hazards affecting Story County. Public Education of the risks and hazards and how to prepare the public is key to protect lives and reduce injury during disaster. The public will also understand expectations during disaster response and recovery.	Animal/Plant/Crop Disease, Drought, Extreme Heat, Grass/Wildland Fire, Hazmat, Human Disease, Infrastructure Failure, Flooding, Winter Storm, Sinkhole, Summer Weather, Tornado/Wind, Transportation Incident	County Outreach and Special Projects Manager, Communications Assistant; in partnership with other county offices and departments.	Low; Local funds and Citizen Corp Program grant funds	Ongoing	Medium	Not Started.
Story-2	Development and implementation of a COOP/COG plan for Story County government. Story County government consists of critical facilities and infrastructure that currently do not have adequate plans to ensure the continuation of government in the event of a disaster or emergency. Development of this plan will ensure that County government will allow Story County government the ability to enhance their ability to continue operations when impacted by disaster or emergency with a minimum investment of resources.	Animal/Plant/Crop Disease, Drought, Extreme Heat, Grass/Wildland Fire, Hazmat, Human Disease, Infrastructure Failure, Flooding, Winter Storm, Sinkhole, Summer Weather, Tornado/Wind, Transportation Incident	Story County Emergency Management Agency	Little to no cost; Staff Time, Local funds	Ongoing	Medium	Annual Implementation. The adopted COOP/COG is reviewed annually and/or as needed.
Story-3	Fixed and mobile generation capabilities on county owned buildings in order to continue operations and provide essential services in the event of a disaster or emergency. Not all Story County buildings have adequate back up power to provide	Animal/Plant/Crop Disease, Drought, Extreme Heat, Grass/Wildland Fire, Hazmat, Human Disease, Infrastructure Failure, Flooding,	Story County Board of Supervisors, Story County Emergency Management	Moderate; Hazard Mitigation Grant funds and local funds	Long Term	High	In Progress. It is budgeted for in FY24 to fully back up Administration Building and add back up to the Engineers complex. The Story County Conservation



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
	essential services during a disaster or emergency electrical service is lost. Many essential services would cease during prolonged power outages and endangering public health and negatively impacting commerce.	Winter Storm, Sinkhole, Summer Weather, Tornado/Wind, Transportation Incident					Board (SCCB) residences have been improved to accept portable generators.
Story-4	Continued promotion and participation in the National Flood Insurance Program (NFIP). Story County has participated in the NFIP program in the past. Through the provisions of NFIP, flood risk is studied and documented, new development is protected, and the public becomes more aware of flooding risk when purchasing properties.	Flooding	Story County Board of Supervisors	Little to no cost; Staff Time, existing budgets	Medium Term	High	Annual Implementation.
Story-5	Enrollment and support of the NFIP Community Rating System (CRS) Program for the unincorporated areas of the county to reduce flood insurance costs and enhance floodplain management. Since the adoption of the revised FIRMS in 2008, the number of properties with structures location in the special flood hazard area increased substantially, along with increasing interest and requirements by lenders for flood insurance. As the Biggert-Waters Act of 2012 is implemented, many of the policies based upon use of grandfathering clauses (post 2008) will lose this benefit and experience substantial premium increases.	Flooding	Emergency Management, Story County Engineer's Officer, Story County Conservation, IDNR, Planning and Development	Little to no cost; Staff Time, existing budgets	Ongoing	High	Annual Implementation. Story County is a Class 7 CRS Community.



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Story-6	Develop and implement a program to provide wildfire training and preventative measures Wildfire fighting in many aspects is fundamentally different than structure fire fighting. Wildfire fighting capacity within the county could be significantly improved by facilitating training of local fire departments.	Grass or Wildland Fire	Story County Board of Supervisors, Story County Conservation Board, Story County Emergency Management Agency, Iowa Department of Natural Resources, Story County Fire Chiefs	Low; Local funds and Living Roadways Trust Fund grants	Ongoing	Medium	Not Started.
Story-7	Develop a density-based zoning program to mitigate potential conflicts between agricultural and non-agricultural uses. The majority of land in unincorporated Story County is agricultural, and there are potential impacts of non-ag uses on those ag uses nearby.	Animal/Plant/Crop Disease, Infrastructure Failure	Story County Board of Supervisors, Story County Conservation Board, Story County Planning and Zoning Commission	Low; Staff time, Local funds	Medium Term	Medium	In Progress. Some crop land is being converted to permanent vegetated buffer. Planning and Development is working to develop minimum levels of service in address potential impacts.
Story-8	Continue offering radon test kits Radon is a naturally occurring gas that is invisible, odorless, and tasteless that can be found throughout the United States. Radon comes from the natural (radioactive) breakdown of uranium occurring in soil, rock, and water. Radon gas can enter into any type of building (homes, offices, schools) which can then lead to a high indoor radon gas level in the air you breathe. Lung cancer is the only health effect which has been definitively linked to radon gas exposure. Radon gas is the second leading cause of lung cancer in the United States.	Human Disease	Story County Board of Supervisors, Story County Planning and Development	Low; Local funds, Other - Grant funds	Ongoing	High	Annual Implementation. Story County Environmental Health actively promotes the radon test kits.



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Story-9	Communicate with IDOT, UP, IEDA, and IDOT Freight Optimization Program to determine freight train capacities and plans The Union Pacific (UP) Railroad controls three major rail lines running through and within Story County and permitting 143 tons gross weight cars and unit trains. As these pass-through communities, materials are being carried that if derailment were to occur, could have costly impacts.	Hazardous Materials Incident, Transportation Incident	Story County Emergency Management Agency, Story County Planning and Development, Story County Engineer, IEDA, IDOT, UP	Low; Local funds	Long Term	High	In Progress. Conversations with UP, Story County and some communities in Story County are underway to address concerns of blocked crossings. Perhaps this overall mitigation action should be reworded?
Story-10	Hazardous tree removal mitigation project, including the removal of dead ash trees in the public road rights-of-way. Through the development of this project within the public right-of-way, Story County may take the approach of preemptively removing a portion of their non-infested ash trees annually to minimize these impacts over time and also act in a reactive mode to remove ash trees that are either infested with EAB or dead.	Animal/Plant/Crop Disease, Grass/Wildland Fire; Severe Winter Storms; Tornado/Windstorms; Infrastructure Failure; Transportation Incidents;	Story County Secondary Roads, Story County Board of Supervisors	High; Will seek out grant funding as appropriate, adopted budget item	Medium Term	High	New in 2023
Story-11	Mobile emergency power generation charging facilities using PowerFilm capacities. Identify ways to provide emergency power generation in a mobile format and potential partners for the development of systems and plan for rapid deployment of systems as necessary.	Drought & Extreme Heat; Infrastructure Failure; Transportation Incidents; Tornado/Windstorms; Severe Winter Storms;	Board of Supervisors; Facilities Management	High; FEMA HMA Grants	Medium Term	Medium	New in 2023
Story-12	Development of a healthy homes program. Create a Healthy Homes Program that takes a comprehensive approach to the quality of existing housing stock by	Human Disease; Infrastructure Failure; Severe Winter Storms;	Board of Supervisors; Story County Environmental Health; Story	High; FEMA HMA Grants	Long Term	High	New in 2023



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
	focusing on housing-related hazards in a coordinated fashion, rather than addressing a single hazard at a time including mold, water intrusion, lead paint, allergens, asthma, carbon monoxide, home safety, pesticides, and radon (a dangerous gas found mainly in basements).		County Planning and Development				
Story-13	Conduct physical inventory of street signs and prioritize replacement. Develop and analyze cost-efficient sign replacement strategies	Infrastructure Failure; Transportation Incidents;	Story County Secondary Roads Department; Story County Planning and Development; Board of Supervisors	Moderate; Existing Budgets	Medium Term	Medium	New in 2023
Story-14	Adopt and enforce building codes for unincorporated Story County. The adoption and enforcement of building codes in unincorporated Story County can ensure structures are built to withstand hazards.	Infrastructure Failure; Flooding; Severe Winter Storms; Sinkhole; Tornado/Windstorms;	Story County Planning and Development Department; Board of Supervisors	Moderate; Existing Budgets	Medium Term	High	New in 2023
Story-15	Monitor Mitigation Plan implementation. Monitoring the implementation of the hazard mitigation plan to ensure that mitigation actions are being completed through: Annual meeting of the local hazard mitigation planning committee to monitor progress on local mitigation actions. Adhering to the plan implementation monitoring schedule in Chapter 6 including outlined roles for those responsible for monitoring. Preparing and submitting an annual plan implementation progress report to the Board of Supervisors.	Animal/Plant/Crop Disease; Drought & Extreme Heat; Grass/Wildland Fire; Hazardous Materials Incident; Human Disease; Infrastructure Failure; Flooding; Severe Winter Storms; Sinkhole; Severe Summer Weather (Thunderstorms/Lightning/Hail); Tornado/Windstorms; Transportation Incidents;	Board of Supervisors	Little to no cost; Staff Time	Ongoing	High	New in 2023



Table 5-4 City of Ames Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Ames-1	Develop and enhance capabilities to communicate hazard-related information to City employees, other jurisdictions, and the public. Continued coverage of the outdoor warning system is needed as the City grows, and newer technologies to model and communicate hazards citywide or to specific groups are needed to help provide directions in the event of an imminent disaster. The City must continue to upgrade communications equipment to effectively marshal resources before, during, and after disasters of all types. A Distributed Antenna System (DAS) is needed at the Incident Command Center located at the Water Plant to improve emergency communication capability via cellular networks.	Animal/Plant/Crop Disease, Drought, Extreme Heat, Grass/Wildland Fire, Hazmat, Human Disease, Infrastructure Failure, Flooding, Winter Storm, Sinkhole, Summer Weather, Tornado/Wind, Transportation Incident	Police, Water & Pollution Control, Electric, Fire, Information Services; ISU	High; Water Plant DAS, Hazard Mitigation Assistance Grants	Medium Term	High	In Progress. Water Plant - A Distributed Antenna System is still needed to provide robust cell communications in support of ICC events.
Ames-2	Plan for and install backup power supplies to critical facilities. All of the City's water wells are connected to just one source of electricity. In the event of an extended power outage, water production would stop, and the safety of the drinking water supply could be threatened.	Animal/Plant/Crop Disease, Drought, Extreme Heat, Grass/Wildland Fire, Hazmat, Human Disease, Infrastructure Failure, Flooding, Winter Storm, Sinkhole, Summer Weather, Tornado/Wind, Transportation Incident	Water and Pollution Control, Electric;	Very High; 570000 \$220,000 - SAM generator; \$985,000 - YSC Generator; \$1,000,000 - North River Valley Generator; Water Fund; FEMA HMA	Medium Term	High	In Progress. Water Plant - contracts have been awarded for standby power at the SAM pump station and for the new North River Valley Well Field. But lead times for generators are being reported at 50+ months, and large transformers are at 110+ months. We are in our second year of trying to work through a FEMA hazard mitigation grant application for standby power in the Youth Sports Complex; but the cost has skyrocketed since our initial



