

Chapter 3: Hazard Identification and Risk Assessment

The second phase of the planning process is to develop a hazard analysis and risk assessment. In this chapter we identify the hazards that could affect Adams County and assess the relative risk to the county and its jurisdictions using various criteria. Before a community can assess the on-going mitigation activities, evaluate mitigation measures that should be undertaken, or outline a strategy for implementing mitigation projects, it must be aware of those hazards that, if they occur, could harm the community.

Hazard analysis and risk assessment answers the following fundamental question: What hazards can occur and what would happen if a hazard event occurred in our community? Hazard analysis and risk assessment is the process of measuring the potential loss of life, injury, economic loss, and property loss resulting from hazards. Further, risk assessment teaches us:

- The hazards to which your community is susceptible;
- What these hazards can do to physical, social, and economic assets;
- What areas are most vulnerable to damage from these hazards; and
- The resulting costs of damages or costs avoided through future mitigation activities.

The hazard analysis identifies potential hazards that could affect Adams County and the various jurisdictions in the county for the purposes of mitigation planning. It is important to note the focus of mitigation is on reducing long-term risks of damage or threats to public health and safety caused by hazards and their effects. Thus, in some cases, the hazards identified for mitigation will not necessarily include all of or the same hazards identified for preparedness, response, or recovery.

The risk assessment identifies how people, properties, and structures will be damaged by the event. If the hazard can harm people or damage their homes and other structures, they are vulnerable. Finding the weak points in the system, for example, identifying building types that are vulnerable to damage and anticipating the loss in high risk areas will help the community decide what mitigation measure should be undertaken and how to implement the activities they select.

The risk assessment for Adams 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

This chapter is divided into six main parts:

- **Section 3.1 Hazard Identification** identifies the hazards that threaten the planning area and the rationale for acceptance and elimination of hazards from further consideration;
- **Section 3.2 Assets at Risk** provides the planning area's total exposure to hazards, considering critical facilities and other community assets at risk;
- **Section 3.3 Development Since Previous Plan Update** provides information relative to development that has occurred since the previous plan update for each jurisdiction;
- **Section 3.4 Future Land Use and Development** discusses areas of planned future development;
- **Section 3.5 Hazard Profiles and Vulnerability** analyzes each hazard and its effects. The methodology utilized to score or rank the hazards is outlined. For each hazard, this section is divided into two parts: 1) Hazard Profile discusses the threat to the planning area, the geographic

location/extent at risk, previous occurrences of hazard events, and probability of future occurrence; and
2) Vulnerability Assessment further defines and quantifies populations, buildings, critical facilities, and other community assets at risk to natural hazards;

- **Section 3.6 Risk Assessment Summary** provides a tabular summary of the hazard ranking for each jurisdiction, an annual loss estimation, and a consequence analysis for the hazards that have potential impact on the planning area. This section also includes a series of risk assessment issue or problem statements.

3.1: Hazard Identification

Adams County used the State of 2018 Iowa Hazard Mitigation Plan as the basis for the list of hazards the County’s mitigation planning team considered for discussion. The Adams County planning team did not add to this list. FEMA requires that all natural hazards be studied in the mitigation plan. However, the planning team recognized the need for and importance of planning for other hazards also identified in the State plan.

This part of the plan addresses the following Stafford Act requirement:

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

For this assessment, the following definitions are used for each natural hazard to be considered:

Dam/Levee Failure: the uncontrolled release of water resulting from a structural failure in a dam, wall, dike, berm, or area of elevated soil that causes flooding.

Drought: a period of prolonged abnormally low precipitation producing severe dry conditions.

Earthquake: Any shaking or vibration of the earth caused by the sudden release of energy that may impose a direct threat on life and property.

Expansive Soils: Soils and soft rock that tend to swell or shrink excessively due to changes in moisture content.

Extreme Heat: Summertime weather that is substantially hotter and/or more humid than average for a location at that time of year.

Flood- Flash: A flood event occurring with little or no warning where water levels rise at an extremely fast rate.

Flood - River: a temporary condition of partial or complete inundation of normally dry land areas from the overflow of stream banks.

Grass or Wildland Fire: An uncontrolled fire that threatens life and property in either a rural or wooded area.

Landslide: A downward and outward movement of slope-forming materials reacting under the force of gravity.

Severe Winter Storm: Severe winter weather conditions that affect day-to-day activities. These can include blizzard conditions, heavy snow, blowing snow, freezing rain, heavy sleet, and extreme cold.

Sinkhole: The loss of surface elevation due to the removal of subsurface support.

Thunderstorm, Hail, and Lightning: Atmospheric imbalance and turbulence that may result in thunder, heavy rains (which may cause flash flooding), and strong winds reaching or exceeding 58 mph resulting in tornadoes, or surface hail of at least 1 inch in diameter, and lightning.

Tornado/Windstorm: A violent, destructive, rotating column of air taking the shape of a funnel-shaped cloud that progresses in a narrow, erratic path. Windstorms are extreme winds associated with severe winter storms, severe thunderstorms, downbursts, and very steep pressure gradients.

For this assessment, the following definitions are used for each “man-made” hazard to be considered:

Animal/Plant/Crop Disease: An outbreak of disease transmitted from animal to animal or plant to plant.

Hazardous Materials Incident: Encompassing fixed hazardous materials, pipeline transportation, and transportation of hazardous materials, 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.

Infrastructure Failure: Encompassing a variety of occurrences, including communication failure, energy

failure, structural failure, and structural fire, this includes an extended interruption, widespread breakdown, or collapse (part or all), of any public or private infrastructure, that threatens life and property.

Pandemic Human Disease: A disease that is prevalent over a whole country, region, continent, or world.

Radiological Incident: An occurrence resulting in a release of radiological material at a fixed facility or in transit.

Terrorism: Encompassing a wide variety of human-caused threats including enemy attack, biological terrorism, agroterrorism, chemical terrorism, conventional terrorism, cyber terrorism, radiological terrorism, and public disorder, this includes the use of multiple outlets to 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.

Transportation Incident: Encompasses air transportation, highway transportation, railway transportation, and waterway incidents, a transportation incident is described as an accident involving any mode of transportation that directly threatens life, property damage, injury, or adversely impacts a community's capabilities to provide emergency services.

Please note that the above definitions have changed slightly in some cases since the previous Adams County HMP was approved in 2014.

Past Presidential Disaster Declarations Involving Adams County

The following details the Iowa Presidential declarations since 1990 through February 2021 that included Adams County, or in some cases when counties impacted are not known.

Figure 3.1: Past Federal Declarations of Major Disaster Involving Adams County

Event	Declaration #	Year	General Impact
Iowa COVID-19 Pandemic	Federal DR-4483-IA	2020	COVID Emergency – Public and Individual Assistance
Iowa COVID-19	Federal 3480-EM	2020	COVID Emergency – Public Assistance
Severe storms and flooding	Federal, DR-4421	2019	Adams County Public Assistance
Severe storms, tornadoes, straight-line winds, and flooding	Federal, DR-4181	2014	Adams County Public Assistance
Severe storms, flooding, and tornadoes	Federal, 1930-DR	2010	Adams County Public Assistance
Severe winter storms	Federal, 1880-DR	2008	Adams County Public Assistance
Severe storms, tornadoes, and flooding	Federal, 1763-DR	2008	Adams County Public and Individual Assistance
Severe winter storm (ice storm)	Federal, 1737-DR	2008	Adams County Public Assistance
Hurricane Katrina (Emergency Dec.)	Federal	2005	All counties, funds to evacuees
Severe storms, tornadoes, and flooding	Federal, 1518-DR	2004	Adams County included
Flooding	Federal, 1121-DR	1996	Adams County included
Flooding, severe storm (2 nd event of yr.)	Federal, 996-DR	1993	Adams County included
Flooding, severe storm (1 st event of yr.)	Federal, 986-DR	1993	Information not available by county
Flooding, severe storm	Federal, 965-DR	1992	Adams County included
Ice Storm	Federal, 928-DR	1991	Adams County included
Flooding, severe storms	Federal, 911-DR	1991	Information not available by county
Flooding, severe storm (2 nd event of yr.)	Federal, 879-DR	1990	Information not available by county
Flooding, severe storm (1 st event of yr.)	Federal, 868-DR	1990	Information not available by county

Source: www.fema.gov, March 2021

Since 1964, Adams has had an average to below average number of Presidential declarations for the county size.

Obviously, the types of hazards that can affect Adams County include all those in which FEMA assistance was given, but many other hazards have occurred and affected the county.

Potential Hazards in Adams County – Initial Hazard Screen

The initial hazard screen is an initial review process to determine what kind of information is available about each potential hazard and then a determination of the potential for the hazard to occur in the future, based on the various official and anecdotal data sources. Hazards are identified as either: a) has occurred, b) can occur but has not occurred, or c) cannot occur.

Figure 3.2: Initial Hazard Screen Matrix

		Has Occurred	Can Occur	Cannot Occur
Hazard	Where Information Was Found, Planning Team Comments			
Natural Hazards				
Dam/Levee Failure	2018 State Mitigation Plan, Watershed maps, Conservation Board, and the planning team states it can happen at the various smaller to mid-sized earthen public and private dams in and upstream of county, which are not often inspected. Several large lakes exist in the county and all are inspected regularly. This event can occur in some jurisdictions. The planning team knows of no levees. Agricultural terraces can and do fail, impacting cropland only.		X	
Drought	2018 State Mitigation Plan, USDA websites, past disaster declarations, local news media, consultant personal experience, planning team indicates droughts are common and affect rural farmland areas severely.	X		
Earthquake	2018 State Mitigation Plan, geological and seismic maps, maps of past events. Minor tremors have been noted in the county in the late 1980s. Epicenters of minor quakes have occurred 75 miles southwest in Fremont County (Iowa) and 275 miles east near Davenport. Events have been limited with minimal felt effects.	X		
Expansive soils	2018 State Mitigation Plan, soils maps, USDA and USGS websites, small areas of expansive soils have occurred in a widespread area in the county due to clay soils, the planning team reports. Officials serving the rural area and many of the towns report this event has happened. Many basements have been impacted, including cracks and shifting foundations.	X		
Extreme heat	2018 State Mitigation Plan, federal storm data sources, NWS, Weather Channel, local news media, consultant personal experience, and planning team comments. Excessive heat occurs at least once most summers.	X		
Flood - Flash	2018 State Mitigation Plan, past disaster declarations, county/city surveys, federal storm data sources, consultant personal experience, planning team, and local news media. Flash flooding is found in most areas of the county after the heaviest of rains. Some areas have common events. Undersized infrastructure is the main concern or problem, with topography a close second. Most jurisdictions report past events and the remaining indicate potential events.	X		
Flood - River	2018 State Mitigation Plan, federal storm data sources, FIRM maps, past disaster declarations, city/county surveys, consultant personal experience, watershed maps, and planning team comments. Flooding can and has occurred in rural areas and several jurisdictions. The entire county is mapped.	X		
Grass and wildland fire	2018 State Mitigation Plan, local news media, fire dept. reports, planning team, city/county surveys. The team indicates that small grass and forest fires occur during dry seasons annually. Most jurisdictions report past events and most others indicate potential events.	X		
Landslide	2018 State Mitigation Plan, city/county surveys, planning team, soils maps, county engineer, and conservation staff. Landslides have affected properties along road and rail cuts and have affected utilities and roadside ditches.	X		
Severe winter storm	2018 State Mitigation Plan, federal storm data sources, past disaster declarations, local news media, Weather Channel, NWS, consultant personal experience, planning team. Heavy snow, ice storms, and/or severe wind chills occur most winters.	X		
Sinkhole	2018 State Mitigation Plan, USGS, maps of past mining and caverns, city/county surveys, planning team. After review of data, planning team indicates sinkholes can occur in several jurisdictions. Mining is not common in the past, but installation of infrastructure can result in small-scale incidents. Filled in wells have collapsed with no warning.	X		
Thunderstorm, hail, lightning	2018 State Mitigation Plan, federal storm data sources, Weather Channel, NWS, local news media, past disaster declarations, consultant personal experience, and planning team. Thunderstorms that are deemed severe by the NWS occur almost every year, usually many times per year. Large hail has occurred in all areas of the county and can occur in all seasons.	X		
Tornado/windstorm	2018 State Mitigation Plan, federal storm data sources, Weather Channel, NWS, local news media, past disaster declarations, consultant personal experience, and planning team. Tornadoes of EF0-EF2 occur most years in the county and EF3 and larger have occurred. Warnings and sighting have occurred in all jurisdictions but not necessary all jurisdictions have been directly	X		

Hazard	Where Information Was Found, Planning Team Comments	Has Occurred	Can Occur	Cannot Occur
	hit. Straight-line winds have exceeded 70 MPH, causing extensive damage in the county. Sustained winds above 40 MPH over many hours during fair weather can cause significant damage to unsecured property and traveling vehicles.			
Man-made and Combination Hazards				
Animal/crop/plant disease	2018 State Mitigation Plan, local news media, Iowa Dept. of Public Health website, Iowa State Extension website, USDA website, planning team. Team members indicated no major outbreaks but remain concerned over oncoming diseases and pests.	X		
Hazardous materials incident	2018 State Mitigation Plan, local news media, Iowa DNR contaminated sites website, Iowa Utilities Board website, chemical and pipeline company websites, Iowa DOT website, DOE website, EPA Tier II facility maps, planning team, first responders, planning team. Events have occurred in Corning and various rural areas and can occur in other jurisdictions because of sewer lagoons, factories, and agricultural facilities as well as transportation of extensive volumes of agricultural chemicals. Corning and other parts of Adams County have been impacted by relatively minor cuts in gas lines.	X		
Infrastructure failure	2018 State Mitigation Plan, Iowa DOT website, communications system map, energy systems maps, utility company websites, Iowa Utilities Board, city/county surveys, planning team, first responders and fire department reports, visual survey of building condition, assessor's data on age of buildings. Some buildings and structures have collapsed, mostly on a small scale. There have been no sudden major failures. Communications failures have been scattered and mostly short-term. Energy failures due to things like ice storms have lasted multiple days. Structural fires occur at least a dozen times a year throughout the county.	X		
Pandemic human disease	2018 State Mitigation Plan, Iowa Dept. of Public Health website, Adams Co. Public Health, regional TV stations, planning team, CDC. Public Health reports H1N1 impacts in 2009-10 and COVID hit the county considerably in 2020-21.	X		
Radiological incident	2018 State Mitigation Plan, IDPH and EPA websites, planning team. There are no appreciable radiological sites identified in the county; the hospital and clinics present very small risk. An incident can occur but should be controlled quickly with no significant effect on people and properties outside of where it occurs. The BNSF Railway has occasional shipments.		X	
Terrorism	2018 State Mitigation Plan, DHS website, USDA website, DHS website, EPA website, communications websites, news media, planning team. After review of data, relatively minor events, mostly threats that were not carried out, have occurred of the biological and conventional types. Cyber terrorism is difficult to identify, but breaches of wider systems (not directly targeting the county) have impacted the county.	X		
Transportation incident	2018 State Mitigation Plan, IDOT crash data, IDOT and FAA airplane data, BNSF Railway website, planning team, first response agencies, and local news media. With the Interstate and other highways, events occur requiring extensive response and road closures each year. Several jurisdictions have had incidents. US Highway 34 passes through the heart of the county and has high traffic volumes. Crashes sometimes involving multiple cars occur each year. The BNSF mainline and Amtrak travel through the county. All cities are at risk. There are an estimated 50 trains per day on this line, including two daily Amtrak passenger trains. People have drowned in waterway incidents. Several Adams County water bodies are popular in all seasons for fishing, swimming, and boating.	X		

The following is the results of an online public survey in which members of the public were asked about their personal level of concern over each of the following hazards. Twenty-three responded.

Figure 3.3: Planning Team and Public Concern Over Various Hazards

Hazard	Very concerned	Significantly concerned	Moderately concerned	Unconcerned
Dam/Levee Failure	2	0	10	11
Drought	4	8	10	0
Earthquake	0	0	6	16
Expansive soils	0	1	9	12
Extreme heat	3	7	9	4
Flood – flash	2	10	7	4
Flood – river	4	10	9	0

Hazard	Very concerned	Significantly concerned	Moderately concerned	Unconcerned
Grass and wildland fire	3	6	18	3
Landslide	0	0	2	21
Severe winter storm	10	4	8	1
Sinkhole	1	1	8	13
Thunderstorm, hail, lightning	6	10	7	0
Tornado/windstorm	9	8	5	1
Animal/plant/crop disease	4	7	9	2
Hazardous materials incident	0	4	7	12
Infrastructure failure	8	9	5	1
Pandemic human disease	8	7	7	1
Radiological incident	Combined with hazardous materials			
Terrorism	0	6	8	9
Transportation incident	2	9	10	2

Severe winter storm gained the most “very concerned” votes, with tornado/windstorm, infrastructure failure, and pandemic human disease closely behind. Several hazards, such as earthquake, expansive soils, dam/levee failure, landslide, hazardous materials, and sinkhole have overall very little concern. It should be noted that the survey occurred in January through March, when severe winter conditions were occurring and when COVID-19 remained a hot topic.

Adams County Hazard Identification by Jurisdiction

Based on the above results, the planning team has used various data sources to determine in which participating or other government jurisdiction the various hazards have occurred, might occur, and will not occur. Note that this table considers whether the hazard can occur within the jurisdiction and does not consider the potential that hazards occurring outside of a jurisdiction may impact the jurisdiction in question.

Figure 3.4: Potential Hazards by Jurisdiction (Y = occurred, P = can occur, N = cannot occur)

Hazard	Rural Adams Co.	Corning	Nodaway	Prescott	Southwest Valley Schools	CHI Health
Natural Hazards						
Dam/Levee Failure	P	P	N	P	N	N
Drought	Y	Y	Y	Y	Y	Y
Earthquake	Y	Y	Y	Y	Y	Y
Expansive soils	Y	Y	Y	Y	P	P
Extreme heat	Y	Y	Y	Y	Y	Y
Flood – flash	Y	Y	Y	Y	Y	Y
Flood – river	Y	Y	Y	Y	P	N
Grass and wildland fire	Y	P	Y	P	N	N
Landslide	Y	P	P	P	N	N
Severe winter storm	Y	Y	Y	Y	Y	Y
Sinkhole	P	P	Y	P	P	P
Thunderstorm, hail, lightning	Y	Y	Y	Y	Y	Y
Tornado/windstorm	Y	Y	Y	Y	Y	Y
Man-made and Combination Hazards						
Animal/plant/crop disease	Y	P	P	P	P	P
Hazardous materials incident	Y	Y	P	Y	P	P
Infrastructure failure	Y	Y	Y	Y	Y	Y
Pandemic human disease	Y	Y	Y	Y	Y	Y
Radiological incident	P	P	P	P	P	P
Terrorism	P	Y	P	P	P	P
Transportation incident	Y	Y	Y	Y	P	P

Of the 13 natural hazards considered, all of them can or have occurred in at least one jurisdiction. Of the 7 other hazards, six of them have occurred in at least one jurisdiction. Hazards are most likely to occur in the rural unincorporated part of the county because it is the largest geographically. The hazard profiles later in this chapter describe reported hazard events where listed in the above table.

3.2: Assets at Risk

Step 3 of the HARA process involves the assessment of risk to the assets in the county’s jurisdictions. The assessment of risks includes an analysis of how each hazard affects: a) populations, b) structures, and c) land. Of notable interest is the impact on essential facilities, which are those facilities that are to be the target of potential mitigation projects because of the risk caused by hazards and importance to the community. The vulnerability assessment includes at a minimum: 1) assessment of each hazard and how it impacts the community, 2) types of structures and populations at risk, 3) the impact on future development, and 4) estimation of losses. The data in this section is based on the best available or, in the absence of qualified data, estimated data. Data sources included the 2018 Iowa Hazard Mitigation Plan, US Census Bureau, local officials, Iowa Homeland Security and Emergency Management, Iowa DNR, the previous Adams County HMP, and other agencies and sources as cited.

This part of the plan addresses the following Stafford Act requirements:

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

Section 201.6 (c)(iii): 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.

This remainder of this chapter is organized into several parts related to the topic of assets at risk:

- Description and itemization of assets at risk;
- Assets at risk by hazard (for geographically specific hazards);
- Summary of development and new risks since the original plan was adopted;
- Estimation of future assets at risk and future growth; and
- General description of vulnerability.

Plan Update Changes in Assets at Risk

In this update, the planning team focused on the hazards that have been identified as presenting the greatest concern to the county. Some new ways of analyzing these hazards have been incorporated, along with an update of the quantitative impacts to properties, property values, and populations. Also, this new plan is organized quite differently than the existing plan, organized by hazard and then by jurisdiction.

Figure 3.5: Risk Graphic



Note: Modified from U.S. Geological Survey and Oregon Partnership for Disaster Resilience Models.

This chapter addresses the convergence of hazards with the structures, properties, and people that are in the area where hazards occur. Figure 3.5 illustrates this concept, calling risk the potential for loss due to the hazards interacting with assets. While this illustration is for natural hazards, it can apply to all kinds.

DMA 2000 calls for the determination of the assets at risk for various hazards, both hazards that can affect all assets and those that can affect only certain areas. The following tables show asset data by jurisdiction in the planning area. In the hazard profile section of this chapter are breakdowns of assets at risk to specific hazards.

Description of Assets at Risk by Structure/Land Use

This assessment includes a summary of each hazard’s potential impact on the multiple jurisdictions’ vulnerable structures and properties. The following pages detail the estimated impacts of each hazard event on the assessed valuation of each property category, including infrastructure and government buildings. These estimates are not losses. Rather, this section covers the percentage of structures and the population *that can be* impacted negatively by the hazard, without regard to extent of loss.

Notes for tables in this section:

- Estimated value is based on County Assessor data when possible, directly from the source when available, and from HAZUS or other State data when available.
- Number of people is the total population, estimate during peak business hours, or facility census, as relevant. It will usually vary from the Census population because it takes in consideration the maximum regular population in each category.
- Taxable infrastructure includes private utilities, gas and electric, and railroads.
- Government/institutional facilities are government facilities, schools, non-profit organizations, churches, parks/recreation, public roadways as a whole, and land used for public and non-profit purposes.

Description of Critical Assets

The planning team used existing resources and FEMA “Understanding Your Risks” worksheets to determine what should be included as locally identified essential assets and lifeline utilities and transportation systems. Numerous tables in this chapter detail the assets. The values used in the tables provided from local data sources, where available, and the remaining values are estimated. The consultant worked with the planning team and others to determine approximate values.

The following are the types of facilities and assets that the planning team defined as critical:

- Economic assets: Major employers that do not fall into the other critical asset categories but have a transformative nature on the local economy.
- Essential facilities: Those essential for the health and welfare of the whole population and are vital during and after hazard events. They include hospitals, medical facilities, police and fire stations, EOCs, schools, colleges, and shelters.
- Essential transportation systems: Those essential for the transportation of the emergency supplies to and within the community and evacuation from it.
- Lifeline utility systems: Those essential for basic public health and economic recovery, such as potable water, wastewater collection, gas pipelines, electric power systems, and central communications.
- High potential loss facilities: Those that would have a high loss associated with them, such as nuclear power plants, large dams, large universities, and military installations. (None exist in Adams County)
- Vulnerable population centers: housing and other facilities that normally contain vulnerable populations, such as small children, elderly, disabled, or those that need other medical care. They might include nursing homes, senior apartments, childcare facilities, preschools, group homes, and mobile home parks.
- Historical and cultural resources: Those are historic and cultural facilities, landmarks, and other assets that create a sense of place and are important to the quality of life in the community.

Rural Adams County Assets at Risk

Figure 3.6 shows the potential properties and populations affected by the various hazards considered in this plan in the unincorporated part of the county.

Figure 3.6: Rural Adams County Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	951	\$77,100,000	1,700	100%
Commercial	15	\$3,700,000	40	100%
Industrial	10	\$74,700,000	100	100%
Ag Structures and Land	5,000 buildings; 250,000 acres	\$278,300,000	70	100%
Taxable Infrastructure	10	\$73,200,000	5	100%
Government/Institutional	20	\$200,000,000	100	100%
Totals	6,006	\$707,000,000	2,015	100%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

As this table shows, 1,700 residents live in rural areas and nearly 315 people are in or using other rural area assets at a given time. The total valuation of the rural area assets in approximately 6,006 properties exceeds \$707 million dollars, it is estimated. For example, at night, when most people are home, the population at risk may be the official population of 1,839.

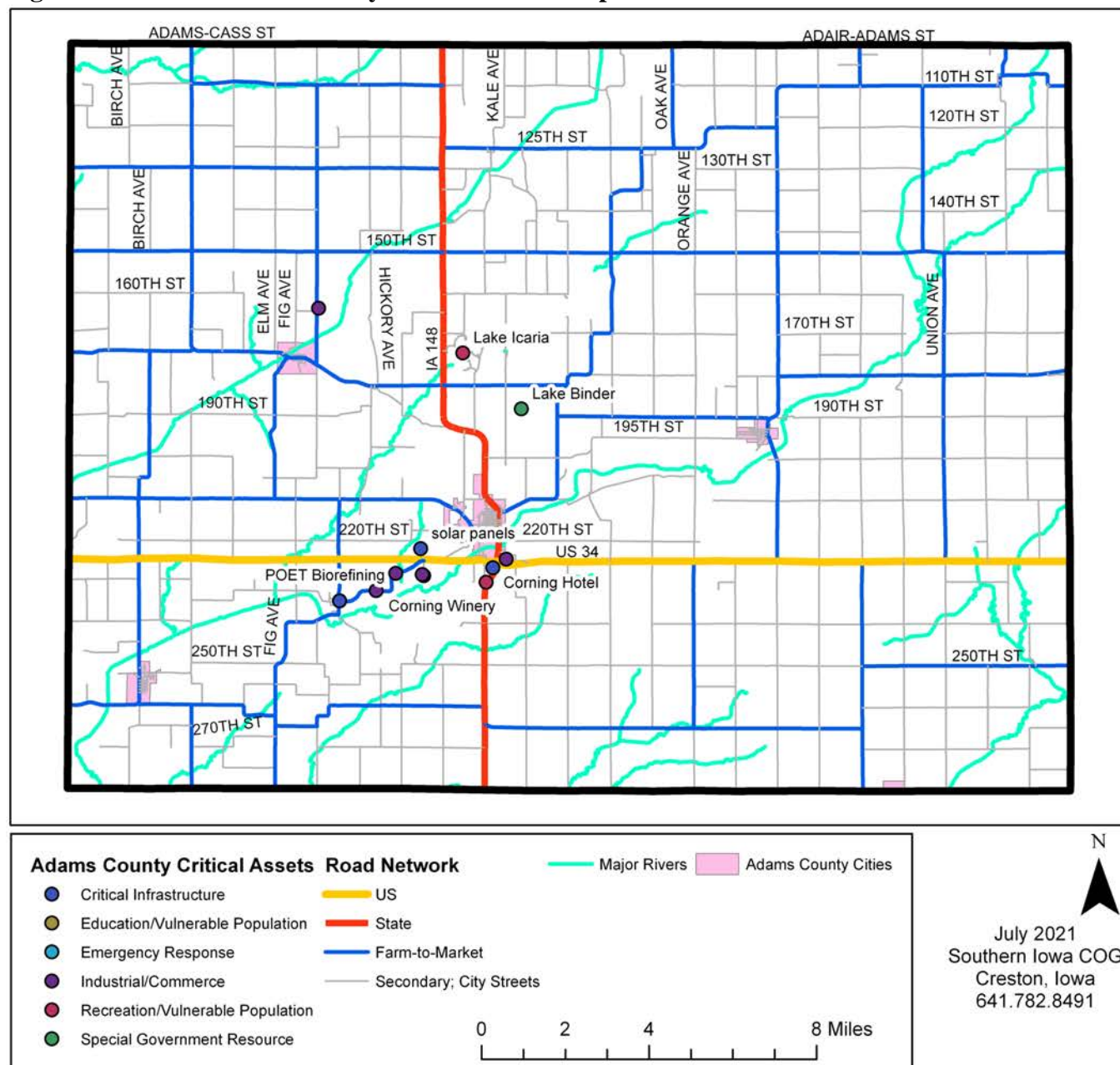
Figure 3.7 shows the current list of locally identified critical assets in the rural part of the county.

Figure 3.7: Rural Adams County Critical Assets

Facility	Location	Primary Type	Size	Replacement Value	Contents Value	Functional Use Value (\$)	Displacement Cost (\$/day)	Occupancy, Capacity (#)
Brown Bear	2248 Avenue of Industries	Economic asset	17,000 SF	\$2 M	\$1 M	\$750 K	\$1,700	30
Corning Hotel	2260 Juniper Ave.	Economic asset	25,000 SF	\$5 M	\$2.5 M	\$1 M	\$5,000	50
Corning Winery	2300 Highway 148	Economic asset	5 acres	\$1 M	\$250 K	\$100 K	\$250	10
Electric substations	Various	Critical facility	1 acre	\$5 M	\$2.5 M	\$100 K	\$10,000	10
Feeders Grain and Supply	2052 Hunter Trail Rd.	Economic asset	7,000 SF	\$500 K	\$200 K	\$300 K	\$500	10
Fiber optic lines	Various	Critical facility	--	\$1 M	\$100 K	\$100 K	\$10,000	0
Houck Supply	1633 Filbert Ave.	Economic asset	5,000 SF	\$300 K	\$100 K	\$100 K	\$500	5
Kinder Morgan Pipeline	Across north part of county	Critical facility	--	\$10 M	\$300 K	\$100 K	\$1,000	0
Lake Binder	1 mile northeast of Corning	Vulnerable population	250 acres	\$5 M	\$1 M	\$500 K	\$5,000	100
Lake Icaria	3 miles north of Corning	Vulnerable population	2,000 acres	\$25 M	\$10 M	\$2 M	\$10,000	250
Nutrien Crop Services	1823 Brooks Rd.	Economic asset	10,000 SF	\$1 M	\$750 K	\$750 K	\$1,500	25
Poet Biorefining	1680 Brooks Rd.	Economic asset	100,000 SF	\$25 M	\$5 M	\$3 M	\$20,000	30
Precision Pulley & Idlers (multiple buildings)	2251 Avenue of Industries	Economic assets	100,000 SF	\$20 M	\$5 M	\$3 M	\$20,000	100
SIRWA water towers	Various	Critical facility	1 acre	\$5 M	\$1 M	\$250 K	\$1,000	0
Solar farm (REC)	1 mile west of Corning	Critical facility	2 acres	\$5 M	\$1 M	\$250 K	\$1,000	2
Various confinement facilities	Various	Economic asset	100,000 SF total	\$10 M	\$10 M	\$1 M	\$10,000	10
Wind towers (estimated 84)	Various	Critical facility	75 acres	\$50 M	\$10 M	\$250 K	\$1,000	2

Sources: planning team, FEMA Understanding Your Risks, Adams County Assessor's data, IDOT

Figure 3.8 shows the rural Adams County critical assets as listed in the above table.

Figure 3.8: Rural Adams County Critical Assets Map**Corning Assets at Risk**

The following table shows the potential properties and populations affected by the various hazards considered in this plan.

Figure 3.9: Corning Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	849	\$50,800,000	1,600	100%
Commercial	25	\$8,500,000	250	100%
Industrial	1	\$127,000	30	100%
Ag Structures and Land	3 buildings; 25 acres	\$134,000	5	100%
Taxable Infrastructure	10	\$850,000	10	100%
Government/Institutional	30	\$70,000,000	500	100%
Totals	918	\$130,411,000	2,395	100%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

Any hazard that can affect all people and property in Corning can affect an estimated 918 structures, 25 acres of farmland, \$130 million in property value, and 2,395 persons. These are rough estimates and vary by time of day. For example, at night, when most people are home, the population at risk may be the official population of 1,564. The following is the current list of critical assets in Corning, as identified by the planning team.

Figure 3.10: Corning Critical Assets

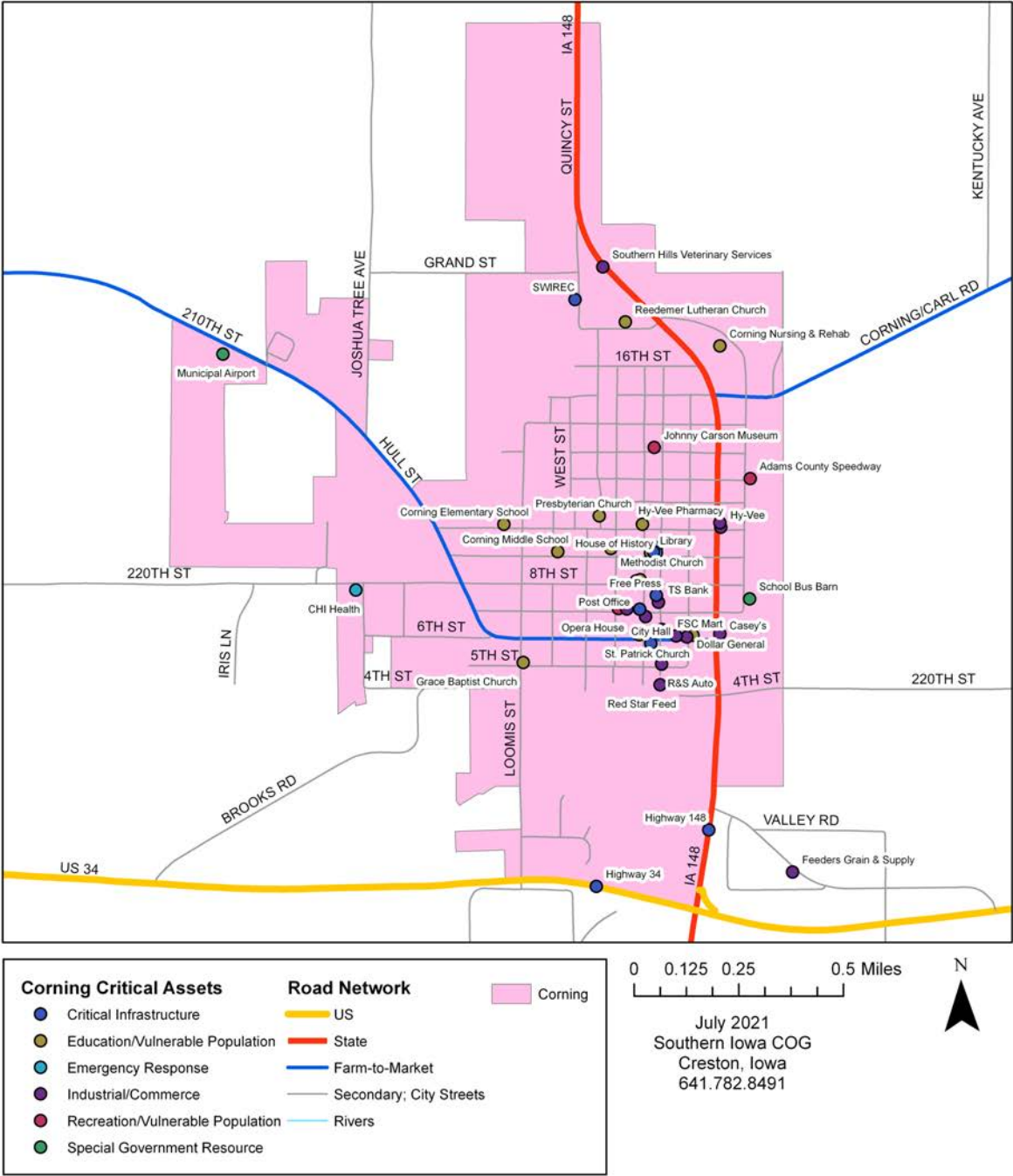
Facility	Location	Primary Type	Size	Replacement Value	Contents Value	Functional Use Value (\$)	Displacement Cost (\$/day)	Occupancy, Capacity (#)
Adams Co. Courthouse	901 Davis Ave.	Critical asset	35,000 SF	\$25 M	\$10 M	\$10 M	\$10 K	100
Adams Co. Free Press	729 Davis Ave.	Critical asset	4,000 SF	\$400 K	\$100 K	\$200 K	\$300	25
Adams Co. Speedway and Fairgrounds	1200 John St.	Cultural asset	20 acres	\$2 M	\$500 K	\$500 K	\$100	500
Alliant Energy pipelines	Various locations	Critical asset	Varies	\$2 M	\$200 K	\$500 K	\$10 K	0
Bank of Brooks	701 Benton Ave.	Economic asset	5,000 SF	\$500 K	\$400 K	\$250 K	\$1,000	5
BNSF Railway/AMTRAK	---	Critical asset	---	\$5 M	\$0	\$250 K	\$5,000	0
Casey's Store	600 Quincy St.	Critical asset	5,000 SF	\$1 M	\$750 K	\$250 K	\$2,500	25
CHI Mercy Hospital	603 Rosary Dr.	Critical asset	35,000 SF	\$25 M	\$20 M	\$15 M	\$10 K	150
Choice and Chance Group Homes	600 8 th St.	Vulnerable population	5,000 SF	\$500 K	\$100 K	\$250 K	\$500	25
Corning Airport	1904 210 th St.	Critical asset	50 acres	1.2 M	\$500 K	\$100 K	\$100	10
Corning City Hall and community center	601 6 th St.	Critical asset	10,000 SF	\$1 M	\$500 K	\$250 K	\$1,500	100
Corning Elementary Sch.	1012 10 th St.	Vulnerable pop.	15,000 SF	\$8 M	\$4 M	\$7 M	\$3,500	250
Corning Fire Station	905 Davis Ave.	Critical asset	5,000 SF	\$3 M	\$500 K	\$100 K	\$3,000	25
Corning High School	8 th /9 th Streets	Vulnerable pop.	30,000 SF	\$50 M	\$25 M	\$10 M	\$5,000	300
Corning Library	603 9 th St.	Vulnerable pop.	3,000 SF	\$300 K	\$200 K	\$50 K	\$300	20
Corning Mun. Utilities	601 6 th St.	Critical asset	50,000 SF	\$25 M	\$5 M	\$750 K	\$15 K	12
Corning Nursing/Rehab	1614 Northgate Dr.	Vulnerable pop.	10,000 SF	\$5 M	\$1 M	\$750 K	\$5,000	50
Dollar General Store	606 Adams St.	Economic asset	7,500 SF	\$1 M	\$500 K	\$200 K	\$1,000	25
FC Mart	408 6 th St.	Economic asset	2,000 SF	\$200 K	\$100 K	\$100 K	\$1,000	10
Grace Baptist Church	1801 Quincy Ave.	Vulnerable pop.	5,000 SF	\$500 K	\$100 K	\$200 K	\$100	150
Highway 148	----	Critical asset	---	\$5 M	\$0	\$250 K	\$2,500	0
House of History	1000 Benton Ave.	Cultural asset	2,500 SF	\$200 K	\$75 K	\$75 K	\$200	10
Hy-Vee Store	300 10 th St.	Economic asset	15,000 SF	\$10 M	\$5 M	\$500 K	\$2,500	50
Hy-Vee Drug	625 Davis Ave.	Critical asset	2,000 SF	\$500 K	\$250 K	\$250 K	\$500	30
Johnny Carson Museum	500 13 th St.	Cultural asset	7,000 SF	\$250 K	\$125 K	\$25 K	\$100	15
Methodist Church	901 Nodaway St.	Vulnerable pop.	5,000 SF	\$500 K	\$100 K	\$200 K	\$100	150
MidAmerican Energy substation	2411 N. Market St.	Critical asset	2,500 SF	\$100 K	\$50 K	\$100 K	\$1,000	2
Midwest Opportunities	724 Davis Ave.	Vulnerable pop.	3,000 SF	\$1 M	\$500 K	\$250 K	\$1,000	25
Opera house	801 7 th St.	Cultural asset	10,000 SF	\$4 M	\$500 K	\$500 K	\$250	50
PCSB Bank	609 Davis Ave.	Economic asset	9,000 SF	\$600 K	\$425 K	\$250 K	\$1,000	6
Post Office	608 7 th St.	Critical asset	5,000 SF	\$500 K	\$100 K	\$250 K	\$500	30
Presbyterian Church	Corning	Vulnerable pop.	5,000 SF	\$500 K	\$100 K	\$200 K	\$100	150
R & S Auto	510 Davis Ave.	Economic asset	15,000 SF	\$500 K	\$750 K	\$500 K	\$100	15
Red Star Feed	401 Davis Ave.	Economic Asset	10,000 SF	\$1.2 M	\$750 K	\$400 K	\$1,000	20
Redeemer Lutheran Ch.	Corning	Vulnerable pop.	6,000 SF	\$600 K	\$125 K	\$200 K	\$100	150
School bus barn	John Street	Critical asset	7,000 SF	\$1 M	\$1 M	\$250 K	\$2,500	5
Southern Hills Veterinary Care	1902 Quincy Ave.	Economic asset	10,000 SF	\$500 K	\$250 K	\$500 K	\$1,000	5

Facility	Location	Primary Type	Size	Replacement Value	Contents Value	Functional Use Value (\$)	Displacement Cost (\$/day)	Occupancy, Capacity (#)
Southwest Iowa REC	1801 Grove Avenue	Critical asset	7,500 SF	\$750 K	\$400 K	\$500 K	\$1,000	5
St. Patrick Church	504 Grove Ave.	Vulnerable pop.	7,000 SF	\$750 K	\$150 K	\$250 K	\$150	150
TS Bank	701 Davis Ave.	Economic asset	9,000 SF	\$900 K	\$500 K	\$300 K	\$1,500	15

Sources: planning team, FEMA Understanding Your Risks, Adams County Assessor’s data, IDOT

The following map shows Corning’s critical assets as listed in the above table.

Figure 3.11: Corning Critical Assets Map



Nodaway Assets at Risk

The following table shows the potential properties and populations affected by the various hazards considered in this plan.

Figure 3.12: Nodaway Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	62	\$2,000,000	70	100%
Commercial	2	\$550,000	10	100%
Industrial	0	\$0	0	--
Ag Structures and Land	2 buildings; 79 acres	\$192,000	2	100%
Taxable Infrastructure	2	\$450,000	1	100%
Government/Institutional	3	\$2,000,000	5	100%
Totals	69	\$5,192,000	88	100%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

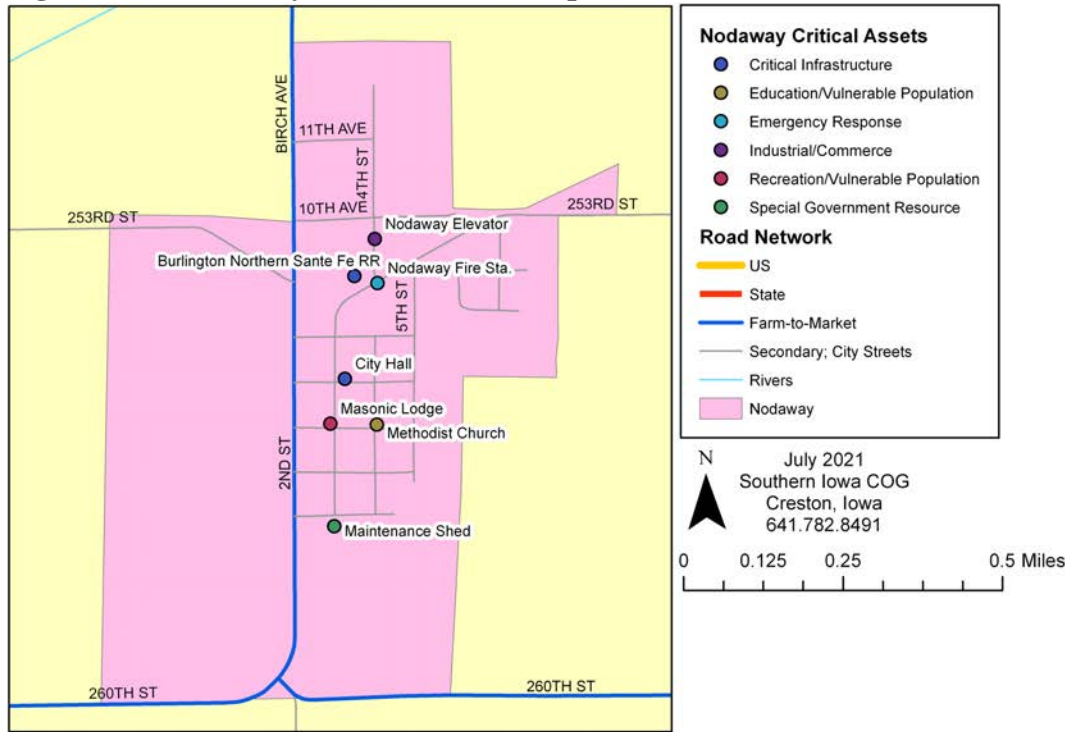
Any hazard that can affect all people and property in Nodaway can affect an estimated 69 structures, 79 acres of farmland, \$5.2 million in property value, and 88 persons. These are rough estimates and vary by time of day. For example, at night, when most people are home, the population at risk may be the official population of 74. The following is the current list of critical assets in Nodaway, as identified by the planning team.

Figure 3.13: Nodaway Critical Assets

Facility	Location	Primary Type	Size	Replacement Value	Contents Value	Functional Use Value (\$)	Displacement Cost (\$/day)	Occupancy, Capacity (#)
BNSF Railway/AMTRAK	---	Critical asset	---	\$2 M	\$0	\$250 K	\$2,500	0
City Hall	300 7 th St.	Critical asset	2,000 SF	\$500 K	\$100 K	\$300 K	\$300	30
Fire Station	904 4 th St.	Critical asset	5,000 SF	\$1 M	\$1.5 M	\$100 K	\$500	15
Maintenance shed	3 rd St.	Critical asset	1,000 SF	\$100 K	\$25 K	\$15 K	\$10	1
Masonic Lodge	Main Street	Vulnerable pop.	3,000 SF	\$300 K	\$100 K	\$50 K	\$250	40
Methodist Church	4 th St. & 6 th Ave.	Vulnerable pop.	5,000 SF	\$500 K	\$100 K	\$100 K	\$500	50
Nodaway Elevator	904 4 th St.	Economic asset	20,000 SF	\$5 M	\$500 K	\$500 K	\$1,000	10
SIRWA assets	Various	Critical assets	---	\$2 M	\$50 K	\$200 K	\$5,000	0

Sources: planning team, FEMA Understanding Your Risks, Adams County Assessor's data, IDOT

Figure 3.14 shows Nodaway's critical assets as listed in the above table.

Figure 3.14: Nodaway Critical Assets Map**Prescott Assets at Risk**

The following table shows the potential properties and populations affected by the various hazards considered in this plan.

Figure 3.15: Prescott Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	127	\$4,312,000	175	100%
Commercial	3	\$115,000	40	100%
Industrial	0	\$0	0	--
Ag Structures and Land	1 building; 24 acres	\$225,000	1	100%
Taxable Infrastructure	3	\$1,347,000	5	100%
Government/Institutional	4	\$5,000,000	15	100%
Totals	138	\$10,999,000	236	100%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

Any hazard that can affect all people and property in Prescott can affect an estimated 138 structures, 24 acres of farmland, \$11 million in property value, and 236 persons. These are rough estimates and vary by time of day. For example, at night, when most people are home, the population at risk may be the official population of 191. The following is the current list of critical assets in Prescott, as identified by the planning team.