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
							application and FEMA and we would need to revise our requested dollar amount.
Ames-3	Identify security and environmental vulnerabilities in utility infrastructure. Develop procedures and policies, install equipment, or modify facilities to reduce the threat of utility infrastructure failure. Portions of the City's utilities infrastructure are not fully controlled for remote site access, leaving open the possibility of unauthorized access and tampering. Portions of the City's electrical infrastructure require additional guarding to reduce outages associated with high winds, ice, tornadoes, and animals.	Animal/Plant/Crop Disease, Drought, Extreme Heat, Grass/Wildland Fire, Hazmat, Human Disease, Infrastructure Failure, Flooding, Winter Storm, Sinkhole, Summer Weather, Tornado/Wind, Transportation Incident	Water and Pollution Control, Public Works, Electric; ISU	High; \$100,000 (remote site access); \$308,000 annually (tree trimming); Water fund, Electric Fund	Medium Term	High	In Progress. Water Plant - Cameras have been added to a pump station and one elevated tank utilizing the ARA-Net system. Additional camera(s) are planned for at least one well field.
Ames-4	Develop plans and preventative actions, train personnel, and obtain equipment to be used to address hazards in the community in concert with other jurisdictions. These jurisdictions include other local, state, and federal agencies, and private organizations. The City of Ames is home to several local, state, and federal offices. Planning is required to ensure that responses of these offices are coordinated with the City's response. This is particularly important for law enforcement responses coordinated with Iowa State University Police. Specialized equipment is necessary to train and effectively protect unique facilities.	Animal/Plant/Crop Disease, Drought, Extreme Heat, Grass/Wildland Fire, Hazmat, Human Disease, Infrastructure Failure, Flooding, Winter Storm, Sinkhole, Summer Weather, Tornado/Wind, Transportation Incident	Police, Fire; ISU, Story County, State of Iowa, U.S. Department of Agriculture, U.S. Department of Energy	Low; Staff Time, Existing Budget	Medium Term	Medium	In Progress. StoryComm has been up and running for a few years now. StoryComm is made up of representatives from Story County, ISU and the City of Ames, with the intent to provide 911 communications throughout the county. This included the buildout of a countywide radio system. The new radio system was fully functional as of the fall of 2020. During a large scale EOC exercise alongside Story County Emergency Management Agency (SCEMA) in April of 2023, additional communication



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
							barriers were identified. It was understood, at a recent Emergency Management Commission meeting in 2023, that SCEMA may be purchasing EOC software that the City of Ames Incident Command Center would be able to use.
Ames-5	Protect properties from river and flash flooding through the construction of water storage areas, building of flood protection structures, implementation of non-structural measures such as buy-outs of flood-prone properties, implementation of policies, and other measures to reduce the risk of property damage and threats to resident safety. The City of Ames has experienced substantial river flooding and localized flooding on multiple occasions. This flooding has caused interruptions in utilities and services, lost productivity, and property damage.	Flooding	Water and Pollution Control, Public Works, Planning and Housing; ISU, Story County, Iowa DOT, Iowa DNR	Very High; Up to \$1.5 billion; \$50,000 to update the HEC-RAS hydraulic flood models; General Fund, Sewer Fund, Transit Fund, grants, loans, FEMA HMA Grants, BRIC	Long Term	Medium	In Progress/Annual Implementation. Some progress has been made including a flood mitigation project completed by Public Works. There are other property protection needs, such as the Water Plant's 30" well line south of E Lincoln Way. Water Plant - Funding is needed to develop an updated hydraulic model of the South Skunk and loway Creek basins. Ongoing development, as well as flood mitigation measures, have rendered the existing model inaccurate. Funding to be proposed in the FY 24/25 operating budget out of the Sewer Fund. P&H current maps adopted in 2021 for floodplains are based upon 2008 data. Iowa DNR is in progress of updating maps based on 2D hydraulic flows and the 2020 LiDAR Iowa DNR gathered for Story Co. DOT plans changes to Skunk River Bridge in the near future that could also



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
							impact this type of study. PW - We are continuing to complete project including incorporation of stormwater management with each new development plus City projects to also reduce flooding within the CIP projects.
Ames-6	Install equipment to protect critical facilities from fire. Part of the Resource Recovery Plant's facility does not have adequate fire protection. Additionally, the City Power Plant has no fire protection systems in the turbine/generators, either gas turbines, the maintenance shop, or over the coal handling system. These locations are all parts of critical facilities. A fire in any of these systems could significantly diminish the City's ability to provide essential utilities to residents.	Infrastructure Failure, Grass/Wildland Fire	Electric, Public Works, Water & Pollution Control;	Very High; \$1,603,969 (Power Plant/Gas Turbines); \$505,370 (Resource Recovery System); Electric Fund, G.O. Bonds, FEMA HMA Grants, BRIC	Medium Term	High	In Progress. WATER POLLUTION CONTROL FACILITY – Design of plant upgrades specifically includes measures to slow the spread of fire, given that the facility does not have access to a typical domestic water system.
Ames-7	Evaluate sanitary sewer infrastructure for deficiencies and improve them to reduce potential service backups in the sanitary sewer system and reduce peak flows to the treatment plant. Evaluate storm sewer infrastructure for deficiencies and improve them to reduce the potential for localized flooding. During heavy rains, residents in some portions of Ames experience sanitary or storm sewer backups on their property. Excess flow to the Water Pollution Control Facility increases treatment costs and presents environmental challenges	Flooding, Infrastructure Failure	Public Works; Storm Sewer Fund, Sewer Fund, State Revolving Loan Fund	Very High; 19665000; Storm Sewer Fund, Sewer Fund, State Revolving Loan Fund, BRIC	Long Term	High	In Progress. WATER POLLUTION CONTROL FACILITY - Design of plant upgrades will accommodate flow rates experienced over the past ten years.



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Ames-8	Develop and enhance a Continuity of Operations Plan In the event of a disaster that disrupts the City's ability to provide essential services, there is currently no plan to provide services from temporary locations. This increases the risk of infrastructure failure immediately after an initial disaster.	Infrastructure Failure	Risk Manager;	Little to no cost; Staff Time, Existing Budget	Medium Term	Medium	In Progress. Have some general ideas but no written plan at this time.
Ames-9	Evaluate the costs and benefits and consider joining the NFIP community Rating System. The City of Ames is susceptible to river flooding and participates in the National Flood Insurance Program. The Community Rating System would encourage the City to consider above-and-beyond measures to reduce flooding risk. It would also reduce flood insurance premiums for those residents that are insured and increase awareness of flood plain regulations and restrictions.	Flooding	Planning and Housing;	Low; Staff Time, General Fund	Short Term	Low	Not Started. P&H--City Council has not directed staff to research the value of participating in this program and what if any premium reductions would occur for properties within the flood plain. The City uses its own flood plain regulation requirements for all development in lieu of CRS. Current practices likely yield about a 7 or 6 Rating, 15-20% insurance premium savings, but not sure the City has any insured facilities in the Hazard Area besides park facilities.
Ames-10	Incorporate Crime Prevention Through Environmental Design strategies into future enhancements and revisions to community design guidelines. City-owned or critical facilities may present a target for criminal activity. As new facilities are added, a review using CPTED principles may reduce the propensity for crime to occur at those facilities. These principles can also be applied to reduce crime in neighborhoods.	Animal/Plant/Crop Disease, Drought, Extreme Heat, Grass/Wildland Fire, Hazmat, Human Disease, Infrastructure Failure, Flooding, Winter Storm, Sinkhole, Summer Weather, Tornado/Wind, Transportation Incident	Police, Planning and Housing;	Low; General Fund, Grant Funding	Medium Term	Low	Not Started. P&H--Landscape code updates are not currently prioritized with the City. DRC does review site design for conformance to general site planning principals, even though CPTED is not currently referenced.



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Ames-11	River/Stream/Slope Stabilization and Restoration. Erosion of S Skunk River, loway Creek, tributary to Ada Hayden, Worrell Creek, Clear Creek, College Creek and Onion Creek contribute estimated 35,400 tons of soil erosion annually according to a completed Ames Stream Assessment 2011 report by Mimi Wagner. Stabilize and restoration of rivers, streams, and mass slopes is critical to protect infrastructure where movement of the waterways jeopardizes health, safety, and operation.	Flooding	Public Works	Very High; \$25,000,000; Storm Water Utility Fund, Sewer Utility Fund, Water Utility Fund, G.O. Bonds, SRF, IDALS, FEMA HMA, Bric Grants	Ongoing	Medium	New in 2023
Ames-12	Community safe room with cooling center project. Over 34% of Ames residents do not have a basement and/or safe room in their home as a place to seek shelter during a tornado or high wind event. Of that population, 75% of them live in apartments where access to the lowest level and interior of the building is not equally accessible to everyone. Additionally, Ames is host to many outdoor athletic events throughout the year, with nowhere to send visitors during severe weather events. Creating a communitywide safe room, that can double as a cooling center during extreme heat warnings, would provide Ames with it's first community safe room and cooling center that would provide equal access to the entire community.	Extreme Heat, Flooding, Winter Storm, Summer Weather, Tornado/Wind	Fire, Iowa State University	Very High; \$1,250,000; Include as part of a larger public building project along with a FEMA HMA or BRIC grant.	Medium Term	High	New in 2023
Ames-13	Urban Tree Management. Natural disasters/diseases caused trees located in the right of way and on private property to fall and block	Animal/Plant/Crop Disease, Drought, Extreme Heat,	Parks and Recreation, Electric Dept., Public Works, Risk	Very High; City of Ames budget, State of Iowa	Long Term	Medium	New in 2023



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
	roadways, cause injury/death to individuals, and cause a loss in tree canopy. Also, trees have fallen on electrical infrastructure causing outages across the Ames community. The City of Ames manages over 17,000 trees with two certified arborists, nine maintenance workers, two chippers, one bucket truck, and multiple other pieces of tree cutting equipment.	Grass/Wildland Fire, Infrastructure Failure, Winter Storm, Summer Weather, Tornado/Wind	Management; Story County Emergency Management, Iowa DHSEM, Iowa DNR, Iowa Agriculture and Land Stewardship, Iowa State University	Funds, FEMA HMA Grants			
Ames-14	Water System Resiliency. 1) Physical connection with other water suppliers (City of Nevada and/or rural water). Emergency potable water hookup with the city of Nevada, IA to allow water sharing in the event of a disaster. 2) 4" water main replacements. Replaces an estimated 7.3 miles of aging 4" water main to allow better fire-fighting capabilities and removes known remaining lead service lines. 3a) Construct new 5-million-gallon ground storage reservoir. Increases water storage capacity and pumping capabilities. 3b) Increase water main size on 13th Street and at Water Plant. 3c) New high service pumps at new plant. To increase pumping capabilities on the East side of the Skunk River and allow 15 MGD pumping from the Water Plant. 4) Water Plant distributed antenna system. Improve communication within the Water Plant which currently serves as the Incident Command Center for the City of Ames. 5a) Back-up power generation to SAM pump station, YSC wells, and River Valley wells. Provides standby power to critical	Drought, Extreme Heat, Hazmat, Infrastructure Failure, Flooding, Winter Storm, Summer Weather, Tornado/Wind	Ames Water & Pollution Control, Ames Public Works	Very High - \$35,000,000; Water Fund, Sewer Fund, SRF, FEMA HMA or BRIC Grants	Long Term	High	New in 2023



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
	remote infrastructure sites. 5b) Remote site fencing (SAM). Increases physical security at a critical infrastructure site containing a pumping station, standby generator, and elevated tanks storage that provides potable water to West Ames. 6) Update to HEC-RAS hydraulic flood model. Update the City's dated flood model to encompass flood mitigation projects and better predict flood events. 7) New 1-million-gallon water tower. Increases water storage capabilities and provides adequate water pressure for industrial users and fire-flow protection.						
Ames-15	Advanced metering infrastructure (AMI). The Utility's electric metering system does not have the functional capability to allow for enhanced utility activities. These include activities like load management for energy peak reductions, identifying outages in real time down to the specific meter, and real-time feeder and transformer studies to avoid overloading of circuits and moving load to other feeders before it becomes an issue. This project will allow for the selection of an advanced metering system and provide a multi-year activity to systematically replace customers' meters as these new services are implemented.	Infrastructure Failure, Winter Storm, Summer Weather, Tornado/Windstorm	Electric Department	Very High; Electric Fund, FEMA HMA, BRIC	Medium Term	Medium	New in 2023
Ames-16	New 161kV Transmission Line to Serve the City and Iowa State University. The Utility's electric infrastructure contains three transmission lines that connect to	Infrastructure Failure, Winter Storm, Summer Weather,	Electric Department	Very High; \$35,000,000; FEMA HMA or BRIC, Electric Fund	Long Term	Medium	New in 2023



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
	the surrounding electric grid outside the Utility's territory. These three transmission lines consist of two 161kV, one going to the West and one to the South, each capable of providing the entire peak energy demand of the city. The third transmission line is 69kV and also goes to the South of the City. Based on regional studies completed by the regional transmission owner in the area, under maintenance scenarios with either of the two 161 kV line out, local fossil fuel generation must be operated for system reliability as a precaution for the next transmission contingency. This project will study, design and construct a new 161kV transmission line. The line will provide a new source of electric delivery to Ames and Iowa State University to significantly reduce the dependency of fossil fuel generation to provide grid stability during periods of transmission maintenance, major storms, and other acts of God.	Tornado/Windstorm					
Ames-17	Solar + Storage at electric distribution and public works. The Public Works Department and Electric Distribution are both crucial entities to ensure the smooth operation of the city of Ames. During widespread power outages, such as the 2020 derecho, both were immediately dispatched to begin clearing city streets to allow for movement of emergency services to all locations within the city. Having a facility as home base that is powered during a widespread outage will create a faster response	Extreme Heat, Infrastructure Failure, Winter Storm, Summer Weather, Tornado/Windstorm	Electric Department	Very High; \$1,525,000; Electric Fund, FEMA HMA Grants, BRIC	Short Term	Medium	New in 2023



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
	time and will help efforts to clear streets and restore power more quickly. This project will study, design, and construct a solar + storage system for the Electric Distribution building. Having the building with an independent power source will allow the distribution department to respond to large system outages more quickly, as well as eliminate the need for fossil-based emergency generators.						

Table 5-5 City of Cambridge Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Cambridge-1	Backup generator for new Cambridge Community Center. Existing fire station is inadequate for City of Cambridge's Emergency Shelter Requirements	Extreme Heat, Flooding, Infrastructure Failure, Severe Winter Storm, Thunderstorm/Lightning/Hail	Cambridge Public Works	Moderate; FEMA HMA Grants, Local Funds	Short Term	High	Not Started. The city will plan on applying for grants and setting aside money to pay for the cost of the generator.
Cambridge-2	Text/phone/email alert and warning system. Implement a text/phone/email alert system that can be used to communicate with Cambridge residents during emergency situations. Currently, we post announcements on the city's website and Facebook page, but not everyone is on Facebook or frequents our website.	Tornado/Windstorms; Transportation Incidents; Hazardous Materials Incident; Grass/Wildland Fire; Infrastructure Failure; Severe Winter Storms;	City of Cambridge Administration	Low; FEMA HMA Grants, City Funds	Short Term	Medium	New in 2023
Cambridge-3	Dead tree removal. There are several dead trees within the right-of-way in the city of Cambridge. Some of these trees are located	Animal/Plant/Crop Disease, Infrastructure Failure;	City of Cambridge Administration	Moderate; FEMA HMA Grants, City Funds	Medium Term	High	New in 2023



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
	near power lines. By removing these dead/dying trees, the city would be eliminating the risk of these trees falling and knocking down power lines.	Tornado/Windstorms; Severe Summer Weather (Thunderstorms/Lightning/Hail);					
Cambridge-4	Updates to city of Cambridge outdoor warning siren system. Make updates and/or replace sirens to get them up to industry standards and make sure they will activate in hazardous weather conditions.	Tornado/Windstorms; Severe Summer Weather (Thunderstorms/Lightning/Hail); Infrastructure Failure;	City of Cambridge Administration	Moderate; FEMA HMA Grants, City Funds	Medium Term	High	New in 2023
Cambridge-5	Education/outreach communication program. Create an education/outreach program to communicate to the public about what to do in the event of a hazardous weather situation or widespread, long-lasting power outage. Let them know of safe spaces they can go during and after storms, such as the community center or residences that are open to having fellow citizens seek shelter in their private homes.	Tornado/Windstorms; Severe Summer Weather (Thunderstorms/Lightning/Hail); Infrastructure Failure;	City of Cambridge Administration	Low; FEMA HMA Grants, City Funds	Medium Term	Medium	New in 2023
Cambridge-6	Removal of dead/damaged trees/tree limbs in Josiah Chandler recreation area. The August 2020 derecho greatly impacted the many trees in Josiah Chandler recreation area in Cambridge. Many trees are dead or have broken limbs that are either hanging or need to be removed. Considering the high drought conditions in recent years, these dead/damaged trees could be a large fire source should a fire break out.	Drought & Extreme Heat; Grass/Wildland Fire	City of Cambridge Administration	Moderate; FEMA HMA Grants, City Funds	Medium Term	Medium	New in 2023
Cambridge-7	Storm sewer improvements on the north side of town in coordination with the City's infrastructure Plan	Flooding	Cambridge Public Works	High; FEMA HMA Grants, City Funds	Medium Term	Medium	New in 2023; The city is in the process of making storm sewer



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
							improvements on the north side of town using grant funding the city recently reviews. With these improvements, it will help move water faster during high rain events and prevent standing water/flooding in that area of town.

Table 5-6 City of Collins Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Collins-1	Establish recreational area/community saferooms. Limited areas to take refuge from storms. Not all homes in town have basements, however many that do experience flooding during heavy rains.	Thunderstorm/Lightning/Hail, Tornado/Windstorm	Elected Officials-City council/Mayor, Public Works; FEMA; IEMD; possibly another entity who would benefit from a dual-purpose facility.	High; FEMA Grant, Local funds, In-Kind	Medium Term	Medium	In Progress. updating our community center to provide a refuge during severe weather events.
Collins-2	Provide indoor NOAA weather radios to critical facilities, community shelters, city facilities, schools, and other identified areas. Source of early notification is needed for inclement weather that has the potential for destruction and loss of life	Extreme Heat, Flood, Severe Winter Storm, Thunderstorm/Lightning/Hail, Tornado/Windstorm	Public Works, Elected Officials; City, Hazard Mitigation Assistance Grant	Little or No Cost; FEMA Grant, Local funds, In-Kind	Medium Term	Low	Not Started. This has been low priority due to other obligations



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Collins-3	Provide training for City employees and landowners on dealing with flash flood events. Collins is prone to flash flooding	Flood	Public Works, Elected Officials;	Little or No Cost; FEMA Grant, Local funds, In-Kind	Ongoing	Medium	In Progress. Council meetings, Try to educate citizens and land owners during
Collins-4	Update Stormwater System City of Collins is prone to flooding issues. The existing stormwater system is insufficient; runoff from agricultural land inundates system.	Flood	Elected Officials/ Public Works Dept.; City, CDBG, FEMA, SRF, Grants	Very High; FEMA Grant, Local funds, In-Kind	Medium Term	High	In Progress. updated culverts and grading of water channels to direct water thru and out of town
Collins-5	Work with Story County Emergency Management to disseminate public information regarding steps citizens can take to prevent or minimize damages and risk to natural and human-caused hazards. Communication between City and County	Extreme Heat, Flood, Hazardous Materials Incident, Infrastructure Failure, Severe Winter Storm, Sinkholes, Terrorism, Thunderstorm/Lightning/Hail, Tornado/Windstorm, Transportation Incident	Story County, Collins Public Works & Elected Officials; Story County & City of Collins	Little or No Cost; Other: Minimal Cost - Basic Communication	Ongoing	Medium	In Progress. Keep in communications with SCEM personnel to implement safety strategies
Collins-6	Annually Review Floodplain Management Ordinance The City of Collins participates in the NFIP and has a floodplain management ordinance to regulate development in the floodplain; not currently reviewed annually but will be reviewed annually in the future	Flood	City Clerk, Public Works, Elected Officials; Iowa Department of Natural Resources	Little or No Cost; Local funds	Ongoing	Medium	In Progress. updating water flow thru town and out of town
Collins-7	Generators for City Hall & Community Centers for safe rooms/shelters, as well as sewer lift	Extreme Heat, Flood, Hazardous Materials Incident, Infrastructure	Collins Public Works & Elected Officials; Story County & City of	Moderate; FEMA HMA Grants, Local tax funding/budget	Short Term	High	New in 2023