Figure 3.16: Prescott Critical Assets

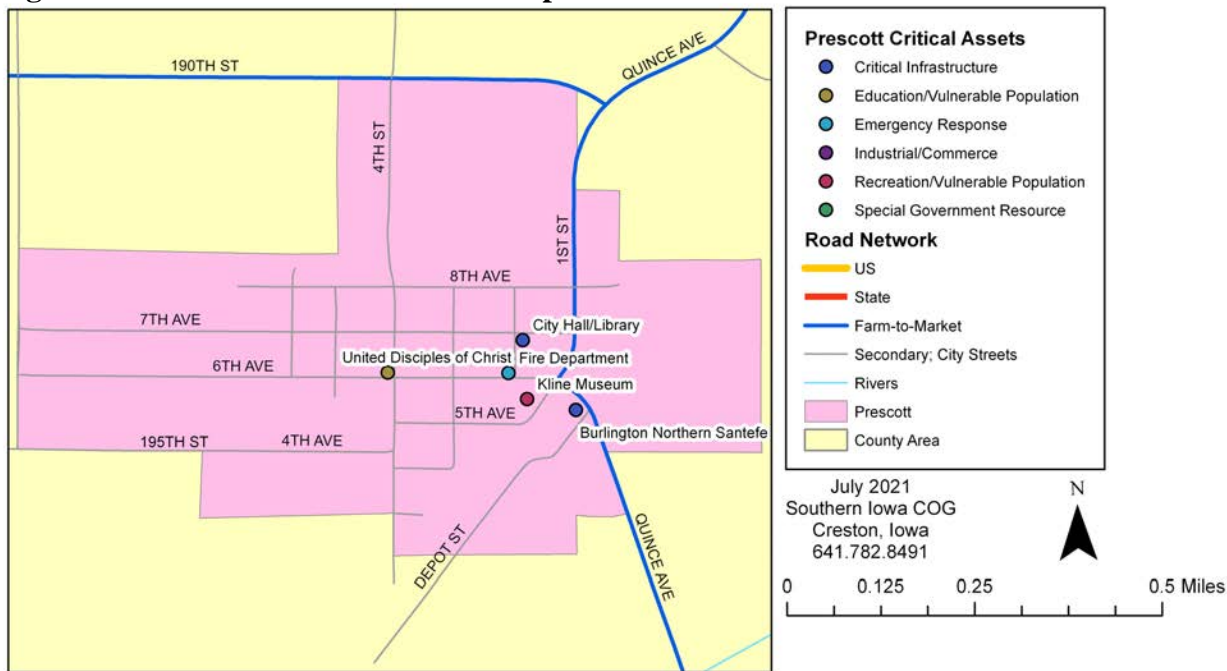
Facility	Location	Primary Type	Size	Replacement Value	Contents Value	Functional Use Value (\$)	Displacement Cost (\$/day)	Occupancy, Capacity (#)
Fire Department	206 6th Avenue	Critical facility	7,000 SF	\$600 K	\$600 K	\$600 K	\$500	20
City hall/library	607 2 nd St.	Critical facility	3,000 SF	\$300 K	\$150 K	\$50 K	\$600	25

Facility	Location	Primary Type	Size	Replacement Value	Contents Value	Functional Use Value (\$)	Displacement Cost (\$/day)	Occupancy, Capacity (#)
United Disciples of Christ Church	Prescott	Vulnerable pop.	5,000 SF	\$300 K	\$150 K	\$100 K	\$500	75
Post office	801 3 rd St.	Critical facility	3,000 SF	\$500 K	\$500 K	\$50 K	\$500	10
Kline Museum	228 6 th Ave.	Economic asset	5,000 SF	\$100 K	\$250 K	\$25 K	\$250	10
SIRWA facilities	Various	Critical asset	---	\$1 M	\$100 K	\$50 K	\$5,000	0
BNSF Railway/Amtrak	Southern part of city	Economic asset	---	\$1 M	\$100K	\$50 K	\$10,000	25

Sources: planning team, FEMA Understanding Your Risks, Adams County Assessor's data, IDOT

Figure 3.17 shows Prescott critical assets as listed in the above table.

Figure 3.17: Prescott Critical Assets Map



Public Perception

The public who responded to the community survey included 19 people who answered a question about the main reasons why the above assets are at risk. Six options were given. Sixteen people selected “has direct and immediate impact on ability to respond to hazards.” Nine people selected “excessive cost to replace, perhaps uninsurable. Six each selected “age of the structure, deteriorating condition, lack of recent investment” and “significant economic impact – irreplaceable jobs.” Other options received four or fewer selections.

3.3: Development Since Adoption of the Previous Plan

Compared to the county's total existing development, little development has occurred since the previous plan was adopted in 2011. While records are difficult to find, it is likely the total assets in terms of quantity has declined about 1 to 3% due to overall population loss. Importantly, compared to other parts of the nation and even Iowa, Adams County has fared well through the Great Recession and the COVID downturn. A few new homes and other buildings have been built. These new assets, for the most part, are constructed to modern

standards and designed to withstand typical weather conditions and are well insured. There have been no major FEMA funded mitigation projects to date. No new habitable construction has occurred in SFHAs. In fact, mitigation efforts in lowland and flood prone areas have reduced flood risk. Using non-FEMA grants and local funds, watershed protection projects, such as terraces, grassed waterways, grade stabilization ponds, shoreline stabilization efforts, and other developments have occurred in various locations with the intent of improving water quality and reducing the threat and magnitude of flooding.

The public in the survey indicated the most notable development by far in the past five years is the development of more wind turbines and solar energy collectors. The second choice was “large public infrastructure investments (new sewer plant, new water tower, new fire station, etc.).” Private development, such as housing and commercial, was selected by fewer survey respondents.

3.4: Future Land Use and development

This part of the plan addresses the following Stafford Act requirements:

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

Section 201.6(c)(2)(ii)C: Vulnerability will be described in terms of 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.

FEMA requires that local mitigation plans consider future development and population growth when considering mitigation strategies. As indicated in Chapter 2, the population is expected to continue to decline slowly overall but not evenly throughout the county. A subdivision in southern Corning and a few scattered rural acreages are likely to see new homes on a small scale. Development planners should consider how new housing developments might affect future mitigation needs and strategies in the future in these areas. Generally, other areas will sustain stagnant populations with very minimal new development. It is very unlikely that there will be substantial new development of commercial or industrial facilities in the county, although the industrial park west of Corning could see some development as well as the stretch of Highway 34 in Corning. Some land annexation is possible by cities of the county, but the amount of land annexed is likely to be modest and should not require an amendment to this plan.

The number of assets is likely to decline at a slower rate than the population, since average household sizes continue to decline and new construction to replace older buildings may not mean the demolition of older buildings. When commodity prices rise, more land that was not farmed (CRP, forested, or pastured land) in the past may be converted to grow corn and soybeans. The opposite is occurring right now with low commodity prices. Some rural areas and small towns are likely to see declines in total numbers of assets, buildings, and values. Other land uses, such as institutional, educational, government, and utilities, are more difficult to project. These developments will depend on available funding but it is anticipated that growth will be limited in most parts of the county, with Corning as the county seat receiving most of the investment.

Overall, the net growth (+) or decline (-) in assets is likely to be as follows over the five-year life of the plan.

Figure 3.18: Projected Changes in Land Use over Next Five Years

Structure/Land Use	Rural	Corning	Nodaway	Prescott	County
Residential	-10	+1	-2	-1	-12
Commercial	0	+1	-1	-1	-1
Industrial	0	0	0	0	0

Structure/Land Use	Rural	Corning	Nodaway	Prescott	County
Ag Structures	+2	0	0	0	+2
Ag Land (acres) *	-1,000	0	0	0	-1,000
Taxable Infrastructure	0	0	0	0	0
Government/Institutional	0	0	0	0	0
Totals	-8	+2	-3	-2	-11

* In rural areas: through conversion of marginal land (pasture, forest, CRP, channeled waterways, as land values increase)

Of course, the above table assumes there are no city boundary changes in the next five years, such as due to annexation. New development will be very minor compared to the current composition of the county; therefore, development will not likely affect the risks in the county in a significant way. The exception may in property values as these inflate and fluctuate over time. In other words, it is not likely that new buildings and population will create appreciable new risks that would not have occurred had the development not occurred.

Planning team members were asked to describe what new risks they could envision in the future due to new development. Some stated that the risks are no more significant than in other areas. The City of Corning has zoning, which regulates development, but no jurisdiction has significant development (building design) standards that consider mitigation. Prescott and Nodaway have no meaningful land use and development regulations. This means that it is almost impossible to project where and when development may occur and similarly impossible to enact some mitigation priorities and ideas in the location, siting, sizing, and building techniques of new development.

With the approval of FEMA FIRM maps in the past few years, all jurisdictions have SFHAs, but have joined the NFIP and have flood regulations that prohibit development in SFHAs. There are no policies for development of safe rooms and earthquake building codes or for wildland interface areas, which could be greater issues if new development occurs. With proper implementation of the mitigation plan, however, future development will not be in the risk area of any high-risk hazards except for hazards that can affect the entire county.

The public who was surveyed gave similar responses for projected future development as was noted in the past five years. New wind turbines and solar panels held a slight advantage over “significant increase of property values (10% increase in five years).”

3.5: Hazard Profiles and Vulnerability Assessments

A hazard profile is essentially a thorough analysis of each hazard included in the hazard mitigation plan. When completed, it provides a reasonable picture of what hazards are the most destructive to the planning area and each jurisdiction and what kind of damages are most likely to occur.

The hazard profile addresses the following information:

- Hazards to be profiled and why
- Hazard profile methodology
- Detailed analysis of each hazard
- Description of its effect on the assets of the county
- Loss estimation for hazards where data is available
- Summary and vulnerability assessment, including listing of hazards by level of risk by jurisdiction

Hazards to Be Profiled

Another change in this plan update is the revision of which hazards are profiled. Part of this is because the 2018 State plan condensed the hazards into a fewer number, where similar hazards were combined. After reviewing other FEMA approved plans, considering readability and brevity, this plan update excludes some hazards from profiling that have nominal impacts on the county or that are just not as important when funds and staff are limited. In other words, the profile attempts to focus resources where it is more likely to make a greater impact. The planning team feels this accomplishes the goals of the plan and the Stafford Act requirements because the information related to hazard risks is not compromised by these actions. The following table shows the hazards that are eliminated and how and why this occurred.

Figure 3.19: Hazards Eliminated from the Profile Process

Hazard	Reason for Omission
Earthquake	Planning area is located in Seismic Zone 1, the second lowest in the U.S. (Sources: USGS, IDNR, State Mitigation Plan). While very minor earthquakes have occurred regionally, no damage has ever been recorded in the planning area.
Landslide	Most of them occur in remote areas along streams and do not affect human development. Minor landslides along grade cuts for highways, bridges, and railroads have caused minimal damage and are mitigated easily without extensive planning and outside resources. This is no history of significant landslides in the planning area. (Sources: Iowa Map Book, State Mitigation Plan)

At the conclusion of their review, the planning team selected the following hazards to profile as hazards that may present substantial risk to the planning area. This includes 10 natural hazards and 4 other hazards.

Figure 3.20: List of Hazards to be Profiled

Natural Hazards		Other Hazards	
Dam/Levee Failure	Grass and wildland fire	Animal/plant/crop disease	Transportation incident
Drought	Severe winter storm	Hazardous materials incident	
Expansive soils	Sinkhole	Infrastructure failure	
Extreme heat	Thunderstorm, hail, lightning	Pandemic human disease	
Flood – flash	Tornado/windstorm	Radiological incident	
Flood – river		Terrorism	

Hazard Profile Methodology

The hazard profile is a more detailed investigation of each identified hazard to determine more precisely the potential impact each hazard could have on each jurisdiction. Data from various sources is used to determine how each hazard affects the county and its jurisdictions. This profile evaluates the relative impact of each potential hazard for each jurisdiction through several evaluation criteria. The profile is completed in order to rank the relative risk each hazard has on each jurisdiction, which will then enable the planning team to best develop goals, objectives, and mitigation actions for each jurisdiction later in this document.

This profiling is not new to communities in Adams County. The previous HMP included a hazard profile. This process has also been used with success in surrounding counties.

Each of the following profiles covers each jurisdiction. Within each profile for each hazard is a description of whether and how different communities have different risks to hazards. The following risk assessment was conducted on a planning area wide basis rather than analyzing each hazard for each individual jurisdiction. Unique conditions within the participating jurisdictions are noted in each hazard profile. For example, flooding will likely impact jurisdictions with Special Flood Hazard Areas (SFHAs) more than those without SFHAs. Unless otherwise stated in the risk assessment, the partnering organizations and other non-incorporated jurisdictions not specifically profiled will have the same risk factors as that of the underlying jurisdiction in which the organizations and assets are located. School districts and the hospital are profiled in terms of how hazards impact assets on their properties.

This part of the plan addresses the following Stafford Act requirement:

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

Explanation of Hazard Scoring Criteria

The following tables provide explanation of the scoring criteria. There are six overall criteria in which each hazard is scored, along with additional scores for one of the seven: severity of impact. While severity of impact is not necessarily a higher weighted score, it is complex and there are many factors related to the kinds of damages and their impacts. For this reason, the overall hazard score by jurisdiction is a sum of all the criteria. All criteria were rated on a scale of one (1) to nine (9), except the various severity of impact scores, which are rated on a scale of one (1) to five (5).

Plan Update Changes in Profile Hazard Scoring

In this update, the planning team took a completely different approach to hazard scoring compared to the previous plan. First, the historical occurrence factor was discussed but is no longer being scored. Past history does not result in future loss. However, historical incidence provides useful data about future probability and risk of loss, as reflected throughout this profile. The severity of impact is broken down into individual scores.

Each planning team member attending the first and second community meetings helped score the assessment criteria, with some individualized data and some team discussion results. The forms used for these discussions are found in Appendix C.

Following the meetings, the planning consultant completed research to confirm and in some cases modify the scores for each jurisdiction. These scores are found in this plan. The sum of the scores for each hazard for each jurisdiction were then added and ranked by community. Following the profile, the remaining part of this chapter details the results of this analysis.

It was important for the assessment team to score each hazard as a single event. Only impacts from that particular hazard were to be considered in the analysis. The planning team profiled hazards without consideration of secondary or cascading impacts and events.

Future Probability

The probability score reflects the estimated frequency of the hazard occurrence in the future. Often the historical occurrence can be extrapolated into the future, but sometimes this is not accurate. If a hazard or its impacts have been mitigated, the future occurrence will most likely be less than the historical occurrence. The opposite can also be true. There may be new hazards that present themselves to the community. For example, a new industry that produces a hazardous material may move into the community where previously the hazard did not exist.

Figure 3.21: Future Probability Scoring Criteria

Score	Description
1	Extremely rare: Less than 1% probability in the next year
2	Very Unlikely: Between 2% and 5% probability in the next year
3	Unlikely: Between 6% and 10% probability in the next year
4	Possible: Between 11% and 25% probability in the next year
5	Probable: Between 26% and 50% probability in the next year
6	Likely: Between 51% and 75% probability in the next year
7	Highly Likely: 76% and 90% probability in the next year
8	Often: Between 91% and 100% probability in the next year
9	Regularly: Most years this hazard will occur multiple times

Vulnerability of the Population

The vulnerability score represents adverse impacts to citizens, visitors, and emergency responders. It is important to consider only adverse effects as vulnerability. Many hazards, even those that are widespread, occur which do not significantly impact people, while others will have a direct impact on any person in the area of the hazard event.

Figure 3.22: Vulnerability of the Population Scoring Criteria

Score	Description
1	Indirect: Impacts exist but do not directly affect the lives of any people
2	Temporary: Quality of life is diminished temporarily – hazard in the area raises awareness/causes preventative action
3	Negligible: Less than 1% of the total population of the jurisdiction
4	Limited: 1% to 10% of the total population of the jurisdiction
5	Moderate: 11% to 25% of the total population of the jurisdiction
6	Significant: 26% to 50% of the population of the jurisdiction
7	Critical: 51% to 75% of the population of the jurisdiction
8	Severe: 76% to 90% of the population of the jurisdiction
9	Catastrophic: More than 90% of the total population of the jurisdiction

Maximum Area of Extent

The maximum geographic extent is the percentage of the jurisdiction impacted by the hazard. As an example, a snowstorm will likely impact the entire community, whereas a hazardous materials incident or flash flood may cover only a few city blocks or farms.

Figure 3.23: Maximum Area of Extent Scoring Criteria

Score	Description
1	Indirect: Impacts exist but do not directly affect land, property, or an identifiable area
2	Random: Specific points randomly impacted, such as individual computers at scattered locations
3	Negligible: Less than 1% of the total area of the jurisdiction
4	Limited: 1% to 10% of the total area of the jurisdiction
5	Moderate: 11% to 25% of the total area of the jurisdiction
6	Large: 26% to 50% of the area of the jurisdiction
7	Significant: 51% to 75% of the area of the jurisdiction
8	Widespread: 76% to 90% of the area of the jurisdiction
9	Total: More than 90% of the total area of the jurisdiction

Severity of Impact

The nine criteria used to score the severity of impact, as follows, are similar to those used by the Emergency Management Accreditation Program (EMAP) standards. The EMAP standards for a risk assessment require inclusion of a consequence analysis for the hazards that have potential impact on the planning area. The EMAP process considers the impact of each hazard on the following:

- General public
- First responders
- Continuity of government operations
- Property, facilities, and infrastructure
- Environment
- Economic conditions
- Public confidence in the jurisdiction’s governance

Notice how these are similar to the following nine scoring criteria that are analyzed in the “severity of impact” section of each hazard profile. A rating of 1-5 rather than 1-9 is in place because the planning team did not want to give the total score for severity of impact too much influence over the overall score compared to other criteria, such as future probability.

Severity of Impact – Health and Safety of the Public

Many hazards directly affect health and safety of the public, and protection of the public is a primary goal.

Figure 3.24: Severity of Impact Health and Safety of the Public Scoring Criteria

Score	Description
1	Negligible: No direct risk to health and safety
2	Limited: A few people may suffer minor injuries or become sick or lack food/water; fatalities are very unlikely
3	Moderate: Minor injuries are likely; major injuries and sickness are possible; fatalities are unlikely
4	Critical: Multiple injuries and sickness are probable; fatalities are likely
5	Catastrophic: Widespread fatalities are very likely; Federal and State emergency response will be necessary

Severity of Impact – Health and Safety of Response Personnel

Many hazards directly affect health and safety of those that respond to hazards, either because they are exposed to the original hazard or to resulting hazards and other risks associated with exposure.

Figure 3.25: Severity of Impact Health and Safety of Response Personnel Scoring Criteria

Score	Description
1	Negligible: No direct risk to health and safety; no response needed or response will occur after incident is over
2	Limited: Responders can be injured or made sick due to exposure but fatalities are unlikely
3	Moderate: Injury and sickness are likely and risk is high; fatalities are possible
4	Critical: Multiple injuries are probable; exposure can make many ill; fatalities are likely; secondary impacts such as radiation and explosions can cause adverse effects to a large part of the response community
5	Catastrophic: Widespread fatalities are very likely; Federal and State emergency response will be necessary

Severity of Impact – Continuity of Government Operations, Utilities, and Related Services

Many hazards have a direct impact on continuity of governments due to the impact on staffing, financial resources, and availability of reliable equipment and infrastructure. Utilities can become unreliable or even lost. Other necessary services can be compromised, and basic needs can go unmet or the public can become unprotected from crime and other risks.

Figure 3.26: Severity of Impact Continuity of Government Scoring Criteria

Score	Description
1	Negligible: Will not have a direct impact of any nature on public facilities, services, and infrastructure.
2	Limited: Services can be temporarily disrupted only if hazard directly impacts the central system/building; non-lifeline systems would be impacted for a few hours to one day
3	Moderate: Non-lifeline systems nonfunctional for days; lifeline systems such as electricity and water out for up to 6 hours
4	Critical: Lifeline systems out for 6 to 24 hours; government officials unable to serve for days; risk to life as a result of essential services being down
5	Catastrophic: Lifeline systems out for at least one day; multiple systems disrupted; complete shutdown of essential facilities for at least a day and many for weeks or more; government unable to operate and local officials unable to make decisions that will require Federal response

Severity of Impact – Property, Facilities, and Infrastructure

Property and infrastructure protection is vital to recovery. Most hazards affect properties, even if no people are injured or killed.

Figure 3.27: Severity of Impact Property, Facilities, and Infrastructure Scoring Criteria

Score	Description
1	Negligible: Will not have a direct impact of any nature on buildings, structures, and other infrastructure or will cause such little damaged that insurance can easily cover
2	Limited: Modern buildings and structures can be modestly damaged; weak buildings heavily damaged; sections of roads and utilities damaged but operable
3	Moderate: Key infrastructure and buildings can be moderately damaged – structurally insecure
4	Critical: Buildings are uninhabitable and some buildings destroyed; key facilities and infrastructure is not useful for days;

Score	Description
	detours needed on key roads
5	Catastrophic: Widespread destruction to strong buildings and infrastructure that will require Federal response

Severity of Impact – Delivery of Services

The public, non-profit, and private sectors deliver important services to the public and businesses in a community. The loss of these affects quality of life and hinders response and recovery.

Figure 3.28: Severity of Impact Delivery of Services Scoring Criteria

Score	Description
1	Negligible: Hazard will not result in any impact on delivery of services physically or via computers and technology
2	Limited: Services are disrupted temporarily both physically and electronically
3	Moderate: Detours will directly impact quality of life for many; deliveries delayed hours to days; Internet unavailable
4	Critical: Services are shut down for days; Internet unavailable for days; deliveries slowed by days
5	Catastrophic: Entire way of life is severely disrupted that will require Federal response

Severity of Impact – Environmental Impact

In a built environment, all kinds of hazards can cause undesirable short- and long-term environmental impacts.

Figure 3.29: Severity of Impact Environmental Impact Scoring Criteria

Score	Description
1	Negligible: No notable impact to the human or natural environment
2	Limited: Temporary impacts that will be cleaned immediately or by the natural environment
3	Moderate: Temporary impacts to the environment which can be cleaned up by local and regional personnel in days
4	Critical: Long-term environmental mitigation needed
5	Catastrophic: Severe damage that may alter wildlife populations and local ecology that will require Federal response

Severity of Impact – Economic and Financial Conditions

Economic and financial impacts of a more general nature can occur as a secondary effect of damage to property, equipment, and infrastructure and of death, injury, illness, and displacement of people.

Figure 3.30: Severity of Impact Economic and Financial Conditions Scoring Criteria

Score	Description
1	Negligible: No direct economic impact
2	Limited: Temporary local slowing of economic activity; a few small businesses temporarily damaged
3	Moderate: Large businesses temporarily damaged; small businesses closed or relocated
4	Critical: Large businesses closed; entire corridors of businesses significantly impacted
5	Catastrophic: Widespread economic losses that affect the regional quality of life that will require Federal response

Severity of Impact – Regulatory and Contractual Obligations

Another secondary impact of a hazard event can be the long-term loss of services so that contracts are broken and quality of life is directly impacted. Regulations may be temporarily ignored, which increases risks to those affected by the regulations. The confusion resulting from the upheaval in a community can raise tempers and distract people from what they are obligated to do.

Figure 3.31: Severity of Impact Regulatory and Contractual Obligations Scoring Criteria

Score	Description
1	Negligible: No direct impact on obligations
2	Limited: Regulations are no longer followed and obligations are not met temporarily
3	Moderate: Vital services and further physical losses directly result from temporary failures
4	Critical: Vital services and severe physical losses result over months and years; lawsuits likely; people financially ruined
5	Catastrophic: Widespread losses result that severely damage local way of life; communities financially ruined; Federal response

Severity of Impact – Reputation of the Entity

Hazard events today are highly visible and people all over the world can learn about them. If the response, cleanup, or other activity is performed poorly, or previous promised mitigation efforts are proved insufficient by an event, local, state, regional, and even federal reputations can be damaged.

Figure 3.32: Severity of Impact Reputation of the Entity Scoring Criteria

Score	Description
1	Negligible: No direct impact on reputation
2	Limited: Reputation of jurisdiction is damaged temporarily or relating to a service provider not directly affiliated with the jurisdiction
3	Moderate: Reputation damage is more than temporary or compromises services in the area temporarily
4	Damaging: Reputation of jurisdiction is severely damaged and trust/confidence is broken for some time; political ramifications to the jurisdiction are notable
5	Severe: other entities must take over responsibility or service/program is entirely terminated

Speed of Onset

The speed of onset is quite simply the amount of warning time available before the hazard occurs. This should be taken as an average warning time. Warning time and the speed the incident develops varies greatly by hazard and by hazard event. Reduced warning time and time to react can worsen the magnitude of damage.

Figure 3.33: Speed of Onset Scoring Criteria

Score	Description
1	More than 2 days warning time
2	1 to 2 days warning time
3	13 to 24 hours warning time
4	7 to 12 hours warning time
5	2 to 6 hours warning time
6	1 to 2 hours warning time
7	31 minutes to 1 hour warning time
8	1 minute to 30 minutes warning time
9	No or virtually no warning (seconds)

Duration of Event

The duration of event is the length of time a typical event affects an area, not counting the cascading events, response, or recovery times. The duration will be from the genesis to the termination of the event in a given area, or the time when warning is sounded or damage begins until an all-clear signal or direct damage ends, not including cleanup, recovery, etc.

Figure 3.34: Duration of Event Scoring Criteria

Score	Description
1	A few seconds to a minute
2	1 minute to 30 minutes
3	31 minutes to 1 hour
4	1 to 6 hours
5	7 to 12 hours
6	13 to 24 hours
7	25 to 36 hours
8	37 hours to 1 week
9	More than one week

Loss Estimation Process

The loss estimation phase includes: 1) the descriptions of loss estimation techniques, 2) the losses for each hazard event, 3) and the estimated losses for each year by hazard by jurisdiction. The chapter also considers future losses due to possible new development in the county.

To complete this process, the planning team considers various data sources. The team uses several loss formulas based on the likely damages that each asset may receive from each type of event. The following formulas can be used:

Structures: structure replacement value X percent damaged = loss to structure

Contents: contents replacement value X percent damaged = loss to contents

Functional/use: functional downtime cost (average daily operating budget X days) + displacement cost (displacement costs per day X days displaced) = functional loss

Total estimated losses to asset: structure loss + contents and inventory loss + functional loss = total

Human loss: value of a human life, as defined by FEMA, plus the value of a severe injury, as defined by FEMA, X the number of injuries and fatalities = total human loss

Plan Update Changes to the Loss Estimation Process

The planning team looked at more outside resources and considered hazard-specific data in each estimation. Unlike the previous plan, which tried to allocate total losses by jurisdiction, this plan looks at types of hazards. Also, the hazard loss estimate is outlined within each hazard profile rather than a separate chapter. The overall assessment of annual losses by jurisdiction is outlined later in this chapter for comparative purposes. Like the previous plan, there is no estimate of losses by structure, as this data is not available.

Animal/Plant/Crop Disease Profile

Type: Biological

Definition: An outbreak of disease transmitted from animal to animal or plant to plant.

Animal/Plant/Crop Disease Description:

The disease outbreak will likely have a significant economic implications or public health impact. The crop/plant pest infestation will likely have severe economic implications, cause significant crop production losses, or significant environmental damage. The crop/plant pests may also harm public health.

The introduction of some high consequence diseases may severely limit or eliminate our ability to move, slaughter, and export animals and animal products. The outbreak will have widespread economic and societal implications for the county. Response and recovery to infectious animal disease outbreaks will be lengthy, and many producers may never be able to return to business. There will be many indirect effects on our economy. Rumors of an infectious animal disease outbreak could cause significant damage to the markets, as was evidenced in an incident in Kansas in 2003 where the mere rumor of a Foot and Mouth Disease outbreak cause the markets to plummet. The same happened to pork sales in 2009 after an H1NI flu outbreak was labeled as “swine flu” and to poultry and egg sales following an avian flu incident in 2015. This hazard is in the spotlight again in early 2022, following the outbreak of another avian flu virus that has resulted in the euthanizing of millions of poultry and harming the state/national poultry industry.

More information on common and emerging animal, crop, and plant diseases in Iowa, as well as impact maps, can be found at the websites of the following organizations, USDA (www.usda.gov), Iowa Dept. of Public Health (www.idph.state.ia.us), Iowa Dept. of Natural Resources (www.iowadnr.com).

Animal/Plant/Crop Disease Historical Occurrence:

According to the USDA Risk Management Agency, millions of dollars in crop losses have occurred in Iowa.

The greatest causes include drought, excessive rain, falling commodity prices, hail, floods, and windstorms. To date, only a small part of crop losses has come from diseases, but the risk seems to be increasing. Every year the Iowa Department of Agriculture and Land Stewardship (IDALS) conducts numerous animal disease investigations. IDALS, under the direction of the state plant regulatory official, works with Iowa’s universities and industries to conduct regular crop and plant pest surveillance. More and more pests are being introduced in Iowa that affect livestock, wildlife, plants, and crops. Some of these have had isolated impact. Rabies and Asian soybean rust have been reported in domesticated animals and crops in the county. Other minor outbreaks of widespread diseases have been reported in rural areas, including West Nile Virus, Foot and Mouth Disease, aphids, emerald ash borer, chronic wasting disease, and others. Economic impact collectively to farmers, consumers, and property owners has been the most significant impact due to incidents to date.

In the summer of 2015 a major avian flu outbreak affected poultry producers all over Iowa. By June 2015, 75 farms were infected in 18 counties, most of them in northwest Iowa. Over 32 million turkeys and chickens succumbed to this disease, which greatly hurt the economy. Emerald ash borer has been found in Adams County, killing thousands of ash trees in Adams County.

When asked about the past occurrence of this hazard in the online survey, 23 persons responded. Three responded that it occurs more than once a year, six indicated it happened once or twice in the last five years, five responded that it has occurred but is rare, and nine stated it has not occurred or they don’t recall it occurring.

Animal/Plant/Crop Disease Future Probability:

The 2013 State of Iowa Hazard Mitigation Plan indicates the probability of a high-impact incident, one with statewide or larger significance, is low in a given year (the 2018 plan did not provide a projection of probability). The local planning team agrees, but more localized incidents that have a profound effect locally are more likely to occur. The issue is heightened because Adams County is very rural and resources to monitor pests are limited. The county is home to a large number of hog and cattle operations and corn and soybean fields. The risk is heightened due to potential deficiencies in communicating about these hazards across state lines (Iowa/Missouri). The production, processing, and transport of large quantities of various agricultural products as well as transport of non-indigenous plants and animals, and diseases that affect them, on local highways also raise the level of risk. Many diseases and pests are easily transmitted, even when the risks are known. Every year the Iowa Department of Agriculture and Land Stewardship (IDALS) conduct numerous animal disease investigations.

The overall rating the community gave for this hazard’s future probability in a survey was: “unlikely” to “moderately likely.” When asked about the likelihood that the incidence of this hazard will increase in the future compared to today in the online survey, 23 persons responded. Four indicated it is more likely, nine indicated no change in likelihood, one indicated less likely, and nine indicated they were unsure or unconcerned.

Score for Rural Adams County: 7	Score for Corning: 5	Score for Nodaway: 5	Score for Prescott: 5
Score for SW Valley Schools: 4	Score for CHI Health: 4		

Animal/Plant/Crop Disease Vulnerability to the Population:

The movement of people, animals, animal products, wildlife, plants, crops and potential disease/pest vectors could cause the introduction of diseases/pests. Diseases/pests could also be introduced naturally, for example by hurricanes or jet streams. Emerging disease is also a threat, such as West Nile Virus, new more virulent influenza strains, etc. Because many diseases/pests are not present in Iowa, our populations of animals, crops, and plants have no immunity and are highly susceptible. Modern farming and animal practices mitigate major widespread losses. The vulnerability to populations in specific structures, such as schools, is somewhat less

but still significant because contaminated food supplies can get into those facilities and people in close confinement can transmit diseases.

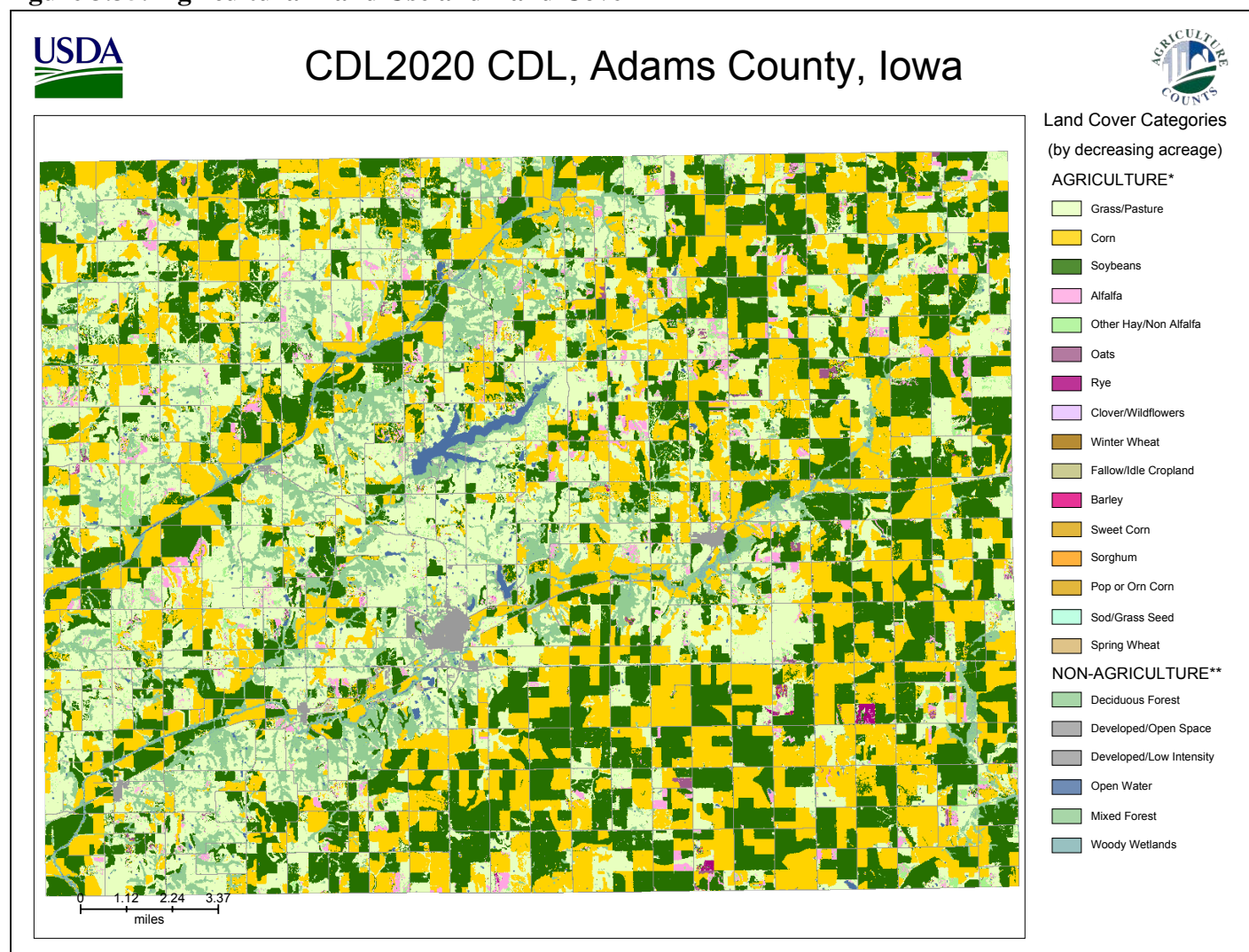
Once infestation occurs, the pest may become endemic, causing repeated losses in subsequent growing years. Loss of production could affect all related industries including fuel, food, synthetics, processors, etc.

Score for Rural Adams County: 4	Score for Corning: 3	Score for Nodaway: 3	Score for Prescott: 3
Score for SW Valley Schools: 3	Score for CHI Health: 3		

Animal/Plant/Crop Disease Area of Extent:

Pest infestations can cause widespread crop/plant loss and resulting economic hardships on farmers, landowners, and related businesses. Nonetheless, the impact will vary by disease/pest and the type of animal/crop/plant infected/infested. Because of the major transportation routes for food products and grain and the large part of the county in agriculture, much of the county can be affected. No parts of the county are entirely immune from animal and plant disease. Indirect effects, such as economic and transmission to human populations outside of the farming community expand to towns, schools, and other populated areas. Figure 3.35 shows agriculture is a key land use and there are many acres and dollars of crops and livestock.

Figure 3.35: Agricultural Land Use and Land Cover



Source: <https://nassgeodata.gmu.edu/CropScape/>, April 2021

In 2017, there were 509 farms with total sales of over \$108 million. Of these, 237 farms had livestock, with the predominant type being cattle at 210 farms, housing over 28,000 cattle. Over 52,000 hogs are housed primarily on 13 farms. Of the total farms, 316 had crops, of which 251 had field crops, mostly corn and soybeans. There were 223,454 acres in farms, well over 75% of land in the county. Cropland made up 141,820 acres of the total farmland. Much of the non-farmland is made of timber areas, where various plant diseases are also possible.

Score for Rural Adams County: 5	Score for Corning: 5	Score for Nodaway: 5	Score for Prescott: 5
Score for SW Valley Schools: 5	Score for CHI Health: 5		

Animal/Plant/Crop Disease Severity of Impact:

The severity will vary by disease/pest. The types of animals, crops, or plants affected will also significantly influence the severity.

The following provides a summary of the typical severity of impact throughout the county.

Figure 3.36: Animal/Plant/Crop Disease Severity of Impact Scoring Matrix

Severity Criteria	Discussion	Score
Health and safety of the public	If humans come into direct contact or consume the animal and plant products, illness and death are possible.	2
Health and safety of responders	Not likely to be affected, but inspectors and those handling diseased animals and plants can be infected.	2
Continuity of operations	Should not be impacted in a major scale, except for those agencies that depend on the food that is affected and that must act to solve a widespread problem, such as quarantining animals and cutting trees.	1
Property, facilities, infrastructure	Should not be impacted in a major scale.	1
Delivery of services	Most would not be affected, but the delivery of food to stores and medicines/health care could be impacted if the diseases cause widespread illness requiring specialized antibiotics.	2
Environmental impacts	Diseases can penetrate the air and water supplies in a localized area. Disposing of millions of dead animals presents its own environmental issues.	3
Economic/financial conditions	If an area food processing facility is shut down to deal with such problems, or if extensive crops and livestock were lost, the economic impact would be very heavy. Should the disease/pest have public health implications, the economic and social impact would be even greater. Crop/plant pest infestations can cause widespread crop/plant loss and severe economic hardship on farmers, landowners, and related businesses. Once infestation occurs, the pest may become endemic causing repeated losses in subsequent growing years. Loss of production will affect all related industries, such as fuel, food, synthetics, processors, etc. If the reputation of the facility, food, or area is tarnished, the loss of food product sales could greatly affect the area economy.	4
Regulatory/contractual obligations	Not likely to be affected in a significant way in most situations but can be harmed if food cannot be supplied, for example.	3
Reputation	Depends on the quality and appropriateness of the response. If panic results, it would be more notable. For example, the nationwide salmonella poisoning scare in 2008 caused a major impact to the sales of tomatoes when it was later found to be caused by something else. The August 2010 egg contamination in northern Iowa has caused the recall of nearly a half billion eggs and hurt sales of Iowa eggs nationally.	3

The overall rating the community gave for this hazard’s magnitude in a survey was: “moderate.”

Score for Rural Adams County: 21	Score for Corning: 21	Score for Nodaway: 21	Score for Prescott: 21
Score for SW Valley Schools: 21	Score for CHI Health: 21		

Animal/Plant/Crop Disease Speed of Onset:

If the diseases and pests are highly infectious (many animals that are infected with disease can be transmitting disease before they show clinical signs), by the time they are discovered, they will likely have spread across

the state or nation. This will put us at a severe disadvantage during response and recovery. Typically, there is warning, however, that diseases are spreading. Most disease incidents that require a massive State or Federal response are known and travel slowly.

Score for Rural Adams County: 1	Score for Corning: 1	Score for Nodaway: 1	Score for Prescott: 1
Score for SW Valley Schools: 1	Score for CHI Health: 1		

Animal/Plant/Crop Disease Duration of Event:

Animal and plant diseases often can last weeks or months before they are discovered, addressed, or a remedy is found.

Score for Rural Adams County: 9	Score for Corning: 9	Score for Nodaway: 9	Score for Prescott: 9
Score for SW Valley Schools: 9	Score for CHI Health: 9		

Animal/Plant/Crop Disease Total Scores:

The following total scores for animal/plant/crop disease indicate low to moderate risk to the public and the planning area where incidents can occur. Because the economic loss is most likely the highest in the unincorporated area, the rural part of the county has a somewhat elevated score.

Score for Rural Adams County: 47	Score for Corning: 44	Score for Nodaway: 44	Score for Prescott: 44
Score for SW Valley Schools: 43	Score for CHI Health: 43		

Animal/Plant/Crop Disease Vulnerability/Assets at Risk:

A widespread infestation of animals/livestock and crops could impact the economic base of the county, and the greatest risk of this hazard is economic. Buildings, infrastructure, and critical facilities are not vulnerable to this hazard. However, virtually all structures, property, and people in the county, as outlined in Section 3.2, could suffer secondary effects of the economic loss. Likely, the most significantly impacted assets would be agricultural land and structures, with a total value of over \$200 million and the 2,000 people who live in agricultural (unincorporated areas).

All critical assets in the county, as outlined in Section 3.2, could be impacted by this hazard, although, again, it would be a secondary effect.

Animal/Plant/Crop Disease Loss Estimation:

Again, most of the quantifiable losses due to this hazard are economic.

Rough estimates of potential direct losses from a maximum threat event fall in the range of 1 to 75% of livestock receipts. The market value of all livestock sold in Adams County in 2017 was \$44,151,000, according to the 2017 Agricultural Census. Based on a worst-case scenario where 75% of livestock is lost in a given year due to agricultural infestations, the total loss could exceed \$33.11 million in economic activity.

Rough estimates to potential direct losses from a maximum threat event fall in the range of 1 to 50% of annual crop receipts. The market value of all crops sold in Adams County in 2017 was \$64,146,000, according to the 2017 Agricultural Census. Based on a worst-case scenario where 50% of crop production is lost in a given year due to agricultural infestations, the total loss could exceed \$32.07 million in economic activity.

In the past four-plus years (2017-March 2021), no crop insurance claims have been made due to diseases.

According to the Iowa State University Extension and the U.S. Forest Service, there are up to 5,000 ash trees in Adams County. An emerald ash borer infestation that impacts 50% of those trees could translate to millions in losses, assuming an average of \$675 in costs to remove and replace each dead tree.

Most of the above losses would be covered by insurance, in most cases crop insurance. Nonetheless, the risk of a major infestation could be significant in terms of asset contents, even though structures would not suffer loss and in most cases humans would not be infected. However, some pests can harm humans who ingest infected plants and meats.

Future Development and Animal/Plant/Crop Disease:

Future development is not expected to significantly impact the planning area's vulnerability to this hazard unless crop and livestock numbers greatly increase. Avoiding the introduction of new species of plants and animals, including exotic pets, to the area will also ensure the risks do not increase.

Dam and Levee Failure Profile

Type: Natural

Definition: The uncontrolled release of water resulting from a structural failure in a dam, wall, dike, berm, or area of elevated soil that causes flooding.

Dam and Levee Failure Description:

Dams are constructed for a variety of uses, including flood control, erosion control, water supply impoundment, hydroelectric power generation, and recreation. Flooding, operating error, poor construction, lack of maintenance, damage due to burrowing animals, vandalism, terrorism, and earthquakes can cause dam failure. Dams are classified into three categories based on the potential risk to people and property should a failure occur: **High Hazard** - If the dam was to fail, lives would be lost and extensive property damage could result; **Moderate (or Significant) Hazard** - Failure could result in loss of life and significant property damage; and **Low Hazard** - Failure results in minimal property damage only. The classification may change over time due to development downstream from the dam since its construction. Older dams may not have been built to the standards of its new classification. Dam hazard potential classifications have nothing to do with the material condition of a dam, only the potential for death or destruction due to the size of the dam, the size of the impoundment, and the characteristics of the area downstream of the dam. The Iowa Department of Natural Resources tracks all dams in the state of Iowa with a height of at least 25 feet or a total storage of at least 50 acre feet of water. The inventory excludes all dams less than 6 feet high regardless of storage capacity and dams less than 15 acre feet of storage regardless of height. The county has three lakes with dams that have been given a moderate or significant hazard class and one given a high hazard class by the State of Iowa. A further 52 dams are low hazard dams, for a total of 56. The following table shows the current high and significant risk dams in the county.

Figure 3.37: High and Moderate Hazard Dam Information

Lake and Dam	Location	Height	Acre-Feet Storage	Classification
Binder Lake Dam	41.0031, -94.7091, 1 mile east of Corning	35 ft.	1,100	Significant
Corning Reservoir Dam	41.001, -94.7262, just east of Corning	30 ft.	315	Significant
Lake Icaria Dam	41.0481, -94.7534, four miles north of Corning	56 ft.	25,310	Significant
Prescott Flood Prevention Dam	41.0307, -94.6179, just north of Prescott	27 ft.	157	High

Source: State of Iowa Hazard Mitigation Viewer, Dam and Levee Failure tab,
<https://iowahsemd.maps.arcgis.com/apps/MapSeries/index.html?appid=581c59432cb24779af37161c492309fa>, 4/29/21

Levees are man-made structures designed to control water and protect structure and property in normally flood-prone areas. These can include berms and dikes. These structures can fail when flooding is too severe, they are improperly designed and built, or when they are not maintained. According to the State of Iowa Hazard Mitigation Viewer's Dam and Levee tab, there are no National Levee Database (NLD) levees or other recognized levees in the county, nor are there any major levees in upstream counties, so this hazard is not a major concern.

Dam and Levee Failure Historical Occurrence:

There have been no notable or recorded dam failures in Adams County. Dam failures can occur in rural Adams County and the towns of Corning and Prescott due to dams in those areas. Small farm pond failures have occurred, affecting low hazard dams and causing very localized flooding. The four moderate and high hazard dams have experienced no failures nor do they show signs that one is likely in the future.

When asked about the past occurrence of this hazard in the online survey, 23 persons responded. Three indicated it happened once or twice in the last five years and 20 responded that it has not occurred to their knowledge.

Dam and Levee Failure Future Probability:

With increased attention to sound design, quality construction, and continued maintenance and inspection, dam failure probability can be reduced, which is the case for the largest dams located within the county. The four moderate/high risk dams and any other public dams in the county are inspected regularly and the IDNR is contacted if evidence comes about that makes officials question their safety. Other private dams are small (a few acres at most) and do not pose any significant hazard to other property (private or public) outside of the dam owner's property. Because of the flow of water in rivers in and around Adams County tends to be from northeast to southwest, and because the proximity of dams outside of the county if broken would most likely not affect Adams County directly, there does not appear to be much risk from dams outside of the county. Dam failures can occur in Corning and Prescott, with small or medium sized and moderate/significant risk dams in Corning and a high-risk dam in Prescott. Downstream flooding could affect both communities. The Corning Reservoir represents the large risk to the City of Corning. The reservoir in Prescott is actually north and upstream, but the stream flows only a half mile south and then through the heart of the city.

The overall rating the community gave for this hazard's future probability in a survey was: "extremely rare." When asked about the likelihood that the incidence of this hazard will increase in the future compared to today in the online survey, 23 persons responded. Two indicated it is more likely, five indicated no change in likelihood, four indicated less likely, and 12 indicated they were unsure or unconcerned.

Score for Rural Adams County: 1	Score for Corning: 1	Score for Nodaway: 0	Score for Prescott: 1
Score for SW Valley Schools: 0	Score for CHI Health: 0		

Dam and Levee Failure Vulnerability to the Population:

Iowa has 4,173 dams on the state's dam registry, of which 56 are located in Adams County (Iowa DNR, 4/29/21). Yet, the bulk of these are very small low-hazard dams, and only four are significant or high-hazard dams. No dams are considered a direct risk to a significant population in the immediate area below the dam. People and property along streams are most vulnerable to failures of these dams. Based on the topographical characteristics of these dams and outflow areas, it is possible that failure of any of these dams will take out numerous county, state, or federal highways, several bridges, and extensive crops. Those roads most vulnerable are Highway 148 north of Corning, Quince Avenue in Prescott, and 210th Street east of Corning. Businesses and other buildings in or near flood plains downstream from the four dams could be impacted. Travel would be severely disrupted, especially if Lake Icaria dam failed, but few people would have to be evacuated from structures. Prescott, south of Prescott dam, is the most vulnerable area in the county as identified by the planning committee. The western part of the community may need to be evacuated in the case of a dam failure.

If Lake Binder, Lake Icaria, or the Corning Reservoir fails, it could have a direct impact on the City of Corning water supply. Because about 35% of Corning's water is sold to SIRWA for rural residents, a significant part

of the county's population could be vulnerable to these effects. Temporarily, water can be provided by SIRWA from other regional plants until the Corning water plant is put back online.