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
	stations to maintain city function following a disaster.	Failure, Severe Winter Storm, Sinkholes, Terrorism, Thunderstorm/Lightning/Hail, Tornado/Windstorm, Transportation Incident	Collins, Story County				
Collins-8	Solar power systems to offset power needs after storms.	Summer weather, winter weather, tornado/wind, flooding, extreme heat	Collins Public Works & Elected Officials; Story County & City of Collins,	Moderate; FEMA HMA Grants, Local tax Story County, funding/budget	Short Term	High	New in 2023
Collins-9	Culverts/piping and pond to carry excess water away from town.	Summer weather, winter weather, flooding	Collins Public Works & Elected Officials; Story County & City of Collins, Story County	Moderate; FEMA HMA Grants, Local tax funding/budget	Medium Term	High	New in 2023
Collins-10	Tree management to protect power lines	Summer weather, winter weather, flooding	Collins Public Works & Elected Officials; Story County & City of Collins, Story County	Moderate; FEMA HMA Grants, Local tax funding/budget	Short Term	High	New in 2023
Collins-11	Community sirens and warning systems	Summer weather, winter weather, flooding	Collins Public Works & Elected Officials; Story County & City of Collins, Story County	Moderate; FEMA HMA Grants, Local tax funding/budget	Short Term	High	New in 2023



Table 5-7 City of Colo Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Colo-1	Provide multi-hazard public information. Citizens need to be aware of potential hazards	Animal/Plant/Crop Disease, Drought, Extreme Heat, Grass/Wildland Fire, Hazmat, Human Disease, Infrastructure Failure, Flooding, Winter Storm, Sinkhole, Summer Weather, Tornado/Wind, Transportation Incident	Fire & Rescue; Mayor City Council Clerk, Story Co, Emergency Manager	Little or no cost; Local Funds	Ongoing	Medium	In Progress
Colo-2	Encourage adoption of manufactured home development storm shelter ordinances. Possible loss of life in manufactured housing developments	Tornado/Windstorm	City Attorney; City Attorney/Mayor/ City council	Low; FEMA HMA Grant, Local funds	Medium Term	Medium	Not Started
Colo-3	Encourage installation of protective fencing surrounding propane tanks, anhydrous ammonia tanks, and other applicable hazardous materials. Propane/anhydrous ammonia tanks stored in open-possible access by unauthorized individuals	Hazardous Materials Incident	City Attorney/ Mayor/ Council/ Clerk, Fire & Rescue; Story County Emergency Management/Local Coop	Low; Local Funds	Medium Term	Medium	Not Started
Colo-4	Establish policies and procedures for obtaining water from alternate sources. Need for water supply if local supply is interrupted/contaminated	Drought	Mayor/Council/ City Clerk; Story County Emergency Management	Low; Local Funds	Medium Term	Medium	Not Started
Colo-5	Establish recreational area storm shelters. Protection for participants/spectators using recreation areas	Thunderstorm/ Lightning/Hail	Mayor/Council, Recreation Board; Story County Emergency Management	High; FEMA HMA Grant, Local funds	Medium Term	Medium	Not Started
Colo-6	Identify, inventory and map areas that contain hazardous materials.	Hazardous Materials Incident	Fire & Rescue; Story County	Little to no cost; Local Funds	Medium Term	Medium	Not Started



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
	Hazardous Material storage areas need to be identified		Emergency Management				
Colo-7	Promote water conservation landscaping practices. Excessive water runoff needs to be minimized	Extreme Heat	Mayor/Council/ City Attorney; Local landscape architects and contractors	Little or no cost; Local funds	Medium Term	Medium	Not Started
Colo-8	Community Center Generator. In case of a natural disaster where the town is without power it would benefit the community to have somewhere to come to whether as a cooling place or heating place. A place to charge phones, computers, etc.	Multi: Extreme Heat, Grass/Wildland Fire, Flooding, Summer Weather, Winter Weather, Terrorism, Tornado/Wind	City Clerk, Public Works Dept.	Low; FEMA HMA Grants	Medium Term	Medium	New in 2023

Table 5-8 City of Gilbert Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Gilbert-1	Annually review Floodplain Management Ordinance to ensure it addresses concerns related to development in the floodplain. To ensure compliance with applicable federal rules and regulations	Flooding	City Clerk/City Council; Iowa Department of Natural Resources	Little to no cost; Staff Time, Existing Budget	Ongoing	Low	In Progress
Gilbert-2	Protection of Transformer at City Hall / Fire Station. Currently is vulnerable to being hit by car or truck turning into parking lot or veering off street	Infrastructure Failure	City of Gilbert; Fire Dept., Fire Agency	Moderate; FEMA HMA Grant, Local funds	Medium Term	Medium	Not Started.
Gilbert-3	Protection of Ammonia Tank and Valving. Tank and valve are vulnerable to being hit by truck causing accidental release	Hazardous Materials Incident, Transportation Incident	City of Gilbert; Business	Moderate; FEMA HMA Grant, Local funds, Other - business	Medium Term	Medium	In Progress



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Gilbert-4	Backup generator for community room. In case of a power outage Gilbert is not set up to provide shelter to citizens with appropriate heat or air conditioning. By setting up a new generator the community center will be functional with or without electricity.	Multi: Extreme Heat, Grass/Wildland Fire, Flooding, Summer Weather, Winter Weather, Terrorism, Tornado/Wind	Gilbert Public Works	Low; FEMA HMA Grants, Local Funding	Medium Term	Medium	New in 2023

Table 5-9 City of Huxley Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Huxley-1	Maintain a list of sites that could be used as cooling shelters as public retreats during extreme heat events. Give public a place to go to escape extreme heat periods or power outages during summer months	Extreme Heat	Police Dept. / Fire Dept.	Little or no cost; Local funds	Short Term	High	In Progress. Place used (saferoom) maintained on list. List will grow as other facilities come into existence.
Huxley-2	Annual Floodplain Management Ordinance Review. This is necessary to ensure the city is doing what it needs to protect city and private property from flooding. Flash floods due to heavy short period rains.	Flooding, Thunderstorm/Lightning/Hail	Public Works/ Administration/ Engineers	Little or no cost; Local funds	Ongoing	High	Annual Implementation. Continued review annually
Huxley-3	Additional/updated outdoor hazard warning system. Review and update the existing mapping for the outdoor warning system and look to upgrade existing system and add additional outdoor warning system due to the growth and expansion of the community.	Summer Weather, Tornado/Windstorm	Police Dept. / Fire Dept.	Low; FEMA HMA Grants, Local Funding	Medium Term	Medium	New in 2023



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Huxley-4	Tree Management. Survey of existing trees in the ROW and some on private property that pose a threat. Most of the ash trees have been removed. Once the hazardous trees are removed the city will develop a plan for replacing the tree canopy in the city.	Animal/Plant/Crop Disease, Drought, Extreme Heat, Grass/Wildland Fire, Flooding, Summer Weather, Winter Weather, Tornado/Wind	Huxley Tree Board; Public Works	Moderate; FEMA HMA Grants, Local Funding	Long Term	Medium	New in 2023

Table 5-10 City of Kelley Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Kelley-1	Amend and enforce ordinance regarding connection of sump pumps. Storm water drainage entering sanitary sewers from illegal connections causing enormous spikes in the costs for sanitary treatment.	Flooding, Infrastructure Failure	Safe Building & Compliance; City Staff	Low; Local funds	Medium Term	Medium	In Progress. A list of sump pumps connected incorrectly has been made. No cahnd in Ordinance as of yet
Kelley-2	Review stormwater management plan. Identify and plan flood control projects. Budget and complete improvements as needed. Localized flooding into low lying area causes property damage to public and private property - chronic issue	Flooding, Infrastructure Failure	Outside engineering contractors, farmland owner, DNR, County Conservation; City of Kelley, elected officials, Story Co. Emergency Management, USACE	High; FEMA HMA Grant, BRIC	Long Term	High	In Progress. The next project and location involving water retention has been identified. Cost estimates are being gathered



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Kelley-3	Provide training for City employees and landowners on dealing with flash flood events. Provide education materials for current and future staff and landowners so that they may be more proactive with their property	Flooding	Elected Officials; City Hall, Story County Emergency Management	Little or no cost; Local funds	Short Term	High	Not Started.
Kelley-4	Work with Story County Emergency Management to disseminate public information regarding earthquake, hailstorm, structural failure, thunderstorm and lightning, Tornado, windstorm, and winter storm - related emergencies. Need ongoing/updated info to new residents as needed	Earthquake, Infrastructure Failure, Severe Winter Storm, Thunderstorm/Lightning/Hail, Tornado/Windstorm	City of Kelley City Clerk; Story County Emergency management	Little or no cost; Local funds	Short Term	High	Not Started.
Kelley-5	Promote Availability of Flood Insurance. Citizens may not be aware of the availability of flood insurance	Flooding	City of Kelley City Clerk; Story County Emergency management	Little or no cost; Local funds	Short Term	Medium	Not Started.
Kelley-6	Creation of storm water retention areas. There has been several severe storm water flooding since 1993. Storm water retention areas would help protect lives and property.	Human Disease, Infrastructure Failure, Flooding, Severe Summer Weather (Thunderstorms/Lightning/Hail), Tornado/Windstorms	City of Kelley Public Works; Story County	High; City Budget, County Budget, FEMA HMA Grants	Medium Term	High	New in 2023



Table 5-11 City of Maxwell Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Maxwell-1	Review and develop an acquisition program to remove structures from area prone to flash flooding. The City has little storm drainage infrastructure and, consequently, storm water during heavy rains drain across backyards where it ponds or causes flooded basements. Curbs, gutters, and storm drains along with targeted acquisitions will reduce property damage.	Flooding	City Council / Mayor	Very High; Local funds	Long Term	High	In Progress. Currently improving an outlet for water on 5th St and Woodlawn St to allow storm sewer improvements to handle 25 year storms in Flash Flood areas.
Maxwell-2	Review and develop an acquisition program to remove structures from area prone to river flooding. The city is bordered on the East and West by creeks that have a tendency to flood. Flooding damages residential properties costing residents money and time to repair and clean up damages.	Flooding	City Council/Mayor	Very High; FEMA Grants, Local funds	Long Term	Medium	In Progress. Awaiting FEMA buyout funding for private property voluntary purchase
Maxwell-3	Review potential to participate in the Community Rating System. The city is bordered on the East and West by creeks that have a tendency to flood. Flooding damages residential properties costing residents money and time to repair and clean up damages. Participating in the CRS could provide reduced insurance rates and other benefits to the city and residents.	Flooding	Council/Mayor	Little or no cost; Local funds	Medium Term	Medium	In Progress. Need clarification from Story County concerning ordinance to participate.
Maxwell-4	Flood mitigation efforts. Issue: Maxwell has two creeks that converge just south of town, causing flooding areas. The city floods when the creeks are full, and we get large rains. Benefit: stopping the loss of property, as well as losses to the city cleanup, as well as potential loss of	Drought, Extreme Heat, Flooding, Severe Winter Storm, Thunderstorm	City of Maxwell, Story County, Landowners, DNR.	Very High; County Funds, Iowa DNR, FEMA HMA and BRIC Grants	Long Term	Medium	New in 2023



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
	life, as well as infrastructures losses due to damaged road and bridges. Create wetlands north of town to slow waterflows, as well as considering bridge and levee effects as the water flows through town.						
Maxwell-5	Underground utilities and Backup power supply. Issue: Aerial utilities can be subject to weather damage/accidents, and cause outages affecting ageing/vulnerable population. As well as deteriorating infrastructure. Without reliable energy such as generator backup, the potential for loss of life raises. Background: Derecho of August of 2020 left many residents without power, of up to a week. This caused many people to lose property, as well as costs associated with finding additional sources of power. Benefit: Consistent power supply, preventing lose, and potential lifesaving.	Severe Winter Storm, Thunderstorm, Tornado/Windstorm	City of Maxwell, Alliant Energy, Consumers Energy cooperative of Iowa, and Windstream.	Very High; FEMA HMA or BRIC Grants, Private Funding, Capital Investment	Long Term	Medium	New in 2023

Table 5-12 City of McCallsburg Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
McCallsburg-1	Purchase/install backup power generators. In case of power failure, McCallsburg is not set up to provide shelter to citizens with appropriate heat or air conditioning. By hopefully installing a generator on the new geothermal system, emergency shelter can be provided when electricity non-functional.	Extreme Heat, Infrastructure Failure, Flooding, Winter Storm, Summer Weather, Tornado/Wind	City Clerk/ City Council in conjunction with Fire Department; Fire Department	Moderate; Tax Increment Funding	Medium Term	Medium	Not Started. Should get done next 3 years



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
McCallsburg-2	Annually review Floodplain Management Ordinance to ensure it addresses concerns related to development in the floodplain. To ensure compliance with applicable federal rule and regulation	Flooding	City Clerk/City Council; Iowa Department of Natural Resources	Low; None	Ongoing	Medium	In Progress.
McCallsburg-3	Tornado Shelter. Build a new community center that can function as a tornado/severe weather shelter	Extreme Heat, Severe Winter Storm, Thunderstorm, Tornado/Windstorm	City of McCallsburg, Story County	Very High; City funding, FEMA HMA Grants, BRIC, State Grants	Medium Term	Medium	New in 2023

Table 5-13 City of Nevada Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Nevada-1	Review potential to participate in the Community Rating System. Trying to evaluate storm sewer system and low areas to improve flooding potential	Flooding	City of Nevada P&Z, Streets, WWTP; IDNR	Low; Local funds	Long Term	Medium	In Progress
Nevada-2	Annually review Floodplain Management Ordinance to ensure it addresses concerns related to development in the floodplain. Prevent possible damage to structures, utilities, roadways	Flooding	City of Nevada, P&Z Dept, Streets Dept.; Story County Assessor & Recorder	Little or no cost; Local funds	Ongoing	High	In Progress
Nevada-3	Buried public utilities project / Tree elimination in right of way City of Nevada. As new subdivisions are developed in Nevada, all public utilities shall be designed and planned for underground installation in the public right of way. As the ash trees are removed the City should consider a plan to reduce trees in the public right of way. During the	Tornadoes, severe weather, ice storms	Planning and zoning, street department, city attorney, city administration	Very High; Developers, FEMA HMA Grants	Medium Term	High	New in 2023



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
	Derecho of 2020, trees in the right of way along with overhead poles became a major obstacle in community resilience. Most of the recovery was spent removing trees and overhead power lines taken down by the storms.						
Nevada-4	Hazard Materials Response City of Nevada. The City of Nevada and companies with Tier 1 and 2 reporting of hazards will develop a response capability to address hazardous material incidents. These capabilities involve joint training, exercises, and expanding fire department staffing, equipment, and training to provide an initial adequate response capability while Des Moines Hazmat is being summoned to respond. This is intended to improve the response for our growing hazardous materials within the city.	Hazmat	FEMA, private industry (Key Coop, Verbio, Hydrogen Plant, Lincolnway Energy, Burke), city administration, Union Pacific	Moderate; FEMA safer grants, AFG, and UP Grants, city funding	Medium Term	High	New in 2023
Nevada-5	Winter blizzard response. The City of Nevada has performed severe snow rescues in and around our city when snow events happen. The city does not have a plan when plows are pulled from the roads and a rescue is needed. The City would like to develop a team of local volunteers equipped with snow removal equipment, atv's, snowmobiles, and off road equipment who are willing to assist as a civilian rescue force to be called upon when a severe winter weather event occurs. A snow rescue happens yearly in Nevada.	Severe Winter Storms	police and fire department, street department.	Little or no cost; Local funds	Medium Term	Medium	New in 2023



Table 5-14 City of Roland Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Roland-1	Identify and plan flood control projects. Budget and complete improvements as needed. Previous events have caused damages that may be preventable if flood control projects are implemented	Flooding	Street Dept.	Very High; FEMA HMA Grants, USACE, local, grants, etc.	Medium Term	Medium	Annual Implementation.
Roland-2	Work with Story County Conservation Board which makes specialized equipment available for rent to assist in planting native grasses, trees, and shrubs for erosion control and water quality improvements. Assistance is needed to help prevent erosion	Animal/Plant/Crop Disease, Drought, Extreme Heat, Grass/Wildland Fire, Hazmat, Human Disease, Infrastructure Failure, Flooding, Winter Storm, Sinkhole, Summer Weather, Tornado/Wind, Transportation Incident	City Clerk	High; Local Budgets	Medium Term	Low	In Progress.
Roland-3	Bury electric and communication lines. Work with electric and communication companies to bury lines that are currently overhead. Adopt an ordinance to require any new developments to have buried utilities. This will help with outages due to extreme weather, vehicles hitting poles, not have to worry about poles falling, help provide uninterrupted communications, possibly prevent outages if there were a sink hole, and won't have fire danger from power lines downed.	Hazardous Materials Incident; Infrastructure Failure; Flooding; Severe Winter Storms; Sinkhole; Severe Summer Weather (Thunderstorms/Lightning/Hail); Tornado/Windstorms; Transportation	Public Works, Alliant Energy, Windstream, Stratford Communications	Very High: More than \$1,000,000; grants, BRIC	Long Term	medium	New in 2023



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
		Incidents; Grass/Wildland Fire;					
Roland-4	Protect properties from river and flash flooding. Construct a storm water retention basin or wetland in the north part of town to slow water down coming through the small creek that starts near Vine St. and Walnut St. which has a history of causing flood damage. Construct a storm water retention basin or wetland in the Elm St. and Vine St. area where flooding off of the field causes damage throughout town. Reconstruct or look at different alternatives to replace the flood wall along the field that does not provide adequate protection.	Animal/Plant/Crop Disease; Human Disease; Infrastructure Failure; Flooding; Severe Summer Weather (Thunderstorms/Lightning/Hail); Transportation Incidents;	Public Works and landowners	High; annual budget, grants; FEMA HMA, BRIC	Medium Term	high	New in 2023
Roland-5	Provide NOAA weather radios and signage encouraging signing up for Smart911/Alert Iowa to all city facilities. Purchase and install NOAA weather radios for the fire station, water plant, library, maintenance shed, wastewater plant, city hall, Erickson shelter house, Britson concession stand, pool so that employees and public can be made aware of severe weather.	Animal/Plant/Crop Disease; Drought & Extreme Heat; Grass/Wildland Fire; Hazardous Materials Incident; Human Disease; Infrastructure Failure; Flooding; Severe Winter Storms; Sinkhole; Severe Summer Weather (Thunderstorms/Lightning/Hail); Tornado/Windstorms;	Public Works	Low; annual budget	Short Term	high	New in 2023



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
		Transportation Incidents;					
Roland-6	Tornado safe rooms at parks. Construct tornado safe rooms at Erickson Park (high school softball games played here), Britson Park (little league games played here), and pool to protect public and staff during severe weather.	Severe Summer Weather (Thunderstorms/L ightning/Hail); Tornado/Windsto rms;	Public Works	High; annual budget, grants, school budget, little league budget	Long Term	low	New in 2023
Roland-7	Backup power supply for City services. Install backup generators at both wells, the water tower, water plant, fire station, industrial park lift station and maintenance shed to provide City services to citizens during power outages.	Drought & Extreme Heat; Hazardous Materials Incident; Infrastructure Failure; Flooding; Severe Winter Storms; Severe Summer Weather (Thunderstorms/L ightning/Hail); Tornado/Windsto rms;	Public Works, Fire Department	High; existing budgets, FEMA HMA Grants	Short Term	high	New in 2023
Roland-8	County wide code enforcement position. Work with the County Planning and Development and Board of Supervisors to create a position of a county wide code enforcement employee to work with the smaller towns to enforce property codes to keep properties safe for residents and neighbors.	Hazardous Materials Incident; Animal/Plant/Crop Disease; Infrastructure Failure; Human Disease;	City Councils, County Board of Supervisors, County Planning and Development staff, Public Works	Moderate; City budgets, county budget	Short Term	medium	New in 2023



Table 5-15 City of Sheldahl Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Sheldahl-1	City-wide pump replacement for weakened or old pumps needed to mitigate flood damage.	Flooding, Infrastructure Failure	City of Sheldahl City worker Matt Rardin and various City Council members; Story County Emergency Management, Polk County Emergency Management, Boone County Emergency Management	High; FEMA HMA Grant, Local Funds, In-Kind	Medium Term	Medium	In Progress. Excessive and repeating rains have overloaded individual systems and there was excessive property damage on many properties during a rain on 6/30/2018 when 8 pumps were weakened significantly.
Sheldahl-2	Install Snow Fences at strategic locations to minimize roadway impacts and transportation incidents and enhance groundwater infiltration	Winter Storm, Drought	City of Sheldahl administration	High; FEMA HMA Grant, Local Funds, In-Kind, DOT funding	Medium Term	Medium	New in 2023
Sheldahl-3	Text alerts to inform public of potential hazard events	Animal/Plant/Crop Disease, Drought, Extreme Heat, Grass/Wildland Fire, Hazmat, Human Disease, Infrastructure Failure, Flooding, Winter Storm, Sinkhole, Summer Weather, Tornado/Wind, Transportation Incident	City of Sheldahl administration	Medium; FEMA HMA Grants, City Funds	Medium Term	Medium	New in 2023



Table 5-16 City of Slater Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Slater-1	Create and maintain a GIS-based review system to document local floodplain permits, LOMRs, LOMAs, and additional studies regarding the floodplain. Changes regarding recognized floodplain areas, requiring insurance occur w/ LOMA/LOMR, etc. The City needs a good GIS-based system to track this.	Flooding	City Administration, Public Works; None	Low; Local funds	Medium Term	Medium	In Progress. Program has been purchased. Information is being gathered
Slater-2	Develop and adopt a stormwater management plan. Prevent flooding and damage to property	Flooding	Public Works Department; Four Mile Creek Watershed Management	Moderate; FEMA HMA Grant, Local funds	Medium Term	Medium	Not Started.
Slater-3	Disseminate information on flood proofing to community residents. Change in floodplain areas and change in property ownership	Flooding	City Administration; None	Little or no cost; Local funds	Ongoing	High	Not Started.
Slater-4	Identify, inventory and map areas that contain hazardous materials. identify hazards	Hazardous Materials Incident	Fire Department; HazMat Services	Little or no cost; None identified	Ongoing	High	In Progress. Areas have been identified. Formal list / map is not complete
Slater-5	Utilize Iowa Public Television wild land fire awareness video as a training film for volunteer fire departments with a certification process. Grassland and cropland directly next to housing and infrastructure	Grass or Wildland Fire	Slater Volunteer Fire Dept. and First Responders; Slater EMS and Slater Public Works	Little or no cost; Local funds	Ongoing	Low	Not Started.
Slater-6	Work with Story County Conservation Board which makes specialized equipment available for rent to assist in planting native	Flooding	Public Works Department, Story County Conservation; DNR,	Little or no cost; Local funds, In-Kind, Private Non-Profit	Long Term	Medium	Not Started.