Score for Rural Adams County: 3	Score for Corning: 3	Score for Nodaway: 0	Score for Prescott: 4
Score for SW Valley Schools: 0	Score for CHI Health: 0		

Dam and Levee Failure Area of Extent:

The area impacted following a dam failure would be limited to those areas in and near the floodplain. People and property outside the floodplain could also be impacted, depending on the proximity to the dam and the height above the normal stream level. No formal study of dam failure inundation has been performed for Adams County, so an estimate is based only on the area topography. In Adams County, only 1-3 percent of the area would be impacted directly by any dam failure. Areas indirectly cut off from emergency services by the resulting flow of water could be larger. There is no means to accurately map the risk areas at this time. Indirectly, all occupied properties in Corning and, to a lesser degree, other parts of the planning area would be affected if a dam failure eliminates public water supplies.

Score for Rural Adams County: 4	Score for Corning: 4	Score for Nodaway: 0	Score for Prescott: 4
Score for SW Valley Schools: 0	Score for CHI Health: 0		

Dam and Levee Failure Severity of Impact:

Dam failure severity will depend on the size of the impoundment, how rapidly it occurs, the extent of failure, and land uses below the dam. The following table shows the relative risks of the worst-case realistic scenario for the size of dams in the county.

Figure 3.38: Dam and Levee Failure Severity of Impact Scoring Matrix

Severity Criteria	Discussion	Score
Health and safety of the public	Up to 10 estimated persons could be injured or drowned if they live below stream or are driving below the dam when the dam breaks or if they are on the dam or in a boat close to the dam. The most significant risk may be to people just below Lake Icaria, because of the size and because people fish below the dam and traffic on Highway 148, which is also not far from the dam, can be significant. Residents in Prescott are also at risk if the failure is total and rapid.	4
Health and safety of responders	Limited unless a further break occurs that widens the floodwater flow while responders are in the area; also, communications can be lost.	2
Continuity of operations	The loss of each lake would have impacts on continuation of recreation and wildlife services. Lake Binder, Lake Icaria, or Corning Reservoir's failure would disrupt water treatment operations for hours to months and would require SIRWA backup.	3
Property, facilities, infrastructure	Failure of each of the dams would result mostly in crop and livestock grazing land flooding and road and bridge damage or loss. Damage to roads and, in Prescott, city streets is possible. If any of the Significant and High Hazard dams fail, county highways, power lines, and other infrastructure will certainly suffer severe damage. Corning Utility Manager Tim Larsen stated that at the Lake Icaria Dam, "There is a series of inlets and piping that run through the dam to a pump house. There are no workable valves for that piping. If a pipe was to fail, there is no way to shut that off, which could create quite an issue depending on where the issue is. It's my understanding the existing valves haven't worked since the late 70's. I don't think they lasted more than two years before they rusted shut."	3
Delivery of services	Damage to roads and the water plant would disrupt the delivery of freight, traffic, and all potable drinking water in the Corning area and much of the county.	2
Environmental impacts	Fish populations and vegetation in the lakes would be harmed. Downstream flash flooding would harm vegetation and wildlife and may cause storage facilities below to fail, which may dump more contamination into the waterway.	2
Economic/financial conditions	Loss of the lakes themselves represents lost tourism and recreation spending. Lake Icaria in particular is home to dozens of annual fishing tournaments and has a full-service marina and a beach, dozens of campsites, and other amenities. Millions of dollars in revenues would be lost if the lake is not restored rapidly. Other lakes would have less recreational economic impacts, although Lake Binder has a campground. Closure and detour of roads in the impacted area,	4

Severity Criteria	Discussion	Score
	including Highway 148 and possibly the BNSF Railway, would result in extensive costly detours to gravel roads. Tens to thousands of acres of farmland would be submerged and livestock could be lost.	
Regulatory/contractual obligations	Corning Municipal Utilities would not be able to meet its obligated water supply production with the failure of any of the three water source lakes.	2
Reputation	If any rescue is botched or if funds allocated to improve dams are not spent properly, leading to the dam failure, the impact could be severe; otherwise, limited.	2

The overall rating the community gave for this hazard's magnitude in a survey was: "modest."

Score for Rural Adams County: 24	Score for Corning: 24	Score for Nodaway: 0	Score for Prescott: 24
Score for SW Valley Schools: 0	Score for CHI Health: 0		

Dam and Levee Failure Speed of Onset:

A dam and levee failure can be immediate and catastrophic, leaving little or no time to warn those downstream of the imminent hazard. With maintenance and monitoring, weak areas and possible failure points can be identified, allowing time for evacuation and securing of the dam. Most dams are only inspected periodically, thus allowing problems to go undetected until a failure occurs. A sudden total failure of the dams in Adams County is unlikely, but a failure can build over minutes and complete within a few hours.

Score for Rural Adams County: 8	Score for Corning: 8	Score for Nodaway: 0	Score for Prescott: 8
Score for SW Valley Schools: 0	Score for CHI Health: 0		

Dam and Levee Failure Duration of Event:

A dam failure may start slowly and take a moderate period of time to complete its destruction. The event could last from a few hours to days before all the water is released. The longer duration of event would likely result in less damage and fatalities because the initial torrent of water after the incident begins will be less. However, the long duration can also mean that responders cannot access the area until it is too late to rescue people and survey property and infrastructure. The score the planning team has used here factors the time required for enough water to be released so that responders can reach the site, based on the size of dams and impoundments in the county.

Score for Rural Adams County: 4	Score for Corning: 4	Score for Nodaway: 0	Score for Prescott: 4
Score for SW Valley Schools: 0	Score for CHI Health: 0		

Dam and Levee Failure Total Scores:

The following total scores for dam and levee failure indicate low to moderate risk to the public and the planning area where incidents can occur.

Score for Rural Adams County: 44	Score for Corning: 44	Score for Nodaway: 0	Score for Prescott: 45
Score for SW Valley Schools: 0	Score for CHI Health: 0		

Dam and Levee Failure Vulnerability/Assets at Risk:

This vulnerability assessment is based on the high and moderate hazard dams in the planning area. Only assets in rural Adams County and parts of Corning and Prescott would be at direct risk. Only small percentage of the assets in these areas would be at risk, as outlined below, compared to the full lists of assets in Section 3.2.

Figure 3.39: Rural Adams County Dam and Levee Failure Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	5	\$250,000	10	0.1%
Commercial	0	\$0	0	0%
Industrial	0	\$0	0	0%

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Ag Structures and Land	10 buildings; 5,000 acres	\$5,000,000	2	2%
Taxable Infrastructure	1	\$3,000,000	1	2%
Government/Institutional	5	\$40,000,000	40	25%
Totals	21	\$48,250,000	53	6%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

As this table shows, an estimated 53 residents live or will be located in rural areas that are at risk of inundation of other loss when a dam failure occurs in Adams County. Based on data available, there is no direct risk due to dam failures in other upstream counties. The total valuation at risk of 21 properties exceeds \$48 million dollars, it is estimated. Only a small number of occupied properties are known to be at risk. No analysis was done to determine the extent of risk to occupied properties, such as the location of inundation versus the home situation on a lot or number of vehicles that may be on impacted roadways at a given time of a dam failure.

The following critical assets in the county, as outlined in Section 3.2, could be impacted by this hazard because they are in or partly within the potential inundation areas:

- Lake Icaria
- Lake Binder
- Fiber optic lines
- Approximately a dozen bridges in the federal classification or county's secondary roads system downstream from the various lakes
- Approximately five miles of rural roads and highways, county roads
- Some electrical facilities owned by SWIREC and others

In Corning, no assets in the city will be directly impacted by a failure of a High or Significant Hazard dam, but low hazard dams could affect up to 1 percent of the area and property value. The main impact would be indirect.

For Prescott, the damage could be more significant. The following are possible impacted properties due to dam failure, based on Figure 3.2.

Figure 3.40: Prescott Dam and Levee Failure Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	12	\$400,000	24	10%
Commercial	1	\$40,000	10	25%
Industrial	0	\$0	0	--
Ag Structures and Land	0 building; 5 acres	\$25,000	0	10%
Taxable Infrastructure	2	\$500,000	2	40%
Government/Institutional	2	\$1,000,000	3	20%
Totals	17	\$1,965,000	39	15%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

As this table shows, an estimated 39 residents live or will be located in rural areas that are at risk of inundation of other loss when a dam failure occurs in Prescott. The total valuation at risk of 17 properties exceeds \$1.9 million dollars, it is estimated. No analysis was done to determine the extent of risk to occupied properties, such as the location of inundation versus the home situation on a lot or number of vehicles that may be on impacted roadways at a given time of a dam failure.

The following critical assets in Prescott, as outlined in Section 3.2, could be impacted by this hazard because they are in or partly within the potential inundation areas:

- City hall/library
- SIRWA facilities

- BNSF Railway
- Fire Station
- Various power lines and city streets/culverts

Dam and Levee Failure Loss Estimation:

The main losses due to a dam failure in Adams County would be quality of life and economic, unless the failure is a sudden complete failure of the entire dam. Based on the topography below local dams and the volume of water, a complete and sudden full failure where there is a wall of water suddenly released downstream would be required to cause significant damage more than immediately below the dam. It is possible in this situation that the above list of assets would be damaged. People would be greatly inconvenienced and businesses would be hindered if roads and bridges were flooded and if water supplies had to be diverted to SIRWA's other sources. Downstream from most of the county's dams within a few miles are major highways, secondary roads, Prescott streets and residences, farmland, and bridges. Anything more than about a mile from the dam would likely suffer the same loss as during a flood event (see river flood profile). The farther the water reaches from the dam, the less severe the physical/structural loss would be. Physical losses from a total failure may reach over \$5 million dollars to crops and livestock lost, damage to docks and boats, bridges damaged or removed, roads washed away, and utilities damaged. A few homes could suffer modest damage but not a complete washout.

In any type of dam failure where the water drains from the lake, the loss would be significant for the local economy, because most the significant and high hazard dams are part of park and recreation areas that host fishing, camping, and other activities. While the local economy is diverse, recreation and tourism are significant elements, and the economic loss could top \$1 million very easily. In fact, if there were a total failure of Lake Icaria's dam and the lake was drained, the loss of tourism dollars in one year would likely exceed \$5 million in lost camping and cabin registrations, boat rentals, and local retail purchases, as tens of thousands of visitors to this lake each year come from well outside of the county.

Future Development and Dam and Levee Failure:

Future development located downstream from dams in floodplains or inundation zones would increase vulnerability. However, such development is unlikely, except perhaps road and bridge upgrades that must be located in the hazard area. In part because zoning is in place, it is unlikely that private development would occur downstream within a few miles of a dam or anywhere in a floodplain.

Drought Profile

Type: Natural

Definition: A period of prolonged abnormally low precipitation producing severe dry conditions.

Drought Description:

There are four types of drought conditions that are relevant to Iowa: Meteorological drought, which refers to precipitation deficiency; hydrological drought, which refers to declining surface water and groundwater supplies; agricultural drought, which refers to soil moisture deficiencies, and socioeconomic drought, which refers to when physical water shortages begin to affect people. Droughts can be spotty or widespread and last from weeks to a period of years. A prolonged drought can have serious economic impact on a community. Increased demand for water may result in shortages of resources. Moreover, food shortages may occur if agricultural production is damaged or destroyed by a loss of crops or livestock. While droughts are generally associated with extreme heat, droughts can and do occur during cooler months.

Drought Historical Occurrence:

Drought has been a significant part of life in rural Iowa, including Adams County, for all of modern history. Because rain/snow fluctuations can be great, drought conditions are normal. At least one part of Iowa is in mild drought conditions most of the time. According to the National Center for Environmental Information (NCEI), Iowa had 14 periods of drought from 1995-2017. During that period, there was \$4.612 billion in crop damage resulting from drought periods and over \$645 million in property damage.

According to the NCEI, Adams County has experienced 14 droughts from 1999 (none reported before that year) through December 2021. While damage and loss are not reported by county for this hazard, the events that affected Adams County caused no deaths and injuries but significant property and crop damage, \$12.65 million and \$97.65 million respectively, regionally. Drought years reported to the NCEI include 1999, 2000, 2001, 2003, 2012, 2013, and 2020. Most occurred in or involved the month of August. While some may have been more severe than others, agricultural areas were impacted more heavily than the metropolitan areas where impacts were indirect. The most common forms of drought historically in Iowa are agricultural and meteorological drought as a result of either low soil moisture or a decline in recorded precipitation.

More prolonged droughts occurred around 1998 and the early part of the last decade (2001-2006). Southern Iowa suffered from a mild but prolonged drought event from 2001-2006 that nearly drained all water supplies, even with regional water in place in the last decade. 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 has lessened the drought severity in all of Iowa and eliminated drought conditions in much of Iowa, including Adams County. After a few wetter years, drought had become an issue in 2019 and 2020 during the growing season. A mild to moderate drought has persisted most of the past two years through the early spring of 2021. At times in 2020, the drought threatened to become severe. The planning team indicated that droughts are not the issue they used to be with the advent of rural water, although farmers are known to truck in water still today when livestock water supplies dry up and rural water cannot meet the need.

When asked about the past occurrence of this hazard in the online survey, 23 persons responded. Eleven indicated it occurs most years, 11 indicated it happened once or twice in the last five years, and one responded that it has not occurred to their knowledge.

In summary, droughts have been in effect about 40% to 50% of the time, with severe droughts relatively rare.

Drought Future Probability:

Drought is part of normal climate fluctuations and can last for years at a time. Research and observations of the El Nino/La Nina climate events are resulting in more predictable climate forecasts. Based on the evidence that drought periods seem to occur in cyclical patterns and that all of Iowa is in a drought about 10-14.9% of the time, it can be assumed that any given area of Iowa is at least this likely to have a disaster in a given year. The planning committee estimates that in a given year Adams County has a 10% to 19% chance of experiencing a severe drought event (-3.0 to -3.9 PDSI) or worse in a given year. The chance of a minor or moderate drought is even higher.

The overall rating the community gave for this hazard's future probability in a survey was: "probable." When asked about the likelihood that the incidence of this hazard will increase in the future compared to today in the online survey, 23 persons responded. Four indicated it is more likely, 15 indicated no change in likelihood, and four indicated less likely.

Score for SW Valley Schools: 5

Score for CHI Health: 5

Drought Vulnerability to the Population:

Being a rural county with mainly surface water supplies, Adams is likely to suffer heavily from an extended drought, both directly and indirectly. In 2006 and again in 2012/13, regional water supplies from some of the regional water source lakes were dangerously low. In the 1980s, before surface lakes were prevalent, many in the county were sick due to drinking from severely low water supply wells. Agriculture, agribusiness, and consumers (if the drought lasted long enough or impacted a large area) would be impacted. Fire suppression can also become a problem due to the dryness of the vegetation and possible lack of water for fire suppression. Farmers would be most impacted, but all county residents are susceptible. Schools and hospitals may suffer short water supplies and increased vulnerably populations due to dehydration. Particular groups most directly impacted include seniors, handicapped persons, and diabetics.

Score for Rural Adams County: 9

Score for Corning: 5

Score for Nodaway: 5

Score for Prescott: 5

Score for SW Valley Schools: 4

Score for CHI Health: 4

Drought Area of Extent:

A drought would likely affect most of Iowa if not the Midwest as a whole. While not all properties and people will be negatively impacted, the drought would occur countywide and in all jurisdiction at a given time.

Score for Rural Adams County: 9

Score for Corning: 9

Score for Nodaway: 9

Score for Prescott: 9

Score for SW Valley Schools: 9

Score for CHI Health: 9

Drought Severity of Impact:

The most commonly used indicator of drought and drought severity is the Palmer Drought Severity Index (PDSI) published jointly by NOAA and the United States Department of Agriculture. The PDSI measures the departure of water supply (in terms of precipitation and stored soil moisture) from demand (the amount of water required to recharge soil and keep rivers, lakes and reservoirs at normal levels). The result is a scale from +4 to -4, ranging from an extremely moist spell to extreme drought. By relating the PDSI number to a regional index, one can compile data that reflects long-term wet or dry tendencies. The following table illustrates the PDSI.

Figure 3.41: PDSI Index Description

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

Regional indicators, such as the PSDI, are limited in that they respond slowly to deteriorating conditions. On the other hand, observing surface conditions and groundwater measurements may provide only a snapshot of a very small area. Therefore, the use of a variety of drought indicators is essential for effective assessment of drought conditions. Other climatic factors such as high temperatures, prolonged high winds/and low relative humidity can aggravate the severity of a drought. Severity depends on duration, intensity, geographic extent and the demands made by human activities and vegetation on regional water supplies.

Figure 3.42 illustrates the potential impacts of drought.

Figure 3.42: Drought Impacts by Severity Classification

Category	Description	Ranges					
		Possible Impacts	Palmer Drought Index	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Short and Long-term Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered	-1.0 to -1.9	21-30	21-30	-0.5 to -0.7	21-30
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested	-2.0 to -2.9	11-20	11-20	-0.8 to -1.2	11-20
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed	-3.0 to -3.9	6-10	6-10	-1.3 to -1.5	6-10
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions	-4.0 to -4.9	3-5	3-5	-1.6 to -1.9	3-5
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0-2	0-2	-2.0 or less	0-2

Source: Iowa Hazard Mitigation Plan, 2018; <http://www.weatherwizkids.com/wp-content/uploads/2015/02/drought-classification.jpg>

The following table shows the relative risks of an extreme drought.

Figure 3.43: Drought Severity of Impact Scoring Matrix

Severity Criteria	Discussion	Score
Health and safety of the public	Health can be compromised due to the lack of quality water. While the bottled water industry can mitigate some of these issues temporarily, running water is necessary. The planning team indicates that the Jordan Aquifer is reported to be very unpleasant and unsafe to drink. Funds are too limited for any other alternative to surface water. Lake sources can shrink and result in the inability to dilute chemicals entering water sources. Wildfires are also increasingly likely. Hospitals indicate a high number of people needing treatment for dehydration taxes their service capacity.	2
Health and safety of responders	Limited unless firefighters are fighting a fire or other hazard and run out of water.	1
Continuity of operations	This impact would be minimal and not easily assessed. Some facilities and services may be unable to operate once the drought was severe enough.	3
Property, facilities, infrastructure	Extreme dry weather can cause lakes to dry up, pipes to heave, and roads and bridges to sustain damage, especially if the drought causes expansive (or contractive) soils. Again, crops and livestock could be lost.	2
Delivery of services	Except for delivery of surface water for humans, pets, and livestock, few services would be impacted. Large industry that requires large volumes of water would not be able to deliver services.	3
Environmental impacts	Fish populations and vegetation in the lakes and streams can be harmed. Sensitive plants and crops would be harmed. Mass vegetative death could impact wildlife negatively or cause greater risk of landslides, erosion, and other soil loss hazards. Land quality can be harmed by overgrazing during drought. Water quality can become degraded and can cause a large nitrate concentration in the rivers. Low stream flow will be negative impacts on riparian habitats and aquatic species.	3
Economic/financial conditions	Drought can lead to large and damaging impacts to the agricultural economy. Because of Iowa's reliance on the agricultural economy, the economic and financial impacts would certainly ripple out into other sectors. Rural areas can be especially affected by long-term drought. In 2012 alone crop damages from drought were \$4.992 billion in Iowa. If	County, 4 Others: 3

Severity Criteria	Discussion	Score
	restrictions were put on manufacturers that use large amounts of water, the local economy would be severely impacted. A local ethanol plant requires very large volumes of water.	
Regulatory/contractual obligations	Area water suppliers would not be able to meet its obligated water supply production with the drop in lake supplies. Regulations in the agricultural sector can be and are often adjusted to provide some lenience for adverse conditions for livestock and crop loss.	3
Reputation	Local jurisdictions can suffer reputation damage if they do not provide source water to residents or respond in a satisfactory manner to provide an alternative supply.	2

The overall rating the planning team gave for this hazard’s magnitude in a survey was: “moderate.”

Score for Rural Adams County: 23	Score for Corning: 22	Score for Nodaway: 22	Score for Prescott: 22
Score for SW Valley Schools: 22	Score for CHI Health: 22		

Drought Speed of Onset:

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 occurrence 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. In fact, an area may already be in a drought before it is even recognized. However, the weather that results in a drought, such as prolonged dry weather, requires weeks or months to produce drought conditions.

Score for Rural Adams County: 1	Score for Corning: 1	Score for Nodaway: 1	Score for Prescott: 1
Score for SW Valley Schools: 1	Score for CHI Health: 1		

Drought Duration of Event:

A drought, especially a severe drought, almost always lasts for weeks before adequate rainfall occurs to alleviate the drought conditions.

Score for Rural Adams County: 9	Score for Corning: 9	Score for Nodaway: 9	Score for Prescott: 9
Score for SW Valley Schools: 9	Score for CHI Health: 9		

Drought Total Scores:

The following total scores for drought indicate moderate risk to the public and the planning area where incidents can occur.

Score for Rural Adams County: 56	Score for Corning: 51	Score for Nodaway: 51	Score for Prescott: 51
Score for SW Valley Schools: 50	Score for CHI Health: 50		

Drought Vulnerability/Assets at Risk:

While all structures, property, and people in the county would be at risk, the greatest risk of this hazard is economic. Buildings, infrastructure, and critical facilities, with rare exception, are not directly vulnerable to this hazard, although shrinking clay soils can cause secondary hazards to buildings and utilities (see expansive soils profile). However, virtually all assets in the county, as outlined in Section 3.2, could suffer secondary effects of the economic loss, namely to crops and livestock. However, the secondary effect of water rationing, soil loss, soil expansion/contraction, and reduction of recreational lake water levels could impact not just the economy but also structures and people in all parts of the county. In a long severe drought, all people would be adversely affected to some degree.

All critical assets in the county, as outlined in Section 3.2, could be impacted by this hazard, although, again, it would be a secondary effect in most cases.

Drought Loss Estimation:

With over 75% of the land in the planning area being used for agriculture, the exposure to drought is very high. 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 soils (see expansive soils profile) during excessively dry soils. According to the USDA's Risk Management Agency, payments for drought crop losses top any other cause for insurance claims in total losses in Adams County. From 2017 through 2020 (four full years), the total paid insurance claim was \$1,594,179.25 or \$0.4 million annually for 43 claims. Farmers suffer the most because wells run dry, crops wilt and die, and forage for livestock becomes scarce and costly. Public health can be compromised due to the loss of water supply. Even with the regional water supplies in place, thousands of residents throughout the county, nearly all those living in the county, would likely suffer some level of risk to their health. Dozens both in town and in rural areas would likely suffer from sickness or other health problems during any drought event.

According to the 2013 Iowa Hazard Mitigation Plan, drought was ranked 2nd of eight hazards in annualized losses based on data spanning 18 years (this data was not found in the 2018 update). Although losses from this hazard reach millions of dollars each time drought occurs, much of it is mitigated by crop insurance. However, negative impacts to public health, industrial and business disruption, fire capabilities, tourism loss, and inconvenience are not covered. 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. If Corning, for example, would have to purchase potable water based on FEMA's potable water cost of \$93 per person per day, the potential cost would be approximately \$163,000 per day.

In the past four years (2017-2020), there have been over \$4.9 million in claims for crop insurance in Adams County, an average of \$1.225 million per year. Over 30% of crop insurance claims during this period in terms of dollars were as a result of drought. According to the 2013 Iowa Crop Profile from the USDA's Risk Management Agency, 90.5% of insurable crops in Iowa are insured with USDA crop insurance. Based on this data, an estimated \$1.35 million in total drought losses per year occur. Based on the 2017 Census of Agriculture total crops sold of \$64,146,000, an estimated 2.5% of crop value is lost due to drought.

Future Development and Drought:

Increases in the amount of land used for crops and in new development resulting in new residents in the planning area both would result in an increased risk, simply because exposure is greater. Commodity prices will affect the economic cost per incident.

Expansive Soils Profile

Type: Natural

Definition: Soils and soft rock that tend to swell or shrink excessively due to changes in moisture content.

Expansive Soils Description:

The effects of expansive soils are most prevalent in regions of moderate to high precipitation, where prolonged periods of drought are followed by long periods of rainfall. The hazard occurs in many parts of the Southern, Central, and Western United States, including most areas of Iowa. Recent estimates put the annual damage from expansive soils as high as \$7 billion nationwide. However, because the hazard develops gradually and seldom presents a threat to life, expansive soils have received limited attention, despite their costly effects. Expansive soils can cause more immediate hazards in high-clay soils like found in Adams County, such as frost bubbles in roads and broken utility lines.

Expansive Soils Historical Occurrence:

In Adams County, high clay soils mean that buildings with weak foundations and basements can be and have been affected by shrinking and swelling soils. Historical events have been isolated and have normally impacted areas of less than 20 feet in diameter. The planning team notes that foundations of homes and some rural bridges have been damaged. The planning team indicates that frost boils have erupted under roads in early spring thaws, causing damage to those roads and to vehicles driving over them. Numerous frost boils occurred in all jurisdictions of the county in April 2008 after a long and wet winter. Other spring thaws since then have resulted in the same issues. Numerous rural bridges have experienced soil loss on bridge approaches. Numerous homes have suffered from cracked and broken basement walls over the course of time. This is an actually pretty common hazard in a small scale and likely is very under-reported or only reported to a property owner's insurance company.

When asked about the past occurrence of this hazard in the online survey, 23 persons responded. One indicated it happens most years, three indicated it happened once or twice in the last five years, and 19 responded that it has not occurred or they do not recall an instance.

Expansive Soils Future Probability:

Probability and frequency analyses have not been prepared because of occurrence of this hazard. This is consistent with other geological hazards that occur slowly over time. The probability is much higher for an individual building suffering from expansive soils than for a widespread incidence affecting multiple properties and requiring a public response. It is likely that individual properties will be affected every year. Only on occasion, such as once every five years, will an expansive soils event occur in widespread areas of the county.

While members of the committee varied greatly on their interpretation of future probability, the consensus of the committee anticipates a 5-25% probability in a given year of finding one or more expansive soils incidents that impact critical infrastructure, such as cause road closures or damage essential pipelines. House and other building foundations will continue to be subjected to this hazard due to Iowa's constantly changing weather conditions and contrasting seasons every year, but that issue is mostly mitigated by property insurance and improved construction processes. Awareness of this hazard in the past ten years has resulted in mitigation through better construction practices, soil testing before construction, and use of proper fill and drainage techniques around buildings and structures. It seems like freeze-thaw issues affecting town and rural roads is a continual problem.

When asked about the likelihood that the incidence of this hazard will increase in the future compared to today in the online survey, 23 persons responded. None indicated it is more likely, six indicated no change in likelihood, two indicated less likely, and 15 indicated they were unsure or not concerned.

While the incidence varies by jurisdiction, overall there is a moderate chance in a year of damaging expansive soils.

Score for Rural Adams County: 7	Score for Corning: 4	Score for Nodaway: 3	Score for Prescott: 3
Score for SW Valley Schools: 2	Score for CHI Health: 2		

Expansive Soils Vulnerability to the Population:

Information on clay soils is limited for most properties, but Adams County residents are accustomed to minor incidents resulting in bowing basement walls and cracking foundations. There is very little risk to human life in most cases. Impacts commonly involve swelling clays beneath areas covered by buildings and slabs of concrete and asphalt, such as those used in construction of highways, walkways, and airport runways. Most major new construction projects, such as government buildings and roads, involve extensive soil testing.

Despite some minor variations by community, the committee believes the overall impact is pretty low overall. Minor road and foundation issues can impact hundreds of people mostly in the way of inconveniences and home repair costs, which are usually insurable. The planning team indicates that the hazard causes “long-term damage rather than an immediate impact.” Damaged or broken electrical facilities and water, sewer, or gas lines can impact a larger population. When organizations build large buildings, the design must often include structural fill to address the expansive nature of the local soils.

Score for Rural Adams County: 4	Score for Corning: 5	Score for Nodaway: 5	Score for Prescott: 5
Score for SW Valley Schools: 5	Score for CHI Health: 5		

Expansive Soils Area of Extent:

According to the map in the 2018 State of Iowa Hazard Mitigation Plan from “Swelling Clays Map of the Conterminous United States,” most of Adams County is in the “part of unit (generally less than 50%) consists of clay having slight to moderate swelling potential.” About 20% of the county is in the “Part of the Unit, generally less than 50%, consists of clay having high swelling potential.” Those who live in the area would agree that this category understates the shrink/swell potential, as evidenced in the common occurrence of damaged roads, sidewalks, driveways, basement walls, and building foundations. The amount of clay in area soils countywide is high, and often it shrinks and swells as a result of rain, drought, and ground frost. Nonetheless, the hazard is not entirely widespread because there are variations in soils and, in areas where development has not occurred, these soils are not hazards. Most occurrences in Adams County will be very limited in size and have no widespread significance.

Score for Rural Adams County: 2	Score for Corning: 2	Score for Nodaway: 2	Score for Prescott: 2
Score for SW Valley Schools: 2	Score for CHI Health: 2		

Expansive Soils Severity of Impact:

The severity of expansive soils depends primarily on what structures and assets are located in the soils that expand. Often expansion and contraction will not cause any damage. Other times the result will be broken pipes, large cracks in roads and foundations, sinkholes, and other hazards. The cascading impacts can be significant if large populations and key assets are in the path of the damage due to hazards such as hazardous materials leaks. The table below shows the relative risks of a typical expansive soils event.

Figure 3.44: Expansive Soils Severity of Impact Scoring Matrix

Severity Criteria	Discussion	Score
Health and safety of the public	Very little to no impact is projected directly. Natural gas or plumbing leaks in homes and buildings present risk in rare cases when undetected or addressed quickly enough. Cracks in basement walls can allow radon, which is a poisonous gas common to Iowa, to enter homes.	2
Health and safety of responders	Usually no response will be necessary, but when critical public infrastructure or pipelines are damaged, emergency response might be necessary.	1
Continuity of operations	Road detours may result, causing inconvenience. Water, sewer, and power facilities may be damaged, causing inconvenience, possible sickness, and possible fires, and other issues. Continuity on a wide scale is not likely to be disrupted.	2
Property, facilities, infrastructure	The most extensive damage from expansive soils occurs to highways and streets. Houses and one-story commercial buildings are more apt to be damaged by the expansion of swelling than are multi-story buildings, which usually are heavy enough to counter swelling pressures. The most obvious manifestations of damage to buildings are sticking doors, uneven floors, and cracked foundations, floors, walls, ceilings, and windows. Major lifeline systems can be affected, including water and sewer lines, gas pipelines, and high voltage power lines.	3
Delivery of services	Delivery of services should not be impacted. Life threatening impacts from the loss of services would not be likely.	1
Environmental impacts	No direct or long-term effect on the environment unless a hazardous material is leaked following pipeline failure or similar damages.	2

Severity Criteria	Discussion	Score
Economic/financial conditions	Economic and financial impacts would be limited, resulting from disruption of the flow of goods and services. Business disruption would likely be very short if any. Loss of infrastructure could cause greater concerns.	2
Regulatory/contractual obligations	The jurisdiction would have to repair the roads and surfaces impacted.	2
Reputation	No foreseeable impacts on the reputation of the entity unless the problem is ignored and allowed to worsen, such as potholes continuing to expand. Damage caused in ROW areas can be controversial related to property owner rights and responsibilities.	2

Score for Rural Adams County: 17	Score for Corning: 17	Score for Nodaway: 17	Score for Prescott: 17
Score for SW Valley Schools: 17	Score for CHI Health: 17		

Expansive Soils Speed of Onset:

Soil issues in Adams County, including frost boils and foundation cracking, would occur rather slowly but could escape notice until suddenly significant damage has occurred. We would have some warning that events could occur soon due to prolonged weather patterns, such as excessive rain and winter weather. These signs might help us understand that expansive soils will likely cause damage but it will not provide details on where they will occur and which assets are affected. Underground pipes might be subject to slowly occurring events that are undetected until suddenly the pipe breaks. These sudden occurrences result in the greatest damage for which mitigation is necessary.

Score for Rural Adams County: 6	Score for Corning: 6	Score for Nodaway: 6	Score for Prescott: 6
Score for SW Valley Schools: 6	Score for CHI Health: 6		

Expansive Soils Duration of Event:

An expansive soils incident will typically last from a few minutes to days or even weeks. If not corrected, the event can continue to occur and the damage can grow perpetually. Mitigation is most urgent for the most rapidly occurring events but long-term shifts in foundations and road cracking can be significant hazards also.

Score for Rural Adams County: 9	Score for Corning: 9	Score for Nodaway: 9	Score for Prescott: 9
Score for SW Valley Schools: 9	Score for CHI Health: 9		

Expansive Soils Total Scores:

The following total scores for expansive soils indicate low to moderate risk to the public and the planning area where incidents can occur.

Score for Rural Adams County: 45	Score for Corning: 43	Score for Nodaway: 42	Score for Prescott: 42
Score for SW Valley Schools: 41	Score for CHI Health: 41		

Expansive Soils Vulnerability/Assets at Risk:

Expansive soils are found throughout the county, but short of a site-by-site analysis of soil data, it is difficult to ascertain which specific properties and assets are at risk and which ones are not. For this reason, the analysis considers that all structures, property, and people, as outlined in Section 3.2, could be at risk. In reality, most structures and properties that do not have basements or that are well built will not experience damage due to this hazard.

All critical assets in the county, as outlined in Section 3.2, could be impacted by this hazard, although the damage to any individual building or structure may be minor and most events or incidents will be of a localized nature, affecting only one or a few structures or portions of structures.

Expansive Soils Loss Estimation:

The losses due to this hazard depend mostly on the location in relation to structures and assets, the type of soil, the quality of construction, and how widespread the hazard is. Sometimes, the conditions, such as prolonged heavy rain, a severe frost followed by rapid thaw, or severe drought, can be widespread and impact dozens or even hundreds of properties, cracking foundations, tipping utility poles, buckling roads, and snapping pipelines. In these extreme events, the effects can be sudden and can cause injuries or, although rare, even death. The greatest likelihood of loss is to foundations of structures, with dozens damaged each incident at an average cost of \$5,000 to the average structure. Physical losses throughout the planning area may exceed \$500,000 per year in years when incidents are widespread. Most of the losses will be covered by property insurance.

Future Development and Expansive Soils:

An increase in the amount of land used for new structures will increase risk simply because exposure is greater. Depending on the type and quality of construction of modern buildings, the risk could vary compared to existing development.

Extreme Heat Profile

Type: Natural

Definition: Summertime weather that is substantially hotter and/or more humid than average for a location at that time of year.

Extreme Heat Description:

In Iowa, extreme heat events (EHE) result from a prolonged period of excessive heat and humidity. Because how hot the temperature feels depends on the interaction of multiple meteorological variables (e.g., temperature, humidity, wind, cloud cover), extreme heat criteria typically shift by location and time of year. In other words, Boston, Philadelphia, Miami, Dallas, Chicago, San Diego, and Seattle are likely to have different criteria at any point in the summer to reflect different local standards for unusually hot summertime weather. In addition, these criteria are likely to change for each city over the summer. Excessive heat is the leading cause of weather fatalities in the nation (through 2009), edging flooding and hurricanes by a small margin. Heat fatality data may actually be under-representative because it might be difficult to see the role of heat in the death of people days or months after the event.

Extreme Heat Historical Occurrence:

According to the NCEI, 3 extreme heat events were reported in Adams County, between 01/01/1995 and 12/31/2021. These events occurred in 2011, 2016, and 2019. No deaths or injuries were reported during these hazard events. Property damage was \$135,000. No crop damage was reported, but the planning team recognizes that crop damage does occur due to extreme heat.

Even though the NCEI has reported only three EHE events, almost every summer there has been at least one EHE as identified by the planning team using the State plan's definition. Extreme heat has stressed crops, exacerbated droughts, and caused sickness to people and livestock. There are no known human fatalities directly attributed to EHE events in Adams County. The week of July 18, 2011 sustained a weeklong excessive heat warning with most of the week seeing 110-degree-plus heat indexes during the day and 90-plus heat indexes at night. In 2012-2014, Adams County experienced at least one day over 100 degrees. It was over 95 degrees for two straight weeks in 2012 and there were at least 12 days that exceeded 100 degrees that summer. The extreme heat affected people, livestock, and crops. Many elderly people suffered during these events. The planning team has not mentioned any more recent extreme heat events but acknowledges them to be common most summers.

Clearly, not all extreme heat events, as defined in this plan, are reported in the NCEI database. Perhaps this is because widespread damages and deaths attributed directly to the event are reported in only a few cases. The planning team indicates that high heat combined with humidity cause damage in some form (lost productivity, increased fire risk, sickness and death, infrastructure problems) almost every summer and sometimes for days at a time during spells in a given summer. Adams County, being in southern Iowa, is typically slightly hotter than the state average.

When asked about the past occurrence of this hazard in the online survey, 23 persons responded. Five indicated it happens more than once per year, six indicated it happens most years, eight indicated it happened once or twice in the last five years, four responded that it has not occurred to their knowledge.

From 2016 through end of 2020, there were 3 NWS excessive heat warnings, and 4 excessive heat watches, and 21 heat advisories issued for Adams County for heat-related events

(<https://mesonet.agron.iastate.edu/vtec/search.php#eventsbypoint/-93.6530/41.5300>)

The history of extreme heat can be measured in one way by looking at past high temperature records. The Iowa State University Department of Agronomy (<http://mesonet.agron.iastate.edu/request/coop/fe.phtml>) maintains records from the NWS weather station at Corning. These records include daily highs from January 1, 1893 through today (March 31, 2021). The recorded high temperature was 115 degrees F. There have been 262 days where the temperature reached or exceeded 100 degrees, most recently on July 26, 2012.

Extreme Heat Future Probability:

Extreme heat is likely in any given summer, sometimes on multiple occasions. If temperature extremes continue to become more common in this region, the likelihood for extreme heat increases. The planning team estimates extreme heat will have a 60-75% chance of occurring in the next year. However, the probability will depend greatly on severity, as the following chart shows.

Figure 3.45: Extreme Heat Probability by Level of Severity

Heat Condition	Probability in Planning Area	Relative Severity
Heat index of 130 degrees F or higher	Very rare (1% chance)	Catastrophic
Heat index of 105 to 129 degrees F	Common (50%+ chance)	Critical
Heat index of 90 to 104 degrees F	Several times to regularly	Limited
Heat index of less than 90 degrees F	Most late spring and summer days	Negligible

For planning purposes, this probability assessment considers the conditions of a heat index of 105 to 129 degrees F.

When asked about the likelihood that the incidence of this hazard will increase in the future compared to today in the online survey, 23 persons responded. Four indicated it is more likely, 12 indicated no change in likelihood, three indicated less likely, and four indicated they were unsure or unconcerned.

Score for Rural Adams County: 8	Score for Corning: 8	Score for Nodaway: 8	Score for Prescott: 8
Score for SW Valley Schools: 8	Score for CHI Health: 8		

Extreme Heat Vulnerability to the Population:

Extreme heat events are known to be among the greatest cause of natural hazard death and illness to humans and pets. Recent information released by the NOAA Office of Climate, Water, and Weather Services states extreme heat is the top non-severe weather related, killer in the United States. Elderly persons, small children, chronic invalids, those on certain medications or drugs (especially tranquilizers and anticholinergics), and persons with weight and alcohol problems are particularly susceptible to heat reactions. The planning team mentions the high population of elderly people in the county. Healthy individuals working outdoors in the sun

and heat are vulnerable. Low-income individuals and inner-city dwellers can also be susceptible without access to air-conditioned rooms. While no reported deaths have been attributed directly to extreme heat in Adams County, illnesses have occurred and the stress of heat is certainly a factor in deaths of the elderly. Currently, there are designated cooling shelters, namely certain school buildings and community halls, as defined in the community profile chapter (Chapter 2).

Indirect effects of extreme heat will impact more people through loss of productivity in business, reduced water supplies, inability to participate in the outdoors, higher utility costs, and reduced agricultural productivity. However, not all people will be affected directly. In the general population the risk is greater than in schools and the hospital, because schools either have air conditioning or they close on extremely hot days and because the hospital has air conditioning.

Score for Rural Adams County: 5	Score for Corning: 5	Score for Nodaway: 5	Score for Prescott: 5
Score for SW Valley Schools: 3	Score for CHI Health: 3		

Extreme Heat Area of Extent:

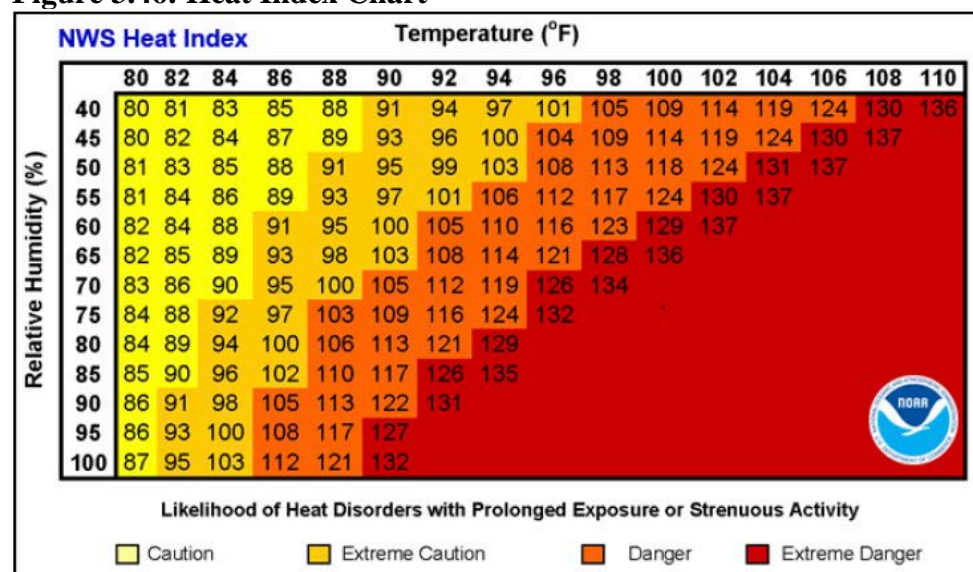
All of Adams County would be subjected to the extreme heat with vary rare exceptions.

S Score for Rural Adams County: 9	Score for Corning: 9	Score for Nodaway: 9	Score for Prescott: 9
Score for SW Valley Schools: 9	Score for CHI Health: 9		

Extreme Heat Severity of Impact:

Heat severity of impact relates to more than just the actual temperature. Air temperature is not the only factor to consider when assessing the likely effects of a heat wave. High humidity, which often accompanies heat in Iowa, can increase the harmful effects. Relative humidity must also be considered, along with exposure, wind, and activity. The heat index devised by the NWS combines air temperature and relative humidity to measure how hot it really feels. For example, if the air temperature is 102 degrees and the relative humidity is 55% then it feels like 130 degrees, 28 degrees hotter than the actual ambient temperature. To find the heat index from the figure below, find the air temperature along the top of the table and the relative humidity along the left side. Where the two intersect is the Heat Index for any given time of day. The new Mean Heat Index is a measure of how hot the temperatures actually feel to a person over the course of a full 24 hours. It differs from the traditional heat index in that it is an average from the hottest and coolest times of each day. Exposure to full sunshine can increase the heat index by at least 15 degrees.

Figure 3.46: Heat Index Chart



The National Weather Service can issue a Heat Advisory or Excessive Heat Warning:

- **Heat Advisory:** A heat index of 100°F or higher is expected for a period of 3 hours or more. A heat advisory shall be continued through the overnight hours, following a day with excessive heat, if the heat index is not expected to fall below 75°F. A heat advisory can be issued for a heat index less than 100°F when the cumulative effect of successive days of near advisory heat leads to potentially life-threatening conditions.
- **Excessive Heat Warning:** A heat index of 105°F or higher is expected for a period of 3 hours or more. An excessive heat warning shall be continued through the overnight hours, following a day with excessive heat, if the heat index is not expected to fall below 75°F. An excessive heat warning can be issued for a heat index less than 105°F when the cumulative effect of successive days of near warning heat leads to life threatening conditions.

As referenced in the probability section, events in the critical stage are typical and are used for the basis of the severity assessment. The following table shows the relative risks of a typical extreme heat event.

Figure 3.47: Extreme Heat Severity of Impact Scoring Matrix

Severity Criteria	Discussion	Score
Health and safety of the public	While heat-related illness and death can occur due to exposure to intense heat in just one afternoon, heat stress on the body has a cumulative effect. The persistence of a heat wave increases the danger. Excessive heat can lead to illnesses and other stresses on people with prolonged exposure to these conditions. People can suffer because the effects creep upon them unawares. Excessive heat is the leading cause of weather fatalities in the nation (through 2009). Many people do not realize how deadly a heat wave can be. In contrast to the visible, destructive, and violent nature of floods, hurricanes, and tornadoes, a heat wave is a silent killer, overloading the human body's capacity to cool itself. In a normal year, about 117 Americans succumb to the bodily stresses of summer heat. In a heat wave in 1980, more than 1,250 people died nationwide.	2 Schools, hospital 4 Others
Health and safety of responders	Response personnel could suffer heat stroke and dehydration working in extreme heat conditions. Firefighters in heavy gear are at the greatest risk.	4
Continuity of operations	Operations can be hindered due to heat impacts on workers and utility systems. All electric utility systems and Southern Iowa Rural Water report damages and strains on their capabilities. Some schools close for the day during extreme heat events.	2
Property, facilities, infrastructure	Transportation impacts include the loss of lift for aircrafts, softening of asphalt roads, buckling of highways and railways, and stress on automobiles and trucks (increase in mechanical failures). Extreme heat can also cause pavement to buckle and rupture. A 2011 article states that, in a typical year, Iowa DOT maintenance equipment operators spend 2,000 to 4,000 hours making temporary repairs of pavement blowups and another 6,000 hours replacing these pavement sections, costing an average of \$400,000 annually. Power lines and facilities can fail.	2
Delivery of services	Electric transmission systems are impacted when power lines sag in high temperatures. High demand for electricity also outstrips supply, causing electric companies to have rolling black outs. The demand for water also increases sharply during periods of extreme heat. This can contribute to fire suppression problems for area fire departments.	3
Environmental impacts	No direct long-term effect on the environment. Livestock and other animals are adversely impacted by extreme heat. High temperatures at the wrong time inhibit crop yields and cause fish kills.	2
Economic/financial conditions	Economic costs in transportation, agriculture, production, energy, and infrastructure are high. Lost productivity, due to conditions that make work outside or in a poorly ventilated building intolerable, can impact many other economic sectors indirectly. Extreme heat can pose a threat to livestock and crops. High temperatures have been shown to reduce summer milk production, impair immunological and digestive function of animals, and increase mortality of livestock. In July 2011, according to The Iowa Cattlemen's Association approximately 4,000 cattle died due to extreme heat. In 1995, livestock-related economic losses due to heat stress were estimated to be \$31 million in Iowa.	3

Severity Criteria	Discussion	Score
Regulatory/contractual obligations	Rural water and electric companies may have trouble providing contracted supplies and meeting sewer discharge regulations. Farmers and other producers may not produce what is required by contracts.	3
Reputation	None if response is adequate and timely.	1

Score for Rural Adams County: 24	Score for Corning: 24	Score for Nodaway: 24	Score for Prescott: 24
Score for SW Valley Schools: 22	Score for CHI Health: 22		

Extreme Heat Speed of Onset:

As with other weather phenomena, periods of extreme heat are predictable within a few degrees within 3 days or so. Variations in local conditions can affect the actual temperature within a matter of hours or even minutes. The NWS will initiate alert procedures when the heat index is expected to exceed 105 degrees Fahrenheit for at least two consecutive days.

Score for Rural Adams County: 2	Score for Corning: 2	Score for Nodaway: 2	Score for Prescott: 2
Score for SW Valley Schools: 2	Score for CHI Health: 2		

Extreme Heat Duration of Event:

An extreme heat event typically lasts for the afternoon and evening of a given day or consecutive days but can be all day long for a few days or even a week before cooler air arrives to an area.

Score for Rural Adams County: 7	Score for Corning: 7	Score for Nodaway: 7	Score for Prescott: 7
Score for SW Valley Schools: 7	Score for CHI Health: 7		

Extreme Heat Total Scores:

The following total scores for extreme heat indicate moderate to high risk to the public and the planning area where incidents can occur.

Score for Rural Adams County: 55	Score for Corning: 55	Score for Nodaway: 55	Score for Prescott: 55
Score for SW Valley Schools: 51	Score for CHI Health: 51		

Extreme Heat Vulnerability/Assets at Risk:

Virtually all structures, property, and people in the county, as outlined in Section 3.2, could suffer from the effects of extreme heat. While the heat itself will rarely damage buildings, it can damage infrastructure that supports buildings. Power lines, towers, roads, and bridges are at the most risk among structures. Contents losses are likely to be minor, even compared to structural losses. The greatest risk is to human health and life due to exposure to heat on the body. Additionally, because of the reduced productivity due to the effects of heat on humans and infrastructure failures, economic losses could be severe in some sectors.

All critical assets in the county, as outlined in Section 3.2, could be impacted by this hazard, although, again, it would be a secondary effect in most cases, as outlined in the above paragraph.

Extreme Heat Loss Estimation:

The most significant losses due to extreme heat are to human health, exposed infrastructure, crops and livestock, and economic impacts due to reduced productivity. Rarely do buildings suffer loss, although power lines and other infrastructure can fail at the cost of millions of dollars.

The loss due to human life and health are significant due to extreme heat. Despite this risk, it is difficult to attribute to extreme heat a death that appears to be due to natural causes. People over the age of 65, which make up well over 1,000 residents, people who are outside and cannot get indoors, and those with old homes and no air conditioning are all at greater risk than the general population. In a typical extreme heat event, it is

estimated that death is possible, severe illness requiring hospitalization is very likely, and multiple minor illnesses are very likely. Because extreme heat is a silent killer and is more common in a given location than a tornado or other killer, this hazard is one of the most likely to cause death in a given year.

According to the USDA's Risk Management Agency, the insured payments in Adams County for damages to crops as a result of heat from 2017-2020 totaled \$12,808 (2 claims), or much less than 1% of all insured loss from three claims. Assuming about 90.5% of insurable cropland is insured, the actual loss is approximately \$14,000 over four years or \$3,500 annually.

Extreme heat also puts strain on electrical infrastructure, where wires and poles are exposed to the heat while having to generate and convey immense amounts of energy to power air conditioning during extreme heat events. Roads, especially asphalt, and bridges are also damaged due to expansion and buckling. Loss figures for these are not available.

Metal buildings and towers, if built poorly, can also suffer damage or weakening that is not visible at the time but that may show up during future hazard events.

Economic losses can be severe, as certain factories and businesses are closed because of the heat. People who are not in good physical condition cannot be productive when they are hot. In Adams County, tens of thousands of dollars in lost productivity are likely due to each extreme heat event. Further, thousands of dollars are spent each year to provide cooling for local businesses during extreme heat events. The intense industries that dominate Adams County's economy are compromised during extreme heat events.

Future Development and Extreme Heat:

The threat could decline as older homes are replaced with newer structures over time, and as the county's population continues to slowly decline. The population of the community continues to age as well.

Flood, Flash Profile

Type: Natural

Definition: Any event when water levels rise at an extremely fast rate with little or no warning.

Flash Flood Description:

Flash flooding results from intense rainfall over a brief period, sometimes combined with rapid snowmelt, ice jam release, frozen ground, saturated soil, or impermeable surfaces. 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 can move at very fast speeds and can roll 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.

Flash flooding can also be caused by inadequate or improper drainage systems including storm sewers, culverts, and drainage ditches. These systems are usually designed to carry up to a specific amount of water (design capacity). When heavy rainfall causes the design capacity of the systems to be exceeded, water will begin to back up and fill low-lying areas near system inlets and along open ditches. This is most common in urban areas. As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. Urbanization increases runoff two to six times over what would occur on natural terrain.

Flash Flood Historical Occurrence:

Adams County is susceptible to both river and flash flooding. While river flooding has drawn more attention over the years, several flash flood events have damaged roads and infrastructure in places like Corning, which is hilly, and Prescott, where gravel roads have developed deep ruts.

Floods are the most common and widespread of all-natural disasters except fire. In Iowa, as much as 21" of rain has fallen in a 24-hour period. Extreme rain events in 2008, 2009, 2010, 2011, and 2014 have occurred in Adams County. The main problem resulting from these rains was flash flooding – both urban and small stream events. Culverts, bridges, roads, and other infrastructure have been damaged in the rural areas. Towns with older storm sewer systems have been overwhelmed, and small un-served towns cannot control water. The planning team for the original plan adopted in 2012 stated that flash flooding has impacted the northern half of Corning. The new planning team mentioned a flash flood in 2019, but no details were given.

The NCEI reports 26 flash flood events from 2000 through the end of 2020, resulting in no injuries or deaths and \$1.27 million in property damage and \$125,000 in crop damage. All jurisdictions have been impacted.

The county's planning team believes that flash flooding is actually much more common and destructive. Dozens of smaller (more localized) events happen in the county during any wet year, many of which are not reported to authorities. They may damage a few blocks of street, a few basements, and the wastewater system, but do not result in a federal response.

When asked about the past occurrence of this hazard in the online survey, 23 persons responded. One indicated it happens more than once a year, seven indicated it happens most years, 10 indicated it happened once or twice in the last five years, and five responded that it has not occurred to their knowledge.

From 2016 through end of 2020, there were 9 NWS flash flood warnings and 27 watches issued for Adams County for flash flood events (<https://mesonet.agron.iastate.edu/vtec/search.php#byugc/IAZ083>).

As previously described, flash flooding can be caused by intense rainfall over a brief period. The following table shows the top 30 rainfall events, as reported in 24-hour calendar day periods from 1900 through December 31, 2020, at the Corning weather station.

Figure 3.48: Heavy Rain Days at Osceola Weather Station

Date	Precipitation (in.)	Date	Precipitation (in.)	Date	Precipitation (in.)
08/27/1903	8.02	07/16/1900	4.33	07/28/1915	3.99
08/26/1987	5.96	06/04/2014	4.33	05/12/2011	3.97
07/29/2015	5.4	09/08/1989	4.3	08/09/1977	3.9
06/02/1941	5.05	08/20/2018	4.27	06/10/1926	3.8
09/01/1914	5	04/21/1974	4.25	08/28/1977	3.75
06/26/1966	4.85	05/09/1950	4.11	07/26/1990	3.73
10/08/1914	4.63	09/19/1986	4.05	07/12/1915	3.72
07/31/2004	4.63	Unavailable	4	08/08/1987	3.72
09/15/1992	4.5	09/12/1972	4	07/18/1916	3.5
06/05/2008	4.5	06/27/2014	4	08/29/1975	3.47

Source: Iowa State University Department of Agronomy, <http://mesonet.agron.iastate.edu/request/coop/fe.phtml>

As can be seen, the largest daily rainfall totals are spread throughout the history of records, although a few years had multiple days: 1914, 1915, 1977, and 2014.

Flash Flood Future Probability:

As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. Urbanization increases runoff 2 to 6 times over what would occur on natural terrain. While Adams County is rural, there are areas within Corning in particular containing significant expanses of impervious surfaces. As more development occurs in the watersheds, the amount of runoff produced also increases. Unless measures are taken to reduce the amount of runoff (or slow its movement), flash floods will continue to occur and possibly increase. Often, aging storm sewer systems are not designed to carry the capacity currently needed to handle the increased storm runoff in certain areas. Rural areas may have more events because of the amount of area on which they can occur, but developed areas are more likely to have flash flooding during less significant rainfalls. Either way, evidence suggests that extreme rain events are becoming more commonplace. Because of this, with existing mitigation efforts or lack thereof, the future probability is likely to be higher than past history.

However, some mitigation measures are occurring to reduce these risks. Through partnerships between farmers and conservation officials, BMPs for storm water control in rural areas are occurring. The Adams County Secondary Roads Department continues to make improvements to culverts and bridges that might reduce the likelihood of flooding and damage when flooding occurs. Corning and Prescott have explored options to reduce storm water damage to streets and related infrastructure. In 2018-19, Prescott retained an engineer to study possible storm water projects but, due to the cost, no major projects have proceeded to date.

According to Karl, T.R., J. M. Melillo, and T. C. Peterson, 2009: *Global Climate Change Impacts in the United States*, 2009, “One of the clearest trends in the United States observational record is an increasing frequency and intensity of heavy precipitation events... Over the last century there was a 50% increase in the frequency of days with precipitation over 101.6 mm (four inches) in the Upper Midwestern U.S.; this trend is statistically significant.” Research has also shown that in Iowa the trend is more heavy rain in the spring and less in the fall.

The overall rating the community gave for this hazard’s future probability in a survey was: “likely.” When asked about the likelihood that the incidence of this hazard will increase in the future compared to today in the online survey, 23 persons responded. Five indicated it is more likely, eleven indicated no change in likelihood, three indicated less likely, and four indicated they were unsure or unconcerned.

Score for Rural Adams County: 7	Score for Corning: 5	Score for Nodaway: 4	Score for Prescott: 5
Score for SW Valley Schools: 3	Score for CHI Health: 3		

Flash Flood Vulnerability to the Population:

Certainly, many buildings and much infrastructure can be damaged by flash floods that include urban small stream flooding, ditch flooding, basement flooding, and clogged storm water control systems. Due to aging infrastructure and lack of use of storm water control BMPs, much of the population can be impacted secondarily through inefficient sewer system flow and rapidly deteriorating streets. Closed roads, even if only temporarily, can disrupt the lives of people who otherwise are not impacted by floodwater.

People who are at the greatest risk of injury, death, and property loss are those close to waterways and in low-lying areas, whether inside and outside of mapped SFHAs. Those downstream from dams, levees, and retention basins are also at risk. People and property in areas with insufficient storm sewers and other drainage infrastructure can also be put at risk because the drains cannot rid the area of the runoff quickly enough. Nearly half of all flash flood fatalities are auto-related. Motorists often try to traverse water-covered roads and bridges and are swept away by the current. Six inches of swiftly moving water can knock persons off their feet and only two feet of water can float a full-sized automobile. Recreational vehicles and mobile homes located in low-lying areas can also be swept away.

The following table shows the warnings and other alerts that address the risks to people.

Figure 3.49: Flash Flood Risk Chart

Product	What It Means	You Should...
Hazardous Weather Outlook	Will there be any threat of flash flooding in the next several days?	If there is a threat of flash flooding, check back later for updated forecasts and possible watches and warnings. Latest Hazardous Weather Outlook
Flash Flood Watch	There is a threat of flash flooding within the next 48 hours, either as a result of heavy rain, ice jams, or the threat of a dam break.	Monitor weather conditions closely, especially if you live in an area prone to flash flooding.
Flash Flood Warning	There is an immediate threat for flash flooding in the warned area, especially in low-lying and poor drainage areas. These warnings are updated frequently with Flash Flood Statements.	If you live in an area susceptible to flash flooding, be prepared to evacuate and head to higher ground. Be very cautious when driving in the warned area, especially at night or while it is still raining. You may not be able to see a flooded road until it is too late!
A Flash Flood Emergency may be declared when a severe threat to human life and catastrophic damage from a flash flood is imminent or ongoing. The declaration of a <i>Flash Flood Emergency</i> would typically be found in either a Flash Flood Warning or Flash Flood Statement. People are strongly encouraged to avoid the geographic area of concern in a <i>Flash Flood Emergency</i> . The <i>Flash Flood Emergency</i> wording is used very rarely and is reserved for exceptionally rare and hazardous events.		
Areal Flood Warning	The threat of flash flooding is over, but there is still significant standing water in the affected area.	Areal flood warnings will typically list locations and roads impacted by the flooding. Try to avoid these locations until the water has receded.

Source: <http://www.floodsafety.noaa.gov/products.shtml>

The risk depends on the jurisdiction. For example, areas like the downtown area of Corning, schools, and the hospital have impervious surfaces in key areas (roofs, walkways, and streets) that limit the ability to take in storm water. School properties and the hospital have modern storm water facilities, unlike small towns and rural areas. The planning team indicates that the topography and rainfall trends make notable areas susceptible to flash flooding events. The scores are based on direct impacts: actual flooding on property and damage due to flooding in areas that directly impact safety and health of those outside of flood areas. Although the risks vary by jurisdiction, it is estimated 20 to 25% of any population is truly vulnerable to losses in a single event, somewhat less in rural areas because the population is spread out and surfaces are less impervious.

Score for Rural Adams County: 5	Score for Corning: 6	Score for Nodaway: 6	Score for Prescott: 6
Score for SW Valley Schools: 4	Score for CHI Health: 4		

Flash Flood Area of Extent:

Areas in a floodplain, downstream from a dam or levee, or in low-lying areas can certainly be impacted. People and property located in areas with narrow stream channels, saturated soil, or on land with large amounts of impermeable surfaces are likely to be impacted in the event of a significant rainfall. Unlike areas impacted by a river/stream flood, flash floods can impact areas a good distance from the stream itself. Streets can become swift moving rivers, and basements can become deathtraps because flash floods can fill them with water in minutes. Rural areas, due to their expanse, would be less impacted by the heaviest rain in a storm.

Cities, schools, and the hospital would have a greater percentage of land impacted by excessive rain events because of the impervious surfaces and smaller area under which a single storm can target. The scores are based on total area that is subjected to damage as a result of the event.

Score for Rural Adams County: 5	Score for Corning: 6	Score for Nodaway: 6	Score for Prescott: 6
Score for SW Valley Schools: 6	Score for CHI Health: 6		

Flash Flood Severity of Impact:

The planning team is not aware of any fatalities directly resulting from flash flooding. Due to the location of Adams County away from large rivers associated with flooding, people can sometimes be naïve or forgetful that flash flooding is a real risk and it can occur with little warning. People are at risk when they may not be aware of the risk at a given location. The following table shows the relative risks of a typical observed flash flood event.

Figure 3.50: Flash Flood Severity of Impact Scoring Matrix

Severity Criteria	Discussion	Score
Health and safety of the public	Flash floods are the #2 weather-related killer in the United States. This is likely in part because flash floods can quickly inundate areas thought to be safe. Flash flooding is a serious risk to people trapped in flooding areas and to those subjected to unforeseen flood impacts, such as flooding basements that cause mold growth.	3
Health and safety of responders	Rescuers are at significant risk when attempting to work in swift moving floodwaters associated with flash flooding. Special training in swift water rescue exists, and most are trained. However, sometimes equipment is lacking. A regional water rescue team, based in a nearby county, is in place to address some of this concern.	3
Continuity of operations	Damage to infrastructure, detours as a result of damaged or covered roadways, and continuous duration of precipitation can result in delays in projects and in facility operation for hours to perhaps days in rare instances.	3
Property, facilities, infrastructure	Personal property can be extensively damaged and destroyed by swift moving water. Facilities and infrastructure can be scoured around and degrading its structural integrity. Because flash flood water is off premises quickly, damages related to standing water are often limited, but the current associated with flash floods causes abrasive type damages such as erosion and undercutting. Roads, culverts, and bridges in Adams County have been heavily damaged. A large part of the County budget is designated to deal with secondary road damages related to this hazard: washouts, damaged and lost bridges, culvert damage, etc.	4
Delivery of services	Flash flooding's impacts on roads and other infrastructure can delay the delivery of essential services, including emergency response. It can immobilize normal function of sewer and water systems that are urgently needed in modern society.	3
Environmental impacts	Destruction of homes, illnesses, transportation accidents, and contamination of water supplies are very possible. Materials swept away by floodwaters can contaminate and leave a lasting impact on the environment.	3
Economic/financial conditions	Most impacts are indirect due to disruption of business and damage to infrastructure on which industry and services rely. Damaged to large buildings and to foundations can have a lasting impact on business. Extensive uninsured losses can have a great impact on financial security.	3
Regulatory/contractual obligations	Impacts are likely to be temporary in most cases and likely indirect. When service providers fail to provide services, or when roads and bridges are closed for many months or years, it can result in political fallout.	2
Reputation	Flash floods can be damaging to the reputation of the community if proper notification and warning are not given. Often times the victim will blame development, deteriorated infrastructure, or other changes in the community as the cause of the flooding on their property.	2

Score for Rural Adams County: 26	Score for Corning: 26	Score for Nodaway: 26	Score for Prescott: 26
Score for SW Valley Schools: 26	Score for CHI Health: 26		

Flash Flood Speed of Onset:

Flash floods are somewhat unpredictable, but there are factors related to speed of onset: soil type, soil covering/surfacing, topography, wetness of soil before the event, and direction of the water's or storm's

origination. As the name implies, flash floods occur within a few minutes or hours of excessive rainfall, a dam or levee failure, or a sudden release of water held by an ice jam. Warnings may not always be possible for these sudden events. Predictability of flash floods depends primarily on the data available on the causal rain. Individual basins react differently to precipitation events. Weather surveillance radar is being used to improve monitoring capabilities of intense rainfall. Knowledge of the watershed characteristics, modeling, monitoring, and warning systems increase the predictability of flash floods. Depending on the location in the watershed, warning times can be increased. However, estimations for flash flood events are difficult at best.

Score for Rural Adams County: 7	Score for Corning: 7	Score for Nodaway: 7	Score for Prescott: 7
Score for SW Valley Schools: 7	Score for CHI Health: 7		

Flash Flood Duration of Event:

Flash floods are usually brief but can last several hours, usually not more than 6 hours.

Score for Rural Adams County: 4	Score for Corning: 4	Score for Nodaway: 4	Score for Prescott: 4
Score for SW Valley Schools: 4	Score for CHI Health: 4		

Flash Flood Total Scores:

The following total scores for flash flood indicate moderate to high risk to the public and the planning area where incidents can occur.

Score for Rural Adams County: 54	Score for Corning: 54	Score for Nodaway: 53	Score for Prescott: 54
Score for SW Valley Schools: 50	Score for CHI Health: 50		

Flash Flood Vulnerability/Assets at Risk:

Virtually all structures, property, and people in the county, as outlined in Section 3.2, are susceptible to flash flooding. While the planning team does not believe all property is likely to be damaged and that it is a localized hazard, there is no definitive conclusion as to what properties are exempt from its effects. For this reason, the planning team has identified all properties and assets as potentially at risk. In reality, the properties most at risk include those on slopes, lower elevations, and at or near impervious surfaces. Almost anything can flood when there is enough rainfall in a short amount of time.

All critical assets in the county, as outlined in Section 3.2, could be impacted by this hazard. Exceptions may include a few assets that are above the ground and would likely not be damaged, including:

- Major overhead power lines anchored by heavy and deeply drilled poles
- Wind turbines
- Water towers

Flash Flood Loss Estimation:

The most significant losses include foundations and basements of structures on sloping and low-lying areas, not necessarily in a Special Flood Hazard Area (SFHA, see river flood profile), and infrastructure in the same area, namely streets, culverts, and bridges. Underground infrastructure, such as pipelines, can be damaged by scouring of flash flooding water, and overloaded sewer mains can back up into homes and businesses. Areas with large buildings and parking areas, such as in downtown Corning or in industrial areas of Corning, are likely to experience more flash flooding damage than other areas. In a given flash flood event, Corning and the rural area of the county are likely to experience the greatest loss to structures and property, topping hundreds of thousands of dollars. If one secondary road bridge is washed away, it can cost \$2 million to replace the bridge and create a traffic detour that can last for a year or more.

According to the NCEI, there have been 26 flash flooding events in Adams County through 2020. Since 2000, \$1.27 million in property losses and \$125,000 in crop losses have been reported. Over a 20-year period, total reported losses were \$1.4 million, which averages \$70,000 per year.

According to www.weather.gov, each year more people die from flash flooding than any other thunderstorm-related hazard. The loss of human life and health are significant due to flash flooding, mostly when people make a bad decision to drive into a flooded area. While rare in rural Iowa, extremely rapid rise of waters and flooding of impervious areas are more common in urban areas, where people get trapped and are killed by the raging torrent. However, it is certainly possible for death and injuries in Adams County. Fortunately, most people living in the county know where the risk is greatest and avoid those areas close to home when traveling during and after a rain event.

From 2017 to 2020, there were 54 crop insurance claims as a result of “excess moisture/precipitation/rain.” The results from these claims is a net \$1,681,390.67, which is over 25% of claims from that time period in terms of dollars, exceeding all hazards. Considering that only about 90.5% of covered crop losses are claimed, the real loss over 4 years is approximately \$1.8 million or \$450,000 per year.

According to the State’s Hazard Mitigation Viewer’s Flood Tab, as of April 1, 2021, there have been the following flash flood statistics:

- Number and annual loss from flash flood events impacting property: 23; \$65,323
- Number and annual loss from flash flood events impacting crops: 2; \$7,035
- Total annual loss reported for flash floods: \$72,358

Economic losses can be severe, depending on where flash flooding occurs. If it floods a major bridge accessing the factory or damages the building itself, it can shut down operations for a time. Contents and functional use losses can be significant when water gets into buildings and roads are closed, forcing a time-consuming detour.

Future Development and Flash Flood:

This impact depends mostly on the amount of new development and if mitigation measures are implemented. Mitigating flash flooding in new development is fairly simple with the combination of appropriate water quality practices (often called BMPs) and regulations, such as building codes and zoning, which force developers to consider hydrology in their building plans. Fortunately, the trend today is to consider these “green” principles and the reduction in impervious surfaces in development planning, often called “low-impact design.”

Flood, River Profile

Type: Natural

Definition: A rising or overflowing of a tributary or body of water that covers adjacent land not usually covered by water when the volume of water in a stream exceeds the channel’s capacity.

River Flood Description:

River flooding is a natural and expected phenomenon that occurs annually, usually restricted to specific streams, rivers or watershed areas. Floodwaters can be extremely dangerous; the force of six inches of swiftly moving water can knock people off their feet and two feet of water can float a car. Floods can be slow or fast rising but generally develop over a period of days.

River flooding is usually the result of heavy or prolonged rainfall or snowmelt occurring in upstream inland watersheds. Melting snow can combine with rain in the winter and early spring; severe thunderstorms can bring heavy rain in the spring or summer. Intense rainfall over a short period of time, or an ice or debris jam can also cause a river or stream to overflow. River floodwaters can occur quickly and move rapidly, as in a flash flood, or waters can rise slowly over a period of hours or even a few days as they often do where the land is gently sloping or flat. The National Flood Insurance Program (NFIP) defines flooding as a partial or complete inundation of normally dry land areas from:

1. The overland flood of a lake, river, stream, ditch, etc.
2. The unusual and rapid accumulation or runoff of stream waters.
3. Mudflows or the sudden collapse of shoreline land.

Unlike flash floods, river floods occur within defined areas of basins (watersheds) 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 of the floodplain that is subject to one percent or greater change of flooding in a given year. FEMA has mapped these areas and calls them “Special Flood Hazard Areas.” For the purpose of this profile, river flooding only occurs within those mapped areas. Flooding caused by dam failure and flash flooding is profiled in other sections of this chapter.

River Flood Historical Occurrence:

The Floods of 1993 and 2008 are still fresh in the minds of Iowans. Flooding has been a regular and frequent hazard in Iowa. Iowa has been involved in 36 or more Presidential Declarations of a major disaster related to flooding since 1953. Several of those have been from 2008-2011, affecting virtually all of Iowa’s counties and sometimes including Adams County. River floods have occurred in Adams County, resulting in relatively modest damage compared to other counties. However, the flood of 2008 stands out because of the damage two floods that year did to the southeast part of Corning. They flooded the racetrack, fairgrounds, part of the water plant property, school bus barn, and several businesses, at least one of which never reopened. Largely no action was taken in the area after the 2008 flooding, other than a few abandoned buildings have been demolished. The East Nodaway River, Middle Nodaway River, and their tributaries have the greatest impact on Corning, Prescott, Nodaway, and the rural county. Each town has suffered some flood damage in years such as 1993, 2008, 2009, and 2010. The planning team also reported events in 2014 and 2019, although no details were offered about these events. Rural farmland totaling thousands of acres have also been flooded. Smaller streams have flooded and impacted adjacent properties, culverts, and bridges. More recently, FIRM maps have been created to confirm damage potential in all these jurisdictions. CHI Health is identified as having no waterways susceptible to river flooding (although flash flooding can occur).

Information on past events in Adams County is incomplete because most flood events reported for Adams County show the results of the larger flood event. Because flooding does not stop at a county boundary, flood events are reported regionally, and most or all the damages reported might be located outside of Adams County in some events. The only official source is the NCEI. According to the National Centers for Environmental Information, there have been 14 river flooding events in Adams County in modern history (since 1996 through 2020) with \$937,500 in reported property damages and over \$20.383 million in crop losses. The majority of the historical losses occurred in 2010 (likely on a regional basis). The latest flood event reported by the NCEI was in 2015.

When asked about the past occurrence of this hazard in the online survey, 23 persons responded. One indicated it happens once or twice a year, 11 indicated it happens once per year on average, 11 responded that it happened rarely, and no one responded that it has not occurred or don’t recall an occurrence.

FEMA declarations involving flooding including Adams County were made 12 times since 1990. FEMA has funded repairs to bridges and county assets along several rivers and streams. The National Flood Insurance

Program (NFIP) Repetitive Loss Properties (RLP) report identifies properties vulnerable to multiple flood losses. Through the end of 2020, there have been no RLPs in Adams County.

River flooding has not occurred (been reported) at Southwest Valley Schools and at the hospital.

More information on river flooding and how it is addressed in Iowa can be found at <http://www.iowadnr.gov/Environmental-Protection/Land-Quality/Flood-Plain-Management>. This discusses the IDNR's approach to this hazard.

Plan Update Change to Future Flood Risk

The previous plan included flood risk in the various jurisdictions based on maps in place at that time. With the new official FIRM maps that show hazards in the rural area, Corning, Nodaway, and Prescott. These changes are based on the fact that, while flooding can occur outside of a SFHA, such flooding is unlikely based on past history, and, if it occurs, will likely be flash flooding in nature. No municipalities are likely to annex area that includes SFHAs not already in the city.

River Flood Future Probability:

Minor flooding, not necessarily to the 1% (100-year) flood elevation, is likely to continue in the rural county and the cities that have flood hazard areas. Major flooding requiring Federal response is moderately likely in the next five years. Adams County is hilly in most locations with many bisecting small streams to moderate rivers. The largest of these that impact the planning area the most are the East and Middle Nodaway Rivers. These pass through area cities and there are dozens of bridges crossing these streams. As the incidence of extreme heavy rains seem to become more often, these jurisdictions will be affected by flooding more often.

When asked about the likelihood that the incidence of this hazard will increase in the future compared to today in the online survey, 23 persons responded. Five indicated it is more likely, 15 indicated no change in likelihood, three indicated less likely, and none indicated they were unsure.

The following scores assume that flooding is only occurring in areas with Special Flood Hazard Areas (SFHAs) as mapped by FEMA. This includes Corning, Nodaway, Prescott, SW Valley Schools Corning campus, and the unincorporated area. Any other flooding that might affect other areas is assumed to be flash flooding and is profiled as such in this section.

Score for Rural Adams County: 5	Score for Corning: 4	Score for Nodaway: 4	Score for Prescott: 4
Score for SW Valley Schools: 3	Score for CHI Health: 0		

River Flood Vulnerability to the Population:

The vulnerability from river flooding is quite delineated to the 1%-chance level and with new mapping efforts to the 0.2%-chance level. Much work in the area of flood hazard mapping, where maps have been completed, has allowed many communities to restrict development in hazardous areas. Adams County now has countywide FIRMs (Flood Insurance Rate Maps) and an FIS (Flood Insurance Study).

Over 90% of the county's flood hazard area (Zone A) is currently used for agriculture, so the greatest impact on private property due to flooding is agricultural land, crops, and potentially livestock and outbuildings. There are several occupied properties within Corning located in the flood hazard area, most of them being small businesses and parking areas. Examples include auto repair shops and similar businesses. Several homes (approximately ten, based on a GIS property record search of the area) in Corning on or near John Street and south of the railroad tracks are in the SFHA. The racetrack, fairgrounds, school bus barn, and other structures are also in the hazard area. Further, infrastructure, such as bridges and roads, is more likely to be lost. Over 100 bridges are located in flood hazard areas or that cross over waterways that can flood around the

base of the bridge. Public properties, such as water and sewer plants, electrical infrastructure, and dams in public recreational areas, could be damaged by floodwaters. It is unknown if any rural homes are in the flood hazard area, but it is unlikely more than a few would be.

The National Flood Insurance Program (NFIP) Repetitive Loss Properties (RLP) report identifies properties vulnerable to multiple flood losses. To date there are no repetitive loss properties (RLPs) in Adams County.

Currently, only Corning and Prescott are in the NFIP. The other jurisdictions do not have occupied properties in the floodplain that might have strong interest in flood insurance.

Figure 3.51: NFIP Participation Information

Community	CID	Initial FHBM *	Initial FIRM **	Current Effective Map Date	Regular Program Entry Date	Sanction Date
Carbon	190001A	06/25/1976	04/05/2017	04/05/2017	n/a	06/25/1977
Corning	190002A	06/21/1974	08/01/1986	04/05/2017	08/01/1986	n/a
Nodaway	190003A	08/22/1975	04/05/2017	04/05/2017	n/a	08/22/1976
Prescott	190004A	11/05/1976	01/01/2006	04/05/2017	01/01/2006	n/a
Adams County	190842A	n/a	04/05/2017	04/05/2017	n/a	04/05/2018

Source: FEMA Community Status Book Report, 4/1/2021, <http://www.fema.gov/cis/IA.pdf>

*Flood Hazard Boundary Map **Flood Insurance Rate Map (NSFHA) – no SFHA exists

According to the Iowa DNR Floodplain staff, there have been 5 (\$212,517) in losses reported by NFIP insurance product purchasers in Adams County from 1978 through 12/31/2020. The following show policy coverages currently in force and total claims since 1978.

Figure 3.52: Flood Insurance Information

Community	Insurance Zone A			Insurance Zone B, C, and X		
	Policies in Force	# of Claims	\$ of Claims	Policies in Force	# of Claims	\$ of Claims
Carbon	0	0	\$0	0	0	\$0
Corning	3 (\$211,100)	5	\$212,517	0	0	\$0
Nodaway	0	0	\$0	0	0	\$0
Prescott	1 (\$113,200)	0	\$0	0	0	\$0
Adams County	0	0	\$0	0	0	\$0

Source: FEMA Community Information Service (CIS), provided by Iowa DNR Floodplain Section, 4/1/2021

Corning and Prescott are non-delegated communities, which means a State floodplain permit must be issued prior to the community issuing the local permit. Iowa floodplain regulations establish higher standards than the minimum NFIP standards. One example of higher standards is that all new and substantially improved construction must be elevated one foot above base flood elevation. Additional DNR standards have been established for development in the floodway.

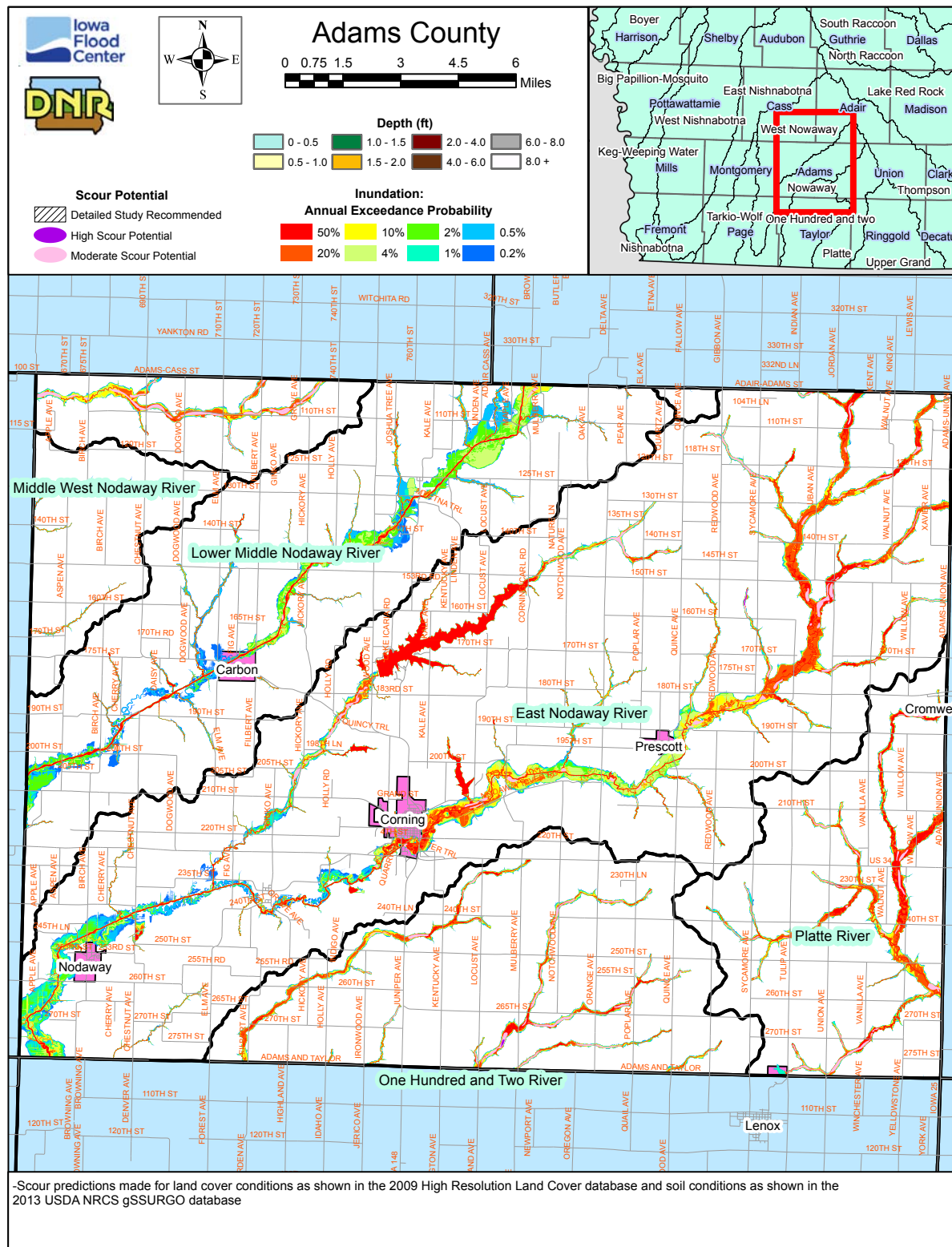
Corning and Prescott have issued regulations to prohibit future development in flood areas. Only a small number of people who live in homes in SFHAs will be directly impacted. Therefore, the impact to most of the population is likely to be economic and indirect: detours due to road closures, tax increases to fund new bridges, etc. The planning team is concerned that flooding may cut access to homes in some rural areas in the event of emergency. Infrastructure, such as bridges and roads, rather than private development, is more likely to be lost in a “100-year” flood. However, this infrastructure impacts people and vulnerable populations outside of the flood hazard area. The ratings below are based on the direct impact to the population, as it is impossible to really measure the indirect impact, which will vary by location and severity of the flood event. Operations of water and sewer treatment facilities can result in some temporary impact.

Score for Rural Adams County: 4	Score for Corning: 5	Score for Nodaway: 3	Score for Prescott: 3
Score for SW Valley Schools: 2	Score for CHI Health: 0		

River Flood Area of Extent:

Flood mapping helps delineate risk. Fortunately, FIRM maps are now in place. Printed copies of these are in Appendix E. The following map from the Iowa Flood Center outlines potential inundation areas based on the recently adopted FIRM maps and other data.

Figure 3.53: Iowa Flood Center Inundation Areas Map



Source: Iowa Flood Center, retrieved 5/6/2021

Note from the maps that there are special flood hazard areas (SFHAs) in the following jurisdictions: unincorporated Adams County, Corning, Nodaway, Prescott, and the Corning campus of SW Valley Schools (as well as Carbon, which is not participating in the plan). Over 98% of the property in the SFHA is in the unincorporated area. As these maps show, river flooding primarily affects rural agricultural areas. In total, the estimated number of parcels located in the SFHAs of Adams County would be 250 agricultural parcels in rural areas and 20 agricultural parcels in incorporated cities. As shown here, only about 2% of the county as a whole is in a flood hazard area, while 3 to 5% of Nodaway, 10% of Prescott, and nearly 15% of Corning area in the SFHA. Corning has unique risks to recreational areas, public properties, businesses, and even a few homes (total of nearly 50 parcels).

It is important to know that there is a difference between being unmapped and having no SFHA:

- **Unmapped:** If a community is unmapped, there has been no formal effort to determine if or where flood risk areas may be located. The community has no flood map. The “unmapped” community requires a level “a” ordinance. (No parts of the county are “unmapped.”)
- **No SFHA:** If a community was studied and mapped, and it was found that there were no SFHAs within that jurisdiction, FEMA has determined the community has no special flood hazard areas. (Rescinded FHBMs fall within this category.) The NSFHA community does not require an ordinance.

(Sources: Iowa Flood Center; IHSEMD Regulation “Staircase”)

Rural areas are becoming less susceptible due to flood mitigation measures in watersheds, such as basins, terracing, grassed waterways, and large water source lakes. However, major flooding could possibly cause water source dam failure (although the risk is very remote). Flooding remains possible in any SFHA, even if the risk and extent of the flood impacts decline as a result of mitigation measures used to date. With this said, only small parts of any jurisdiction experience a direct threat of flooding.

It is possible (although very difficult) to perform a scenario analysis to determine where flooding could occur in a given storm event, and in most storm events the resulting flooding would not cover the entire planning area’s SFHA. However, for the planning team’s purposes, simply using the entire SFHA in each jurisdiction is adequate for planning purposes. The following list summarizes the flood hazards impacting each of the jurisdictions in this plan:

- **Rural Adams County:** Several small/medium rivers and streams pass through the county, most of them originating in the county or just east and north of the county. Approximately 3% of the land surface in the unincorporated area is within SFHAs.
- **City of Corning:** much of the area east of Quincy Avenue (Highway 148) and south of the railroad tracks as well as a few small slivers of land in the western part of the city, in total composing nearly 15% of the area of the city.
- **City of Nodaway:** the very northern part of the city and a sliver in the west-central part of the city, composing up to 3% of the city’s area.
- **City of Prescott:** the easternmost part of the city and a small part of the southeast corner, composing about 10% of the land area.
- **Southwest Valley School District:** Rural areas within the district have SFHAs, as well as a sliver of land containing recreational fields owned by the District within Corning.
- **CHI Health:** No land owned by the hospital or under its responsibility is within those areas.

Score for Rural Adams County: 4	Score for Corning: 5	Score for Nodaway: 4	Score for Prescott: 4
Score for SW Valley Schools: 3	Score for CHI Health: 0		

River Flood Severity of Impact:

The extent of damage caused by floods is determined by many factors including depth, frequency, velocity, rate of rise, duration and the potential presence of ice and debris. These factors also determine which mitigation methods will work best.

Depth is the primary factor in evaluating the potential for flood damage. Every floodplain is unique in terms of the different levels of flooding that can be expected.

- Very shallow flooding, usually defined as a depth of 1 foot or less, is not life threatening, but can still cause considerable amounts of damage to a building.
- Shallow flooding of 1 to 3 feet in depth can result in significant amounts of damage both to structures and their contents.
- Moderate flooding, depths of 3 to 6 feet, can destroy buildings and threaten lives due to the large flood forces involved.
- Deep flooding, depths exceeding 6 feet, are the most destructive and dangerous.

Frequency, or how often the flooding occurs, is usually the second factor considered. All floodplains are subject to floods of differing depths, with the lower depths occurring more frequently than higher levels. Although historical flood depths provide some indication of the level of risk, there is no certain method to predict future flood levels. A method of estimating flood frequencies has been developed to determine the statistical probability of specific flood levels. For example, the flood that has a 1-percent (1 in 100) probability of being equaled or exceeded in any year is referred to as the 100-year flood event. However, this does not mean that a 100-year event is one that happens every 100 years or that once a 100-year event happens it will not occur again for another 100 years. This is only a statistical tool used to estimate the risk of certain flood levels. The 100-year flood is known as the base flood elevation or BFE. Once a BFE has been established, it is published on a Flood Insurance Rate Map (FIRM). These maps delineate areas of a specific community that are subject to the base flood.

Velocity is the speed at which floodwaters move. Slow moving floodwaters are usually defined as those having a velocity of less than three feet per second and they usually do not present substantial problems. Fast moving floodwaters, those moving over five feet per second, can quickly erode or scour the soil leading to foundation failure or even moving the house off its foundation. Historical flood event information is often the best way to determine potential flood velocities, although it is possible to hydraulically calculate theoretical velocities.

The speed floodwaters rise, or *Rate of Rise*, is the primary factor in determining the amount of warning time. In steep topography or when large amounts of rainfall occur within a short period of time, flash floods can occur. In low, flat areas the warning time can be several hours or even days. The rate of rise is also important because of the effects of hydrostatic pressure. For example, if the water rises quickly, water may not be able to flow into the building fast enough for the pressure inside to rise as quickly as the level outside. When the internal and external pressures (pressure of the water inside the building and the water outside the building) are significantly different, it could cause serious structural damage and even collapse.

The *duration* of the flood is how long it lasts. Often duration is related to rate of rise and rate of fall. Usually water that rises and falls rapidly will recede more rapidly and water that rises and falls slowly will recede more slowly. How long the structural members, interior finishes, service equipment, and building contents are affected by floodwaters is related to how much damage will occur. Duration also determines how long buildings remain uninhabitable.

Ice and/or debris can often pose a greater danger than the floodwater itself. For example, ice floes, caused by ice breakup, can often strike a building causing serious damage or the ice may form around a flooded building causing uplift and structural damage. Floodwaters can carry all types of debris, including trees, portions of flood damaged buildings, storage tanks, mobile homes, as well as dirt and other substances such as oil, gasoline, sewage and chemicals. At low velocities the debris can cause damage and pose a health and safety threat; at higher velocities it can destroy structures, including buildings and bridges.

Most floods in Adams County will have modest depth and frequency but, because they are more likely to be flash floods initially, they will likely have a rapid rate of rise and velocity. They will also likely have a short duration compared to other floods in Iowa. The following assessment is based on these characteristics.

Figure 3.54: River Flood Severity of Impact Scoring Matrix

Severity Criteria	Discussion	Score
Health and safety of the public	Flooding impacts include potential loss of life. River flooding has less risk than flash flooding because of the slower onset of the river flood. In Adams County, large floods with large areas of deep water are unlikely. Despite this, the risk of death remains. The 2008 floods resulted in 18 fatalities and 106 injuries, the evacuation of approximately 38,000 Iowans and impacting 21,000 housing units (only a few of which were in Adams County).	3
Health and safety of responders	Responding to river flooding often includes sandbagging and working in floodwaters. Response personnel should have current tetanus and hepatitis shots. Rescuing victims often requires rescue from boat. Wearing personal protective gear such as life vests at all times can prevent most injuries.	2
Continuity of operations	Operations could be disrupted from direct impacts if facilities are in the floodplain and indirectly from loss of critical services (such as electricity) to maintain operations. Backup power and other services can eliminate the impact to operations. Water and wastewater treatment plants are often located in floodplains because they must either take or deposit water into a waterway. This is the case in Corning. Other operational elements can be damaged in other communities and the rural area.	2
Property, facilities, infrastructure	Facilities and infrastructure can be scoured around, which degrades its structural integrity. Most losses in rural Adams County have been limited to bridges and serving rural areas; some have been destroyed. Because a large area can be impacted, flood damages could be severe. In Corning, extensive private property has been destroyed.	Corning: 3 Others: 2
Delivery of services	Damage and disruption of communications, transportation, electric service, and community services are likely in severe cases. Water and wastewater treatment facilities are located in or near the floodplain and are at some risk of flooding and eventually being taken offline.	3
Environmental impacts	Hazards of fire, health and transportation accidents, and contamination of water supplies are likely effects of flooding situations. In Adams County, considerable hazardous materials facilities are not in flood hazard areas.	3
Economic/financial conditions	Crop and livestock losses and interruption of businesses either from direct flooding or loss of the delivery of critical services can have damaging impacts on the local economy. The magnitude and location of flooding in the county, however, is not likely to have a long-term impact on the overall economy. Counties covered in the 2011 disasters ranged from the western border due to flooding on the Missouri River to eastern counties along the Mississippi River. Crop losses in Iowa alone from Missouri River flooding were an estimated \$162 million.	2
Regulatory/contractual obligations	None are known – unlikely to be significant to the population.	1
Reputation	The jurisdiction should pay careful attention to disclosing flood risk in the community. Participation in the National Flood Insurance Program and providing accurate and up to date flood insurance rate maps should mitigate this concern.	1

Score for Rural Adams County: 19

Score for Corning: 20

Score for Nodaway: 19

Score for Prescott: 19

Score for SW Valley Schools: 19

Score for CHI Health: 0

River Flood Speed of Onset:

Gages 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 National Weather Service 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. The planning team recognizes that Adams County is the source or is near the source for several rivers and streams, so in most cases flooding originates in the county rather than approaches the county from farther upstream. Therefore, the speed of onset is often much quicker than areas like Des Moines, Davenport, and Ottumwa, where larger rivers may take on a flood from hundreds of miles upstream. Towns with SFHAs in this county are at or near the very upper reach of the river, so they will occur relatively quickly.

Score for Rural Adams County: 6	Score for Corning: 6	Score for Nodaway: 6	Score for Prescott: 6
Score for SW Valley Schools: 6	Score for CHI Health: 0		

River Flood Duration of Event:

River floods can last for days to even one week in a given area of a river. Most flooding in Adams County will be of a shorter duration because the streams generally originate in or near the county and will flow through the county before going to downstream locations like Clarinda and northern Missouri. Typically, the river floods in the county are much briefer as a result, although there can be exceptions if rain persists for days or there is an exceptional snowmelt over several days. Flooding on the Middle Nodaway River, for example, could last longer because it is more of a mid-sized river.

Score for Rural Adams County: 7	Score for Corning: 7	Score for Nodaway: 7	Score for Prescott: 7
Score for SW Valley Schools: 5	Score for CHI Health: 0		

River Flood Total Scores:

The following total scores for river flood indicate moderate risk to the public and the planning area where incidents can occur.

Score for Rural Adams County: 45	Score for Corning: 47	Score for Nodaway: 43	Score for Prescott: 43
Score for SW Valley Schools: 38	Score for CHI Health: 0		

River Flood Vulnerability/Assets at Risk:

With the availability of Digital Flood Insurance Rate Maps (DFIRMs) as well as detailed parcel data with assessed values, analysis is possible to quantify the risk to structures, properties, and people. This will allow for analysis of actual structures and values by type that fall within the boundaries of the regulatory floodplain (SFHA). At the time this plan update was written, the County's GIS system did not have a flood hazard layer, so the estimates are tentative at best. It is hoped that by the next update the GIS system will have this data.

As stated earlier, about 3% of the rural (unincorporated) area is within a SFHA. Primarily the area within the floodplains is made up of farmland and timber/wildland. Very few inhabited structures are found in this area. Note the following table of rural assets that could be at risk.

Figure 3.55: Rural Adams County River Flood Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	5	\$400,000	12	<1%
Commercial	1	\$300,000	5	8%
Industrial	0	\$0	0	0%
Ag Structures and Land	10 buildings; 15,000 acres	\$25,000,000	2	5%

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Taxable Infrastructure	2	\$8,000,000	1	15%
Government/Institutional	5	\$40,000,000	20	25%
Totals	23	\$73,700,000	40	8%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 8% of the assets in the unincorporated part of the county are at risk. As can be seen, most of them are agricultural lands/crops and infrastructure that is necessary in rural areas, such as bridges, roads, culverts, and utilities that must cross over waterways. The cost/value of bridges and culverts, which is a major budget concern for the County, inflate the asset valuation in comparison with the percentage of the planning area that is within SFHAs. For the estimated five residential properties above, these are properties that are partially in the SFHA but the County GIS maps seem to show the structures themselves are not in the flood hazard area. The following critical assets listed in Section 3.2 are susceptible:

- Fiber optic lines (if scouring occurs)
- Kinder Morgan Pipeline (if scouring occurs)
- Lake Binder
- Lake Icaria

Approximately 250 acres in the east, southeast, and south of Corning are also at risk. The land includes mostly farmland and open space but also considerable public land and developed properties. The following structures and properties are included.

Figure 3.56: Corning River Flood Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	12	\$750,000	25	2%
Commercial	5	\$250,000	10	10%
Industrial	0	\$0	0	--
Ag Structures and Land	1 building; 10 acres	\$7,000	0	35%
Taxable Infrastructure	2	\$150,000	2	20%
Government/Institutional	4	\$10,000,000	25	5%
Totals	24	\$11,157,000	62	5%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is estimated that about 5% of the assets in Corning are at risk, mostly in the form public infrastructure and facilities that can be flooded as well as some private property. The following critical assets listed in Section 3.2 are susceptible:

- Adams County Speedway
- Alliant Energy Pipelines (if there is scouring)
- BNSF Railway/AMTRAK
- Highway 148 (bridge over river)

Approximately 10 acres through the north and west central parts of Nodaway are also at risk. The following structures and properties are included.