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
	grasses, trees, and shrubs for erosion control and water quality improvements. Erosion control to minimize flooding potential and to improve water quality		Story County Conservation, Garden Club Chapter				
Slater-7	Work with Story County Emergency Management to disseminate public information regarding Severe weather-related emergencies and provide a storm shelter / safe room. Ongoing issue - need quicker weather updates and more accurate weather forecasts	Severe Winter Storm, Thunderstorm/Lightning/Hail, Tornado/Windstorm	City Staff, Fire Chief, EMS, Story County Emergency Management; FEMA/State	Very High; FEMA HMA Grant, Local funds, Other	Short Term	Medium	In Progress. public information has been distributed. No progress towards providing a storm shelter/safe room
Slater-8	Construction of storm shelter. Approximately 85 homes within Slater do not have basements for severe storm events. Slater would like to construct a Storm Shelter to benefit these residents	Severe Winter Storms, Severe Summer Weather (Thunderstorms/Lightning/Hail), Tornado/Windstorms	City of Slater, Story County EMA	Very High; FEMA HMA Grants, City Budget, FEMA BRIC	Long Term	Medium	New in 2023
Slater-9	Build and/or reinforce Radio Towers and Radio System for Emergency Response Entities (ie Fire & EMS) to stay in communication with City Officials, and City/County Public Works Department in the event of serious / significant event. This should be in place in order to help emergency response vehicles to have up to date information on road closures, directing residents to safety, and directing manpower and special equipment in and around the City/County.	Drought, Extreme Heat, Grass/Wildland Fire, Hazardous Materials Incident, Human Disease, Infrastructure Failure, Flooding, Severe Winter Storms, Sinkhole, Severe Summer Weather (Thunderstorms/Lightning/Hail),	City of Slater; Story County EMA, all other municipalities in Story County, Neighboring Counties	Moderate; FEMA HMA Grants	Medium Term	Medium	New in 2023



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
		Terrorism, Tornado/Windstorms, Transportation Incidents					
Slater-10	Stormwater management. Slater has a history of severe flooding since 1993. This project would involve upgrading storm water system throughout the entire community and creating storm water retention areas. This project would protect lives and property; and would also increase the longevity of the City's waste water facility by reducing infiltration while decreasing costs of processing sewer.	Animal/Plant/Crop Disease, Infrastructure Failure, Flooding, Severe Summer Weather (Thunderstorms/Lightning/Hail), Tornado/Windstorms	City of Slater Public Works	Very High; FEMA HMA Grants, City Budget, BRIC	Long Term	Medium	New in 2023

Table 5-17 City of Story City Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Story City-1	Create a water conservation public awareness and educational campaign, including educational materials on water conservation measures to implement during drought periods. To educate public on water conservation. Getting the information to the public. Continue meeting with	Drought	City Administration	Little or no cost	Short Term	Medium	Annual Implementation.



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
	golf course and school on water conservation.						
Story City-2	Tornado Safety / Conference Emergency Room Community safety	Tornado/Windstorm	Undetermined	High; FEMA HMA Grants, BRIC	Medium Term	Medium	Not Started.
Story City-3	Update Tornado Sirens. Old sirens have significant age to them and don't have battery backup	Tornado/Windstorm	Fire Department	Moderate; Local Funding, NWS	Medium Term	High	Annual Implementation. All 3 are in working order but will need to come up with a plan for replacement over the next 3 to 6 years.
Story City-4	Hazardous Ash Tree Removal. Continue to remove hazardous ash trees.	Animal/Plant/Crop Disease, Grass/Wildland Fire; Severe Winter Storms; Tornado/Windstorms; Infrastructure Failure; Transportation Incidents;	Parks & Recreation, Tree Board	High; General Fund	Ongoing	High	New in 2023
Story City-5	Backup Generator(s). Determine need and location of backup generators	Extreme Heat, Infrastructure Failure, Flooding, Winter Storm, Summer Weather, Tornado/Wind	City Administration, Water & Wastewater Department	Moderate; Existing Budgets, FEMA HMA	Short Term	Medium	New in 2023



Table 5-18 City of Zeiring Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Zeiring -1	Dakins Community Center stand-alone generator. This project would include the purchase and installation of a stand-alone generator to be supplied by natural gas and/or propane. The convenience and need for such a piece of equipment was identified during a storm that took out power to the entire community for almost 7 days. The biggest benefit is that the generator will allow for continuous operation of the emergency storm shelter for the community.	Extreme Heat, Severe Winter Storms, Thunderstorms/ Lightning/Hail, Tornado/ Windstorms	City of Zeiring Administration	High; FEMA HMA Grants	Short Term	High	New in 2023

Table 5-19 Ames CSD Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
CSD Ames-1	Install systems inside buildings to monitor and stop unauthorized intruders from terrorism or vandalism. Install camera systems inside buildings. Install additional barriers and devices to compartmentalize interior building spaces to reduce unauthorized access inside the entire building. New installation – 7 buildings, upgrades to 2 buildings. Provide communications link to rescue/response resources. In	Terrorism	Facilities Planning and Management	High; Local funds	Medium Term	High	In Progress



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
	response to school shootings, we want to increase safety features within buildings to mitigate loss of life in the event of a shooter in the building.						
CSD Ames-2	Construct facilities at baseball/softball complex for shelter due to inclement of weather. Unexpected weather at our remote site	Thunderstorm/Lightning/Hail, Tornado/Windstorm	Facilities Planning and Management	Very High; Local funds	Medium Term	Medium	New in 2023
CSD Ames-3	Critical facilities protection. Install Glass hardening film at exterior windows of school buildings.	Thunderstorm/Lightning/Hail, Tornado/Windstorm	Facilities Planning and Management	Moderate; Existing budgets	Medium Term	Medium	New in 2023

Table 5-20 Ballard CSD Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
CSD Ballard-1	Revise Evacuation/Emergency Plans and practice drills. The school district has new buildings and new additions. As a result, plans need to be revised to ensure safety of students and staff.	Animal/Plant/Crop Disease, Drought, Extreme Heat, Grass/Wildland Fire, Hazmat, Human Disease, Infrastructure Failure, Flooding, Winter Storm, Sinkhole, Summer Weather, Tornado/Wind, Transportation Incident	District Safety Coordinator; Story Co. EM, Story Co. Sheriff, Huxley, Slater, and Cambridge first responders.	Moderate; Local funds	Medium Term	Medium	In Progress. Will keep this strategy as a continued work in progress.
CSD Ballard-2	Safe shelter feasibility study. District will begin collaboration with City of Slater to consider feasibility of constructing a storm shelter.	Tornado/Windstorms ; Severe Summer Weather (Thunderstorms/Lightning/Hail);	Ballard School District	Very High: More than \$1,000,000; Facility budget	Long Term	Medium	New in 2023



Table 5-21 Colo-Nesco CSD Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
Colo-NESCO-1	Tornado Saferoom. Story Co. has a history of tornadic conditions. Over eight million dollars of damage have been done over a period of the last 60 years. While the county has a great deal of open area communities and schools are at risk for major damage and loss of life. Our students are in multiple communities and buildings putting all of them in danger. There is no real place to go in case of tornado	Tornado/Windstorm	Colo-NESCO Community School District	Very High; FEMA Hazard Mitigation Assistance Grant; Private Non-Profit	Medium Term	Medium	Not Started.
Colo-NESCO-2	Backup generators. Hook school up to back up generator to provide Community Shelter.	Extreme Heat, Severe Winter Storm, Thunderstorm, Tornado/Windstorm	Colo-NESCO Community School District	Moderate; PPEL - Grants, School Budget	Long Term	Medium	New in 2023

Table 5-22 Gilbert CSD Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
CSD Gilbert-1	Emergency backup generator. Our school district currently does not have a backup generator to provide power if we were to lose power due to a storm or other infrastructure failure. Without backup power, we would be very limited with what we could do as a district in times of emergency.	Extreme Heat, Hazmat, Infrastructure Failure, Flooding, Winter Storm, Summer Weather, Tornado/Wind	Gilbert CSD	Moderate; Existing budget- any state or federal grants that were available. Possibly adding this to our plans for new construction.	Medium Term	Medium	New in 2023



Table 5-23 Nevada CSD Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
CSD Nevada-1	Construct facilities at new baseball field for shelter due to inclement of weather. Unexpected weather at our remote site.	Thunderstorm/Lightning/Hail, Tornado/Windstorm	Buildings & Grounds, Admin; City of Nevada	Very High; Local Funds	Short Term	High	In Progress. Estimated completion Oct/Nov. 2023
CSD Nevada-2	Secure entries and response measures. Eliminate CCTV blind spots. Automate door locks with crash bar motors, add hardware for emergency access, replace wireless door locks with wired locks, integrate door locks to CCTV system, signage door and windows numbered and visible from exterior for expedited emergency response.	Terrorism	District Admin.; Iowa DHSEM	High; Existing Budget	Short Term	High	New in 2023

Table 5-24 Roland-Story CSD Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
RS-1	Construct saferooms in schools. Schools do not currently have saferooms to provide a safe area of refuge for students and staff during extreme weather events	Thunderstorm/Lightning/Hail, Tornado/Windstorm	Superintendent's Office; Iowa Homeland Security & Emergency Management, FEMA	Very High; FEMA Hazard Mitigation Assistance Grant; school district revenue	Medium Term	Medium	Not Started.
RS-2	High School Secure main entrance. A recent vulnerability assessment brought attention to significant vulnerabilities at Roland-Story High School, specifically relating to doors, door hardware, and visitor access. To remedy these issues, the school plans to embark on a	Terrorism	School board, superintendent, architect, engineers, general contractor	High; The estimated cost for this specific safety improvement is approximately \$95,000, while the overall renovation project is	Short Term	High	New in 2023



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
	construction project during the summer of 2024. The project aims to upgrade doors, door hardware, and implement a system to direct visitors through the main high school office where a background check is conducted before granting them access to the building.			projected to cost around \$500,000; Revenue purpose bonds (one-cent sales tax revenues)			

Table 5-25 Iowa State University Mitigation Action Plan

Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
ISU-1	Protect properties and structures from river and flash flooding through the construction of water storage areas, building of flood protection structures, removal of flood-prone properties, implementation of policies, and other measures to reduce the risk of property damage and threats to resident safety. The City of Ames and ISU have experienced substantial river flooding on multiple occasions. This flooding has caused interruptions in utilities and services, lost productivity, and property damage.	River Flood	ISU Facilities Planning & Management; Ames Water and Pollution Control, Ames Public Works, Story County, Iowa DOT, Iowa DNR	Very High; Up to \$1.5 billion; ISU Funding, Grant Funding	Long Term	High	Annual Implementation. Ongoing flood control assessment is incorporated into new construction planning (e.g., CyTown development).
ISU-2	Evaluate storm sewer and sanitary infrastructure for deficiencies and improve them to reduce service backups and localized flooding. During heavy rains, some ISU buildings experience sanitary or storm sewer backups.	Flash Flood	ISU Facilities Planning & Management; Ames Public Works	Very High; ISU Funding, Grant Funding	Long Term	High	In Progress. ISU Facilities Planning & Management maintains awareness of known areas of concern.



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
ISU-3	Construct safe rooms or retrofit current structures to provide protection to occupants in the event of tornado or severe weather. ISU has locations of conferencing, gathering, and general operations which can be enhanced with addition and construction of storm shelters.	Tornado	ISU Facilities Planning & Management; ISU Police, ISU FP&M, ISU Risk Management, ISU EH&S, City of Ames	High; ISU Funding, Grant Funding	Short Term	High	Annual Implementation. Inclusion of severe weather sheltering space in new construction is a component of the Facilities Planning & Management design manual.
ISU-4	Prepare a site-specific vulnerability assessment of critical facilities that use the best available science and technology with regard to human-caused hazards. ISU has large, robust, and highly integrated infrastructures. Identifying critical linkages and vulnerabilities in the infrastructures is important to ensure ISU facilities and properties are safe for use by emergency personnel, displaced persons, and for routine operations.	Terrorism	ISU Facilities Planning & Management, IT Services, ISU Police; City of Ames, Story County	High; ISU Funding, Grant Funding	Ongoing	High	Annual Implementation. ISUPD, ISU Facilities Planning & Management, and ISU IT Services maintain awareness of the university's critical infrastructure and current best practices for securing it against malicious acts.
ISU-5	Purchase detection equipment and/or canines to allow bomb sweeps prior to high consequence events and as needed. Also implement training and procedures to allow effective use of equipment/canines. ISU has many research facilities and large event venues that could be targets for terrorists. Having the ability to conduct bomb sweeps with canines or detection equipment would enhance the safety of these facilities.	Terrorism	ISU Police; Ames Police	High; ISU Funding, Grant Funding	Short Term	Medium	Not Started. ISUPD would like to maintain this item in the plan until such time as there is personnel availability and interest for such a program. In the interim, ISU will continue to rely on our partners in the State Fire Marshal's office for explosive detection canines as needed.
ISU-6	Develop plans and preventative actions, train personnel, and identify key resources to be used to address hazards on campus in concert with	Animal/Plant/Crop Disease, Drought, Extreme Heat,	ISU Police; City of Ames, Story County, State of Iowa, U.S. Department of	Low; Staff Time, ISU Funding, Grant Funding	Ongoing	High	Annual Implementation. Emergency planning is an ongoing process for the university. Major event



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	other jurisdictions. These jurisdictions include local, state, and federal agencies, and private organizations. ISU has many research facilities and large event venues. Planning is required to ensure response to these facilities is coordinated with local response agencies. This is particularly important for law enforcement response coordinated with Ames Police.	Grass/Wildland Fire, Hazmat, Human Disease, Infrastructure Failure, Flooding, Winter Storm, Sinkhole, Summer Weather, Tornado/Wind, Transportation Incident	Agriculture, U.S. Department of Energy				venues are the current priority for this level of planning.
ISU-7	Develop Comprehensive Emergency Operations Plan and identify necessary resources to support planning, training and exercises. Many ISU departments have their own Emergency Operations Plan, but they are not tied together by a single comprehensive plan for the entire university.	Animal/Plant/Crop Disease, Drought, Extreme Heat, Grass/Wildland Fire, Hazmat, Human Disease, Infrastructure Failure, Flooding, Winter Storm, Sinkhole, Summer Weather, Tornado/Wind, Transportation Incident	ISU Environmental Health & Safety; ISU Police, ISU FP&M, ISU Risk Management	Low; Staff Time, ISU Funding, Grant Funding	Ongoing	High	In Progress. ISU is in the final approval stage for a five-year update to its Comprehensive Emergency Operations Plan. Once released, this plan will provide the strategic framework for integration of division-, college-, and department-level plans.
ISU-8	Address vulnerabilities to critical infrastructure [including utilities, power plant, sanitation, water wells, people (student, staff), large venues, communications/IT, electronic information, research enterprises	Animal/Plant/Crop Disease, Drought, Extreme Heat, Grass/Wildland Fire, Hazmat,	ISU Facilities Planning & Management, IT Services, ISU Police; City of Ames, Story County	High; ISU Funding, Grant Funding	Ongoing	High	Annual Implementation. Various ISU units make incremental improvements on this front as able. Since 2018, projects completed or in



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
	(viral/bacterial agents, genetics, intellectual capital/property, field research, etc.), security, heavy equipment, mass transportation, and food storage and distribution] to determine plans, resources and equipment necessary to mitigate risks and provide continuity of operations during catastrophic events. ISU has large, robust, and highly integrated infrastructures. Identifying critical linkages and vulnerabilities in the infrastructures is important to ensure ISU facilities and properties are safe for use by emergency personnel, displaced persons, and for routine operations.	Human Disease, Infrastructure Failure, Flooding, Winter Storm, Sinkhole, Summer Weather, Tornado/Wind, Transportation Incident					progress include: improved backup systems for the ISU power plant, additions to backup generator coverage of campus buildings, establishment and outfitting of a backup EOC, upgrades to public safety radio communication (ISU is a stakeholder in the county-wide Storycomm P25 system), flood mitigation measures at the Iowa State Center and adjacent intramural fields, including retention basin fencing to improve safety through intrusion deterrence access control for student safety), participation in the GETS/WPS program
ISU-9	Develop and implement education/outreach programs to improve preparedness efforts to minimize property damage and minimize injury or loss of life. University and City of Ames are responsible for their communities' public awareness and education to improve emergency preparedness and minimize property damage and personal injury.	Animal/Plant/Crop Disease, Drought, Extreme Heat, Grass/Wildland Fire, Hazmat, Human Disease, Infrastructure Failure, Flooding, Winter Storm, Sinkhole, Summer	Environmental Health and Safety Department, University Police, Facilities Planning & Management; City of Ames, Story County, State of Iowa	Moderate; ISU Funding, Grant Funding	Medium Term	High	Annual Implementation. Multiple ISU departments engage in employee and student outreach and safety training. Current programs include Violent Incident Response Training (VIRT), hands-on fire safety training, safety and leadership training for residence hall staff, numerous online safety courses for employees and students, and



Action ID	Action Title	Hazards Addressed	Lead Agency and Supporting Agencies	Estimated Cost & Potential Funding Sources	Timeline	Priority	Status & Implementation Notes
		Weather, Tornado/Wind, Transportation Incident					information pushed through the Iowa State Safe mobile app.
ISU-10	Develop and enhance capabilities (warning systems and facilities) to communicate hazard-related information to university community, City of Ames, other jurisdictions, and the public. Expanded coverage of outdoor warning system is needed as City/university grows, and newer technologies to model and communicate hazards are needed to help provide directions in the event of an imminent disaster. Upgrading communication centers to tornado safe shelters to be able to continue to both receive vital requests for assistance and to be able to provide emergency information to the community before, during and after an event. Upgrading emergency operation centers to tornado shelters to be able to continue to both receive vital requests for assistance and to be able to provide information to the community before, during and after an event.	Animal/Plant/Crop Disease, Drought, Extreme Heat, Grass/Wildland Fire, Hazmat, Human Disease, Infrastructure Failure, Flooding, Winter Storm, Sinkhole, Summer Weather, Tornado/Wind, Transportation Incident	ISU Police, ISU FP&M; Ames Police, City of Ames	High; ISU Funding, Grant Funding	Medium Term	Medium	Annual Implementation. Internal initiatives and vendor support drive continuous incremental improvements to ISU Alert (ISU's mass notification system) and its supporting systems (e.g., the Iowa State Safe mobile app). Recent enhancements include the addition of video display integration for ISU Alert messaging and the rollout of Rave (the ISU Alert software platform) personnel accountability functions for departments. Additionally, ISU Strategic Relations and Communication (SRC) has developed and adopted a university-wide crisis communication plan to ensure prompt public communication and unity of messaging during major incidents. This mitigation item's priority may rise if we identify a major deficiency in the program.



6 Plan Implementation and Maintenance

DMA Requirement §201.6(c)(4)(ii):

[The plan shall include] a plan maintenance process that includes:

- (i) A section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.*
- (ii) A process by which local governments incorporate the requirements of the mitigation plan into other planning process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.*
- (iii) Discussion on how the community will continue public participation in the plan maintenance process.*

This chapter provides an overview of the overall strategy for plan maintenance and outlines the method and schedule for monitoring, updating, and evaluating the plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

6.1 Monitoring, Evaluating, and Updating the Plan

6.1.1 Hazard Mitigation Planning Committee (HMPC)

With adoption of this plan, the HMPC will continue to be tasked with plan monitoring, evaluation and maintenance. The participating jurisdictions and agencies, led by the Story County Emergency Management Coordinator, agree to:

- Meet annually to review the Hazard Mitigation Plan
- Act as a forum for hazard mitigation issues
- Disseminate hazard mitigation ideas and activities to all participants
- Pursue the implementation of high priority, low- or no-cost recommended actions;
- Maintain vigilant monitoring of multi-objective, cost-share, and other funding opportunities to help the community implement the plan's recommended actions for which no current funding exists
- Monitor and assist in the implementation and update of this plan
- Keep the concept of mitigation in the forefront of community decision making by identifying plan recommendations when other community goals, plans, and activities overlap, influence, or directly affect increased community vulnerability to disasters
- Report on plan progress and recommended changes to the Story County Board of Supervisors and governing bodies of participating jurisdictions
- Inform and solicit input from the public

The HMPC is an advisory body and can only make recommendations to county, city, town, or district elected officials. Its primary duty is to see the plan successfully carried out and to report to the community governing boards and the public on the status of plan implementation and mitigation opportunities. Other duties include reviewing and promoting mitigation proposals, hearing stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information in areas accessible to the public.