Figure 3.57: Nodaway River Flood Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	0	\$0	0	--
Commercial	0	\$0	0	--
Industrial	0	\$0	0	--
Ag Structures and Land	0 buildings; 10 acres	\$10,000	0	5%
Taxable Infrastructure	0	\$0	0	--
Government/Institutional	1	\$100,000	1	5%
Totals	1	\$110,000	1	2%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that approximately 2% of the assets in Nodaway are at risk. No critical assets listed in Section 3.2 are impacted.

Approximately 50 acres through the east and southeast parts of Prescott are also at risk. The following structures and properties are included.

Figure 3.58: Prescott River Flood Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	0	\$0	0	--
Commercial	0	\$0	0	--
Industrial	0	\$0	0	--
Ag Structures and Land	1 building; 20 acres	\$200,000	1	85%
Taxable Infrastructure	1	\$50,000	1	3%
Government/Institutional	1	\$250,000	1	5%
Totals	3	\$500,000	3	4%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that approximately 4% of the assets in Prescott are at risk. No critical assets listed in Section 3.2 are impacted.

River Flood Loss Estimation:

The potential losses to existing development will be provided for the following categories of losses:

- Building losses – this will include counts and values for buildings exposed to potential damage from the 1-percent annual chance flood for each jurisdiction in the planning area;
- Estimated population displaced;
- Agricultural impacts; and
- Critical facilities and infrastructure at risk.

When estimating potential losses to structures, it is important to remember that, when a flood occurs, it rarely causes total destruction of the properties in the floodplain. As stated in the severity of impacts section of this profile, factors like depth, velocity, and building type are also important. Based on FEMA Flood Insurance Administration (FIA) flood depth-damage curves, the percent of damage is directly related to the flood depth. FEMA's HAZUS flood loss estimation tool and the flood benefit/cost module both use this simplified approach to model flood damage based on building type and flood depth. A damage estimation of 20 percent of the total value was used based on FIA depth-damage curves for a one-story structure with no basement flooded to two feet. While there are several limitations to this model, it does present a methodology to estimate potential damages. This model may include structures within the 1-percent annual chance floodplain that may be elevated above the level of the base flood elevation, according to local floodplain development requirements, and thus mitigate the risk. Additionally, structures with finished basements and commercial properties would likely sustain a higher percentage of damage.

To determine the population that would be impacted and potentially displaced by a 1-percent annual chance flood event, the average household size, as determined by the Census 2015-2019 estimate, was multiplied by the number of residential structures in the 1-percent annual chance floodplain for each jurisdiction.

The following table outlines this analysis and provides an estimate of losses due to flooding caused by a 1-percent annual chance flood on structures (not including contents).

Figure 3.59: Estimated Loss in Adams County Due to River Flood

Jurisdiction	Total Improved Value	Improved Value in SFHA	Estimated Loss	Loss Ratio	Residential Properties in SFHA	Average Household Size	Estimated Impacted Population
Rural Adams County	\$707,000,000	\$73,700,000	\$14,740,000	2.08%	5	2.25	12
City of Corning *	\$130,411,000	\$11,157,000	\$2,231,400	1.71%	12	2.25	27
City of Nodaway	\$5,192,000	\$110,000	\$22,200	0.43%	0	2.25	0
City of Prescott	\$10,999,000	\$500,000	\$100,000	0.91%	0	2.25	0
Totals	\$853,602,000	\$85,467,000	\$17,093,600	2.00%	17	--	39

Sources: Adams County DFIRM, Adams County GIS, US Census Bureau, 4/2020 * Includes school and hospital property.

While flawed, the model provides a rough idea of what could happen. In Adams County, the clear majority of physical losses will be to county infrastructure, with more modest impact to residential structures. Recall from the flash flood profile that river flooding is much less likely to cause death and injury than the more sudden and rapid flash flooding. Displacement is likely to some homes in Corning if a flood reaching or exceeding the 1% level occurs.

According to the State's Hazard Mitigation Viewer's Flood Tab, as of April 1, 2021, there have been the following river flood statistics:

- Number and annual loss from river flood events impacting property: 9; \$51,314
- Number and annual loss from river flood events impacting crops: 5; \$1,100,601
- Total annual loss reported for river floods: \$1,151,915

USDA crop insurance claims for excess moisture/precipitation/rain and flood conditions for the four-year period of 2017-2020 show 54 claims, more than for any other individual hazard and over one-third of the total claims during this period. The total amount of claims was \$1,681,390.67, which is the highest amount all causes of crop loss. This averages to \$420,348 annually. It is likely that much of these losses occurred outside of the SFHA, but data is not available to determine this.

Due on the limited information available about properties, structures, and infrastructure in SFHAs, it is difficult to estimate losses due to a flood event. Likely the greatest losses, based on past history, will be to County-owned infrastructure, namely roads, bridges, and culverts. These will be partially to totally washed-out either through one flood event or the compound impacts of multiple floods. A new bridge over a small stream or river will cost over \$1 million dollars. A larger bridge required to address the traffic demands of a major State/US highway would be upwards of \$2 million. Culverts for smaller streams are less expensive but can cost over \$100,000. There are approximately 100 bridges and a similar number, if not more, culverts within SFHAs, almost all of them in unincorporated areas.

Economic losses include more than crops. When infrastructure is washed out, vehicles must take costly detours and some businesses that are isolated will lose sales. The functional use value of businesses, organizations, and governments can be diminished to some degree.

Future Development and River Flood:

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 by preventing future construction in those areas. However, even if mitigation actions occur, evacuation may still be necessary due to rising waters. In addition, floods that exceed mitigated levels may still cause damages.

Grass and Wildland Fire Profile

Type: Natural

Definition: An uncontrolled fire that threatens life and property in a rural or wooded area.

Grass and Wildland Fire Description:

Grass and wildland fires can occur when conditions are favorable, such as during periods of drought when natural vegetation would be drier and subject to combustibility. In Iowa, landslides and wildfires often happen in similar circumstances. Both tend to occur in forest or sloping grassland areas. For wildfires, Iowa is in “Ag Land” and Model R. These are both “light fuel” according to the US Forestry Service.

Grass and Wildland Fire Historical Occurrence:

Grass and wildland fire are the most common type of fire in Adams County, and all participating jurisdictions except the Southwest Valley Schools and CHI Health Mercy Hospital campus can be affected. By far most grass and wildland fires have occurred in the rural part of Adams County. Consistent and accurate data is not available for Adams County, but in total the area fire departments report multiple incidents per year. Most of these are small (less than five acres), impact only ditches and cropland or timberland, and can be handled with local fire department resources. Occasionally, more than one property, aboveground infrastructure, and structures are impacted, and a few times per year an incident occurs that requires more than local (in-county) fire department to respond. The planning team, in describing the hazard said it happens “several times a year.” The planning team called out 2018 as a memorable year for wildland fires. No injuries or deaths were reported, however. With local fire departments partnering through mutual aid compacts, it is relatively easy to gain assistance and put out fires before they become a major hazard.

According to the National Interagency Fire Center, there were 1,817 wildfires spanning 33,122 acres and 1,884 prescribed fires spanning 14,079 acres from 2002 through 2012 in Iowa. None of the state’s wildland fires reported to the Center has been considered historically significant. Again, grass and wildland fires are localized hazards. The NCEI reports no wildfires in Adams County from 1950 through December 2020.

When asked about the past occurrence of this hazard in the online survey, 23 persons responded. Three responded that this occurs more than once per year, seven indicated it happens most years, seven indicated it happened once or twice in the last five years, and six responded that it has not occurred or they do not recall it occurring.

Grass and Wildland Fire Future Probability:

There is nearly 100% chance that there will be a grass fire in each county in the state each year; however, the chance of a wildfire that requires more than day-to-day capabilities to handle is much less. Based on State Fire Marshal and National Interagency Fire Center, there is a very low probability of significant wildland fires impacting thousands of acres. Adams County planning team members indicate wildland fires are increasingly common, mostly with growth of CRP acres and rural acreages, many of which are in wild areas. The risk is much lower within incorporated communities. For wildfires, Iowa is in “Ag Land” and Model R. These are both “light fuel” according to the US Forestry Service. No specific information for the state on critical fire days was found. Based on climate information obtained, it would be suggested that 2 to 7 days per year would be a good level for southern Iowa. In 2 to 7 days/year fire weather frequency and light fuel, the state has a moderate hazard, no matter the slope of the area surveyed. Only in the more densely forested areas with steeper than 40% slopes are the hazard high in Iowa. All participating jurisdictions except the Southwest Valley Schools and CHI Health Mercy Hospital campus can be affected by wildfire starting or invading the jurisdiction’s property. The two jurisdictions above are separated from wildland areas by roads and other development that does not include wildland vegetation.

The overall rating the community gave for this hazard’s future probability in a survey was: “likely” to “highly likely.” When asked about the likelihood that the incidence of this hazard will increase in the future compared to today in the online survey, 23 persons responded. Five indicated it is more likely, 12 indicated no change in

likelihood, three indicated less likely, and three indicated they were unsure or unconcerned.

Score for Rural Adams County: 8	Score for Corning: 3	Score for Nodaway: 2	Score for Prescott: 2
Score for SW Valley Schools: 0	Score for CHI Health: 0		

Grass and Wildland Fire Vulnerability to the Population:

People choosing to live in wildland settings are more vulnerable to wildfires, and the value of exposed property is increasing at a faster rate than the population. This is because the few new homes are being built in forested and wildland areas, where the risk is greatest. Compared to forest fires, grass fires are often more easily contained and extinguished before there is damage to people or developed property, although farms, rural developments, and campgrounds are at risk. Fires often burn large portions of field crops in the fall when the crops are dry and the harvesting equipment overheats or throws sparks. This can be quite costly to the farmer in terms of lost production. Forest fires and cropland fires present a greater threat to firefighters than the general public. While most rural residents are at risk to fire, very few are at risk due to any one event due to the limited size of the fire. Generally, people can escape the fire but property and crops are damaged.

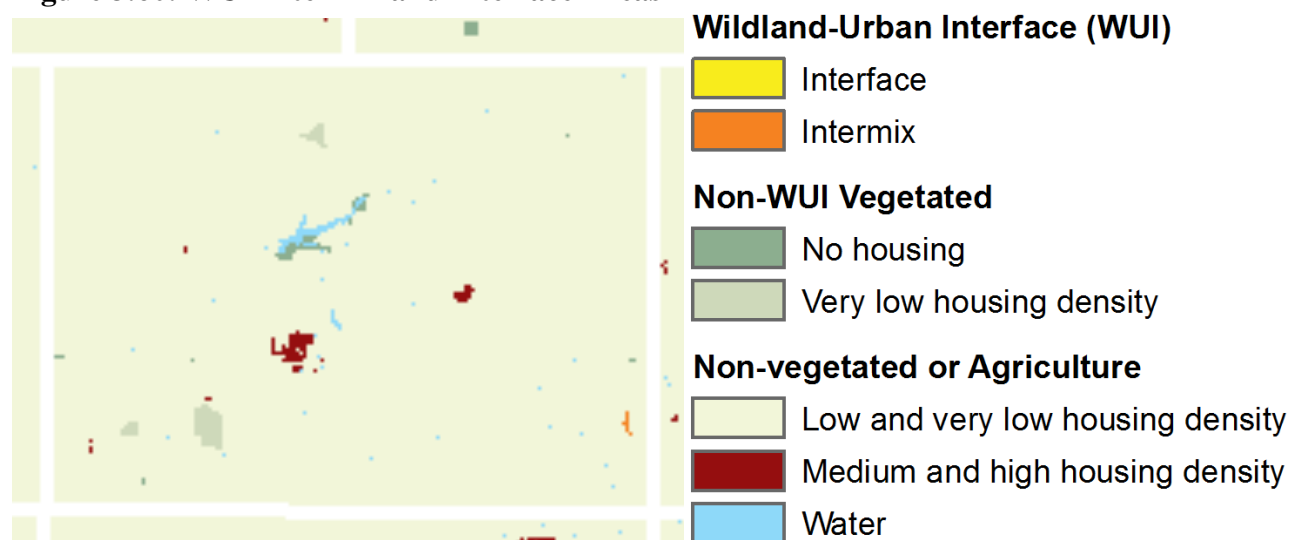
Score for Rural Adams County: 3	Score for Corning: 3	Score for Nodaway: 3	Score for Prescott: 3
Score for SW Valley Schools: 0	Score for CHI Health: 0		

Grass and Wildland Fire Area of Extent:

Iowa is less vulnerable to large-scale wildland fire because of the large percentage of land that is developed. 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. However, larger fires are possible. The extent is dependent upon conditions such as land use/land cover, moisture, and wind. For example, high winds can turn a small flame into a multi-acre grassfire within a matter of minutes or can change fire direction suddenly. Local fires rarely exceed 20 acres but can exceed a few thousand acres in the right locations during dry seasons.

Damaging wildland/grass fires are most likely to occur in the Wildland Urban Interface (WUI). This is the area where houses meet or intermingle with undeveloped wildland vegetation. Within the WUI, there are two specific areas identified: 1) interface and 2) intermix. The interface areas are those that abut wildland vegetation and the intermix areas are those areas that intermingle with wildland areas. As can be seen by the following graphic, Adams County has very few areas of WUI intermix and no WUI interface areas. WUI areas impact less than 1% of the area of the county (0.5 square km) and only 0.3% of the county's population.

Figure 3.60: WUI Intermix and Interface Areas



Source : <http://silvis.forest.wisc.edu/data/wui-change/>, 5/10/21

Score for Rural Adams County: 3	Score for Corning: 4	Score for Nodaway: 4	Score for Prescott: 4
Score for SW Valley Schools: 0	Score for CHI Health: 0		

Grass and Wildland Fire Severity of Impact:

Grass and wildfire fire severity is usually related to environmental factors in the area where the fire is occurring. The conditions that may exacerbate or mitigate the effects of wildfires include:

- Climatic conditions (dry air, high wind, and ambient heat worsen situation)
- Topography (steep slopes increase risk)
- Geography—fuels, hazardous materials areas, open construction areas
- Flammable materials on exteriors of structures
- Narrow roadways
- Inadequate hydrants
- Combustible landscaping
- Development on the interface with the wildland area (adjacent to forests and row crops).

The following table shows the relative risks of a typical observed grass and wildland fire that exceeds normal day-to-day response capabilities.

Figure 3.61: Grass and Wildland Fire Severity of Impact Scoring Matrix

Severity Criteria	Discussion	Score
Health and safety of the public	Injuries and deaths from fires and from smoke inhalation are possible. Generally, people can escape the fire area.	3
Health and safety of responders	Injuries and deaths from fighting the fire most often occur by natural causes such as heart attack or stroke. Rapidly advancing fires in windy conditions can overtake a firefighter. Other weather conditions can also exacerbate risks due to exposure. The potential lack of water in rural areas (few hydrants and limited tanker capacity) increases risk in remote areas of the county. The risk is actually quite high for responders, but today's first responders are well trained, mostly well equipped, and have modern PPE.	3
Continuity of operations	Most operations would unlikely be disrupted.	1
Property, facilities, infrastructure	Property damage is usually limited to grass, small trees, etc. Occasionally a house or outbuilding can be damaged or destroyed. Major infrastructure, such as bridges and pipes, are unlikely to be damaged. Power lines, poles, and towers are at risk.	3
Delivery of services	Insignificant impacts for the most part. Fire services can be disrupted if equipment is lost.	2
Environmental impacts	Environmental impacts of grass and wildland fires do not deviate much from the burning of the grasses, crops, or other low land cover. If a building or vehicle is burned, it could release damaging chemicals and gases.	3
Economic/financial conditions	The loss of crops could potentially lead to economic hardships within a community in the event of a widespread fire. Typically, if the farmer has insurance, his losses are limited.	2
Regulatory/contractual obligations	None known, unless water supplies are not available as promised.	2
Reputation	Grass fires occur frequently enough that they usually have little impact on reputation.	1

The overall rating the community gave for this hazard's magnitude in a survey was: "limited."

Score for Rural Adams County: 20	Score for Corning: 20	Score for Nodaway: 20	Score for Prescott: 20
Score for SW Valley Schools: 0	Score for CHI Health: 0		

Grass and Wildland Fire Speed of Onset:

Most fires occur without warning and get out of hand in a hurry, perhaps within a few minutes.

Score for Rural Adams County: 8	Score for Corning: 8	Score for Nodaway: 8	Score for Prescott: 8
Score for SW Valley Schools: 0	Score for CHI Health: 0		

Grass and Wildland Fire Duration of Event:

Grass and wildland fires that are likely in Iowa would not be to the size or magnitude of those in Western states, which can last for days or weeks. Usually, a fire can be extinguished in 6 hours. The rating is a bit shorter for fires within towns served by fire departments because the response is more likely to be quicker.

Score for Rural Adams County: 4	Score for Corning: 3	Score for Nodaway: 3	Score for Prescott: 3
Score for SW Valley Schools: 0	Score for CHI Health: 0		

Grass and Wildland Fire Total Scores:

The following total scores for grass and wildland fire indicate low to moderate risk to the public and the planning area where incidents can occur.

Score for Rural Adams County: 46	Score for Corning: 41	Score for Nodaway: 40	Score for Prescott: 40
Score for SW Valley Schools: 0	Score for CHI Health: 0		

Grass and Wildland Fire Vulnerability/Assets at Risk:

As evidenced by the previous wildland-type fires in the planning area, they have historically been the smaller brush/grass fires that can occur anywhere that has open grassy areas. Most of the assets at risk are located in rural areas. For this assessment, the planning team looks at more than the WUI but also any other rural structures and properties that could be damaged by wildland fire by virtue of location where fires could occur. Note the following table of rural assets that could be at risk.

Figure 3.62: Rural Adams County Grass and Wildland Fire Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	900	\$72,000,000	1,600	93%
Commercial	15	\$3,700,000	40	100%
Industrial	10	\$74,700,000	100	100%
Ag Structures and Land	5,000 buildings; 250,000 acres	\$278,300,000	70	100%
Taxable Infrastructure	8	\$60,000,000	4	80%
Government/Institutional	13	\$140,000,000	65	65%
Totals	5,946	\$628,700,000	1,879	85%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 85% of the assets in the unincorporated part of the county are at risk. The following critical assets listed in Section 3.2 are susceptible:

- All the industries listed
- Corning Hotel
- Corning Winery
- Electric substations
- Feeders Gain and Supply
- Houck Supply
- Lakes Binder and Icaria (parkland)
- Nutrient Crop Services
- The solar farm
- Various confinement facilities
- Wind towers

The fringes of the town of Corning are also at risk. The following structures and properties are included.

Figure 3.63: Corning Grass and Wildland Fire Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	50	\$4,000,000	100	7%
Commercial	2	\$600,000	20	7%
Industrial	0	\$0	0	0%
Ag Structures and Land	3 buildings; 25 acres	\$134,000	5	100%
Taxable Infrastructure	2	\$250,000	2	20%
Government/Institutional	4	\$8,000,000	50	12%

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Totals	61	\$12,984,000	177	7%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 7% of the assets in Corning are at risk. The following critical assets listed in Section 3.2 are susceptible:

- Adams County Speedway and Fairgrounds
- BNSF Railway
- Corning Airport
- School bus barn
- Southern Hills Veterinary Care

The fringes of the town of Nodaway are also at risk. The following structures and properties are included.

Figure 3.64: Nodaway Grass and Wildland Fire Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	31	\$1,000,000	55	50%
Commercial	1	\$300,000	25	50%
Industrial	0	\$0	0	--
Ag Structures and Land	2 buildings; 79 acres	\$192,000	2	100%
Taxable Infrastructure	2	\$225,000	1	50%
Government/Institutional	1	\$500,000	2	33%
Totals	37	\$2,217,000	85	50%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is estimated that about 50% of the assets in Nodaway are at risk. The following critical assets listed in Section 3.2 are susceptible:

- BNSF Railway/AMTRAK
- Nodaway Elevator

The fringes of the town of Woodburn are also at risk. The following structures and properties are included.

Figure 3.65: Prescott Grass and Wildland Fire Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	20	\$750,000	40	18%
Commercial	1	\$50,000	15	35%
Industrial	0	\$0	0	--
Ag Structures and Land	1 building; 24 acres	\$225,000	1	100%
Taxable Infrastructure	1	\$500,000	2	35%
Government/Institutional	1	\$500,000	1	10%
Totals	24	\$2,025,000	59	18%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 18% of the assets in Prescott are at risk. None of the critical assets listed in Section 3.2 are susceptible because they are located in the developed part of the city and would very unlikely be impacted by a wildfire on the scale likely to be experienced in this area, except the BNSF Railway.

Grass and Wildland Fire Loss Estimation:

Wildfires can be responsible for extensive damage to crops, the environment, and occasionally residential and business facilities. Homes built in rural areas, and particularly in the WUI Interface are most vulnerable, especially where construction is occurring, on hilly land, or if the property owner burns trash and other debris.

The vulnerability is exacerbated by the lack of hydrants in those areas and the distance from which fire departments housed in towns must respond.

For the purpose of loss estimation, it is believed that most of the grass and wildland fire loss in Adams County is to cropland. Buildings and vehicles (usually farm implements) are also vulnerable but most of the time they are not involved, partly due to the low density of development. In the typical wildland fire, 50 acres will be burned, impacting \$10,000 in crops. On average perhaps \$5,000 in structural loss will be experienced. Per the USDA’s crop insurance claim report, no claims have been made for wildland fire loss in the four-year period of 2017-2020.

Injuries and fatalities to civilians and firefighters are certainly possible, although not common. In fact, the planning team estimates a very small probability of either injuries (10%) or fatalities (less than 1%) per incident.

Economic losses can be severe, depending on the size and location of the wildland fire. Most often it will be localized to a few fields, where crops and outbuildings will be lost. If the fire impacts a traveled road, it can result in detours that can be economically costly for businesses and farmers in that area.

The costs to area fire departments to respond to a fire are small compared to some hazard losses, but since most departments are underfunded, a very large fire (by Iowa standards) can drain resources quickly.

Future Development and Grass and Wildland Fire:

Future development in the wildland-urban interface/intermix areas would increase vulnerability. Such development is likely on a very small scale involving a few structures each year in the rural part of the county.

Hazardous Materials Incident Profile

Type: Technological

Definition: An 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.

Hazardous Materials Description:

This profile includes the following hazards from the previous version of the Adams County plan: fixed hazardous materials incident, pipeline transportation incident, and transportation hazardous materials incident.

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 ever increasing types and quantities. As many as 500,000 products pose physical or health hazards and can be defined as “hazardous chemicals.” Each year, over 1,000 new synthetic chemicals are introduced. Under the Emergency Planning and Right to Know Act of 1986, the US Department of Transportation (USDOT) identified 308 specific hazardous chemicals from 20 chemical categories. USEPA sorts hazardous materials (HAZMAT) into the numerous categories as well.

Fixed hazardous materials incidents originate from fixed facilities. This does not mean that all hazardous materials spills originate from regulated facilities that handle them. Most major spills that affect life and property originate from specific materials handling fixed facilities. The following table shows the current EPA regulated facilities by jurisdiction as of April 2020. *This data is official EPA database results and not necessarily the current building occupant.*

Figure 3.66: List of EPA Regulated Hazardous Materials Handlers

Name	Address/Location	Name	Address/Location
Rural County			
Adams County Home	Carbon area	Kosar Creek Farms, Inc.	1218 Sycamore Ave.
Smithy's Tap	Carbon area	Kralik Hog Site	1243 Uban Ave.
Adams and Taylor County Regional Service Agency	RR 1	Lake Icaria	Lake Icaria Rd.
Adams/Taylor County Sanitary Landfill	East half of the NE ¼ of Section 13	Linda Van Eaton	1020 Oak St.
Adams County Conservation Board	1688 Lake Icaria Road	Lone Star Welding & Transmission	2237 Adams-Union Ave.
Adams County Care Facility (FSO)	0.2 miles W. of US 34 and Amp	Luke Kaufman	2361 170 th St.
Adams County Conservation Board	1656 Lake Icaria Road	Marvin Jorgensen	2558 230 th Lane
AgriLand FS, Inc., Prescott	1301 Quince Ave.	Maynes Arnold (Corning)	1759 Brooks Rd.
Alvin Inman	2423 125 th St.	Maynes (Lenox)	2201 Tulip Ave.
AT&T – FSO	2173 265 th St.	Michael and Marnie Cline	1627 Poplar Ave.
Avila Farms	2581 Highway 148	Mt. Etna Quarry	1273 Juniper Ave.
Blacktop Service Co. – Corning	1290 Juniper Ave.	Muschamp	2581 Highway 148
Blake/Randy Cooper	1625 Quince Ave.	National By-Products	1915 183 rd Street
Blue Horizon Stock Farm	2144 160 th St.	Natural Nutrients USA LLC	Industrial Drive
Brown Bear Corp.	2248 Avenue of Industries	New Fashion Pork, LLP	1913 Aspen Ave.
Brown Bear Corp.	602 Avenue of Industries	Nodaway City of (SIRWA) STP	0.3 miles west of Intersection of 2 nd St. and 11 th Ave.
Brown Bear Corp.	Rte 1, Lenox	Nodaway Feedlot North	Birch Avenue
Cactus Family Farms – NWG Fini	2400 Mulberry Ave.	Nodaway Feedlot South	Birch Avenue
Cactus Family Farms – Corning	2047 265 th St.	Norvell Huck	1597 165 th St.
Cactus Family Farms – Prescott	2450 195 th St.	Olive Finisher – Berrytown Farm	270 th St.
Corning, IA 474/Crop Production Services/DeBruce Ag Service, Inc.	1823 Brooks Rd.	Open Field	Highway 34 & Redwood Ave.
Countryside Products-Corning	1960 State Highway 148	Peterson Farm Trucking	2731 Mulberry Ave.
Crestland Coop	RR 4	Poet Biorefining – Corning	1680 Brooks Rd.
Crossroads Finisher	140 th Street	Precision, Inc.	1102 Avenue of Industries
Curt Pearson	2153 125 th St.	Precision Pulley & Idler – Corning (Division #2)	1101 Avenue of Industries
Defender Co.	RR 1	Precision Pulley & Idler Inc. Corning Plants	701 Avenue of Industries
Don Hogan Farms	2305 Mulberry Ave.	Precision Pulley & Idler Corning 1	2251 Avenue of Industries
Doug James	7 N. on N-61	Precision Pulley & Idler Corning 2	2269 Avenue of Industries
Dougherty Farms, Inc. (Corning)	2159 240 th St.	Premium Plant Services	1680 Brooks Rd.
Echco Concrete LLC – Corning-Port Plant #1	1824 Brooks Ave.	Prescott City of STP	Just outside of Prescott
Environmental Recycling Company	Ginko Ave. & RR Street	Road ditch	½ mile south of 140 th St.
Fairview Church of Christ	Jerico Ave.	Road surface	Brooks Road, 1 mi. S. of Highway 34
Farm Service Cooperative-Corning	1964 Highway 148	Roscoe Brown Farm Bldg.	County Rd., Lenox
Feeders Grain & Supply	2052 Hunter Trail	Russell Farms, Inc. (Prescott)	1823 Quince Ave.
Feeders Grain & Supply	2060 Hunter Trail	SCCI-Corning Quarry	2299 Quarry Rd.
Feeders Grain & Supply	2306 Mulberry St.	Schildberg Construction (Corning Quarry)	2295 Quarry Rd.
Fred Boswell	1307 Highway 148	Schrader Farm	1011 Pear Ave.
Gaesser Farms (Corning)	2507 Quince Ave.	SGE-Double D Finisher	Poplar Avenue
Gary West	2962 200 th St.	Signal Energy Constructors	2363 Adams-Taylor Rd.
Hogan Farms	2229 US Highway 34	SIRWA-Corning/Brooks	2350 Ginko Ave.
Houck Ray	1671 Filbert Ave.	Standard Register	Avenue of Industries
IDOT Maint. Garage	2011 State Highway 148	Standley's Ridge View Farm	3140 210 th St.
Iowa DNR	1551 Locust Ave.	Steve Kerns – Butler/Barker	Redwood Ave. south of 250 th
Iowa DOT	Highway 148, 1 mile north of Corning	Stringtown Country Café	2906 US Highway 34
Iowa Nutrients Plant	Avenue of Industries	Sunrise Pork – Prescott Site	2813 170 th St.
ISO Finisher	240 th St.	Timber Ridge – Luke Kaufman	2860 190 th St.

Name	Address/Location	Name	Address/Location
J. F. Edwards Construction Co.	2363 Adams-Taylor Rd.	Timmerman, Lyle DBA Southwest Flying	RR 1, Nodaway
Jeff Yearington	1415 175 th St.	Travis Gilbert & Sons, Inc.	South 148/Box 148
Jerry Peckham	Rte. 4 Box 43	Tyler Edwards	2409 150 th St.
Joe Maynes Jr.	2970 250 th St.	United Farmers Mercantile Coop Corning Bulk Fuel	1964 State Highway 148
Joyce Haley	1308 235 th St.	Van Eaton Pork	3369 Delta Ave.
Judy Loonan	1724 Holly Road	Walter Feedlots	2898 110 th St.
Kevin Pottorff	1701 East St.		
Corning			
Adams County Cooperative Electric Co.	North Grove Ave.	Corning Tire and Exhaust	301 Quincy Ave.
Adams County Courthouse	500 9 th St.	Curtis Animal Health Products	605 8 th St.
Adams County Shop	5 th and Benton	Downeys DX	900 Quincy Ave.
American Concrete Products	301 Davis Ave.	Feeders Grain & Supply	Highway 148 & 4 th St.
Anderson & Miller Oil Co.	6 th and Benton	Ferrellgas	403 7 th St.
Antisdel Property	402 ½ 6 th St.	Former Creamery	817 Benton
Bauers Texaco Service	601 Adams St. Lot #291	Former DX Service Station & Bulk Storage	6 th & Quinicy
Casey's General Store 1653	204 6 th St.	Mercy Hospital	502 Adams
Central Telephone Company	403 7 th St.	Mercy Hospital Corning	603 Rosary Drive
City of Corning	510 Benton Ave.	Pioneer	800 Nodaway St.
City of Corning	200 15 th St.	Safety-Kleen Household Hazardous Waste	1200 John St.
Colonial Manor	Northgate Drive	Southern Hills Veterinary Services	1902 Quincy Ave.
Corning City of STP	.25 miles SE of Loomis Avenue & 4 th St. intersection	Southwest Valley High School	904 8 th St.
Corning CSD Barn	10 th & John Street	UAP Distributions, Inc. #16006	1701 Quincy St.
Corning Mini-Mart	801 Hull St.	UFC Mart	408 5 th St.
Corning Muni Water Dept.	501 Benton Ave.	United Farmers Mercantile Cooper – Corning Stanton	306 6 th St.
Corning Municipal Airport	1906 210 th St.	Wirecraft Iowa Warehouse	800 Nodaway St.
Corning Municipal Utilities Water Treatment Plant	NE corner of city		
Nodaway			
Bob's Service	300 6 th Ave.	Nodaway Elevator	904 4 th St.
Prescott			
Clifford Freshour	405 8 th Ave.	Crestland Coop	Depot Street
Prescott Comm. School District	813 First St.		

Source: EPA EnviroMapper Website, https://iaspub.epa.gov/enviro/fii_map_master.fii_retrieve#TopMap, 5/10/2021; FSO – former site of

Each year, thousands of hazardous materials are transported across the county via semi-truck, aircraft, and trains. Hazardous substances are categorized as toxic, corrosive, flammable, irritant, or explosive. Hazardous materials incidents generally affect a localized area, and the use of planning and zoning can minimize the area of impact. *The scope of this update did not include obtaining data about the types and quantities of hazardous materials transported through the county. Such data should be gathered and included in the next plan update.*

Under the Emergency Planning and Right to Know Act of 1986, the US Department of Transportation (USDOT) identified as hazardous 308 specific chemicals from 20 chemical categories. The 1986 Act requires that companies report releases of designated hazardous chemicals to USEPA, even if releases do not result in human exposure. Hence, hazardous materials are greatly regulated, but the sheer volume of data involved can overwhelm local authorities. To identify the extent of the hazard in a particular community, planning personnel and others must determine what types of HAZMAT are stored, handled, processed, or transported and where and how those functions are performed. With limited staffing capabilities this is nearly impossible for Adams County.

The issue is complicated because some incidents may be the result of failure to close valves on the vehicles, resulting in unnoticed releases that are not tied to a reportable event. At other times, events may not be reported if there are no witnesses besides the driver, pilot, or engineer.

Natural hazards may cause transportation HAZMAT events. Heavy rainfall and winter storms can cause slippery road conditions resulting in highway carrier accidents. Floods, lightning, fires, and severe winter storms cause pipelines to fail. High-wind conditions cause traffic accidents. High velocities and volumes of floodwaters wash out bridges and roads and flood hazardous waste sites.

Iowa is served by many high-pressure pipelines for residential and industrial uses. An underground pipeline incident can be caused by environmental disruption, accidental damage, or sabotage. Incidents can range from a small slow leak that is not ignited to a large rupture in which the gas is ignited. Inspection and maintenance of the pipeline system along with marked gas line locations and an early warning and response procedure can lessen the risk of those in close proximity to the pipelines. Pipeline transportation facilities are mapped in Chapter 2. Pipelines cross portions of rural areas and access Corning and Prescott, where natural gas is used for heating and other household and business needs.

Hazardous Materials Incident Historical Occurrence:

A high impact occurrence is one defined as an environmental emergency by the Environmental Protection Agency. An environmental emergency is a sudden threat to the public health or the well-being of the environment, arising from the release or potential release of oil, radioactive materials or hazardous chemicals into the air, land, or water. Locally there have been very few incidences that would meet this definition. Nonetheless, releases do occur and do impact the planning area. According to the Iowa DNR Hazardous Spill Reporting System (<https://programs.iowadnr.gov/hazardousspills/Introductory.aspx#&&SearchResult=1>), there have been two reported spills in Adams County from 2016 through 2020 (in 2019 and 2020 specifically). The nature of the hazard events (fixed or transportation) was not provided, but Corning is listed as the location for most of the spills over time, although some could be located in rural areas with a Corning address.

According to the planning team, almost all fixed facilities incidents have occurred within or near Corning, and many of these in industrial areas. Most past events have been contained and cleaned within local response capabilities in most cases. The ratio of fixed versus transportation incidents is not known, but both occurred. A pipeline failure approximately 2010 near Prescott resulted in the loss of natural gas in the winter to 2,000 households in Adams and Taylor Counties. The planning team reported leaks in pipelines near Prescott and Nodaway. The planning team reported no events or incidents in the past few years. No major events causing loss of life have been discussed. No events in recent years have resulted in widespread mandatory evacuations. The most common types of substances have been agricultural materials, including stolen anhydrous ammonia, and petroleum. Local gas stations, agricultural facilities, and manufacturing plants are common sites, as well as rural highways.

Incidents have not been reported in Nodaway, at the school, or at the hospital but can happen. Incidents in the past few years include transported chemicals, such as ammonia, liquid chlorine, and propane, and mobile methamphetamine labs (2 or 3 events).

Natural gas service is used in homes and businesses for heat and manufacturing processes in parts of rural Adams County and all of Corning and Prescott. Pipeline transportation incidents of a small scale, with no injuries or major losses, have occurred in the rural area and Prescott. These have been limited to Prescott and rural areas, where only a portion of the population and properties were affected temporarily with the loss of natural gas.

When asked about the past occurrence of this hazard in the online survey, 23 persons responded. No one indicated it happened once or twice in the last five years, one responded that it has occurred once per year on average, two stated that it is rare, and 20 responded they did not know or could not recall an incidence.

Hazardous Materials Incident Future Probability:

Combined, fixed and transportation hazardous materials incidents and pipeline transportation incidents are somewhat common. However, the percentage of significant or serious incidents that are beyond local capabilities or that threaten life or significant property is relatively low. However, because of the railroad and US highway 34, and heavy manufacturing, including the ethanol plant, facilities, this is an important hazard for the county to consider. The manufacture and transportation of ethanol is a concern for the planning team, as well as transportation of spent nuclear waste (see radiological incident profile) by the railroad.

Fixed HAZMAT events from Tier II sites are possible in or affecting all jurisdictions. There are nearly 150 sites in Adams County that, because of the volume or toxicity of the materials on site, are designated as Tier II facilities under the Superfund Amendments and Reauthorization Act. Despite increasing safeguards, more and more potentially hazardous materials are being used in commercial, agricultural, and domestic activities. While protection methods are improving, the probability is likely to increase over time in some jurisdictions. Adams County has numerous agricultural and energy facilities, including bulk plants, LP tanks, and anhydrous ammonia tanks. Fuel leaks can happen in most or all jurisdictions, whether or not they are Tier II facilities. Several manufacturers in rural Adams County also handle large quantities of hazardous materials.

Transportation incidents that are of a major threat are limited to the US 34, the BNSF Railway, Iowa Highway 148, and paved county highways. The probability varies by jurisdiction; however, the probability is low in all jurisdictions of a significant event requiring extended road closures, large fires, evacuations, and/or full mobilization of outside response capabilities.

Pipelines are found in the county but are very well monitored. Petroleum and natural gas pipeline accidents occur with some regularity, but they usually have a limited impact and are quickly and adequately handled by pipeline company emergency crews and local and state responders. Pipeline operators are required to coordinate all safety preparedness and response activities with the communities. Planning, training, and exercising of emergency procedures with all involved parties help to limit the occurrence and severity of incidents. This risk is mainly limited to Corning, Prescott, and parts of the rural county where pipelines travel. In Adams County, as pipeline use continues to increase and more homes are put on natural gas, the probability of incidents will increase.

Current planning is significant to address future probability. Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986 requires that each community establish a Local Emergency Planning Committee (LEPC) to be responsible for developing an emergency plan for preparing for and responding to chemical emergencies in that community. The plan is reviewed by the State Emergency Response Commission (SERC) and publicized throughout the community. It must include the following:

- An identification of local facilities and transportation routes where hazardous materials are present;
- The procedures for immediate response to an incident (including a community-wide evacuation plan);
- A plan for notifying the community that an incident has occurred;
- The names of response coordinators at local facilities;
- A plan for conducting exercises to test the plan.

Adams County is generally current with LEPC planning and has the correct policies and trained personnel in place.

Overall, the chance of an incident that threatens life and property is greatest in the Corning and along Highway 34 west of Corning but is low overall. The following is the probability for an incident that requires response beyond local resources is a direct risk to the public or critical environmental resources, such as streams and waterways.

When asked about the likelihood that the incidence of this hazard will increase in the future compared to today in the online survey, 23 persons responded. One indicated it is more likely, five indicated no change in likelihood, five indicated less likely, and 12 indicated they were unsure or unconcerned.

Score for Rural Adams County: 6	Score for Corning: 3	Score for Nodaway: 2	Score for Prescott: 2
Score for SW Valley Schools: 2	Score for CHI Health: 2		

Hazardous Materials Incident Vulnerability to the Population:

HAZMAT releases pose short- and long-term toxological threats to humans and to terrestrial and aquatic plants and wildlife. Toxic materials affect people through one of three processes: a) inhalation, b) ingestion, and c) skin contact. People, pets, livestock, and vegetation in close proximity to facilities and transportation corridors 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, a larger area may be in danger from explosion, absorption, injection, ingestion, or inhalation. Occupants of areas previously contaminated by a persistent material may also be harmed either directly or through consumption of contaminated food and water.

Tier II Fixed Facilities are required to have an off-site consequence plan that addresses the population of the surrounding area. Responding personnel are required to be trained to HAZMAT Operations Level to respond to the scene, and those personnel that come into direct contact with the substances released are required to have HAZMAT Technician level training. However, for fixed HAZMAT purposes, risk is most pronounced at reporting facilities, even though they can occur at any “fixed” site. People work in facilities that house chemicals. For the purpose of this plan, for simplicity, direct impacts will occur within a 1,000-foot radius of a facility.

Transportation incidents like train derailments, semi-truck spills, and agricultural implement spills are common and can occur where people are located. These are more difficult to regulate, contain, and cleanup because most of the spills occur outdoors and many times they occur in adverse weather conditions such as high winds and snowstorms. Using a 1,000-foot buffer on paved highways, some areas are populated and some roads have considerable traffic. Some jurisdictions are greatly impacted; others will only see a small part of the population at risk. Through evacuations and sheltering in place, most people are not likely to be directly harmed if warned before the substance(s) reach them. People within critical assets are not likely to be widely affected.

People and property with pipelines on their land or nearby are the most at risk. People excavating earth near a pipeline are also at risk. Whether the greater hazard is posed to those upwind or downwind from a site depends on the product spilled, for example - natural gas is lighter than air. Private homes and business served by natural gas have smaller diameter pipelines connected to their structure. The underground pipelines cross public streets, roads, highways, and streams. Iowa’s natural environment is also vulnerable to contamination from an underground pipeline incident. People can suffer from the loss of gas service to their homes. The greatest potential impact as a percentage of population is the cities that have full gas service, which are Corning, Southwest Valley Schools, Prescott, and the hospital. It can take days for personnel to go to each house and re-pressurize and re-light facilities for each building. Manufacturers would have to use other fuels to continue operating. Buildings like the schools and hospital use other heating that does not require much pipeline capacity.

The following assessment of the vulnerable population reflects the combined risk of any one event for any one of these forms of hazardous materials.

Score for Rural Adams County: 4	Score for Corning: 5	Score for Nodaway: 4	Score for Prescott: 4
Score for SW Valley Schools: 6	Score for CHI Health: 6		

Hazardous Materials Incident Area of Extent:

Most of the hazardous materials incidents are localized and are quickly contained or stabilized by the highly trained fire departments and hazardous materials teams. To identify the extent of the hazard in a particular community, planning personnel must determine: a) what types of HAZMAT are stored, handled, processed, or transported, and b) where and how those functions are performed. Depending on the characteristic of the hazardous material or the volume of product involved, the affected area can be as small as a room in a building or as large as 5 square miles or more. Many times, additional people outside the immediately affected area are evacuated for precautionary reasons. More widespread effects occur when the product contaminates the municipal water supply or water system such as a river, lake, or aquifer. For direct impact, the planning committee assumes a 1,000-foot radius of the fixed facility, transportation corridor, or major pipeline. Of course, the percent of area of extent will vary by jurisdiction.

Identification and caution signs are posted wherever pipelines pass under roads, streams, fence lines, or at any aboveground utilities. Despite warnings, people excavating earth near a pipeline are at high risk. Because chemicals and gases vary in how they react when a pipeline is severed, people and property with pipelines on their land or nearby are the most at risk. Since pipelines are most common in populated areas, in order to serve residential and industrial needs, the extent could be very high. Private homes and business served by natural gas have smaller diameter pipelines connected to their structure and the threat of failure in terms of explosion risk is low. Underground pipelines cross public streets, roads, highways, and streams. Iowa's natural environment is also vulnerable to contamination from an underground pipeline incident. People can suffer from the loss of gas service to their homes. Corning has full gas service, so an outage could affect 90% of properties. However, these impacts, in most cases are an inconvenience at best. In the winter, during severe cold, a modest percentage of residents without gas due to the outage could be harmed. Pipelines have automatic shutoff valves installed so that damaged sections can be isolated and the volume of product escaping can be limited.

Score for Rural Adams County: 4	Score for Corning: 5	Score for Nodaway: 5	Score for Prescott: 5
Score for SW Valley Schools: 6	Score for CHI Health: 6		

Hazardous Materials Incident Severity of Impact:

Severity of hazardous materials incidents is difficult to assess. The root cause of the incident can exacerbate conditions. Natural hazards, for example, can cause HAZMAT releases. When a HAZMAT event occurs during a natural disaster, access to facilities may be restricted, water lines for fire suppression may be broken, and response resources (equipment and personnel) may be limited.

The following provides a summary of the severity of impact throughout the county for a major or "environmental emergency" HAZMAT incident resulting from a natural hazard event. This summary is based on a scenario. Keep in mind the magnitude or severity will be greatly impacted by the chemical or gas involved, location, quantity, and capabilities to respond, in addition to the circumstances surrounding the incident (weather, time of day, etc.). Enforcing and/or facilitating either a shelter in place protocol or full evacuation of an area also can hinder response greatly.

Figure 3.67: Hazardous Materials Incident Severity of Impact Scoring Matrix

Severity Criteria	Discussion	Score
Health and safety of the public	The release of some toxic gases may cause immediate death, disablement, or sickness if absorbed through the skin, injected, ingested, or inhaled. Some chemicals may cause painful and damaging burns to skin if they come in direct contact with your body. Within fixed facilities and in close proximity of outdoor incidents the risks are very high. People evacuating an area are exposed to natural hazards. With pipeline failures, particularly, an explosion risk is high, which could instantly kill multiple people.	3
Health and safety of responders	Specialized training is needed to respond to these types of incidents. If inadequately trained personnel attempt to respond, the impacts could be the same as those for the general public exposed to the toxic materials. Proper training and equipment greatly reduce the risk to responders. Responders would also be exposed to any natural hazards that caused the incident. There are a limited number of trained people. The effort to locate and fix a ruptured pipeline or other source of a leak offers additional great risk to responders.	4
Continuity of operations	None directly unless the incident occurs on or near critical facilities or services (which includes pipelines). Road closures and evacuations can also stall operations. Response agencies may lose equipment and members could be injured or sick and unable to respond. Proper decontamination may be needed before the facilities go back in service.	3
Property, facilities, infrastructure	Physical damage is usually limited to the immediate property involved. Proper decontamination is needed before the facilities go back in service. Fire and the decontamination process can damage buildings as much or more than the original hazardous material. Pipeline infrastructure can suffer from extensive damage.	3
Delivery of services	Contaminated water resources may be unsafe and unusable for days or longer. Other services can be delayed due to road closures, evacuations, and the cleanup process. Petroleum products may not be delivered or will be delivered in limited quantity.	2
Environmental impacts	Contamination of air, ground, or water may harm fish, wildlife, livestock, and crops. The release of hazardous materials into the environment may cause debilitation, disease, or birth defects over many years. The costs and time involved in cleanup can be months or even years and involve millions of dollars. Pipeline failures can cause the rapid and sudden erosion and contamination of soil.	4
Economic/financial conditions	Loss of livestock and crops, industrial fires and shutdowns, and evacuations may lead to economic hardships within the community. The time required for cleanup and decontamination can ruin a small business and cause hardship for those in the area. Insurance rates and costs may also increase.	3
Regulatory/contractual obligations	None directly, but EPA and related environmental violations can cause regulatory ramifications to the jurisdiction. Affected businesses and organizations may not meet demand from customers.	2
Reputation	Safe and timely response will greatly limit any damage to the jurisdiction's reputation. Proper warning and public information before, during, and after the incident can also limit reputation damage.	2

Score for Rural Adams County: 26	Score for Corning: 26	Score for Nodaway: 26	Score for Prescott: 26
Score for SW Valley Schools: 26	Score for CHI Health: 26		

Hazardous Materials Incident Speed of Onset:

Most of the various kinds of incidents are unplanned accidents due to weather damage, human error, mechanical failure, and the like. The incident can be immediate and, although not common, severe from the start. There may be no warning that an incident is about to occur. Even if reported immediately, people in the area of the release have very little time to be warned and evacuated. During some events, sheltering in-place is the best alternative to evacuation because the material has already affected the area and there is no time to evacuate safely. Public address systems, television, radio, reverse E911, and the NOAA Weather Radios are used to disseminate emergency messages about hazardous materials incidents.

Score for Rural Adams County: 9	Score for Corning: 9	Score for Nodaway: 9	Score for Prescott: 9
Score for SW Valley Schools: 9	Score for CHI Health: 9		

Hazardous Materials Incident Duration of Event:

The incident duration can vary greatly by the type of chemical or gas released, ambient conditions (wind, weather, darkness, etc.), how long it has been released, and the capacity of the local response team(s) to respond adequately in containing the hazard. If you include the process of cleanup so that the public can again enter the area, the duration could be hours to a day or more. The process of evacuations can delay containment.

Score for Rural Adams County: 5	Score for Corning: 5	Score for Nodaway: 5	Score for Prescott: 5
Score for SW Valley Schools: 5	Score for CHI Health: 5		

Hazardous Materials Incident Total Scores:

The following total scores for hazardous materials incidents indicate moderate to high risk to the public and the planning area where incidents can occur.

Score for Rural Adams County: 54	Score for Corning: 53	Score for Nodaway: 51	Score for Prescott: 51
Score for SW Valley Schools: 54	Score for CHI Health: 54		

Hazardous Materials Incident Vulnerability/Assets at Risk:

Generally, past hazardous materials incidents were very localized and usually had no effect beyond the immediate area. Nonetheless, government agencies regulate the areas where impact can occur in relation to a fixed facility based on the types of chemicals involved. However, based on past experience and likely future incidents where evacuations or sheltering in place may be needed, the planning team uses a 1,000-foot buffer around fixed facilities and main transportation routes (highways and railroads), as well as main pipelines. Note the following table of rural assets that could be at risk.

Figure 3.68: Rural Adams County Hazardous Materials Incident Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	200	\$16,000,000	400	20%
Commercial	14	\$3,500,000	37	93%
Industrial	10	\$74,700,000	100	100%
Ag Structures and Land	100 buildings; 10,000 acres	\$10,000,000	5	3%
Taxable Infrastructure	7	\$60,000,000	5	80%
Government/Institutional	15	\$175,000,000	95	80%
Totals	346	\$339,200,000	642	33%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 33% of the assets in the unincorporated part of the county are at risk. The following critical assets listed in Section 3.2 are susceptible:

- All the industries listed
- Corning Hotel
- Corning Winery
- Electric substations
- Feeders Gain and Supply
- Houck Supply
- Kinder Morgan Pipeline
- Nutrien Crop Services
- The solar farm
- Various confinement facilities
- Wind towers

Corning is also subject to hazardous materials from a few fixed facilities, a pipeline brings natural gas to the city, and key transportation routes. At least half of the town is within 1,000 feet of a source of hazardous materials.

Figure 3.69: Corning Hazardous Materials Incident Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	600	\$35,000,000	1,100	70%
Commercial	24	\$8,300,000	240	97%
Industrial	1	\$127,000	30	100%
Ag Structures and Land	1 building; 10 acres	\$50,000	0	35%
Taxable Infrastructure	7	\$700,000	7	70%
Government/Institutional	25	\$60,000,000	450	85%
Totals	658	\$104,177,000	1,827	75%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 75% of the assets in Corning are at risk. All of Corning's critical assets identified in Section 3.2 are within 1,000 feet of the major transportation route or a fixed facility. Properties not served by natural gas or that have low-capacity service (individual units, for example) are not included.

Nodaway is also subject to hazardous materials from a few fixed facilities and a county highway that holds truck traffic, mostly agricultural vehicles, so the risk within 1,000 feet covers most of the town of Nodaway. The following structures and properties are included.

Figure 3.70: Nodaway Hazardous Materials Incident Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	40	\$1,300,000	70	65%
Commercial	2	\$550,000	50	100%
Industrial	0	\$0	0	--
Ag Structures and Land	2 buildings; 50 acres	\$150,000	2	75%
Taxable Infrastructure	2	\$450,000	1	100%
Government/Institutional	2	\$1,500,000	4	75%
Totals	48	\$3,950,000	127	75%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is estimated that about 75% of the assets in Nodaway are at risk. All the critical assets listed in Section 3.2 are susceptible, with the exception of the SIRWA assets, which are mostly underground.

Nodaway is also subject to hazardous materials from a few fixed facilities, natural gas pipeline, and a county highway that holds truck traffic, mostly agricultural vehicles, so the risk within 1,000 feet covers most of the town of Prescott. The following structures and properties are included.

Figure 3.71: Prescott Hazardous Materials Incident Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	85	\$3,200,000	185	75%
Commercial	3	\$115,000	40	100%
Industrial	0	\$0	0	--
Ag Structures and Land	1 building; 20 acres	\$215,000	1	95%
Taxable Infrastructure	3	\$1,347,000	5	100%
Government/Institutional	3	\$4,000,000	14	80%
Totals	95	\$8,877,000	245	80%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

It is believed that about 80% of the assets in Prescott are at risk. All critical assets listed in Section 3.2 are susceptible, except the SIRWA facilities, which are mostly underground.

Hazardous Materials Incident Loss Estimation:

The impact of this hazard will likely be localized to the immediate area surrounding the incident, but with the lack of other credible data, the planning team used 1,000 feet from locations where the incident is likely to

occur, which are regulated fixed facilities, major transportation corridors, and major pipelines. The initial concern will be for people, and then for structures and the environment. The current practice is that the spiller is responsible for the cleanup actions and is to contact local responders and then the Iowa DNR and possibly the EPA to ensure that cleanup is done safely and in accordance with federal and state laws.

The losses would reflect the location, type of substance spilled or released, ambient conditions where it occurs, and response capabilities. It is difficult to determine the potential losses to existing development because of the variable nature of a hazardous materials spill. For example, a toxic airborne chemical or gas in a developed area could make dozens of people sick and kill numerous people. A simple spill of 500 gallons of anhydrous on a cornfield might only require modest soil remediation.

In Adams County, most incidents will have minor loss in terms of property, simply because the population density is low. However, in the worst-case scenario, based on past history, a factory could be destroyed by fire, one or more vehicles can be destroyed, and surrounding buildings and properties can catch on fire or suffer damage from chemicals and gases. Typically, up to \$100,000 per occurrence in property loss is expected. Depending on the asset, contents losses could be as high.

Economic/functional use losses could be considerable if an entire factory or neighborhood is cordoned off and people cannot enter or leave the area. A mass evacuation would disrupt many people's lives and make it so they cannot contribute to the economy. Businesses that are not even responsible for the incident can be closed for hours or longer. Economic losses due to a typical incident might exceed \$100,000.

Rarely do hazardous materials incidents cause the loss of life, but injuries and illnesses are not uncommon. It is reasonable to assume that in the most severe cases that can be expected that one or more persons will be killed by an explosion or by exposure to fumes and gases.

According to the Pipeline and Hazardous Materials Safety Administration in the US DOT, the overall average per-gallon response cost for crude oil, gasoline, and other fuels is \$1,270. From January 2016 through December 2020, 4 years, there were two spills in Adams County, according to the Iowa DNR spill reporting system. The reports do not mention the amount of fuel spilled, but we can assume at least ten gallons per incident, meaning that over \$6,000 per year was spent to clean up these spills.

Future Development and Hazardous Materials Incident:

The number and types of hazardous chemicals stored and, even more so, transported through the county is likely to increase substantially. Population and business growth along major transportation corridors increases the vulnerability to transportation hazardous materials incidents. While the county's population is not likely to grow significantly, if at all, any growth is likely to occur in areas where this hazard exists.

Infrastructure Failure Profile

Type: Technological

Definition: An extended interruption, widespread breakdown, or collapse (part or all) of any public or private infrastructure that threatens life and property.

Infrastructure Failure Description:

Infrastructure failure involves numerous types of infrastructure profiled in the previous plan: energy utilities, communications systems, and structural failures and fires. Pipelines, even though they are infrastructure, carrying hazardous materials are profiled under the hazardous materials profile. These types of infrastructure are vital to hazard warning, response, cleanup, and recovery. Improving the conditions of infrastructure, making them stronger to withstand the impact of hazards, and modernizing them all can mitigate hazards and

can improve local quality of life and the economy. This hazard includes an extended interruption, widespread breakdown, or collapse (part or all) of any public or private infrastructure that threatens life and property. Infrastructure failure can result from hazard incidents, overuse, normal age and deterioration, and space weather/solar flares.

The following paragraphs offer a brief description of the types of infrastructure considered.

Communications systems involve personal and emergency systems. 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 communication systems to effectively protect citizens. Business and industry rely heavily on various communication media as well. Mechanical failure, traffic accidents, power failure, line severance, and weather can affect communication systems and disrupt service. Disruptions and failures can range from localized and temporary to widespread and long-term. If switching stations are affected, outage could be more widespread. Key communications systems are shown in the communications map in Chapter 2.

Energy failure is the loss of power and other energy supplies needed for day-to-day human survival. International events could potentially affect supplies of energy-producing products, while local conditions could affect distribution of electricity, petroleum or natural gas. The magnitude and frequency of energy shortages are associated with international markets. Local and state events such as ice storms can disrupt transportation and distribution systems. If disruptions are long lasting, public shelters may need to be activated to provide shelter from either extreme cold or extreme heat. Stockpiles of energy products eliminate short disruptions, but can also increase the level of risk to the safety of people and property in proximity to the storage site. Key power and energy systems and pipelines are shown in applicable maps in Chapter 2.

A road, bridge, or building may collapse due to the failure of the structural components or because the structure was overloaded. Heavy snow may cause a roof of a building to collapse under its weight. High winds can destroy a building. Heavy rains and flooding can undercut and wash out a road or bridge. The age of the structure is sometimes independent of the cause of the failure. 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 volume/quantity of products stored in the structure.

Structural fires present a great 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 firefighting 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. Fire stations and response facilities are mapped in Chapter 2.

Infrastructure Failure Historical Occurrence:

Most widespread infrastructure failure in Adams County has been caused by the combination of weather events and system/facility age, the latter making the infrastructure more vulnerable to weather events.

Local communications failure incidents due to weather conditions, equipment failure, excavation incidents, and traffic accidents have been reported, but outages have usually been resolved in a timely manner. Infrastructure is aging in the county, and minor events have occurred in several, mostly rural, locations. A few ice and windstorms have cut communications lines and systems for hours to days over the past twenty years in

parts of Adams County. Emergency communications have improved with the updating to the new narrow-banding requirements, but Adams County has had very limited resources and is unable to afford major capital upgrades to the emergency communication system. Further, much of the outlying infrastructure is aging, and the increased reliance on cellular phones is a problem when tower equipment fails, which happens from time to time due to various weather events. Rural areas have experienced the most E-911 incidents because of the lack of adequate technology.

All areas of the county have experienced short-term and most areas have experienced long-term electrical failures. Short-term failures are common and may include loss of power to a neighborhood for a few minutes. The 2007 ice storm produced a prolonged power failure, where many rural residents were without electricity for several days and even city residents were without power for hours to a day or more. High wind events and heavy snow have also knocked out electricity for hours to a day or more in various areas of the county. Losses, mostly infrastructure and economic, due to the 2007 ice storm were significant but no figures have been discussed in the planning process. Fortunately, back-up power was available at hospitals and critical care facilities. Due to the age of facilities and high proportion of lines that are above ground, most areas have random short-term outages even in normal weather conditions. Groups like the Southwest Iowa Rural Electric Cooperative are working on line retrofits to prevent the losses such as suffered in the past, totaling in the million so dollars. Gas and other fuel lines that provide energy for the county have also been severed but have been back on-line within a day or two. With no local production capabilities, all power failures have been to facilities in other counties or to power lines and wires as they cross the county.

In the past ten years several rural culverts and bridges failed or were closed due to the threat of failure. In almost all the towns and in the rural area older buildings have collapsed, either slowly over time or suddenly. Most structures are not occupied or are used for storage. Structural failure affects Secondary Roads Department the most due to the large number of aging bridges and culverts in rural Adams County. On several occasions in the past twenty years, other structures (not buildings) have failed. The planning team recognizes a problem in some rural areas and small towns where the population has declined and abandoned buildings have collapsed, mostly with no long-term effects. According to the planning team, many buildings have collapsed due to slow deterioration and neglect, none of them have been a hazard to the general public.

The county suffers from approximately 10 occupied structure fires each year, most of which are quickly extinguished by on-site personnel or local fire departments. A few fires in the past year have required more than the local fire department capacity. Approximately 2-5 structure fires per year in Adams County require assistance from fire departments outside the county via Mutual and Automatic Aid Compacts. All jurisdictions have been affected. Adams and rural Adams County have experienced the most structural fires requiring outside intervention. In the past five years, there have been no known fire-related deaths. Downtown buildings, the committee suggested, have seen many fires. 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. It is believed that larger communities tend to have more fires due to the larger number of structures. There have been 284 deaths in Iowa from fires from 2006 to March of 2013 according to the State Fire Marshall Division. The year 2017 was a record year with structural fire deaths, most of them occurring in rural towns like those found in Adams County.

When asked about the past occurrence of this hazard in the online survey, 23 persons responded. Three people responded that this happens more than once a year, eight indicated it happens most years, eight indicated it happened once or twice in the last five years, and four responded they did not know of any occurrences.

Infrastructure Failure Future Probability:

Although infrastructure failure occurs on a routine basis, events that are life threatening, highly destructive, or otherwise impair the overall economy in the planning area are not as common.

Widespread communications failures are likely to be brief at best due to the extensive redundancy of systems. Local communications failures are likely not to affect large parts of the county. In some places, the infrastructure is adequate and can withstand most hazards, but in other places it is not. Because our society is communications and information oriented, it stands to reason that the probability will increase in failures and the difficulty/expense of storing communications. However, technology and redundancy are improving and should reduce the probability of any given failure to be widespread and prolonged.

The State of Iowa has three strategies to limit the likelihood of an energy shortage: 1) through voluntary and mandatory demand reduction mechanisms; 2) the substitution of alternative energy sources when possible; 3) and state government programs to curtail excessive use, energy supply and demand. The federal government has a strategic petroleum reserve to supplement the fuel supply during energy emergencies. Electrical shortages can be unpredictable with immediate effects. Natural events, human destruction, price escalation, and national security energy emergencies can cause unavoidable energy shortages. In the past five to ten years, many large wind turbines (nearly 100) have been installed in the county. These provide power, but the power is transported to other regions and is not used locally to meet local needs. In an emergency, it is possible that these turbines can provide power to the local grid. Further, most critical assets lack fixed power generators, although more are adding them due to the lessons learned from recent events. Widespread incidents are less likely in the future, but local areas are still at considerable risk.

With the aging structures in the country along with problems with new materials, structural failures will continue to occur. Efforts to inspect and maintain these structures will lessen the probability of a failure but not guarantee that it will not happen in the future. Internal weaknesses can be hidden from inspectors and not be realized until it is too late. In Adams County, old bridges, culverts, homes, and abandoned buildings pose a failure risk. These structures are only getting older, and resources to improve them are lacking.

Much of the fire prevention efforts have gone into nonresidential fires and the results have been highly effective. Even with an increase in the prevention efforts in residential fires, both residential and nonresidential fires will continue to occur. During colder months, clogged chimneys, faulty furnaces and fireplaces, and use of space heaters can increase the probability of structural fires. Fires that impact a wider area or require a regional, state, or federal response are very unlikely, but deaths are possible.

Considering the variety of infrastructure and the fact that infrastructure of one kind or another is found in all parts of the county, the probability of an incident with negative consequences (economic loss, health implications, etc.) to the community is high, mostly due to fires. When asked about the likelihood that the incidence of this hazard will increase in the future compared to today in the online survey, 23 persons responded. Six indicated it is more likely, ten indicated no change in likelihood, three indicated less likely, and four indicated they were unsure or unconcerned.

Score for Rural Adams County: 8	Score for Corning: 5	Score for Nodaway: 4	Score for Prescott: 4
Score for SW Valley Schools: 3	Score for CHI Health: 3		

Infrastructure Failure Vulnerability to the Population:

Much of the county's population could be impacted for up to 2 days, mostly indirectly, but with so many means to communicate today, the real impact is negligible in terms of human life. Phone and data transmission could be impacted temporarily. Various firms provide communications services, so the loss of one service will be very localized. Should underground fiber systems become damaged, the E911 service as

well as contact with agencies outside the service areas may be impossible. Other avenues of communication such as cellular phones may also be affected. Radio communications would not be adversely affected by fiber loss but could be impacted if repeaters and towers are incapacitated. Rural facilities and assets are uniquely vulnerable in the event of fires and other emergencies. Cell tower damage would make communications with physicians and other responders very difficult. People who cannot afford services or rural residents that have limited reception would be most vulnerable.

Because Iowa is almost entirely dependent on out-of-state resources for energy, Iowans must purchase oil, coal, and natural gas from outside sources. World and regional fuel disruptions are felt in Iowa. It is likely that increasing prices will occur as market mechanisms are used to manage supply disruptions. This will greatly affect the low-income population because of their lower purchasing power. Agricultural, industrial, and transportation sectors are also vulnerable to supply, consumption, and price fluctuations. In Iowa, petroleum represents 97% of transportation fuel. Individual consumers such as commuters are also vulnerable. Many electrical systems are backed up and redundant systems prevail, making long-term vulnerability unlikely. Nursing homes, medical facilities, shelters, and assisted living facilities are especially vulnerable, due to the need to provide care to frail and sick individuals. Fortunately, because of past failures, many residents and public facilities owners have purchased backup power generators, but most people do not yet have access to these. Due to the distances involved, rural electric cooperative (REC) service areas are more vulnerable. The SWIREC is retrofitting lines and poles to reduce future risk, but some areas have not been retrofitted yet.

There are many structures in Adams County that are very old or which may become hazardous in the event of an earthquake, fire, high winds, or other natural events. All bridges are vulnerable to the effects of the elements and the deterioration that results. Increases in the amount and weight of traffic they are expected to support increase their vulnerability to failure. Adams County has many occupied old homes and buildings that can collapse due to age and disrepair. Grain elevator failures can cause widespread damage in some towns. Because some buildings and structures can contain a large number of people, 10% or more of the population can be impacted. Schools and the hospital can be subject to a partial collapse that may directly impact up to half the population on those properties.

Older structures with outdated electrical systems not built to current fire codes are particularly vulnerable to fire. Combustible building materials obviously are more vulnerable than structures constructed of steel or concrete. Structures without early detection devices are more likely to be completely destroyed before containment by response agencies. Structures in areas served by older, smaller, or otherwise inadequate water distribution infrastructure such as water mains and hydrants are also at significant risk. Income and other demographics are also involved, because some people cannot afford home improvements that might prevent fires. The fire death risk for the elderly and children under 5 years of age is more than twice that of the average population. Industrial and business fires could affect hundreds of people due to lost employment. Some public and high-occupancy buildings are not sprinkled due to being built before sprinkling was required. The hospital is even more at risk because it is difficult to move people and expensive equipment if a fire occurs in occupied areas. Flammable chemicals and gases can also exacerbate a fire at the hospital.

The scores below reflect the relative impact on any given area of any one of these infrastructure hazards.

Score for Rural Adams County: 7	Score for Corning: 6	Score for Nodaway: 6	Score for Prescott: 6
Score for SW Valley Schools: 6	Score for CHI Health: 6		

Infrastructure Failure Area of Extent:

Most communications failures would be limited to localized areas. In the event of a widespread communications failure, only portions of the county would likely be impacted. The extremities of the county

are the weakest in terms of reception through wireless devices due to topography. The increasing number of cell towers and improvement of fiber lines is reducing the areas where losses would be notable. Individual events are more likely to cause widespread impact on towns, schools, and the hospital due to their limited geographic area.

The effects of an energy shortage could be felt throughout the state if there is a loss of supply sources. Because the distribution systems are very developed, local shortages can quickly be covered by secondary sources in most cases; therefore, in normal conditions, most outages will be very localized and brief. Failures caused by weather events, however, can tax utility repair crews that must address local and regional damages. Most incidents will damage one power system or substation and impact a small part of the county or city. Smaller towns and individual buildings could see total loss until generators or other sources are provided.

The impacts of the failed structure would be contained to the immediate area and adjacent properties. This could be as small as the house and yard of a fallen chimney, or the area could be relatively extensive if the structure that failed was a multi-story downtown building, a grain elevator, and a tall communication tower. Dam and bridge failures and those involving hazardous materials can impact a wider area. Bridge failures cause transportation delays, crashes, and hazardous materials spills.

With modern training, equipment, fire detection devices, and building regulations and inspections, most fires can be quickly contained and limited to the immediate structure involved. Certain circumstances, such as the involvement of highly combustible materials or high winds, can threaten a larger area. The age and density of a particular neighborhood can also make it more vulnerable to fire from neighboring structures. Flammable chemicals and gases can also exacerbate a fire at the hospital and in industrial facilities.

The scores below reflect the relative impact on any given area of any one of these infrastructure hazards.

Score for Rural Adams County: 5	Score for Corning: 5	Score for Nodaway: 5	Score for Prescott: 5
Score for SW Valley Schools: 6	Score for CHI Health: 6		

Infrastructure Failure Severity of Impact:

The severity of infrastructure failure will be related to the duration, type, and area of effect. It will also depend on the specific system that is affected. The scoring considers the significant or widespread events. The following provides a summary of the severity of impact throughout the county.

Figure 3.72: Infrastructure Failure Severity of Impact Scoring Matrix

Severity Criteria	Discussion	Score
Health and safety of the public	A communications or energy failure would rarely directly result in injuries or fatalities. If 911 systems were to fail due to phone communication disruption, secondary impacts could occur by the inability of citizens to reach responders. Those dependent on energy for survival, such as those on breathing equipment, are at great risk. Personal injury, death, and property damage may occur in a building or structure failure or fire itself or by falling debris from nearby structures. Based on national averages in the 1990s, there is one death for every 119 residential structure fires and one injury for every 22 residential fires. In nonresidential fires, there is one death for every 917 fires and one injury for every 52 fires. From 2006-April 2010, Iowa sustained 167 fire fatalities.	4
Health and safety of responders	If health and safety personnel cannot communicate with other personnel, they are at risk when responding; for example, if a firefighter is in a building and cannot call for assistance. Responders can be electrocuted or response equipment, such as boom trucks, can fail. Structural collapse rescue is a specialized form of rescue and can result in injury or death to responders. Workers in or near the building or structure could be subject to further impacts. In the US, about 100 firefighters die annually while on duty. Typically, responders are at lower risk than the general public because they are properly clothed, trained, and alert when at the scene. Adverse weather conditions, which often cause failures, can put responders at additional risk.	4

Severity Criteria	Discussion	Score
Continuity of operations	Operations can be hindered when service interruptions are prolonged. So many things today depend on reliable communications. Hospitals, shelters, emergency response vehicles and facilities, and other critical facilities would have priority during energy shortages. Most critical assets have backup power, but heating systems may not be powered. Functional purpose of the building would be terminated or suspended until the integrity of the structure could be restored or a new location is found. Responders can be overly taxed and could operate at diminished efficiency for a time.	4
Property, facilities, infrastructure	Communications failures are often the result of infrastructure failures. Critical facilities, such as technical water plants, and infrastructure can fail due to the loss of communications between system components. Depending on the cause of an energy failure, the impact on property, facilities, and infrastructure could be greatly impacted. If there is a regional blackout, it might have no direct impact on local infrastructure. However, if it is caused by a storm, the damage to the infrastructure could be very extensive. Sometimes power outages in one area can cause damage to other facilities, especially if there are no modern and well-maintained surge protections and other measures. Impacts could range from minor disruption to full destruction of the structure.	4
Delivery of services	Service providers can be slowed by the lack of access to communications. Effects of energy failure could range from minor heating and air conditioning disruptions to transportation limitations all the way to civil unrest due to the high demand, low supply, and subsequent high price. Bridge failures and debris in the streets and sidewalks would interrupt normal travel routes.	3
Environmental impacts	Failed communications and energy infrastructure could result in malfunctioning systems and the subsequent unplanned discharge of hazardous materials into the environment. The same is true if a structure fails or burns. Modern structural fires and many structural failures release hazardous substances that could contaminate the air, water, or soil.	3
Economic/financial conditions	Financial losses would be incurred due to the direct damage to electronic equipment and the communication system infrastructure. Today, almost all businesses and industry require extensive and reliable communications and energy. With modern day electronic funds and data transfers, economic and financial losses in the public and private sectors could be enormous. In the event that power is lost due to infrastructure failure, business disruption and increased cost of business would have far-reaching financial implications across many sectors of the economy. When structures fail or experience fire, there would also be a considerable price tag to replace or fix the structure, not to mention the loss of revenue that would occur because the structure could not be used. Cleanup costs could be very high. The incident can also severely damage surrounding businesses through disruption.	4
Regulatory/contractual obligations	Obligations of service providers to customers can be unmet. Failure or fire during construction can be the liability of the contractor or owner. Code development and enforcement can play a significant role in limiting the impact from structural failures and fires.	3
Reputation	Widespread communication failures could moderately harm the reputation of the jurisdiction. Data transmission failure could also affect public trust. If caused by natural disasters, there would be no significant impact unless the response to the power outage was poor. If the structural collapse or fire could have been averted or limited in any way by code enforcement or if response is inadequate, the reputation could suffer from public outcry.	3

Score for Rural Adams County: 32	Score for Corning: 32	Score for Nodaway: 32	Score for Prescott: 32
Score for SW Valley Schools: 32	Score for CHI Health: 32		

Infrastructure Failure Speed of Onset:

The actual failure of any form of infrastructure, building, or other structure or any structural fire would likely occur suddenly with little or no warning. There are several events that could lead up to the failure that have various warning times. Causal hazards can include fire, explosion, overloading of ice and snow, vibration, earthquakes, flooding, high wind, erosion, tornado, flooding, chemical corrosion, subsidence, cyber or other terrorism, and lack of general upkeep. Sometimes structures begin failing long before there is a total collapse, but the planning team is concerned about those that have no warning, because if there is warning, the incident can be prevented or people can be out of the way.

Score for Rural Adams County: 9	Score for Corning: 9	Score for Nodaway: 9	Score for Prescott: 9
Score for SW Valley Schools: 9	Score for CHI Health: 9		

Infrastructure Failure Duration of Event:

The kinds of failures most likely to be hazards are rapid and will not take more than six hours from beginning until stabilization of the remaining members or security of the site is achieved. Structural fires and especially energy failures and communications failures can take a day or more before any meaningful response is provided to those at risk in a rural area such as Adams County.

Score for Rural Adams County: 7	Score for Corning: 7	Score for Nodaway: 7	Score for Prescott: 7
Score for SW Valley Schools: 7	Score for CHI Health: 7		

Infrastructure Failure Total Scores:

The following total scores for infrastructure failure indicate high risk to the public and the planning area where incidents can occur.

Score for Rural Adams County: 63	Score for Corning: 64	Score for Nodaway: 63	Score for Prescott: 63
Score for SW Valley Schools: 63	Score for CHI Health: 63		

Infrastructure Failure Vulnerability/Assets at Risk:

All structures, property, and people in the county, as outlined in Section 3.2, are susceptible to infrastructure failure.

All critical assets in the county, as outlined in Section 3.2, could be impacted by this hazard.

Infrastructure Failure Loss Estimation:

It is very difficult to estimate losses to infrastructure for several reasons: a) it is impossible to know for sure about the loss due to regular wear and use versus damage due to hazard events, b) much of the infrastructure cannot be seen because it is underground, and c) trained specialized people are required in many instances to properly estimate and articulate the real impact of hazard events on a given failure. Typically, when a local official or an insurance agent estimates damages due to a hazard, they consider primarily the physical losses to structures and properties, sometimes including contents but rarely considering more abstract values, such as functional use, economic, or displacement costs. In this way, infrastructure failure is a considerable form of loss in itself but it is also a hazard that can cause other losses.

The purpose of this loss estimation is to consider the further losses caused by the infrastructure failure types outlined in the profile (communications failure, energy failure, structural failure, and structural fire). As can be imagined, the greatest losses will be to infrastructure. Energy and communications failures may result in further losses to those systems. Structural failures and fires can destroy surrounding structures and infrastructure in addition to the initial failure or fire.

The physical losses due to communications failure and energy failure are less likely to affect other physical infrastructure, compared to structural failure and fire. The failure of utilities, towers, stations, cables, pipes and other assets can cascade and cost millions of dollars to fix. Only in some situations will extensive cascading effects occur, such as when lightning strikes a power line, which then damages computers and other equipment in numerous homes and businesses. There are considerable life-threatening issues with all these failures. Communications failures can cause responders not to respond or to respond in a delayed or ineffective manner, thereby increasing risk of death. Similarly, an energy failure can cause emergency equipment to quit working, such as life-preserving oxygen in a home setting, thereby indirectly causing death or sickness. The elderly can suffer when natural gas heat supplies are cut off from homes. Economic and functional use losses are also likely when equipment is not functional and business cannot be conducted. It is very difficult to calculate these losses because they are often secondary or indirect, but the population and duration of the outage are key factors.

Structural failure and fire are somewhat easier to account for losses because they are more tangible and localized. However, it is difficult to differentiate for the purpose of loss estimation the loss to a structure or property caused by another hazard and the cascading loss caused by the infrastructure failure. An attempt is made in this plan. In a given incident, likely only one or two buildings or structures will fail or burn, and the value of buildings ranges from a few thousand dollars to \$10 million or more for the hospital, courthouse, and school buildings. Rarely will a larger building suffer complete failure, so we can estimate something on the range of \$100,000 plus content loss and functional use loss per incident of a magnitude where life can be endangered.

Economic and functional use losses are even more difficult to ascertain. In most cases, these will involve the cost of loss of business, loss of records and contents that are required to conduct business, cost of detours and delays in delivery, and inability for people to report to work. These costs, depending on the type of structure lost, could be very significant, topping a million dollars.

As an aid to loss estimation of this kind of hazard, FEMA has developed standard loss of use estimates in conjunction with their Benefit-Cost Analysis (BCA) methodologies to estimate the cost of lost utilities and infrastructure on a per-person, per-use basis. See the following table.

Figure 3.73: Example Loss of Service Values for Various Types of Infrastructure Failure

Type of 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 – Total economic impact	\$41 per person per day
Loss of road/bridge service – Vehicle delay detour time	\$38.15 per vehicle per hour
Loss of road/bridge service – Vehicle delay mileage	\$0.55 per mile (or current federal mileage rate)

Source: FEMA BCA Reference Guide, June 2009, Appendix C

Future Development and Infrastructure Failure:

Increases in development and population growth increase the demand for utilities and use of infrastructure as well as the level of impacts when the utilities and infrastructure fail. Because growth is projected to be modest, without mitigation measures the future should be similar to today. The introduction of wind turbines to the area adds to the risk of infrastructure and energy failure. New structures will tend to be better built but overall the building stock of the county continues to age.

Pandemic Human Disease Profile

Type: Environmental

Definition: A disease that is prevalent over a whole country, region, continent, or world.

Pandemic Human Disease Description:

Public health action to control infectious diseases in the 21st century is based on the 19th century discovery of microorganisms as the cause of many serious diseases (e.g., cholera and TB). Disease control has resulted from improvements in sanitation and hygiene, the discovery of antibiotics, and the implementation of universal childhood vaccination programs. Scientific and technologic advances have played a major role in each of these areas and are the foundation for today's disease surveillance and control systems. Scientific findings also have contributed to a new understanding of the evolving relation between humans and microbes. As of 2013, a total of 67 infectious diseases were designated as notifiable at the national level. A notifiable disease is one for which regular, frequent, and timely information regarding individual cases is considered necessary for the prevention and control of the disease.

Of special concern are pandemics. Pandemic refers to a microbe that has the ability to spread across the world. The word, ‘pandemic’, means that a particular disease has caused illness in a person on nearly every continent. Many diseases throughout the history of the world have been pandemic. Examples are HIV/AIDS, influenza, and of course, COVID-19. A pandemic will have widespread economic and societal implications for our state. Response and recovery to a pandemic will likely be lengthy.

More information on human disease incidents and pandemics, as well as impact maps, can be found at the websites of the following organizations, Iowa Dept. of Public Health (<https://idph.iowa.gov/>), Centers for Disease Control and Prevention (www.cdc.gov), and World Health Organization (www.who.int).

Pandemic Human Disease Historical Occurrence:

The Iowa Department of Public Health tracks epidemiological statistics in Iowa. Their data indicate no major incidents of diseases that have high percentages of loss of life or severe illness in the last 25 years.

Minor outbreaks of things like pertussis, mumps, and salmonella have occurred in the county. Factories, schools, and medical facilities seem to have suffered the worst from human disease incidents, but fatalities directly from communicable diseases have been limited. Humans in Adams County have suffered from influenza, chicken pox, Lyme disease, pertussis, mumps, measles, Hepatitis C, and other diseases. Virtually all jurisdictions have been affected, although data to the city and school level is limited.

The data for various true pandemics is limited, because the number of them has been modest. The planning team, being mostly concerned with pandemic incidents, because they have the greatest impact on the community as a whole and greatest potential for mitigation measures, focuses on this hazard. To understand historic impacts, we look at the impact of COVID-19 on Adams County. Like all counties in Iowa, COVID had a significant impact on the local economy and resulted in multiple deaths. Being a lower density rural county, COVID was not found in the county until most other counties had outbreaks. As of May 26, 2020, according to <https://coronavirus.iowa.gov/>, Iowa has had 6,044 COVID-related deaths and 401,331 positive tests. Being the smallest county in Iowa in terms of population, it is no surprise that, at four deaths, Adams has suffered the least of all counties in this metric. Adams County also had 353 positive tests and 336 persons who had recovered. Like most of Iowa, however, the economic losses due to business shutdowns and supply chain issues have been catastrophic for the county. Overall, however, Adams County has not suffered as much economically as more urban counties, but economic recovery is likely to be slower.

When asked about the past occurrence of this hazard in the online survey, 23 persons responded. Six people responded that this happens more than once a year, seven indicated it happens most years, nine indicated it happened once or twice in the last five years, and one responded they did not know of any occurrences.

Pandemic Human Disease Future Probability:

Public health agencies work to protect Iowans from infectious diseases and preserve the health and safety of Iowans through disease surveillance, investigation of suspect outbreaks, education and consultation to county, local, and other agencies. Public health agencies also work to reduce the impact of communicable diseases in Iowa and to eliminate the morbidity associated with these diseases. Programs guide community-based prevention planning, monitor current infectious disease trends, prevent transmission of infectious diseases, provide early detection and treatment for infected persons, and ensure access to health care for refugees in Iowa. While vaccines are available for many diseases, Iowans remain vulnerable to various kinds of diseases. An example of this is the Ebola outbreak in 2015 that infected several Americans who died. The main factor that may increase the probability is the increase in travel and influx of refugees into the region. This risk is countered by better monitoring and improved tactics to combat the threat. Novel viruses, such as COVID-19, are more difficult to predict their likelihood.

When asked about the likelihood that the incidence of this hazard will increase in the future compared to today in the online survey, 23 persons responded. Nine indicated it is more likely, 12 indicated no change in likelihood, zero indicated less likely, and two indicated they were unsure or unconcerned.

The following scores reflect a declared pandemic situation and not the normal seasonal diseases that are common to the region and affect relatively few people directly.

Score for Rural Adams County: 4	Score for Corning: 4	Score for Nodaway: 4	Score for Prescott: 4
Score for SW Valley Schools: 4	Score for CHI Health: 4		

Pandemic Human Disease Vulnerability to the Population:

Public health agencies work to reduce the impact of communicable diseases in Iowa and to eliminate the morbidity associated with these diseases. Programs guide community-based prevention planning, monitor current infectious disease trends, prevent transmission of infectious diseases, provide early detection and treatment for infected persons, and ensure access to health care for refugees in Iowa. While vaccines are available for many diseases, Iowans remain vulnerable to other diseases. An estimated 20% of Iowans are considered high risk for disease incidents. Adams County has acute medical care and specialty care is available 90 miles away in Des Moines or Omaha. The public health leaders state that the lack of staff and funding makes the concern over a major outbreak especially significant. However, local public health staff indicates the number of people in a typical event that would be directly impacted is limited. The exception to this is in confined areas, such as schools, where many children can contact disease in a short time.

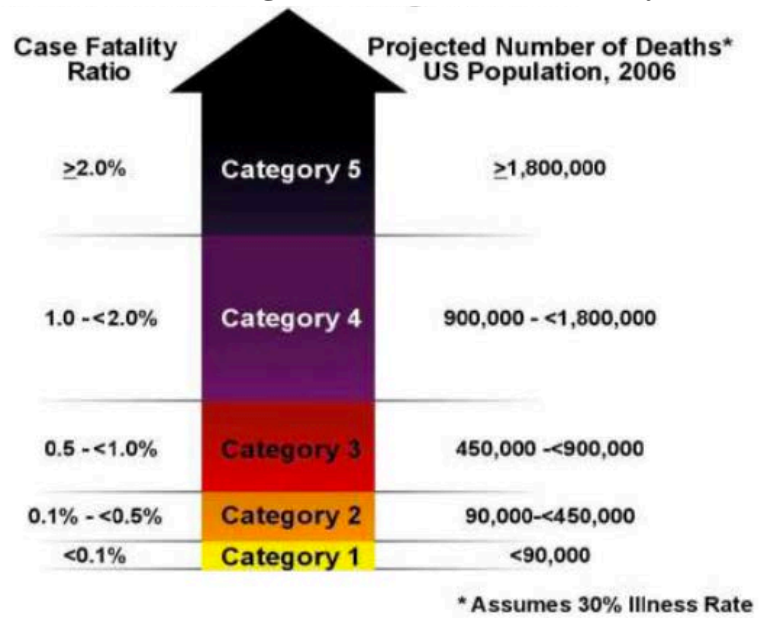
Pandemic disease response, however, exceeds local resources rather quickly. Influenza (flu) happens every year in nearly every country in the world. It spreads through a population for a few months and then will disappear or will move onto another country. Influenza usually occurs in the fall and winter months. Typically, people who usually become ill are the elderly, the very young and people with chronic medical conditions and high-risk behaviors. Individuals that travel internationally and have high exposure to potential vectors of disease are also very susceptible. Greater than 20% of Iowa’s population is considered high risk. However, using COVID as a guide, about 8% of the population tested positive but only 0.1% of the population died.

Score for Rural Adams County: 5	Score for Corning: 5	Score for Nodaway: 5	Score for Prescott: 5
Score for SW Valley Schools: 5	Score for CHI Health: 5		

Pandemic Human Disease Area of Extent:

Because of our highly mobile society, these diseases can move rapidly across the state and across the nation within days, weeks, or months, impacting seemingly random areas. Individual buildings could see widespread impacts, while large areas like a county might see minimal areas of impact. There is no evidence the risk varies much by jurisdiction’s location. People live close enough to one another that any disease can impact any jurisdiction. COVID had a direct impact in many households and businesses, with very little of the occupied area of the county unaffected. However, since the population density is low, the overall area is modest.

Score for Rural Adams County: 4	Score for Corning: 5	Score for Nodaway: 5	Score for Prescott: 5
Score for SW Valley Schools: 6	Score for CHI Health: 6		

Figure 3.74: Pandemic Severity Index


Pandemic Human Disease Severity of Impact:

The severity of impact will be based on the magnitude of the event spatially and the severity of the disease on human life.

The Pandemic Severity Index chart from the Center for Disease Control shows fatality rates and projected deaths for each category. An example of the corresponding steps to take would be if the case-fatality rate during a pandemic is less than 1 percent (with estimated deaths nationwide under 90,000), the pandemic would be considered a category 1 and the only recommended community measure would be voluntary isolation of ill persons. However, communities could choose to take additional measures. In contrast, a category 5 pandemic (i.e., case fatality rate of 2 percent or higher and estimated deaths nationwide of nearly 2 million) would warrant recommendation of all of the community mitigation strategies. COVID-19 mitigation measures would be reflective of the Category 5 level.

Adams County Public Health is proactive and aggressive. With limited resources they handle incidents well when they occur. Despite this, people can and do become ill from infectious diseases, and some die as a direct result or due to complications.

The following severity assessment looks at the local impact of the COVID-19 pandemic that passed through the region, and whose effects are still lingering as of May 2021.

Figure 3.75: Pandemic Human Disease Severity of Impact Scoring Matrix

Severity Criteria	Discussion	Score
Health and safety of the public	Many of the diseases on the national notification list result in serious illness if not death. Some are treatable; others only the symptoms are treatable. Because resources are limited and incidents can spread quickly, multiple deaths in Adams County, mostly to people that are aging or in poor health, are likely. Historically pandemics result in serious illness if not death. Some are treatable; others, only symptoms are treatable. The acute affect could result in numerous deaths in the county, but the spread of resources over many counties could dilute the response in one area, thus possibly resulting in unnecessary deaths.	4
Health and safety of responders	Doctors, nurses, paramedics, and emergency medical technicians are vulnerable to contagious diseases. Universal precautions can greatly diminish the transfer rate and risk responders face. Overworked public health and medical staff can be susceptible to other problems associated with stress.	4
Continuity of operations	It depends on the extent that local critical assets are able to operate during events where many are ill and health-care and first-response crews are occupied with the incident response. It is likely that some services will be highly compromised. Potential exists for severe or complete disruption involving multiple levels of government. Key workers and elected officials may not be able to serve. Schools and businesses can be closed because too many people are sick.	3
Property, facilities, infrastructure	No lasting impacts are likely.	1
Delivery of services	Limited impact on most critical services. Healthcare services may be at the limits of capacity. Sick workers can delay he delivery of services, as well as any services based within an area that is cordoned off for quarantine. COVID greatly disrupted supply chains and caused a worker shortage when things started to “open back up.”	4

Severity Criteria	Discussion	Score
Environmental impacts	No direct impacts are likely in most cases. In a pandemic, if special treatment is needed that requires the use of certain chemicals and substances, it is likely that these substances and any disposal efforts could impact the environment.	2
Economic/financial conditions	Large outbreaks may warrant travel advisories to the area and will impact the tourism and general commerce in the area. Sick workers can also reduce productivity and could severely hurt small business. High number of ill human resources will affect the conduction of local businesses and will cost the community much in healthcare provision. Economic costs could be of greater impact than the direct impact of the disease itself. COVID nearly shut down the economy for months and resulted in supply chain, labor, and financial access issues that lingered for months after herd immunity was reached through vaccination. While Adams County did not suffer directly to the extent more urban areas have, many small businesses have not reopened and economic activity remains slow well into 2022.	4
Regulatory/contractual obligations	Since the incident is widespread, local response will not be a focus. Local response and public health personnel may have trouble meeting other obligations because they are focused on the incident or pandemic.	2
Reputation	Adequate disease prevention programs and response to the outbreak can limit the damage to the jurisdiction's reputation. If there is panic, the reputation can be hindered.	2

The overall rating the community gave for this hazard's magnitude in a survey was: "moderate."

Score for Rural Adams County: 26	Score for Corning: 26	Score for Nodaway: 26	Score for Prescott: 26
Score for SW Valley Schools: 26	Score for CHI Health: 26		

Pandemic Human Disease Speed of Onset:

Pandemic disease tends to spread much more slowly and more warning time is possible. As COVID-19 showed, it was possible to track its origin and spread throughout the world. However, it is the local practitioner who identifies an individual case in a community and then confirms it through standardized testing. Since the disease can spread somewhat randomly, it is difficult to determine when it will arrive in a community. The Iowa Department of Public Health and the U.S. Centers for Disease Control monitor reports submitted by doctors, hospitals, and labs to identify patterns. These agencies are tasked with providing information to the health care community on medical concerns.

Score for Rural Adams County: 2	Score for Corning: 2	Score for Nodaway: 2	Score for Prescott: 2
Score for SW Valley Schools: 2	Score for CHI Health: 2		

Pandemic Human Disease Duration of Event:

Pandemic human disease incidents can spread for days even before the cause can be identified. COVID was discovered in Iowa in early 2020 and is still impacting the state and virtually all counties in May 2021.

Score for Rural Adams County: 9	Score for Corning: 9	Score for Nodaway: 9	Score for Prescott: 9
Score for SW Valley Schools: 9	Score for CHI Health: 9		

Pandemic Human Disease Total Scores:

The following total scores for human disease indicate moderate risk to the public and the planning area where incidents can occur.

Score for Rural Adams County: 50	Score for Corning: 51	Score for Nodaway: 51	Score for Prescott: 51
Score for SW Valley Schools: 52	Score for CHI Health: 52		

Pandemic Human Disease Vulnerability/Assets at Risk:

Any area where people live, work, learn, play, or visit are susceptible to the impacts of human disease. This hazard will primarily impact human health and life and will not have a direct impact on structures and

contents. However, it will have a direct impact on functional use and the economy because of the number of people that will be unable to work and possible closure and quarantine of buildings.

Virtually all structures, property, and people in the county, as outlined in Section 3.2, are susceptible to human disease. Again, there should not be physical building or property losses, but people living in or using any building and property in the county can be at risk.

All critical assets in the county, as outlined in Section 3.2, could be impacted by this hazard.

Pandemic Human Disease Loss Estimation:

There is no expected structural, building, or property losses to existing structures, buildings, and properties due to this hazard.

According to The Annual Impact of Seasonal Influenza in the US: Measuring Disease Burden and Costs by Molinari et al., nationally the economic burden of influenza medical costs, medical costs plus lost earnings, and the total economic burden was \$10.4 billion, \$26.8 billion, and \$87.1 billion respectively. The financial burden of healthcare-associated infections nationally has been estimated at \$33 billion annually. Specific amounts for Adams County are not available, but just from this data, based on the portion of the national population that is in Adams County, the losses are approximately \$1.75 million.

U.S. Centers for Disease Control and Prevention (CDC) estimates 76 million people suffer foodborne illnesses each year in the nation, accounting for 325,000 hospitalizations and more than 5,000 deaths. Health experts estimate that the yearly cost of all foodborne diseases in America is \$5 to \$6 billion in direct medical expenses and lost productivity. Infections with the bacteria Salmonella alone account for \$1 billion annually in direct and indirect medical costs. Prorated to the local population of Adams County, this cost is approximately \$75,000.

COVID loss data is still far from complete. However, when you consider the four deaths, valued at millions of dollars each, over 300 illnesses, the loss of economic activity (through early 2021), and the great increase in government spending to address the pandemic, it is clear that COVID alone will cost Adams County \$10 million or more. Given that pandemics of this scale are relatively rare, not every year will see such losses.

Future Development and Pandemic Human Disease:

The overall population of the county is slowly declining but the median age continues to slowly increase, so overall the future incidence of human disease is likely to remain the same, barring any change in prevention, treatment, and other mitigation measures that may be introduced.

Radiological Incident Profile

Type: Technological

Definition: An occurrence resulting in a release of radiological material at a fixed facility or in transit.

Radiological Incident Description:

An incident resulting in a release of radiological material at a fixed facility includes, but is not limited to, power plants, hospitals, and laboratories. Although the term "nuclear accident" has no strict technical definition, it generally refers to events involving the release of significant levels of radiation. Most commercial nuclear facilities in the United States were developed in the mid-1960s and are designed to withstand aircraft attack. With this level of design, they should withstand most natural hazards, but events that occurred in 2011 at the Fukushima nuclear plant in Japan illustrate the possibilities of what can happen in a worst-case scenario. The Japanese plant may have been able to withstand either the earthquake or the tsunami, but both hazards

together caused release of radioactive materials. There are no nuclear production facilities within 75 miles of Adams County, but small amounts of spent nuclear fuel travels across the county on the railroad in occasion. Small stable radioactive materials are used in the hospital and other labs and could also spill or release for a very localized impact.

The United States Nuclear Regulatory Commission regulates nuclear sites, such as power plants. The agency has four levels of emergency classifications: unusual event, alert, site area emergency, and general emergency. However, this level of regulation is confined to major handlers of nuclear energy, much larger than the radioactive materials used in the medical community or related institutions in Adams County.

Transportation of fuels is more likely to affect the county. As a rule, there are two categories of radioactive materials that are shipped over the interstate highways. Low-level waste consists primarily of materials that have been contaminated by low-level radioactive substances, but pose no serious threat except through long-term exposure. These materials are shipped in sealed drums within placarded trailers. The danger to the public is no more than that which exists from other hazardous materials. High-level waste, usually in the form of spent fuel from nuclear plants, is transported in specially constructed casks that are built to withstand a direct hit from a locomotive. The BNSF railroad serves as a potential route for spent materials.

Radiological Incident Historical Occurrence:

Since 1990, hundreds of shipments have been made through the state and there have been no occurrences of a major radiological incident in Iowa. It is possible that there have been minor releases of radioactive materials, such as in a hospital lab, but these have been managed and mitigated with local resources.

Radiological Incident Future Probability:

It is very unlikely there will be a major release requiring response beyond local capabilities in Adams County due to the small number and highly regulated and secured shipments of nuclear fuel.

Score for Rural Adams County: 1	Score for Corning: 1	Score for Nodaway: 1	Score for Prescott: 1
Score for SW Valley Schools: 1	Score for CHI Health: 1		

Radiological Incident Vulnerability to the Population:

Radiological incidents, if they were to occur, are most likely to be along the railroad and will affect properties within a mile of the railroad. Small releases at hospitals or other medical facilities may affect those individual properties and the people inside them.