6.1.2 Plan Maintenance Schedule

The HMPC agrees to meet annually to monitor progress, discuss recent hazard events and changes in development that impact vulnerability, and update the mitigation strategy. The Story County Emergency Management Coordinator will be responsible for initiating the plan reviews.

In coordination with the other participating jurisdictions, a written update of the plan will be submitted to the Iowa Homeland Security and Emergency Management Department and FEMA Region VII for approval within the required five-year cycle per Requirement §201.6(c)(4)(i) of the DMA of 2000, unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule. During the third interim annual meeting, the HMPC will outline steps to begin the next plan update process so that the effort can be completed during year four and five; this will ensure there is time for completion, approval, and re-adoption within the five-year time frame. This should include the identification and pursuit of grant funding to procure assistance with the five-year update.

6.1.3 Plan Maintenance Process

Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan. Changes in vulnerability can be identified by noting:

- Decreased vulnerability as a result of implementing recommended actions,
- Increased vulnerability as a result of failed or ineffective mitigation actions, and/or
- Increased vulnerability as a result of new development (and/or annexation).

The annual reviews and updates to this plan will:

- Consider changes in vulnerability due to action implementation,
- Document success stories where mitigation efforts have proven effective,
- Document areas where mitigation actions were not effective,
- Document any new hazards that may arise or were previously overlooked,
- Incorporate new data or studies on hazards and risks,
- Incorporate new capabilities or changes in capabilities,
- Incorporate growth and development-related changes to inventories, and • Incorporate new action recommendations or changes in action prioritization.

In order to best evaluate the mitigation strategy during the plan review and update, the participating jurisdictions will follow the following process:

- A representative from the responsible office identified in each mitigation action will be responsible for tracking and reporting the action status on an annual basis to the jurisdictional HMPC member and providing input on any completion details or whether the action still meets the defined objectives and is likely to be successful in reducing vulnerabilities.
- If the action does not meet identified objectives, the jurisdictional HMPC member will determine what additional measures may be implemented, and an assigned individual will be responsible for defining action scope, implementing the action, monitoring the success of the action, and making any required modifications to the plan.
- As part of the annual review process, the Story County Emergency Management Coordinator will provide the updated Mitigation Strategy with the current status of each mitigation action to the County Board of Supervisors and County Department Heads as well as all Mayors, City Clerks, and School District Superintendents requesting that the mitigation strategy be incorporated, where appropriate in other planning mechanisms.



Modifications to the plan will occur to address actions that have either failed or are deemed impractical after a thorough assessment of their alignment with established criteria, time constraints, community priorities, and available funding resources. Additionally, actions with lower rankings that were identified as potential mitigation measures will undergo a reevaluation during the monitoring and update processes of this plan to assess their feasibility for future implementation. Updates to the plan will be made through written changes and submission, as deemed suitable and necessary by the Story County HMPC, and will require approval from both the Story County Board of Supervisors and the governing boards of other participating jurisdictions.

6.2 Incorporation into Existing Planning Mechanisms

Many of the small jurisdictions in Story County do not have standing formal planning mechanisms such as a Comprehensive Plan or Capital Improvement Plan through which formal integration of mitigation actions can be documented. As a result, activities that occur in these small communities are developed through annual budget planning, regular City Council Meetings and other community forums rather than a formal planning process. Planning mechanisms that do exist to some degree within the participating jurisdictions include:

- Comprehensive Plans;
- Various ordinances of participating jurisdictions, including floodplain management ordinances in NFIP-participating communities;
- Capital Improvement Plans (CIP).

For a detailed summary of planning mechanisms and other mitigation-related capabilities, see Chapter 2.

6.2.1 Incorporation of Updated Hazard Mitigation Plan into existing Planning Mechanisms

Where possible, plan participants will use existing plans and/or programs to implement hazard mitigation actions. After the annual review of the Hazard Mitigation Plan, the Story County Emergency Management Coordinator will provide the updated Mitigation Strategy with the current status of each mitigation action to the County Board of Supervisors and County Department Heads as well as all Mayors, City Clerks, and School District Superintendents requesting that the mitigation strategy be incorporated, where appropriate in other planning mechanisms.

Table 6.1 provides additional details on each jurisdiction regarding how the 2018 Hazard Mitigation Plan was integrated into existing planning mechanisms as well as the strategy going forward to integrate this plan update into existing planning mechanisms.

Table 6.1: Integration of Previous Plan and Strategies to Integrate Plan Update

Jurisdiction	Incorporation of 2018 Plan into Existing Planning Mechanisms	Integration Process for Plan Update
Story County	The previous plan was incorporated into C2C annual reviews, COOP-COG annual reviews, the Strategic Plan update and annual CIPs.	Update will continue to be updated into the plans noted previously. Opportunities to cross reference with future updates to the Comprehensive Plan will be evaluated.
Ames	The previous plan was incorporated into the Ames CSD Emergency Operations Plan.	This update will continue to be incorporated in the City's CIP as well as there has been a change in community priorities related to the vulnerability assessments provided through the State of Iowa.



Jurisdiction	Incorporation of 2018 Plan into Existing Planning Mechanisms	Integration Process for Plan Update
		Ames will ensure that there are monthly fire and tornados drills, active shooter conversations, and ALICE drills throughout Ames.
Cambridge	The City noted that over the past 5 years there have been a few new homes built in Cambridge, but nothing that should cause vulnerability concerns.	This update will also be incorporated into the City's infrastructure plan: the city is in the process of making storm sewer improvements on the north side of town using grant funding the city recently reviews. With these improvements, it will help move water faster during high rain events and prevent standing water/flooding in that area of town.
Collins	The plan was integrated when the city reviews and revises its capital improvement plan.	This has been noted as an area of improvement for the next 5 years to look for opportunities beyond the CIP.
Colo	The plan was integrated when the city reviews and revises its capital improvement plan, as well as comprehensive/land use plan.	This has been noted as an area for improvement for the next 5 years, along with developing for future house development and a Debris Management Plan.
Gilbert	The previous plan implemented a zoning ordinance.	The plan update added new zoning of PDR (Planned Development Residential District) in new subdivision as well as rate increase for water, sewer, gas, or electrical services.
Huxley	The city would incorporate mitigation planning into the upcoming CIP and into new development within the town.	The city will incorporate mitigation planning into the upcoming CIP and into new development within the town.
Kelley	Over the last 5 years, there has only been 3 new homes and 2 new business in the past 5 years.	The City can incorporate findings of the HMP into zoning/land use restrictions as well as NFIP participation.
Maxwell	The plan was integrated with a facility improvement plan to improve storm sewers to better handle flash flooding and with the City's Capital Improvements Plan and Infrastructure Plan.	The plan update will continue to be incorporated with the CIP and infrastructure plan, including developments on the north side of town have just become available for potential new housing. It was noted that the parcels do share marsh land which will have to be taken into consideration when building housing.
McCallsburg	No integration occurred.	The community will be going through infrastructure planning initiatives in the next few years and will incorporate the hazard mitigation plan into this effort.
Nevada	The City of Nevada used the Hazard Mitigation Plan in preparing their internal disaster recovery plan. The plan was integrated in comprehensive planning and capital improvements planning.	The plan will continue to be integrated in comprehensive planning and capital improvement planning. Also, the city is looking at putting a couple fuel tanks at the water plant in the event the community loses power at local fueling sites.
Roland	No integration occurred.	The plan will continue to be integrated in critical facilities protection plans such as upgrading the generator at the water plant and moving City Hall to a safer building.



Jurisdiction	Incorporation of 2018 Plan into Existing Planning Mechanisms	Integration Process for Plan Update
Sheldahl	The was incorporated into the City's infrastructure plan.	The plan will continue to be integrated in comprehensive planning and capital improvements planning.
Slater	No integration occurred.	The City has a mitigation action (Slater-2) to develop a stormwater management plan, which provides an integration opportunity. The city has implemented an emergency plan for City offices to open and get back to regular business. The includes contact information for city staff and elected officials, where to procure computer and office supplies and optional locations for temporary location of City Hall as necessary.
Story City	The plan was reviewed as part of the update to the City Comprehensive Plan completed in 2016.	The updated plan will continue to be referenced to update the building codes. The city will be utilizing a private company (Safe Building) for building plan review and inspections. City Engineer does site plan reviews for non-residential construction.
Ames CSD	The district's mitigation actions will be integrated with school infrastructure and emergency planning.	The plan will help improve local funding availability.
Ballard CSD	No integration occurred	The plan will be incorporated into campus safety planning for capital improvement projects and new construction and will be integrated into the school infrastructure plan.
Colo-NESCO CSD	No integration occurred	The plan will be integrated with Emergency Notification Agreements
Gilbert CSD	No integration occurred	The plan will be incorporated into capital improvement projects and School Emergency Plan.
Nevada CSD	The plan was integrated with Nevada CSD OEP	The plan update will continue to be integrated with the school's infrastructure and emergency plans as well as Nevada's comprehensive plan, capital improvement plan, and infrastructure plan.
Roland-Story CSD	No integration occurred	This update will be incorporated into the School Infrastructure Plan and the School Emergency Plan
Iowa State University	The plan aligns with the County HMP's hazard assessment methodology, through the internal hazard assessment specific to ISU differs from the county's broader assessment.	The school's mitigation actions are integrated with the State of Iowa (expand on thisRisk Assessments?).



6.3 Continued Public Involvement

The public will be involved in the plan maintenance process by publication of a Press Release after each annual review indicating the committee has met with a summary of mitigation action status updates and highlights of specific completed mitigation actions, as applicable. The public will be invited to provide comments on HMPC meeting outcomes and/or attend HMPC meetings.

The update process provides an opportunity to publicize success stories from the plan's implementation and seek additional public comment. When the HMPC reconvenes for the update, it will coordinate with all stakeholders participating in the planning process, including those who joined the HMPC after the initial effort, to update and revise the plan. Public notice will be posted through available website postings, community message boards, and social media outlets.