Score for Rural Adams County: 4	Score for Corning: 5	Score for Nodaway: 5	Score for Prescott: 5
Score for SW Valley Schools: 5	Score for CHI Health: 5		

Radiological Incident Area of Extent:

For the sake of this plan, it is likely that any radiological release of spent fuels in Adams County would result in evacuation of no more than one mile from the site of the release. The lack of incidents to be studied as a guide for the response makes it impossible to come up with another metric.

Score for Rural Adams County: 4	Score for Corning: 7	Score for Nodaway: 8	Score for Prescott: 8
Score for SW Valley Schools: 8	Score for CHI Health: 8		

Radiological Incident Severity of Impact:

The severity of impact will be based on the magnitude of the release and location in relation to the population of the county. This plan assumes a release of all spent fuel in a populated area due to a train derailment.

Figure 3.76: Radiological Incident Severity of Impact Scoring Matrix

Severity Criteria	Discussion	Score
Health and safety of the public	Time, distance, and shielding minimize radiation exposure to the body. Nuclear radiation above normal levels could be a health and safety consideration because of its ability to damage human cells biologically as well as environmentally damage property that provides safety to people. However, the type and level of radiation likely in Adams County is unlikely to cause long-term injury or death.	2
Health and safety of responders	Generally, responders are trained in the proper response techniques and are able to identify the materials. However, in a rural county like Adams, it is possible that responders will not have access to proper PPE and shielding during the immediate response. Risk of explosion and exposure during the response is higher than the risk to the general public.	3
Continuity of operations	This should not be impacted for a very long time unless there are evacuations that require government operations to temporarily end. A government or response agency building could become contaminated and access limited for a longer duration.	2
Property, facilities, infrastructure	If an explosion occurs or radiation thoroughly contaminates an area, property damage up to a mile of the site could be moderate to considerable.	2
Delivery of services	Disruption in evacuated areas could cause delays in services and travel. A train derailment involving radiological materials could close the railroad for days or longer and greatly slow shipments as well as cause economic losses.	3
Environmental impacts	Long-term environmental hazards from radiological fallout could include water, air, and soil contamination.	3
Economic/financial conditions	Likely evacuations and the closure of the railroad will have the greatest economic impact, as people are unable to go to work and trains are unable to continue deliveries. Secondary impacts could be damage to commercial and industrial buildings that slow commerce as well.	3
Regulatory/contractual obligations	Indemnification would be a vital issue to address, because of the ownership of the facility by the private sector and all the regulatory issues involved long after the release is contained. The incident could be tied up on the courts for months or years.	2
Reputation	Reputation of the community could be greatly damaged due to the high profile of these events. The negative impact could be felt for decades following a contamination.	3

Score for Rural Adams County: 23	Score for Corning: 23	Score for Nodaway: 23	Score for Prescott: 23
Score for SW Valley Schools: 23	Score for CHI Health: 23		

Radiological Incident Speed of Onset:

Because of the nature of these events, they are most likely going to be sudden and unplanned accidental releases. Ionizing radiation cannot be sensed by humans, so special instruments are needed. Distance from the incident would dictate the amount of time needed to avoid exposure from damaging levels of radiation.

Score for Rural Adams County: 9	Score for Corning: 9	Score for Nodaway: 9	Score for Prescott: 9
Score for SW Valley Schools: 9	Score for CHI Health: 9		

Radiological Incident Duration of Event:

Transportation radiological incidents may take several hours to clean up or even contain, depending on the size of the release, weather conditions in the area, and explosion risk. The process of evacuations can delay containment.

Score for Rural Adams County: 7	Score for Corning: 7	Score for Nodaway: 7	Score for Prescott: 7
Score for SW Valley Schools: 7	Score for CHI Health: 7		

Radiological Incident Total Scores:

The following total scores for radiological incident indicate moderate risk to the public and the planning area where incidents can occur.

Score for Rural Adams County: 48	Score for Corning: 52	Score for Nodaway: 53	Score for Prescott: 53
Score for SW Valley Schools: 53	Score for CHI Health: 53		

Radiological Incident Vulnerability/Assets at Risk:

Virtually all structures, property, and people within a mile of the railroad, as outlined in Section 3.2, are susceptible to a radiological incident. Most of the losses will not be directly to properties, but property damage is possible and people in buildings can be affected even if there are no physical property losses.

In rural Adams County, a small percentage of properties and population are within a mile of the railroad, as follows.

Figure 3.77: Rural Adams County Radiological Incidents Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	100	\$8,000,000	175	11%
Commercial	3	\$750,000	10	20%
Industrial	9	\$65,000,000	90	90%
Ag Structures and Land	500 buildings; 25,000 acres	\$28,000,000	7	10%
Taxable Infrastructure	6	\$40,000,000	4	65%
Government/Institutional	4	\$25,000,000	15	15%
Totals	622	\$166,750,000	301	15%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

Roughly 15% of structures, value, and people in rural Adams County are found within a mile of the railroad and are in the planning area of risk. The following of the listed assets in Section 3.2 are at risk:

- Brown Bear
- Corning Hotel
- Corning Winery
- Lake Binder
- Nutrien Crop Services
- Poet Biorefining
- Precision Pulley and Idler

The following properties and people are at risk in Corning.

Figure 3.78: Corning Radiological Incidents Structures, Values, and People at Risk

Structure/Land Use	Number of Structures	Estimated Value	Number of People	Estimated %
Residential	800	\$47,000,000	1,500	94%
Commercial	25	\$8,500,000	250	100%
Industrial	1	\$127,000	30	100%
Ag Structures and Land	3 buildings; 20 acres	\$120,000	5	90%
Taxable Infrastructure	9	\$800,000	9	92%
Government/Institutional	28	\$68,000,000	490	94%
Totals	886	\$124,547,000	2,284	96%

Sources: Hazard Mitigation Planning Team, US Census, various local data sources, Iowa Dept. of Management

Over 90% of the properties, values, and people are within a mile of the railroad and are within the planning area of risk. All critical assets listed for Corning in Section 3.2 are within the area of risk.

All properties, values, people, and critical assets in Nodaway and Prescott are within the one-mile buffer of the railroad, which is the area of risk for planning purposes.

Radiological Incident Loss Estimation:

Estimating losses for this hazard is very challenging, in part due to the lack of experience with it. A scenario where a train derails and one or more casks of materials is released suddenly in downtown Corning could have devastating impact if an explosion occurs or contamination nearly shuts down the downtown commercial area. Multiple deaths could occur, as well as sickness and injury. At the least, the railroad, which carries up to 50 trains daily, would stop operating for hours to days. The economic losses could total in the tens of millions in

delays, lost retail sales, and property damage to private property. However, because the probability is so low, it is likely that the losses on an annual level by jurisdiction are extremely low, well under \$1 million.

Future Development and Radiological Incident:

Unless there is an increase or decrease in the number of shipments, the risk is not likely to be appreciably changed as a result of new development.

Severe Winter Storm Profile

Type: Natural

Definition: Severe winter conditions including blizzard conditions, heavy snow, blowing snow, freezing rain, heavy sleet, and extreme cold/wind chills that can affect day-to-day activities and can cause fatalities and property damage.

Severe Winter Storm Description:

Winter storms can take on many forms and involve many elements. Typically, the severity of the weather is dependent on the temperature. Because temperature can change in various seasons, severe winter weather is relatively common from October to April. Winter winds can be so much more dangerous at 25 MPH than the same winds during the summer because of the cold. Varying weather conditions, combined with cold, can bring about severe conditions due to the impact of ice and snow on surfaces such as roadways and power lines. Wind is not just cold but also causes snow to drift, causing impassable roads and damaged infrastructure and buildings. For the purposes of the local HMP, severe winter storms are the kinds of events that significantly impact commerce and cause widespread damage, whether or not they are accompanied by some form of advisory or warning. The planning team indicates that any winter weather that causes imminent danger to the public is severe, no matter its statistical magnitude.

Severe Winter Storm Historical Occurrence:

Adams County experiences a great variety of winter weather every year, including heavy snow, blizzards, high winds, extreme wind chill, ice storms, and bitter cold. While most Iowans are accustomed to the cold, extreme weather is dangerous and causes extensive damage almost every winter. Some winters have multiple severe winter storms.

According to the NCEI, there have been 74 recorded winter storm related events (blizzard, cold and wind chill, frost/freeze, heavy snow, ice storm, winter storm, and winter weather) events affecting the county, causing \$2.015 million in property damage and \$6.894 million in crop damages, along with no fatalities and no injuries from 1996 through the end of 2020. It is unknown how much of the reported damages occurred in Adams County versus part of a larger storm. The actual casualties from severe winter weather is much higher when we add in traffic injuries and deaths due to icy roads, people that die due to exposure or over-exertion, and other causes. Many times, these casualties are not included in NCEI reports. Three winter storm related Presidential Declarations for Major Disaster have been declared in Adams County since 1996 (through 2020).

Perhaps the worst winter storm in recent memory was the December 2007 ice storm that knocked out power for hours in all parts of the county and days in many rural areas. This storm destroyed thousands of trees, and caused millions of dollars in power line losses in the county. Many rural electric cooperatives and other providers are now undertaking FEMA mitigation projects to strengthen power lines as result. The local economy was at a near standstill for a few days because of this storm.

Since that time, there have been many instances of extreme cold and heavy snow, the most recent in February 2021 (as of May 2021). All members of the planning team acknowledge this hazard and many listed either 2020 or 2021 as recent examples. A so-called “polar vortex” occurred both winters in either January or

February. One planning team member listed a 12” snow in 2021. Severe winter weather costs local governments, schools, and businesses a lot of money each year in lost productivity, snow removal costs, and slowed shipping.

From 2006 through early 2021, there were over 120 warnings, watches, and advisories issued for Adams County for various winter storm events (<https://mesonet.agron.iastate.edu/vtec/search.php#byugc/IAZ083>). The following were issued.

Figure 3.79: Historical Winter Weather Events

Type of Winter Weather	Warning	Watch	Advisory	Total
Blizzard	3	1	0	4
Freeze	13	4	0	17
Frost	0	0	6	6
Ice storm	1	0	0	1
Snow squall	1	0	0	1
Wind chill	4	1	19	24
Winter storm	9	11	0	20
Winter weather	0	0	50	50
Totals	31	17	75	123

Source: Iowa State University Department of Agronomy, <https://mesonet.agron.iastate.edu/vtec/search.php#byugc/IAZ083>

The history of severe winter storm events can be visualized by looking at heavy snow events as a proxy. Snowfall data is available from the Corning weather station from 1893 through current (May 2021). The date function did not populate in the download from <http://mesonet.agron.iastate.edu/request/coop/fe.phtml>, but the one-day snowfall amounts are available. The largest single-day snow event was 16”. There were three days with 15”, one day with 14”, one day with 13”, one day with 12”, and two days with 11”. There were nine days with 10” to 10.8” of snow. In total, there have been 18 days with 10” or more of snow in recorded history.

The same data source was accessed about the recorded low temperature. The coldest low recorded was -32 degrees F (4 days), with 103 days of recorded temperatures at or below -20 degrees F. The coldest day in the past five or so years was January 31, 2019 (-25 degrees F).

When asked about the past occurrence of this hazard in the online survey, 23 persons responded. Five indicated that this occurs more than once a year, twelve indicated it happens most years, five indicated it happened once or twice in the last five years, and one indicated the hazard does not occur or they don’t recall an instance.

Severe Winter Storm Future Probability:

Winter storms regularly move easterly and use both the southward plunge of arctic cold air from Canada and the northward flow of moisture from the Gulf of Mexico to produce heavy snow and sometimes blizzard conditions in Iowa and other parts of the Midwest. The cold temperatures, strong winds, and heavy precipitation are the ingredients of winter storms. Adams County can usually expect a half dozen winter storms a season, but not all of them are severe. Almost every winter we can expect one severe winter storm with high winds, heavy snows, and/or crippling ice and cold. Sometimes high winds and crippling cold can last for days after or in the absence of a snow event. A snow of 10 inches or more occurs about half of the winters. A severe ice storm occurs about every five to ten years.

When asked about the likelihood that the incidence of this hazard will increase in the future compared to today in the online survey, 23 persons responded. Four indicated it is more likely, 16 indicated no change in likelihood, two indicated less likely, and one indicated they were unsure.

Score for Rural Adams County: 9	Score for Corning: 9	Score for Nodaway: 9	Score for Prescott: 9
Score for SW Valley Schools: 9	Score for CHI Health: 9		

Severe Winter Storm Vulnerability to the Population:

Due to the large number of low-income and elderly people in Adams County, the limited sheltering, and the demand for nearly all people to travel on area roads, nearly all people of the county are vulnerable. Heavy snows cause immobilized transportation systems, downed trees and power lines, collapsed buildings, and loss of livestock and wildlife. Heavy snows of more than 6 inches in a 12-hour period or freezing rain greater than 1/4-inch accumulation causing hazardous conditions in the community can slow or stop the flow of vital supplies as well as disrupt emergency and medical services. Loose snow begins to drift when the wind speed reaches 9 to 10 mph. The potential for some drifting is substantially higher in open country than in urban areas where buildings, trees, and other features obstruct the wind. Ice storms result in fallen trees, broken tree limbs, downed power lines and utility poles, fallen communications towers, and impassable transportation routes. Hazardous driving conditions due to snow and ice on highways and bridges lead to many traffic accidents, which is the leading cause of winter storm deaths. About 70% of winter-related deaths occur in automobiles and about 25% are people caught out in the storm. The majority of these are males over 40 years of age. Emergency services such as police, fire, and EMS are unable to respond due to road conditions. Emergency needs of remote or isolated residents for food or fuel and for livestock care are unable to be met. 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 or very young. Use of kerosene heaters and other alternative forms of heating may create other hazards, such as structural fires and carbon monoxide poisoning. Elderly and others can slip and fall and can die due to exposure. Because schools are closed in severe storm situations, the vulnerability is slightly less, although buses can still crash or become stuck hours or days after a storm. The hospital is somewhat insulated because the hospital can function in severe weather, although employees and responders may not be able to travel. Rural roads require tons of rock to meet demand after the winter thaw. Thawing conditions also exacerbate expansive soils conditions and cause water line breakage.

Score for Rural Adams County: 7	Score for Corning: 6	Score for Nodaway: 6	Score for Prescott: 6
Score for SW Valley Schools: 5	Score for CHI Health: 5		

Severe Winter Storm Area of Extent:

Winter storms are quite vast and would likely impact multiple counties. Certain areas may experience local variations in storm intensity and quantity of snow or ice and thus severity within the parent storm.

Score for Rural Adams County: 9	Score for Corning: 9	Score for Nodaway: 9	Score for Prescott: 9
Score for SW Valley Schools: 9	Score for CHI Health: 9		

Severe Winter Storm Severity of Impact:

The National Weather Service bases winter weather warnings on stages of severity, as follows:

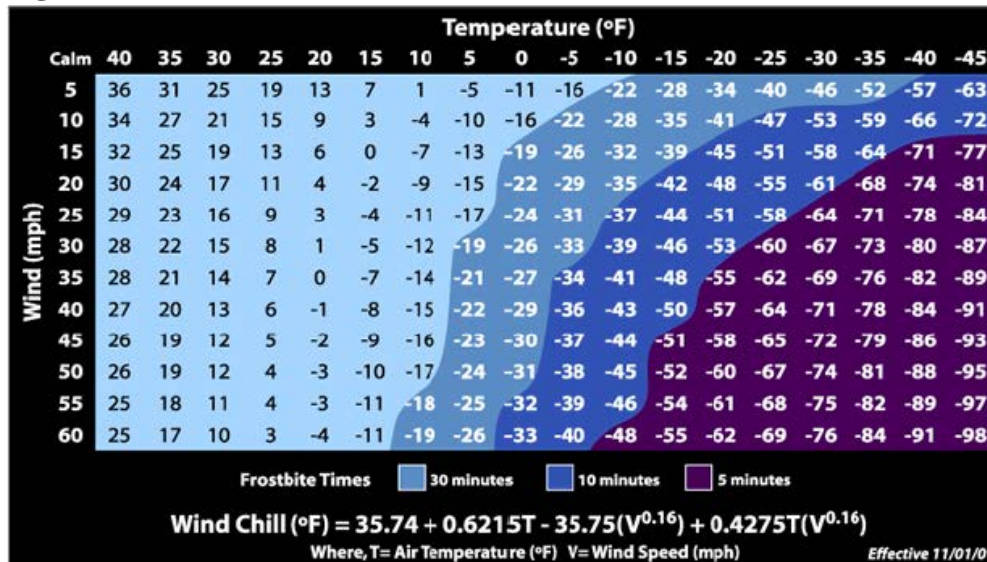
- **Blizzard Warning:** the most dangerous of all winter weather is occurring or imminent. A blizzard is defined as a combination of winds 35 mph or greater with snow or blowing snow reducing visibility to less than 1/4 mile for three or more hours. In blizzards, whiteout conditions, deep snowdrifts, and frigid wind chills form a life-threatening partnership. You should seek refuge immediately.
- **Winter Storm Warning:** severe winter weather is occurring or imminent. You should already be prepared and should take protective actions immediately. This warning is issued when 6 inches of snow is expected in 24 hours at lower elevations (below 7500 feet). Travel can become difficult or impossible, especially for vehicles without four-wheel drive.
- **High Wind Warning:** hazardous winds are occurring or will soon occur across a significant area. For elevations below 7500 feet, sustained winds of 40 mph or greater or gusts to 60 mph or more are expected. Travel can be dangerous, especially for high profile vehicles.

- **Wind Chill Warning:** wind chill is the combined effect of cold temperatures and wind in chilling the body. A warning is issued when wind chills of minus 40 degrees F or colder with winds of at least 10 mph are occurring or imminent. Frostbite can occur in seconds, and hypothermia within minutes. The effects of temperature and wind chill increase the severity of a winter storm. Wind blowing across exposed skin drives down the skin temperature and eventually the internal body temperature. Exposure to low wind chills can be life threatening to humans and animals.

Additionally, winter weather advisories and other bulletins are issued to help the public understand the relative severity and risks posed by a winter weather event.

As referenced below, wind chills exacerbate cold weather by making it feel even colder. The current Wind Chill Temperature Index took effect in 2001, replacing the original index devised in 1945. To find the Wind Chill Temperature Index from the chart, find the air temperature along the top of the table and the wind speed along the left side. The point where the two intersect is the wind chill temperature.

Figure 3.80: Wind Chill Chart



The severity of various events relates the probability and type of event. The following events are assessed for Adams County.

Figure 3.81: Probability of Severe Winter Storm Events by Severity

Event Type	Probability in Adams County	Severity Description
Heavy snow	Highly likely in a given year	Limited, mostly economic and delivery of services
Ice storm (half inch plus)	Occasionally in a given year	Moderate to critical in many severity categories
Extreme cold & wind chill	Highly likely in a given year	Moderate, mostly to health and safety of the public
Blizzard	Likely in a given year	Moderate to critical to safety of the population and economy, limited to infrastructure

The following provides a summary of the severity of impact throughout the county.

Figure 3.82: Severe Winter Storm Severity of Impact Scoring Matrix

Severity Criteria	Discussion	Score
Health and safety of the public	Injuries and deaths occur every year in Iowa due to the impacts of severe winter storms, including the direct impacts of the cold and wind, such as frostbite, hypothermia, and various illnesses. Direct impacts of heavy snow, blizzards, and ice storms include structural failure, auto crashes, and	4

Severity Criteria	Discussion	Score
	inability to access emergency care. People also get sick, injured, or killed as a result of overexertion during and after severe weather. Severity is exacerbated by the inability to access health and emergency care, loss of power, and lack of access to fresh food. People living in older homes with poor heating systems, the elderly, the chronically ill, and the very young are at most risk. Motorists, outdoor workers and recreationists, and those with energy dependent medical needs are at higher risk of death and severe injuries.	
Health and safety of responders	Response personnel are exposed to cold temperatures and traffic accidents when responding to the victims' needs. They also succumb to overexertion when performing their work.	3
Continuity of operations	Operations can be limited or halted when critical services are not available. Staff may not be able to make it to the place of work thus, limiting the continuity of operations. Damage to infrastructure may also hinder continuity of operations. Local government workers may have to work long hours to clear roads and maintain government facilities and will not be available for other essential tasks.	2
Property, facilities, infrastructure	Immobilized transportation (including emergency vehicles), downed trees and electrical wires, building and communication tower collapse, and bodily injury/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, all of which are vital to Adams County. In recent ice storms, rural electric providers sustained many millions of dollars in damage to lines and equipment, some of it in Adams County. Water lines, roadways, and other infrastructure fail on a widespread basis during thawing conditions. Millions of losses are sustained most winters as a result to infrastructure damage and simply being overworked.	4
Delivery of services	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 and lead to pipes freezing and possibly bursting. 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. Ice coating at least one-fourth 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 and loss of water and subsequent evacuations during sub-zero temperatures.	3
Environmental impacts	Winter storms are a natural occurrence and there would be no direct significant impact on the environment. Localized impacts are possible if infrastructure such as natural gas lines burst as a result of the event.	2
Economic/financial conditions	The cost of snow removal, repairing damage, and loss of business can have large economic impacts on the community. The State estimates \$76,159,000 in property damage, and \$346,900,000 in lost crops due to heavy snow, ice storm, or extreme wind-chill events statewide from 1993 through 2006. More than this is the economic loss due to employees being unable to get to work, freight being stranded, and people being able to perform business transactions.	3
Regulatory/contractual obligations	Enforced snow ordinances allow the jurisdiction to more effectively open transportation routes. Delivery and adequate supplies of salt, sand, and saline are important inputs to the snow removal process. These contracts should be in place. Removal of debris and reinstatement of energy are vital to safety of the public as well. Agreements should be in place with the power company to ensure power is restored in an effective and timely manner following the storm.	2
Reputation	Effective and timely response to the snowstorm is key to maintaining a good reputation. Streets clear of snow and ice are important factors to the mobile public.	2

Score for Rural Adams County: 25	Score for Corning: 25	Score for Nodaway: 25	Score for Prescott: 25
Score for SW Valley Schools: 25	Score for CHI Health: 25		

Severe Winter Storm Speed of Onset:

The NWS has developed effective weather advisories that are promptly and widely distributed. Radio, TV, and Weather Radios provide the most immediate means to do this. Accurate information is made available to public officials and the public up to days in advance. Notifications made by the NWS include winter storm watch, winter storm warning, blizzard warning, winter weather advisory, and a frost/freeze advisory. While the magnitude and severity of winter storms can vary greatly from place to place within a storm, typically warning is adequate so that people can prepare for the given storm.

Score for Rural Adams County: 2	Score for Corning: 2	Score for Nodaway: 2	Score for Prescott: 2
---------------------------------	----------------------	----------------------	-----------------------

Score for SW Valley Schools: 2	Score for CHI Health: 2
--------------------------------	-------------------------

Severe Winter Storm Duration of Event:

Severe winter storms can last up to 2 days. It may take another day or two before some sense of normalcy to return.

Score for Rural Adams County: 6	Score for Corning: 6	Score for Nodaway: 6	Score for Prescott: 6
Score for SW Valley Schools: 6	Score for CHI Health: 6		

Severe Winter Storm Total Scores:

The following total scores for severe winter storm indicate high risk to the public and the planning area where incidents can occur.

Score for Rural Adams County: 58	Score for Corning: 57	Score for Nodaway: 57	Score for Prescott: 57
Score for SW Valley Schools: 56	Score for CHI Health: 56		

Severe Winter Storm Vulnerability/Assets at Risk:

All structures, property, and people in the county, as outlined in Section 3.2, could suffer from the effects of winter storms. Power lines, utility poles, towers, and poorly built buildings are at the most risk among structures. Contents losses are likely to be minor, even compared to structural losses. The greatest risk may be to human health and life due to exposure to cold by the body. Thousands of trees and shrubs can be damaged or even destroyed by heavy snow, wind, and ice accumulation. Most properties will not suffer direct damage from a given storm, but winter weather over time is known to accumulatively damage properties.

All critical assets in the county, as outlined in Section 3.2, are exposed to severe winter weather.

Severe Winter Storm Loss Estimation:

Severe winter storm events cause extensive damage to property, human health and life, and the local economy. While storms happen every winter, only once in a while are they truly severe. Many losses simply occur due to the combined effects of prolonged cold, winds, and heavy snow and ice, even in the absence of a single severe storm. This analysis attempts to address these facts.

Structural losses vary greatly by the kind of storm. Normal snowfall, extreme cold, and wind chill events generally don’t cause direct structural losses. However, the combined effects of these conditions over one or more winters can bring about deterioration and failure of structures. Some building elements can become very brittle during extreme cold and break or fail easily when hit by another force. Heavy wet snow can cause failure of weak or old buildings, power lines and poles, and other infrastructure. The freeze-thaw cycle can cause underground pipes to burst and frost bubbles to form in roads and parking areas. All these problems occur commonly in Adams County. These can cause millions of dollars in losses in the planning area during any given storm or winter to both public and private structures and infrastructure.

Ice storms are more likely than any other form of winter storm to cause structural damage. Damage to overhead utilities, trees, towers, and even buildings can be extensive with only a half-inch of ice. Yet, storms delivering over an inch of ice occur once a decade perhaps. Past ice storms have caused millions of dollars in damage in Adams County. Costs include clearing debris, removing trees, repairing utility lines, restoring power to individual homes and businesses, and lost business and functional use loss.

USDA crop insurance claims for winter storms, cold, freeze/frost, and snow conditions for the five-year period of 2017-2020 show 10 claims. The total amount of claims was \$51,472, which is very small compared to drought and flood/rainfall hazards, but is nonetheless significant. This averages to \$12,868 annually. Clearly

most of these losses occurred during early planting season or near harvest, during unseasonably cool weather but not during what most would define as a severe winter storm.

Economic losses can be severe simply because people cannot get to work, people are not conducting business, and transportation of goods comes to a standstill. When a storm is severe enough, the entire planning area's economy can virtually shut down for a day or more, at a cost of millions of dollars. Additional loss is suffered by businesses and government entities having to turn up the thermostat to heat their buildings and repair buildings damaged by storms. Local governments face functional use losses due to the costs of storm debris removal, snow removal, sanding and salting streets/roads, and fixing potholes and other road/bridge damage that comes with Iowa's winters.

The loss due to human life and health are significant due to winter storms. It is often difficult to attribute to winter storms a death that appears to be due to natural causes. People can die to exposure to the cold, health issues like heart attacks triggered by exertion (such as when scooping snow), and fires caused by use of unsafe heating systems during extreme cold. In a typical winter storm event, it is estimated that death is possible, severe illness requiring hospitalization is very likely, and multiple minor illnesses are very likely. Because extreme cold is a silent killer, its risks are actually much higher in a given jurisdiction, kind of like excessive heat. People over the age of 65, which make up over a thousand residents, people who are outside and cannot get indoors, and those with old homes and no reliable heating and insulation may die due to exposure.

Future Development and Severe Winter Storm:

As long as the population remains stable or even declines, it is unlikely that future development will increase exposure or risk of loss.

Sinkhole Profile

Type: Natural

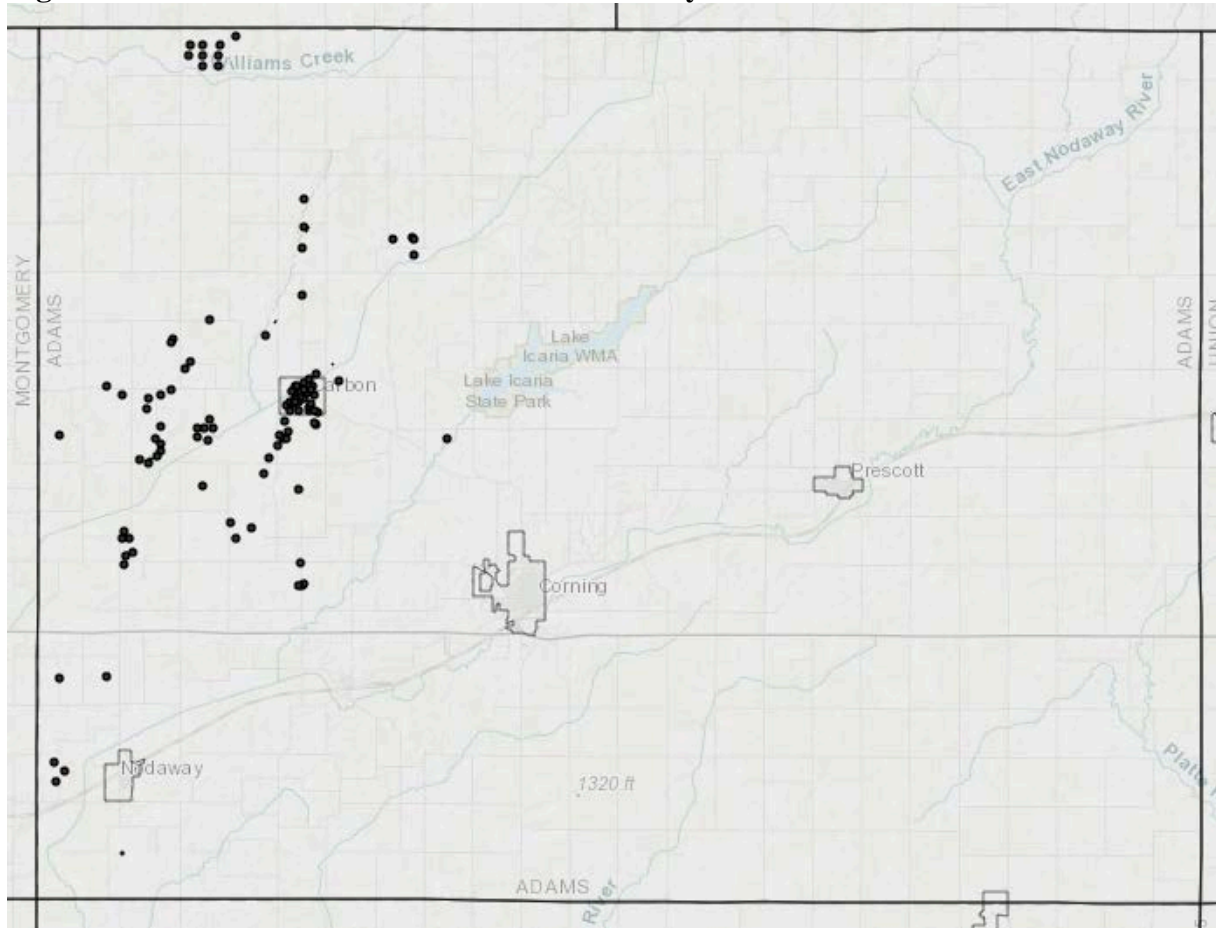
Definition: The loss of surface elevation due to the removal of subsurface support.

Sinkhole Description:

Sinkholes can occur suddenly or slowly over time for a wide variety of reasons. Sinkholes range from broad, regional lowering of the land surface to abrupt localized collapse. The primary causes of most subsidence are human activities such as underground mining of coal, groundwater/petroleum withdrawal, or drainage of organic soils. Sinkholes can aggravate flooding potential, and collapse of an abandoned mine may destroy buildings, roads, and utilities. In other times, they can result from failures of underground utilities and natural events such as earthquakes and landslides. Normally, they occupy a small area but can be hundreds of square feet or larger in size and have been known to swallow homes in some places.

Sinkholes are often found among karst landscapes. The State of Iowa Mitigation Plan adopted in 2018 includes a map that shows no such landscapes in Adams County. The plan also shows old mining locations. These are found in Adams County. The following map (Figure 3.83), obtained from the Iowa Hazard Mitigation Viewer

(<https://iowahsemd.maps.arcgis.com/apps/MapSeries/index.html?appid=581c59432cb24779af37161c492309fa>) on May 26, 2021, shows 104 mining sites and 6 mining areas where coalmines were found in Adams County from the late 1800s through early 1900s. While former mine areas are specifically called out for their risk, technically almost any property in the planning area can experience sink holes.

Figure 3.83: Historic Coal Mines in Adams County

Source: Iowa Hazard Mitigation Viewer

(<https://iowahsemd.maps.arcgis.com/apps/MapSeries/index.html?appid=581c59432cb24779af37161c492309fa>), May 2021

Sinkhole Historical Occurrence:

The Iowa Geological Survey estimates as many as 6,000 underground coalmines, mostly in locations now forgotten, are scattered across 38 counties. These could possibly affect up to 80,000 acres of Iowa land. However, DNR officials say that despite the widespread prevalence of abandoned coalmines, they seldom create sinkholes. According to the IDALS Bureau of Mines and Minerals, two or three mine-related sinkholes typically occur each year in Iowa. However, many of them are localized and not widely reported. In fact, there have been no reports of sinkholes in Adams County. Minor subsidence has been experienced due to underground infrastructure, such as sinking of land above a water main, but nothing of substance has been reported. The planning team is unaware of any notable sinkholes in the natural environment.

When asked about the past occurrence of this hazard in the online survey, 23 persons responded. Zero indicated that this occurs more than once a year, zero indicated it happens most years, four indicated it happened once or twice in the last five years, and 19 indicated the hazard does not occur or they don't recall an instance.

Sinkhole Future Probability:

Because there is not a lot of development or moving of soil using heavy machinery in areas where old mines are located, it is unlikely that the future probability will increase. Based on the data presented in the State Mitigation Plan, there is no reason to panic over the risk but rather people who may build in areas of former mines should become aware of them and plan accordingly. The likelihood is highest in rural Adams County,

where former mines are located (including the City of Carbon, which is not participating in the plan), but they can occur in any jurisdiction.

When asked about the likelihood that the incidence of this hazard will increase in the future compared to today in the online survey, 23 persons responded. Zero indicated it is more likely, four indicated no change in likelihood, three indicated less likely, and 16 indicated they were unsure or unconcerned.

Score for Rural Adams County: 2	Score for Corning: 1	Score for Nodaway: 1	Score for Prescott: 1
Score for SW Valley Schools: 1	Score for CHI Health: 1		

Sinkhole Vulnerability to the Population:

Based on the location of former mines and buried infrastructure, the general population is generally at low risk. While technically they can happen about anywhere, the general population is not vulnerable to a given sinkhole event. At best, one family could be hurt or killed if, for example, one occurs under a home or a traveling car.

Score for Rural Adams County: 3	Score for Corning: 3	Score for Nodaway: 3	Score for Prescott: 3
Score for SW Valley Schools: 3	Score for CHI Health: 3		

Sinkhole Area of Extent:

Based on the map data in the Mitigation Viewer, mines occupy less than 1% of the county area. However, any given sinkhole will take up a very small area in relation to any jurisdiction. Certainly, a portion of a school or hospital building could fail as a result.

Score for Rural Adams County: 3	Score for Corning: 3	Score for Nodaway: 3	Score for Prescott: 3
Score for SW Valley Schools: 4	Score for CHI Health: 4		

Sinkhole Severity of Impact:

The severity of impact will be based on the size, depth, and location of the sinkhole in relation to the public. For the following, it is assumed one occurs in a residential area and impacts a public street in Corning.

Figure 3.84: Sinkhole Severity of Impact Scoring Matrix

Severity Criteria	Discussion	Score
Health and safety of the public	If a sinkhole occurs suddenly with little or no warning underneath a person or building occupied by a person, death and injuries are likely. Otherwise, such risks are very rare, unless curiosity overtakes the person and they approach the sinkhole and exacerbate the hazard.	2
Health and safety of responders	Normally, the risk is small except that responders may come upon a hole that suddenly expands while they are working in the area. Another risk would be if a flammable or explosive pipeline is severed and erupts while responders are in the area.	2
Continuity of operations	Unless a key public building is damaged by the sinkhole, it is unlikely that local government and response capabilities and operations will be dramatically impacted.	2
Property, facilities, infrastructure	Most of the damage will be to property, facilities, and infrastructure within the area of the sinkhole, although cascading impacts could extend beyond that to surrounding properties served by infrastructure, such as severed pipelines, public streets, and overhead power lines.	3
Delivery of services	Closure of roads and damage to infrastructure could delay services to surrounding areas for hours to days or longer.	3
Environmental impacts	Groundwater supplies can be polluted by debris falling into the sinkhole. Severed gas and sewer mains can result in contamination of water, soil, and air.	3
Economic/financial conditions	Likely the economic impact will be mostly to the property lost and the immediate surrounding area. The impact would be greater if a major employer's building were damaged by a sinkhole. Loss of underground infrastructure and road access can impact a wider area.	3
Regulatory/contractual obligations	Not likely to be directly affected.	1
Reputation	Not likely to be directly affected.	1

Score for Rural Adams County: 20	Score for Corning: 20	Score for Nodaway: 20	Score for Prescott: 20
Score for SW Valley Schools: 20	Score for CHI Health: 20		

Sinkhole Speed of Onset:

Because of the nature of these events, they are most likely going to be sudden with little or no warning.

Score for Rural Adams County: 9	Score for Corning: 9	Score for Nodaway: 9	Score for Prescott: 9
Score for SW Valley Schools: 9	Score for CHI Health: 9		

Sinkhole Duration of Event:

Sinkholes vary in duration with most of them happening quickly once initiated. However, they can continue to grow and sink for hours or longer before the site is secured.

Score for Rural Adams County: 6	Score for Corning: 6	Score for Nodaway: 6	Score for Prescott: 6
Score for SW Valley Schools: 6	Score for CHI Health: 6		

Sinkhole Total Scores:

The following total scores for sinkhole indicate low risk to the public and the planning area where incidents can occur.

Score for Rural Adams County: 43	Score for Corning: 42	Score for Nodaway: 42	Score for Prescott: 42
Score for SW Valley Schools: 43	Score for CHI Health: 43		

Sinkhole Vulnerability/Assets at Risk:

Virtually all structures, property, and people, as outlined in Section 3.2, are susceptible sinkholes, because technically they can occur anywhere.

All critical assets in the county, as outlined in Section 3.2, are potential locations of sinkholes.

Sinkhole Loss Estimation:

Estimating losses for this hazard is very challenging, in part due to the lack of experience with it. It is likely in Adams County that any sinkhole will be of a small size of less than 500 square feet of surface. With that in mind, it would impact would likely be from \$10,000 in property losses of an outbuilding or a tree to \$1 million if an industrial building floor fell through. Loss of life would be very unlikely, although very possible.

Future Development and Sinkhole:

Unless there is new development in areas above former mines, the risk is not likely to be appreciably changed as a result of new development. Modern development often includes soil testing to determine suitability of development on a given site.

Terrorism

Type: Human caused-purposeful

Definition: Encompassing a wide variety of human-caused threats including enemy attack, biological terrorism, agroterrorism, chemical terrorism, conventional terrorism, cyber terrorism, radiological terrorism, and public disorder, this includes the use of multiple outlets to 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.

Terrorism Description:

This hazard encompasses a wide variety of human caused threats including enemy attack, biological terrorism,

agro-terrorism, chemical terrorism, conventional terrorism, cyber terrorism, radiological terrorism, and public disorder. This includes the use of multiple outlets to 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 following paragraphs outline the types of hazards included in this terrorism profile.

Enemy attack is an incident that would cause massive destruction and extensive casualties. An all-out war would affect the entire population. Some areas would experience direct weapons' effects: blast, heat, and nuclear radiation; others would experience indirect weapons' effect, primarily radioactive fallout.

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 groups of people assembling together to substantially interfere with public peace and constitute a threat. Use of unlawful force or violence against another person, causing property damage or attempting to interfere with, disrupting, or destroying the government, political subdivision, or group of people are potential methods employed. 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 group or institution. This plan is concerned about incidents that exceed local response capabilities.

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.

Causing intentional harm to an agricultural product or vandalism of an agricultural/animal related facility is classified as agro-terrorism. Activities could include: intentional introduction of disease, animal rights activists who release animals; disgruntled employees who intentionally contaminate bulk milk tanks or poison animals; eco-terrorists who destroy crops/facilities; theft of agricultural products, machinery, or chemicals; or criminals who vandalize agricultural facilities.

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. Liquid/aerosol or dry contaminants can be dispersed using sprayers or other aerosol generators, liquids vaporizing from puddles/containers, or munitions. Contamination can be carried out of the initial target area by persons, vehicles, water and wind.

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. Conventional terrorism can also include tactical assault or sniping from remote locations. For the planning team's purposes, any bomb threat in a public setting, such as a school, is considered a conventional terrorism incident.

Electronic attack using one computer system against another in order to intimidate people or disrupt other systems is a cyber attack.

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.

Useful information and mitigation ideas for terrorism incidents can be found at www.ready.gov.

Terrorism Historical Occurrence:

Collectively, terrorism has occurred in multiple forms in various parts of Iowa, mostly in urban areas. However, notable instances of agro-terrorism and conventional terrorism have occurred in rural Iowa on many occasions. Only radiological terrorism has not occurred in the state. Enemy attack has occurred, but mostly recently during the Civil War.

Reliable data about this hazard in Adams County is difficult to obtain. The planning team has indicated that bomb threats (a form of conventional terrorism) have occurred at what is now Southwest Valley Schools and anhydrous has been stolen and/or equipment vandalized (a form of chemical terrorism) in the attempt to manufacture illicit drugs.

When asked about the past occurrence of this hazard in the online survey, 22 persons responded. Zero indicated that this occurs more than once a year, one indicated it happens most years, two indicated it happened once or twice in the last five years, and 19 indicated the hazard does not occur or they don't recall an instance.

Terrorism Future Probability:

The probability for most forms of terrorism is higher than past history. The animal rights issue continues to become more organized, and farming is becoming more mechanical and industrial in nature, with more concentrated feeding facilities. Domestic terrorism is becoming more probable and sophisticated. Political angst continues to grow and the public is more polarized. While international terrorist cells have been weakened, they still exist and can attack. The nation's focus on school shootings has raised attention on this area, but it seems like these events are becoming more common in schools of all sizes (Centers for Disease Control, Statistic Brain). Shootings, stabbings, and bombings at military installations, sporting events, shopping centers, and workplaces are being reported several times per year across the nation. There is no evidence that these trends will reverse. Cyber terrorism is difficult to identify, but recent activities in other states just this spring of 2021 involving ransomware illustrate a growing crime problem. All forms of terrorism are relatively unlikely in a given year in Adams County but are certainly possible except radiological terrorism, which will likely be too difficult to implement for a terrorist to use in this area. Major highways and the railroad in the county also add to the risk due to ease of access to the area.

The probability of a successful international attack that will affect Adams County in any direct way will be very low. While weapons of mass destruction exist in various parts of the world, Adams County would not be a primary target. The Federal government monitors global political situations and provides security from international attacks.

Although destructive civil disturbances are rare, the potential is always there for an incident to occur. Alcohol is often involved in public disorder, especially related to college campuses, sporting events, and concerts. Because of so limited resources, a small crowd, once out of control, can take some time to subdue.

When asked about the likelihood that the incidence of this hazard will increase in the future compared to today in the online survey, 23 persons responded. One indicated it is more likely, five indicated no change in likelihood, seven indicated less likely, and ten indicated they were unsure or unconcerned.

Score for Rural Adams County: 2
Score for SW Valley Schools: 3

Score for Corning: 2
Score for CHI Health: 1

Score for Nodaway: 1

Score for Prescott: 1

Terrorism Vulnerability to the Population:

While the vulnerability varies by the type of event, most of the population will not be at direct risk of death, injury, or illness or through the loss of property. However, the spreading fear and increase in inconvenience can diminish the quality of life throughout the county. Agro-terrorism is likely to directly impact the farms and agribusiness facilities attacked and other production facilities within a mile or two, depending on wind patterns. Agro-terrorism will not have a direct impact on the schools and the hospital. Bioterrorism will directly impact a contaminated facility. State and local agencies developed the Biological Chemical Threat Agent (BCTA) Protocol Model to guide response agencies. The American public is not vaccinated for many of the agents used as weapons by terrorist groups. Despite this, most of the people in a given area will not likely be adversely affected, with the exception of concentrated populations, such as in schools and the hospital. Chemicals travel through Adams County on highways and railroads; these can be used to produce a bomb or can be released in the air and water to cause harm. Chemical agents may pose viable threats for hours to weeks depending on the agent and the conditions in which it exists. Shielding in the form of sheltering in place can protect people and property from harmful effects. There are a limited number of antidotes available to reduce the vulnerability from chemical agents. The planning team indicates that water supplies in the area are very vulnerable to chemical attacks because surface drinking water is easy to contaminate. Conventional terrorism is most likely to cause serious harm to the public. Terrorists can bring in and detonate a bomb within a populated area, can issue threats that shut down critical assets, and can seriously damage the local economy. A large blast can kill and injure hundreds of people. Security professionals argue that current cyber security approaches are inadequate. With companies increasingly using the Internet to connect to suppliers and customers, they say organizations place too much faith in technology to protect their data, and do not pay enough attention to security education and awareness. Inadequate security can facilitate access to critical computer systems, allowing them to be used to conduct attacks. Depending on the intensity of attack on local systems, hundreds of individuals, students, and businesses can be subject to negative impacts. Random homes and properties far from the origin of the attack can be affected. Radiological terrorism can be very destructive, even in a low-density area, but it is very difficult for terrorists to develop, transport, and detonate a bomb of a size necessary to maximize effect. There are no radiological materials production facilities in or within 50 miles of Adams County. The radiological impacts of the blast might have a greater impact, even if it occurs in a more populated area such as Des Moines. The electromagnetic pulse (EMP) can destroy communications and damage computer systems upon which Adams County residents, businesses, and governments depend. Public disorder is likely to occupy only a small area but could have considerable impact on the population where they occur. Enemy attack impacts would likely be residual as a result of attacks on realistic targets, such as Des Moines and Omaha. Overall rural areas are less vulnerable because they have low population densities.

Score for Rural Adams County: 4	Score for Corning: 5	Score for Nodaway: 5	Score for Prescott: 5
Score for SW Valley Schools: 7	Score for CHI Health: 7		

Terrorism Area of Extent:

Generally, the area of extent of the event is less significant than the affected population and might only be a single building or a few square miles of land or water. Due to shielding and other anti-terrorism actions, some of the population in the exposed area may not be directly affected due to most forms of terrorism events, but public fear, economic and financial loss, and inconvenience often exceeds the area of extent. Agro-terrorism and bioterrorism, specifically, can contaminate food systems and cause contagious diseases that can spread to people beyond the area of extent. Agro-terrorism is likely only to have direct spatial impact on a single herd of animals, a single farm, or a few farms downwind. Biological incidents are likely to involve only a very small amount of powder, so the direct effect might be one building or a room in a building or a playground. Chemical contamination can be carried out of the initial target area by persons, vehicles, water and wind. The micro-meteorological effects of buildings and terrain can alter travel and duration of agents. The extent is

largely determined by the type of chemical, the method of dispersal, and the conditions at the time it is released. Extent of damage is determined by type and quantity of explosive. Effects are generally static other than cascading consequences, incremental structural failure, etc. The likely size and type of explosive used in a terrorism event in Adams County would only impact a small part of the county but could affect a large part of a town or critical asset. Cyber terrorism could be very widespread, covering all parts of the county but not likely impacting all systems and computers. Initial effects of radiological terrorism will be localized to site of attack; depending on meteorological conditions, subsequent behavior of radioactive contaminants may be dynamic. Public disorder is likely to occupy only a small area but could have considerable impact on the population where they occur. Enemy attack would almost certainly not impact any area of the county directly, as Adams County and surrounding counties would not be realistic targets.

Score for Rural Adams County: 3	Score for Corning: 4	Score for Nodaway: 4	Score for Prescott: 4
Score for SW Valley Schools: 5	Score for CHI Health: 5		

Terrorism Severity of Impact:

Clearly, the severity will depend on the size and type of terrorism event. However, Americans are very sensitive to the threat of terrorism since the September 11, 2001 attacks. Likely, the greatest harm will originate from a conventional terrorism attack in a community or populated area, such as a critical asset. The size of attack will be relatively small compared to something found in a more urban part of the nation. However, the discovery of slightly elevated radiation levels, heightened media attention, and conveyed threats from a terrorist group would incite public hysteria. The hysteria can cause great economic, financial, and transportation disruption far beyond the size and scope of the physical destruction.

The effects of an enemy attack are likely to be indirect at best. The severity of public disorder will vary by type and size of the crowd, the value of the assets involved, and the duration of event. Because local response resources are limited, it might take an hour or more to bring in an adequate number of law enforcement personnel to gain control of the situation.

The severity assessment matrix considers the impacts if a crowd in a public place gets out of hand and the incident spills into surrounding neighborhoods and considers the impacts of a terrorist attack of the likely magnitude in Adams County, impacting one critical asset directly. In the worst-case (but very unlikely) scenario, the impacts would be severe.

Figure 3.85: Terrorism Severity of Impact Scoring Matrix

Severity Criteria	Discussion	Score
Health and safety of the public	The potential for mass casualties is great if the event were to take place in the right location. However, in order for this event to take place with its full magnitude, a number of factors must be addressed: a) the amount of material that was used to make the device; b) the type of material that was used; c) the construction of the device; d) the site of detonation, including population; and e) the wind direction. It is possible that hundreds of people can be killed and injured. A massive attack killing thousands of people is very unlikely to target Adams County. Major civil unrest causes injury and can cause widespread fatalities. People involved in the disorder and bystanders can be injured or killed.	5
Health and safety of responders	In a detonation, there could be a significant risk to the health and safety of personnel that would respond to the site. Again, it is completely dependent upon the magnitude of the explosion, and the infrastructure in the area. Soil and rubble may be unstable and unsafe for response operations. Precautions must be made prior to deploying emergency services. Careful consideration to safety in the removing of hazardous rubble as to not further harm the victims as well as the responders should be a priority. Radiation detection and protection equipment must be available and utilized in the event of such an attack. These measures greatly reduce the risk of health and safety of responders. Despite this, secondary attacks designed to harm responders are very possible. Medical staff and volunteers can be overworked and supplies in local care facilities can run out. Response personnel are at high risk of injury or death when trying to quell a public disorder.	5

Severity Criteria	Discussion	Score
Continuity of operations	Dependent upon many factors, especially location of detonation compared to the critical operations. There could be a great impact on operations due to the lack of resources to handle the situation. The continuity of operations will depend upon the capabilities of all responders. The blast may also disrupt communication lines and some equipment. Resulting fear and targeting of government leaders and officials can greatly disrupt local government. Many community operations can be severely stretched and can run the risk of temporary failure. Equipment and supplies of operators can run out or be damaged in the violence, thus reducing future response. Courts can be jammed with prosecutions of crimes. Public buildings and assets are often the targets.	4
Property, facilities, infrastructure	The extent of destruction to property and infrastructure is dependent on the size and the location of the incident as well as the type of terrorism. Entire buildings can be destroyed, and impacts to surrounding utilities, roads, rail, and other infrastructure can affect a larger area. Public infrastructure can be destroyed and take years to replace.	4
Delivery of services	Delivery services from within the blast area will be rendered incapable. All delivery services outside the blast ring will be affected by the range and capabilities of their own services. Radiation may also disrupt some equipment. Services can be severely hampered due to the actual violence, the cleanup, or the fear of future violence that keeps people from providing services in an area or to a business or organization. For example, fires can sometimes burn uncontrolled because firefighters are unable to respond due to resistance from rioters.	3
Environmental impacts	Depending on the type of terrorism, the environmental impact may be severe. Most likely the impact would be minor and temporary. Depending on the type of public disorder incident and damages that result, short-term and long-term environmental damage is likely.	3
Economic/financial conditions	Physically the impacts may be small, but the widespread fear and panic can greatly impact the area economy by reducing economic activity in the area and causing people to make unplanned financial choices that reduce long-term stability of the area. Damaged facilities disrupt productivity, and many times have difficulty reopening and may eliminate jobs in the area. A major blast could permanently displace businesses and laborers. Perhaps even more tragic has been the lingering, negative impact and loss of investment in the communities ravaged by the uprisings. Many riot areas do not fully recover from the damage, destruction, and negative image brought on by such events. Looting, burning, and sniping can occur during severe civil disturbances. Businesses and industry may shut down and move to a safer area.	3
Regulatory/contractual obligations	No significant impact known unless someone or an organization failed to prepare. Events can cause the failure to keep and meet contracts and can be the result of contracts and regulations, thereby putting local business and government in strain. Labor disputes and disputes over government regulations can bring about tighter regulations, fines, and litigation.	2
Reputation	Reputation of the entity can be very damaging because of the high profile of these events. Certain events involving chemicals, radioactive materials, and cyber destruction can cause long-term mistrust in governments and a black mark on the area for fear of contamination or infection. How the response is conducted and political leaders respond will determine the local reputation. It is likely that public disorders will hurt local reputation more than terrorism.	3

Score for Rural Adams County: 32	Score for Corning: 32	Score for Nodaway: 32	Score for Prescott: 32
Score for SW Valley Schools: 32	Score for CHI Health: 32		

Terrorism Speed of Onset:

Acts of terrorism can be immediate and often come after little or no warning. There are occasions where terrorists have warned the targeted organization beforehand, but often the attack comes without previous threat. Even after a threat, the actual event will often be immediate and without time for preparation. Enemy attack similarly could come with no warning or not enough warning to react adequately. Public disorder might have some warning or at least signs that things are “about to get out of hand.” A crowd is needed, so in that way there may be some warning that it could happen.

Score for Rural Adams County: 9	Score for Corning: 9	Score for Nodaway: 9	Score for Prescott: 9
Score for SW Valley Schools: 9	Score for CHI Health: 9		

Terrorism Duration of Event:

This depends on the type of event and if it is connected to a more widespread attack affecting other jurisdictions. While consequences, such as contamination and cascading events can continue for hours to weeks, the typical terrorism event is likely to be brief, no more than a few hours. Stopping or capturing the perpetrator(s) may take hours to one day on average. Public disorder could take a day or more to stop the carnage, round up the perpetrators, and restore some sense of order. Enemy attack and cyber terrorism could last for months or longer, but the direct effects in Adams County might last a shorter amount of time.

Score for Rural Adams County: 7	Score for Corning: 7	Score for Nodaway: 7	Score for Prescott: 7
Score for SW Valley Schools: 7	Score for CHI Health: 7		

Terrorism Total Scores:

The following total scores for terrorism indicate high risk to the public and the planning area where incidents can occur.

Score for Rural Adams County: 57	Score for Corning: 59	Score for Nodaway: 58	Score for Prescott: 58
Score for SW Valley Schools: 63	Score for CHI Health: 61		

Terrorism Vulnerability/Assets at Risk:

All structures, property, and people in the county, as outlined in Section 3.2, could suffer from the effects of terrorism. While terrorism is more likely in some areas of the county, and more remote areas are less likely to suffer direct effects, there is no way to be sure that any area is totally immune or unexposed.

All critical assets in the county, as outlined in Section 3.2, are at risk.

Terrorism Loss Estimation:

Terrorism events are rare occurrences and specific loss data 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.

Adams County is likely to suffer only modest loss, relatively speaking, due to a carried out terrorism event that occur within the county. Most incidents will be threats only or will be very localized, such as individual pipe bombs or suspicious packages and powders. These will not have an impact on the greater community in terms of death, injury, or property damage. However, the risk remains that local terrorism will be severe with the loss of dozens of lives and destruction of dozens or hundreds of buildings.

Structural losses can be very severe. With a nuclear explosion or large conventional bomb explosion, entire neighborhoods could be destroyed. Physical costs could exceed \$100 million in Adams County alone, not including contents loss. In most situations, the loss will be much less. A typical event might cause \$25,000 in damage, such as a fire in a home or government office or damage to a classroom in a school.

Social, economic, and functional use losses are actually likely to be much higher for the kind of terrorism (domestic without coordination with a major terrorism network) incidents that are probable in Adams County. Other losses include loss economic opportunities for businesses, loss of food supplies (including livestock), destruction of computers and electronic equipment, and damage to the food supply chain. Changes in activities, spending patterns, and family lifestyle decisions will result, and the community may become somewhat less cohesive, which can cause population loss, business loss, decline in property values, and damage to the environment. Government entities may have to increase staffing and investing in counter- or anti-terrorism activities and in addressing the loss or attrition of response personnel and equipment.

A cyber attack would greatly impact computer networks and the infrastructure (pipelines, electrical systems, sewer plants, etc.) and businesses that depend on them, and can indirectly cause structural losses, but directly there will be few structural losses.

For the purposes of this plan, the planning team estimates losses using a hypothetical scenario. The attack scenario is staged at a Friday night high school football game in Corning. The hypothetical football stadium has approximately 500 persons in the stadium and concession areas on any home football game nights during the fall.

Analysis of vulnerable populations is aided by a program developed by Johns Hopkins University in 2006 called Electronic Mass Casualty Assessment and Planning Scenarios (EMCAPS), <http://www.hopkins-cepar.org/EMCAPS/EMCAPS.html>, which utilizes scenarios developed by the Department of Homeland Security.

*****THE FOLLOWING HYPOTHETICAL SCENARIO IS FOR INSTRUCTIONAL AND ILLUSTRATIVE PURPOSES ONLY*****

Chemical Attack – Toxic Gas – Chlorine Release

Scenario Overview: A bomb is attached to a truck trailer tanker carrying compressed chlorine and enters the high school football stadium parking lot. The entire contents of the tank escape to the atmosphere and the plume spreads to the stadium and the immediate surrounding parking lot area. This particular type of attack would cause harm to humans and could render portions of the stadium unusable for a short time period in order to allow for a costly cleanup. There might also be a fear by the public of long-term contamination of the stadium and the high school subsequent closing the high school.

Assumptions: (1) The population density is approximately 500 persons around the high school stadium; (2) chlorine is toxic and may damage eyes, skin and respiratory tract; and (3) the rate of “worried well” is equal to 9 times the number of infected cases.

The following table describes health-related losses from such an incident. Other losses may include the suspension of high school sports during the duration of the investigation and the economic losses that result.

Figure 3.86: Estimated Loss Scenario – Chemical Attack

Loss Description	Loss Value
Eye pain & swelling, headache, restricted airflow – difficulty breathing, possible chemical burns	26 persons
Eye pain & swelling, headache, rapid breathing, skin irritation	49 persons
Eye pain & swelling, headache, rapid breathing, coughing, chest pain, skin irritation	97 persons
Eye irritation, headache, throat irritation, coughing, skin irritation	122 persons
Eye irritation, headache, coughing, skin irritation	82 persons
Total “Worried Well” Cases (9 times the number of affected cases)	234 persons
Deaths	17 persons
Cost of Decontamination @ \$12/person (assumes all persons with skin injuries will require decontamination and approximately 1/10 of the worried well will demand to be decontaminated) - total persons =704.	\$8,448

Improvised Explosive Device Attack – ANFO

Scenario Overview: An Improvised Explosive Device (IED) utilizing an ammonium nitrate/fuel oil (ANFO) mixture is carried in a panel van to a high school parking area at the beginning of a home football game when people are leaving their cars and entering the stadium. Potential losses with this type of scenario include both human and structural assets.

Assumptions: (1) The population density in the parking lot during the beginning and ending of the game is high, at least 1 person /100 square feet; (2) the quantity of ANFO used is 500 lbs.

The following table describes health-related losses from such an incident. Other losses may include the suspension of high school sports during the duration of the investigation and the economic losses that result.

Figure 3.87: Estimated Loss Scenario – Explosive Device

Loss Description	Loss Value
Total Dead	86 persons
Total Traumatic Injuries	151 persons
Total Urgent Care Injuries	745 persons
Injuries not Requiring Hospitalization	279 persons
Structures and Other Physical Assets (Damages would certainly occur to vehicles and depending on the proximity of other structures, damages would occur to the stadium itself. The exact amount of these damages is difficult to predict because of the large numbers of factors, including the type of structures nearby and the amount of insurance held by vehicle owners.)	Replacement cost for approximately 350 vehicles @ \$10,000 per vehicle inside the 200 ft BATF described Lethal Air Blast range = \$ 3,500,000 Repair / repainting cost for approximately 70 vehicles @ \$ 4,000 per vehicle inside the BATF described Falling Debris Hazard = \$280,000

The above are simply examples. These examples give one an idea of what could realistically happen in a county like Adams, even if the probability of these scenarios is very small.

Future Development and Terrorism:

As public events are held at the courthouse, county fairgrounds, schools, and many other locations, the potential exists for these locations to become targets of attack. With human-caused hazards such as this that can have multiple variables involved, increases in development is not always a factor in determining risk, although the physical cost of the event may increase with the increased or newly developed areas due to additional exposure.

Thunderstorm/Lightning/Hail Profile

Type: Natural

Definition: Atmospheric imbalance and turbulence that may result in thunder, heavy rains (which may cause flash flooding), and strong winds reaching or exceeding 58 mph, resulting in tornadoes, surface hail of at least 1 inch in diameter, and lightning.

Thunderstorm/Lightning/Hail Description:

Most thunderstorms are small and do not cause any notable damage. These common storms in Iowa contain mostly cloud-to-cloud lightning, moderate but short-lived rain, and little or no wind. Such storms of this nature are not a concern for the hazard mitigation plan. However, occasionally, the combination of moisture in the air, the collision of air masses (fronts), and the rise of unstable warm air cause severe storms, especially during the months of April through June, although they can occur during any month. Severe thunderstorms are dangerous because they can result in multiple hazards, including strong straight-line winds, heavy rain, hail, dangerous cloud-to-ground lightning, and even tornadoes. High winds and tornadoes are profiled in greater detail in the tornado/windstorm profile.

Lightning in its own right is very dangerous and is found in any thunderstorm, although in most thunderstorms there are no or very few bolts that reach the ground. Not just does it reach up to 50,000 degrees Fahrenheit in a split second, it packs enough energy to kill people and animals instantly, start fires, and destroy infrastructure. The electromagnetic effects of lightning can destroy and render unreliable other equipment and systems not even directly hit. Lightning can also occur far (up to 10 miles) from the base of the storm, even in areas with

no overhead clouds, where people may not have started to take cover. Things can be confusing for the public because storms can occur singly, in clusters, and in lines, sometimes without warning or meteorological explanation.

Hail is a fairly common ingredient in thunderstorms that are severe or that occur on cool days. Large hail over one inch in diameter becomes a hazard because of its destructive power.

Thunderstorm winds can be very light to very strong. At 58 MPH, thunderstorm winds become severe. Thunderstorm winds can be unpredictable because they originate within various parts of the storm and might blow in different directions in the forms of updrafts, downdrafts, microbursts, derechos, outflow boundaries, and other phenomena. Most high wind events in Iowa are associated with thunderstorms. Those that are not are covered in the tornado/windstorm profile.

Thunderstorm/Lightning/Hail Historical Occurrence:

Severe thunderstorms have occurred many times in Adams County and are an annual event somewhere in the county. Most years, multiple severe thunderstorm warnings are issued. The most common cause for the severe thunderstorm warnings are strong straight-line winds, but small hail and heavy rain over 1” per hour is also common. Large hail and tornadoes are relatively rare, but have occurred on numerous occasions. Dangerous lightning is common, although most lightning strikes do not cause damage to personal property or cause injuries and death, due to the relatively low density of development in most of the county. The total number of historical events increases (compared to the previous plan) because hail is now included in the thunderstorm/lightning profile rather than as a separate hazard.

The NCEI provides data about severe thunderstorms, lightning, and hail events. This data includes reports of damaging events. Not all declared severe storms end up causing local damage that is reported in to the NCEI, and some damaging storms that are reported by the NCEI are not necessary deemed severe storms at the time they occur.

The NCEI has reported 1 lightning and 78 thunderstorm wind events since 1950, through December 2020, with an average reported loss of \$24,199 per storm event. There have been 0 deaths and 3 injuries reported (reviewing the reports, these injuries occurred in other counties but as part of the same storm impacting Adams County), both from thunderstorms, not lightning events. Over \$1.67 million in property damage and \$217,500 in crop damage in the county attest to the destruction due directly to thunderstorms. Some of these losses may not have occurred in the county but were part of a larger storm that also caused damage in the county. Iowa is among the top states in the nation in lightning-related fatalities and the annual property damages sustained by lightning. There have been 11 Presidential Declarations of Major Disaster in Adams County since 1953 due to severe thunderstorms.

The NCEI reports 88 hailstorm events in Adams County from 1950 through December 2020, resulting in no deaths and injuries but in \$556,500 in property damages and \$1.084 million in crop damage (note that most events before 1995 did not include damage information). Most of these events occurred since 1990, when better reporting was initiated. Of these, 60 were hailstorms that produced hail at or exceeding 1 inch in diameter. Most but not all of the damage reported had resulted from the hailstorms of this magnitude. Hail events were reported in all parts of the county, including the rural area and all municipalities. Most reports did not show the exact location of events, and it is likely that an event that reported from a specific area also affected other jurisdictions not on the list. The following (Figure 3.88) is the summary of the number of events reported by the NCEI that meet the plan definition of a hailstorm listed by reported hail size.

Figure 3.88: Historical Events by Hail Intensity

Hail Size (inches)	Intensity (TORRO Hail Intensity Scale)	# of Events – 1950-11/2017
1.00	Severe	33
1.25	Severe	3
1.50	Severe	4
1.75	Destructive	15
2.00	Destructive	3
2.25	Destructive	0
2.50	Destructive	1
2.75 or more	Destructive	1 (largest is 3.0")

Source: National Centers for Environmental Information, 6/2021 (data available through 12/2020)

The 167 recorded events clearly illustrate that large numbers of thunderstorm events with damaging wind (78), hail (88), and lightning (1) occur in Adams County. While the report goes back to 1950, most of the events in the record are since 1993.

Note that these events/losses do not include windstorms, tornadoes, and other damages, even though most of those damages are spawned by or related to severe thunderstorms. It is likely the actual losses are somewhat under-reported, as many storms cause slight or modest damage to properties on a wide scale, and often these losses are not reported or are only reported to individual owner's insurance.

Thunderstorms have impacted all jurisdictions and areas of the county. The Adams County planning team did not recall specific events but members indicated it is an annual event with greatly varying levels of damage. Adams County was not directly impacted by the 2020 derecho.

When asked about the past occurrence of this hazard in the online survey, 23 persons responded. Ten indicated this hazard happens more than once a year, seven indicated it happens most years, six indicated it happened once or twice in the last five years, and none responded that it has not occurred or there is no memory of it occurring.

The following is the number of severe thunderstorm watches and warnings issued by NOAA's NWS. The data is housed on the Iowa Environmental Mesonet, Iowa State University Department of Agronomy website, (<http://mesonet.agron.iastate.edu/vtec/search.php>).

Figure 3.89: Historical Severe Thunderstorm Events in Past Five Years

Year	Warning	Watch	Total
2016	10	9	19
2017	9	4	13
2018	12	6	18
2019	26	11	37
2020	7	5	12
2021 (through March)	0	0	0
Totals	64	35	99

Source: Iowa State University Department of Agronomy, <http://mesonet.agron.iastate.edu/vtec/search.php>, accessed 5/2021

The average over the past 5.25 years is 12.2 warnings and 6.7 watches per year.

Thunderstorm/Lightning/Hail Future Probability:

Thunderstorms are an annual event in all jurisdictions of the county, and hail of any size is expected two or three times annually. Southern Iowa experiences between 40 and 50 thunderstorm days annually, according to the NCEI. Severe thunderstorms occur nearly every year in all jurisdictions. During most summers, more than one severe thunderstorm occurs in the county, and any given storm affects multiple jurisdictions.

Because large hail tends to occur only in some severe storms and occupies only part of the thunderstorm cell, the probability of 1” or larger hail is not as high as generic severe thunderstorms in any given jurisdiction on a given year. With Iowa’s location in the interior of the U.S., and with the noted trend of increasing severity of weather in recent years, there is a very high likelihood that this trend will continue. According to the NWS, Adams County is subject to 2 to 4 lightning cloud-to-ground strikes per square kilometer per year (roughly 6 to 11 per square mile).

When asked about the likelihood that the incidence of this hazard will increase in the future compared to today in the online survey, 23 persons responded. Six indicated it is more likely, 14 indicated no change in likelihood, two indicated less likely, and one indicated they were unsure or unconcerned.

Score for Rural Adams County: 9	Score for Corning: 9	Score for Nodaway: 9	Score for Prescott: 9
Score for SW Valley Schools: 9	Score for CHI Health: 9		

Thunderstorm/Lightning/Hail Vulnerability to the Population:

During a storm, those in unprotected areas, mobile homes, or automobiles are at risk. 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. (after flash flooding) with nearly 100 deaths and 500 injuries each year. 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. Cascading events, such as tornadoes, power loss, and flooding, can also cause significant loss. The planning team noted that lightning has knocked out power and key facilities for many hours. TV, computer, refrigeration, and power line losses cause hardship, particularly for the low-income and elderly population. Generally, schools and the hospitals have lower population vulnerability because of sturdy modern design and in many cases lightning protections in place. In a given storm, fewer of the rural residents might be directly impacted due to the low density of population, but rural residents tend to have extensive exposed assets that are susceptible to storms.

Hail 1” in diameter or greater, which is not uncommon in severe thunderstorms, can be very dangerous to people, pets, and livestock if shelter is not available. Additionally, hail has destroyed windows, siding, vehicles, and roofs. Agricultural crops such as corn and beans are particularly vulnerable to hailstorms stripping the plant of its leaves. Hail only rarely results in loss of life directly, although minor injuries are not uncommon. People outside away from buildings are most vulnerable to injury, such as those at parks and campgrounds or those out on a lake. People watching the storm inside, but near windows or inside cars can also be hurt if glass is broken. Because most hailstorms impact largely rural areas and people can find safety, the planning team indicates that the vulnerable population is often somewhat lower than the percentage of area impacted. Schools are more likely than the hospital to be vulnerable because large numbers of children can be outside, such as on a playground, bus stop, or ball field, when the storm hits.

Score for Rural Adams County: 7	Score for Corning: 6	Score for Nodaway: 6	Score for Prescott: 6
Score for SW Valley Schools: 5	Score for CHI Health: 4		

Thunderstorm/Lightning/Hail Area of Extent:

Severe thunderstorms can be quite expansive with areas of localized severe conditions. Most severe thunderstorm cells are 5 to 25 miles wide with a larger area of heavy rain and strong winds around the main cell. Most non-severe thunderstorms have a lifespan of 20 to 30 minutes, while severe thunderstorms often last longer than 30 minutes. Because Adams is a small county, a single thunderstorm can impact the entire county very easily, with the severe area covering half of the county and all of any other jurisdictions.

The land area affected by individual hail events is not much smaller than that of parent thunderstorm, an average of 15 miles in diameter around the center of the storm. The largest and most damaging hail usually covers a relatively small part of the hail path. The area of extent is likely to be larger than the true vulnerability of the population and consists of wherever the hail at or exceeding 1” falls. The hazard mitigation planning team indicates that up to 50% of the rural part of the county would be affected by the severe portion of a single storm event, but a much larger part of cities would be affected, and an event would likely cover the entire campus of schools and hospital.

Score for Rural Adams County: 6	Score for Corning: 8	Score for Nodaway: 8	Score for Prescott: 8
Score for SW Valley Schools: 9	Score for CHI Health: 9		

Thunderstorm/Lightning/Hail Severity of Impact:

The severity of thunderstorms is related to the severity of the other hazards that come from the storm clouds: high winds, tornadoes, flood-producing rains, hail, and lightning. Severity, therefore, is a measure of combined impacts of these hazards in a typical storm, which includes winds at the low limit of severe level, hail at 1”, cloud-to-ground lightning, heavy rain, and slight potential for a small tornado. Note that tornadoes and flash floods are covered in their own profiles.

Severity of hailstorms is mostly a factor of the size of hail but also is influenced by the location of the storm and time of day. Most of the past hail events, as reported by the NCEI, were 1” in size or less and were defined as “significant” and “severe” events. However, a quarter of them were “destructive” events. For the assessment in this plan, the planning team is considering the severity of a “destructive event.” Below is a scale showing the classifications of hailstone intensity created by the Tornado and Storm Research Organization (TORRO).

Figure 3.90: Potential Damages by Hail Intensity

Intensity Category	Typical Diameter (in)	Size Description	Typical Damage Impacts
Hard hail	0.2-0.4	Pea	No damage
Potentially damaging	0.4-0.6	Mothball	Slight general damage to plants and crops
Significant	0.6-0.8	Marble, grape	Significant damage to fruit, crops, and vegetation
Severe	0.8-1.2	Walnut	Severe damage to crops; damage to glass and plastic structure; paint and wood scored
Severe	1.2-1.6	Pigeon’s egg	Widespread glass damage, vehicle bodywork damage
Destructive	1.6-2.0	Golf ball	Wholesale destruction of glass; damage to tiled roofs; significant risk of injuries
Destructive	2.0-2.4	Hen’s egg	Bodywork of grounded aircraft dented, brick walls pitted
Destructive	2.4-3.0	Tennis ball	Severe roof damage; risk of serious injuries
Destructive	3.0-3.5	Large orange, softball	Severe damage to aircraft bodywork; increased risk of serious injuries; slight risk of death.
Super hailstorm	3.5-3.9	Grapefruit	Extensive structural damage; risk of severe or even fatal injuries to persons caught in the open.
Super hailstorm	4.0+	Melon	Extensive structural damage; risk of severe or even fatal injuries to persons caught in the open. Damage could be catastrophic if the hail is large enough.

Source: TORRO, www.torro.org/uk/site

The following provides a summary of the severity of impact throughout the county.

Figure 3.91: Thunderstorm/Lighting/Hail Severity of Impact Scoring Matrix

Severity Criteria	Discussion	Score
Health and safety of the public	Thunderstorms and lightning can cause death, serious injury, and substantial property damage. 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. Lightning is the greatest	3

Severity Criteria	Discussion	Score
	thunderstorm cause of death in Iowa, but the probability of being struck is very low. 128 injuries and 4 deaths are attributed to hail in Iowa since 1980 (through April 2013). “Destructive” hailstorms rarely cause death, but it is always possible when people are exposed and cannot get to shelter quickly. Injuries of minor nature are likely if enough people are exposed. Triggered hazards can greatly increase the risk of and number of people injured or killed. Despite this, most severe thunderstorms do not cause severe injury and death.	
Health and safety of responders	Response personnel are exposed to the same risk as the general public when caught in the storm without shelter. Work on ladders and other apparatus during lightning can expose responders to higher risk situations. Typically, they will not respond to the incident until hail has passed but sometimes they have no choice.	3
Continuity of operations	Continuity of operations would be affected through indirect impacts such as loss of critical services. Destruction and disruption of communications equipment, computers, and electronics will make it impossible to complete some tasks at least temporarily. Operations should not be affected to any significant degree by hail, unless utilities are damaged. Impacts might delay services up to one day to electrical systems and other exposed infrastructure and facilities.	3
Property, facilities, infrastructure	High winds can damage trees, homes (especially mobile homes), and businesses and can knock vehicles off of the road. Power lines and related electrical facilities are lost to lightning and high winds. Straight-line winds are responsible for most thunderstorm damage. Hail damage to property, facilities, and infrastructure is usually limited to broken windows, damaged siding, damaged roofs, and vehicle damage. Hail has damaged many properties in the past ten years in Adams and surrounding counties. Most of the losses were insured. Utilities, crops, and trees have been damaged.	3
Delivery of services	One or more severe thunderstorms occurring over a short period (especially on saturated ground) can lead to flooding and cause extensive power and communication outages as well as agricultural damage. Delivery of services should not be affected to any significant degree due to hail. Disruptions are likely to come from high winds and lightning, which damage power systems and block roads.	3
Environmental impacts	High winds and hail can damage trees and other plants, but this is a naturally occurring hazard and the environment proves to be resilient following these and other natural hazards. The destruction of plants and crops can adversely affect the environment temporarily at best. Blowing debris and fire hazards caused by wind and lightning can cause temporary modest impacts.	2
Economic/financial conditions	Thunderstorm wind and lightning occur rapidly and can damage any exposed assets. The aftermath may cause moderate economic impacts, but most will be related to cascading hazards such as flooding. Hailstorms cause nearly \$1 billion dollars annually in property and crop damage in the United States. The peak hail activity coincides with the Midwest’s peak agricultural season. Financial impacts resulting from damage to property is in the millions of dollars every year, most of which is covered by crop and hazard insurance. Damage to homes, vehicles, and electrical facilities could greatly disrupt local business and possibly cause business failure.	3
Regulatory/contractual obligations	These are not likely to be affected in any significant way.	1
Reputation	Reputation is not likely to be affected unless any response and cleanup is inadequate or delayed.	1

Score for Rural Adams County: 22

Score for Corning: 22

Score for Nodaway: 22

Score for Prescott: 22

Score for SW Valley Schools: 22

Score for CHI Health: 22

Thunderstorm/Lightning/Hail Speed of Onset:

Some thunderstorms can be seen approaching, while others hit without warning, as they develop rather quickly in warm unstable air not necessarily associated with a frontal boundary. The NWS issues severe thunderstorm watches and warnings as well as statements about severe weather and localized storms. These messages are broadcast over NOAA Weather Radios and area TV and radio stations. Advances in weather prediction and surveillance have increased warning times. The resolutions of radar and Doppler radar have increased the accuracy of storm location and direction as well as intensity and likelihood/size of hailstones. Weather forecasting and severe weather warnings issued by the NWS usually provide residents and visitors alike adequate time to prepare. Isolated problems arise when warnings are ignored. Warnings in the 20 minutes to 1 hour range are usually available prior to the occurrence of the storm. Often the warning that the conditions

are right for large hail is given hours or even days ahead of time, although sometimes isolated areas of hail at least 1” in diameter can occur in storms that were not expected to produce such hail.

Score for Rural Adams County: 7	Score for Corning: 7	Score for Nodaway: 7	Score for Prescott: 7
Score for SW Valley Schools: 7	Score for CHI Health: 7		

Thunderstorm/Lightning/Hail Duration of Event:

Individual thunderstorm and lightning events generally last up to one hour, although a cluster or line of severe storms can last a few hours over a given area. Hailstorms typically last only a few minutes and always less than 1 hour over a given area. Because of the size of the rural area, it is more likely to see the effects of a storm for a longer duration before the storm moves to another county.

Score for Rural Adams County: 4	Score for Corning: 3	Score for Nodaway: 3	Score for Prescott: 3
Score for SW Valley Schools: 3	Score for CHI Health: 3		

Thunderstorm/Lightning/Hail Total Scores:

The following total scores for thunderstorm/lightning/hail indicate moderate to high risk to the public and the planning area where incidents can occur.

Score for Rural Adams County: 55	Score for Corning: 55	Score for Nodaway: 55	Score for Prescott: 55
Score for SW Valley Schools: 55	Score for CHI Health: 55		

Thunderstorm/Lightning/Hail Vulnerability/Assets at Risk:

All structures, property, and people in the county, as outlined in Section 3.2, could suffer from the effects of thunderstorms and their associated cloud-to-ground lightning, hail, and thunderstorm winds. Power lines, utility poles, towers, and poorly built buildings are at the most risk among structures. Contents losses are likely to be minor, even compared to structural losses.

All critical assets in the county, as outlined in Section 3.2, are exposed and at some level of risk.

Thunderstorm/Lightning/Hail Loss Estimation:

Most lightning damages occur to electronic equipment located inside buildings. However, structural damage can also occur when a lightning strike causes a building fire or fells a tree onto a building. In addition, lightning strikes can cause damages to crops if fields light on fire. Communications equipment and warning transmitters and receivers can also be knocked out by lightning strikes. Thunderstorm winds and hail can cause damage to property, vehicles, trees, and crops.

Loss estimation for structures can be obtained from NCEI historical data on for structures. From 1996 through 2020, there have been \$1.75 million in property damages due to lightning and wind and \$0.56 million in property damages due to hail, for a total of \$2.306 million. The annualized loss is \$92,000 to structure and properties (not including contents).

In the past five years (2017-2020), there has been \$142,864.40 in 9 claims for crop insurance in Adams County, an average of \$35,716 per year, due to hail damage. According to the 2013 Iowa Crop Profile from the USDA’s Risk Management Agency, 90.5% of insurable crops in Iowa are insured with USDA crop insurance. Based on insured loss data above for the past five years, it can be stated that approximately \$14,500 in uninsured losses occurred over that time for an average of \$3,750 per year. An estimated \$39,500 in total hail crop losses occur per year. An estimated 0.2% of crop value is lost due to thunderstorms.

Usually severe thunderstorms do not have a long-term impact on the local economy. Typical storms have only a temporary impact on the economy other than as a direct result of structural damage or damage caused by

electrical damage from lightning. Sometimes fallen trees will disrupt commerce by damaging power lines and other utilities and blocking roads. Again, this is usually temporary in nature. Functional use losses are also usually minor in nature.

The loss due to human life and health are small for most storms. The greatest risk of death is from lightning, but the probability of any one person being struck by lightning during their lifetime is very small, let alone in one given storm. Falling and flying debris from storms and exceptionally large hail can also cause death. The risk of injuries is much higher. There is a 1% chance of death, 5% of serious injury, and 25% of a minor injury in the planning area in a given year directly as a result of a thunderstorm.

Future Development and Thunderstorm/Lightning/Hail:

As long as the population remains stable or grows slightly, it is unlikely that future development will increase exposure or risk of loss appreciably.

Tornado/Windstorm Profile

Type: Natural

Definition: A high wind event involving either widespread straight-line winds of at least 64 knots/73 MPH (windstorm) or a violent whirling wind characteristically accompanied by a funnel shaped cloud extending down from a cumulonimbus cloud in a narrow, erratic path (tornado).

Tornado/Windstorm Description:

A tornado is a violent whirling wind characteristically accompanied by a funnel shaped cloud extending down from a cumulonimbus cloud that progress in a narrow, erratic path. Rotating wind speeds can exceed 300 mph and travel across the ground at average speeds of 25-30 mph. A tornado can be a few yards to around a mile wide where it touches the ground. An average tornado is a few hundred yards wide. A tornado can move over land for distances ranging from short hops to many miles, causing damage and destruction wherever it descends. The funnel is made visible by the dust and debris sucked up and condensation of water droplets in the center of the funnel.

Windstorms are extreme winds associated with severe winter storms, severe thunderstorms, downbursts, and very steep pressure gradients. Windstorms, other than tornados, are experienced in all regions of the United States. It is difficult to separate the various wind components that cause damage from other wind-related natural events that often occur with or generate windstorms. Although Iowa does not experience direct impacts from hurricanes, the state is no stranger to strong, damaging winds. Unlike tornadoes, windstorms may have a destructive path that is miles wide and duration of the event could range from hours to days. These events can produce straight-line winds in excess of 64 knots (73 mph), causing power outages, property damage, impaired visibility, and crop damage.

It is often difficult to separate windstorm and tornado damage when winds get above 64 knots. For this reason, it makes sense to combine the formerly separate hazards of tornado and windstorm for this profile.

Existing weather reporting systems always have wind speeds recorded in knots. The conversion table (Figure 3.92) will provide a quick conversion for winds from calm to 99 knots. The converted values are all rounded to the nearest integer. The formula for exact conversion is 1 Knot=1.15155 MPH. The following is a conversion chart through 99 knots.

Figure 3.92: MPH/Knots Wind Speed Conversion Chart

Knots	+0 MPH	+1 MPH	+2 MPH	+3 MPH	+4 MPH	+5 MPH	+6 MPH	+7 MPH	+8 MPH	+9 MPH
0	0	1	2	3	5	6	7	8	9	10
10	12	13	14	15	16	17	18	20	21	22
20	23	24	25	26	28	29	30	31	32	33
30	35	36	37	38	39	40	41	43	44	45
40	46	47	48	49	51	52	53	54	55	56
50	58	59	60	61	62	63	64	66	67	68
60	69	70	71	72	74	75	76	77	78	79
70	81	82	83	84	85	86	87	89	90	91
80	92	93	94	96	97	98	99	100	101	102
90	104	105	106	107	108	109	110	112	113	114

Tornado/Windstorm Historical Occurrence:

Each year approximately 1,000 tornadoes are spawned by severe thunderstorms in our nation. Although most tornadoes remain aloft, those that touch ground are forces of destruction. Though the description of “tornado alley” varies slightly, Iowa is generally considered to be included in, or on the edge of, the geographic area. Between 2000 and 2013, Iowa has averaged more than 17 tornadoes per year and is ranked third in the number of tornadoes per 10,000 square miles. Most occur in April, May, and June, although Iowa has experienced tornadoes during all seasons/months. Tornadoes tend to be the most common in the late afternoon or evening, but they can occur at any time of day. The vast majority of tornadoes in Iowa’s history have been EF0 and EF1, although tornadoes of all sizes have occurred.

Through 2020, nineteen tornadoes, many of them F2 (pre-Enhanced Fujita scale) in magnitude, have impacted Adams County and have caused over \$29.7 million in property damages, \$37,000 in crop damage, no fatalities, and three injuries. The NCEI has also reported 6 funnel clouds (all from 2011 to 2018) with no reported damages. Four Presidential Declarations have been declared for Adams County due to tornado events. Many of the local jurisdictions have been directly impacted by tornadoes, especially the rural area. The following table summarizes the NCEI data about tornadoes to date.

Figure 3.93: Historical Tornado Events by Fujita Scale Intensity

Scale *	Number	Years	Locations	Fatalities	Injuries	Avg. Property Damage	Avg. Crop Damage
F0	7	1981, 1999, 2008, 2011 (2), 2017, 2020	Rural, Corning, Nodaway	0	0	\$8,000	\$2,000
F1	7	1988, 2001, 2008 (2), 2012, 2015, 2017	Rural	0	1	\$92,857	\$5,000
F2	1	1959	Rural	0	0	\$250,000	\$0
F3	2	1958, 1984	Rural	0	1	\$1,375,000	\$0
F4	2	1998, 1999	Rural	0	1	\$13,000,000	\$0
F5	0	n/a	n/a	n/a	n/a	n/a	n/a

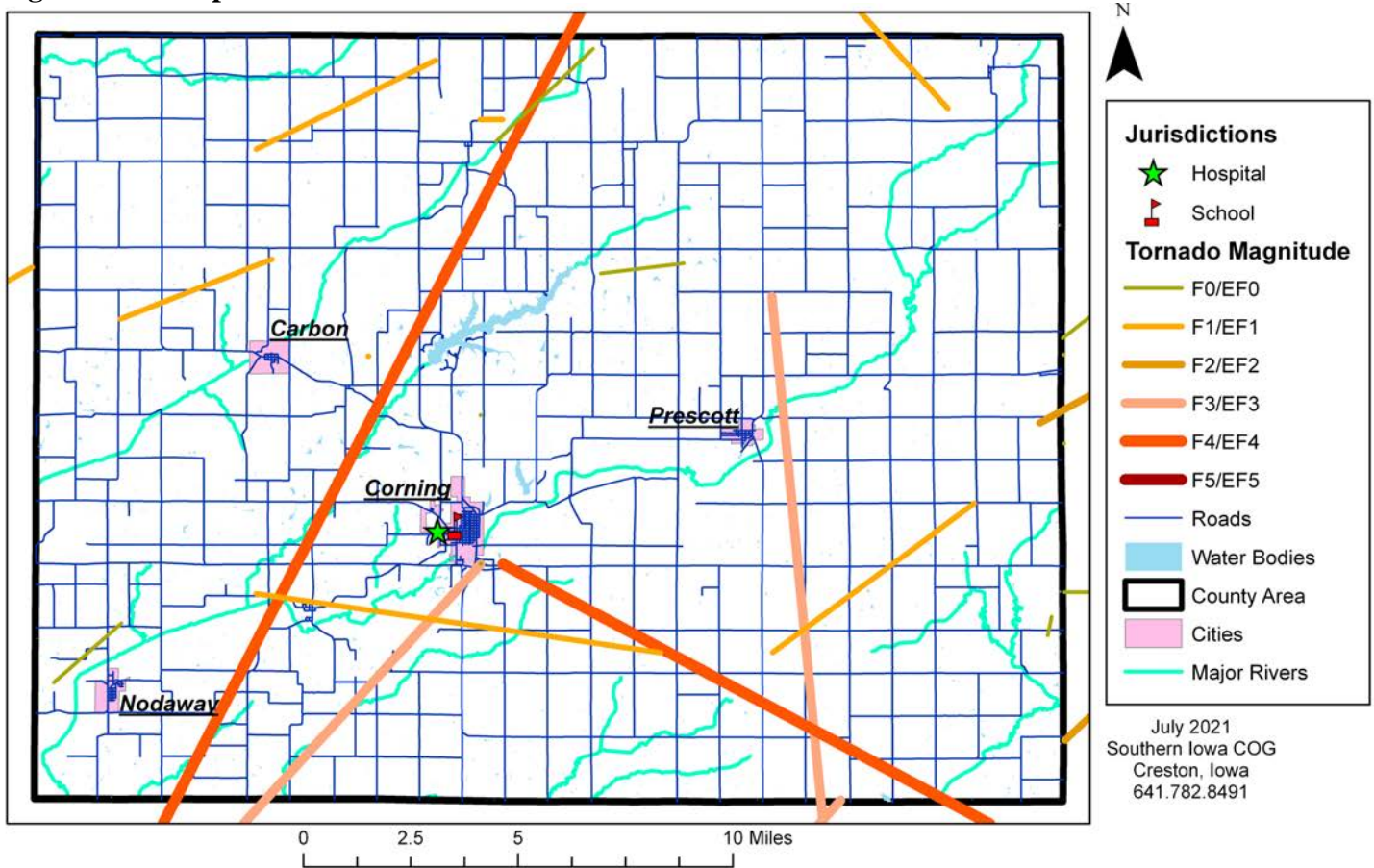
Source: National Centers for Environmental Information, 4/2021 (data available through 12/2020) *Most were pre-Enhanced Fujita Scale

According to the Adams County planning team, major tornado and wind events in Adams County occurred in mid-1980s, 1999, and 2008, impacting Corning and rural areas. More recent reports include 2017 and 2020. The planning team offered no damage reports or details other than the years.

When asked about the past occurrence of this hazard in the online survey, 23 persons responded. Eight indicated it happens more than once a year, nine indicated it happens most years, and six indicated it happened once or twice in the last five years.

The following map shows the historical tornado tracks from 1950 through 2019, as identified by the NWS.

Figure 3.94: Map of Historical Tornado Paths



Source: NOAA NWS Storm Prediction Center GIS mapping (<http://www.spc.noaa.gov/gis/svrgis/>), 7/2021

According to the NCEI, there have been 25 high wind events in Adams County from 1950 through 2020, the most recent in 2014. Winds exceeded 70 MPH in some areas (in 1998 was strongest wind recorded at 61 knots), destroying trees, flattening crops, and damaging or destroying outbuildings. Again, like winter storms and river floods, it is difficult to determine from the NCEI data how much of the high wind damage is located in Adams County, due to the large area such wind events often cover. The reported damages are 0 deaths, 0 injuries, over \$953,000 in property damage, and \$7,600 in crop damage. It is possible that significant wind damage has occurred due to storms that have not reached windstorm warning levels, so possible millions of dollars of accrued losses may not be reported.

Over the recent history of Adams County, windstorms have affected all jurisdictions and have caused widespread damage to trees, crops, buildings, and property in yards and on farms. The planning team has no information on specific storms. No fatalities are known.

Adams County has had one Presidentially Declared Disasters that included straight-line winds in the disaster description (2014).

The total number of high wind events not directly part of a thunderstorm in recent history is difficult to estimate. However, some thunderstorms have caused exceptional damage due to wind gusts associated with microbursts, derechos, and squalls.

The following (Figure 3.95) is the number of tornado watches and warnings and various wind-related alerts issued by NOAA's NWS.

Figure 3.95: Tornado and High Wind Historical Event Data

Year	Tornado Warning	Tornado Watch	Wind Advisory	Red Flag Warning	Red Flag Watch	High Wind Warning	High Wind Watch	Total
2016	1	4	5	0	0	0	0	10
2017	2	4	7	1	0	0	0	14
2018	1	6	6	1	0	0	0	14
2019	0	2	9	0	0	0	0	11
2020	0	2	7	2	0	0	0	11
2021 (through March)	0	0	5	4	0	1	0	10
Totals	4	18	39	8	0	1	0	70

Source: Iowa State University Department of Agronomy, <http://mesonet.agron.iastate.edu/vtec/search.php#byugc/IA/IAC003>

The average over the past five years is 3.5 tornado watches/warnings and 7.6 wind watches/warnings per year.

Tornado/Windstorm Future Probability:

May and June are peak Iowa tornado months. In the future, the chances of tornadoes do not increase notably. Developed areas occupy a small portion of Adams County and stand a likely chance of having a damaging tornado occur in the next ten years. Because of the large expanse of rural Adams County, it has the greatest chance of experiencing a tornado. Larger towns have a greater chance of experiencing the effects compared to the smaller towns. An EF2 tornado is considered typical for this assessment and is used for the estimate of probability.

Based on historical averages, Iowa would expect to have about 15 to 20 wind events each year in which wind speeds exceed 64 knots. According to NOAA, Adams County has a probability of 1.50 to 1.75 days of winds at or over 65 knots per year, based on historical data.

When asked about the likelihood that the incidence of this hazard will increase in the future compared to today in the online survey, 23 persons responded. Six indicated it is more likely, 14 indicated no change in likelihood, 2 indicated less likely, and one indicated they were unsure.

Score for Rural Adams County: 7	Score for Corning: 6	Score for Nodaway: 6	Score for Prescott: 6
Score for SW Valley Schools: 6	Score for CHI Health: 6		

Tornado/Windstorm Vulnerability to the Population:

Those most at risk from tornadoes include people living in mobile homes, campgrounds, and other dwellings without secure foundations or basements, and people in vehicles. The elderly, very young, and the physically and mentally handicapped are most vulnerable because of the lack of mobility to escape the path of destruction. Because most Iowa tornadoes occur from 4 to 9 PM, especially EF3 and larger tornadoes, when people are commuting or recreating outside, Adams County, with its large outdoor recreational population, faces greater risk. People who may not understand watches and warnings due to language barriers, such as those of Hispanic origin, are also at risk. Because of the concentration of homes in a city, the percentage of the population at risk is higher. Using the size and typical path of an EF3 tornado as an example, the percentage of the people directly impacted is modest, especially in rural areas of the county. Small towns are likely to have a higher percentage of the town's population impacted by an EF3. Single assets, like schools, could receive significant impacts unless they are constructed to FEMA 361 standards. At this time, there are no certified safe rooms in the county. People are always at risk if they are not in a FEMA 361 structure when a tornado makes a direct hit.

For this assessment, the planning team based its vulnerability or risk scenario on an EF3 tornado, which is typical of the more damaging tornadoes, although the true vulnerability will vary greatly based on the location and size/strength of the twister.

Those most at risk from windstorms include people living in mobile homes, campgrounds, and other dwellings without secure foundations or basements, as are those in vehicles, especially large and high-profile vehicles. Large sections of Highways 34 and 148 are exposed to high winds. The elderly, very young, and the physically and mentally handicapped are most vulnerable because of the lack of mobility to seek shelter or escape the path of destruction. Wind can precede a storm when people are not prepared for it. People who may not understand watches and warnings due to language barriers are also at risk. Winds can pick up rapidly even on sunny days and clear nights, when the public is not expecting it. An estimated 30% of the population is at direct risk by being outdoors or traveling when high winds hit. A small percentage of properties in the path of the storm are likely to be damaged significantly. Generally, those in schools and the hospital are less vulnerable than the general public because these properties contain modern, well-built brick structures.

The following scores reflect the fact that windstorms are likely to impact more area, and therefore, more people, but that tornadoes are likely to be a true hazard to a larger percentage of the people in a smaller area. In this way, adding these hazards together produces a higher score.

Score for Rural Adams County: 5	Score for Corning: 6	Score for Nodaway: 6	Score for Prescott: 6
Score for SW Valley Schools: 5	Score for CHI Health: 5		

Tornado/Windstorm Area of Extent:

The area of extent varies greatly between tornados and windstorms. For this assessment, the planning team elected to consider the larger damage path of a potential windstorm. The risk assessment looks at the part of the windstorm path that is most destructive, which is perhaps more in line with a large tornado.

Generally, the destructive path of a tornado is only a couple hundred feet in width, but stronger tornadoes can leave a path of devastation up to a mile wide. Normally a tornado will stay on the ground for no more than 20 minutes; however, one tornado can touch ground several times in different areas. Large tornadoes can follow a wide path across an entire county. Damages will be greater as a percentage of area in the towns because a single tornado can be as wide as a small community.

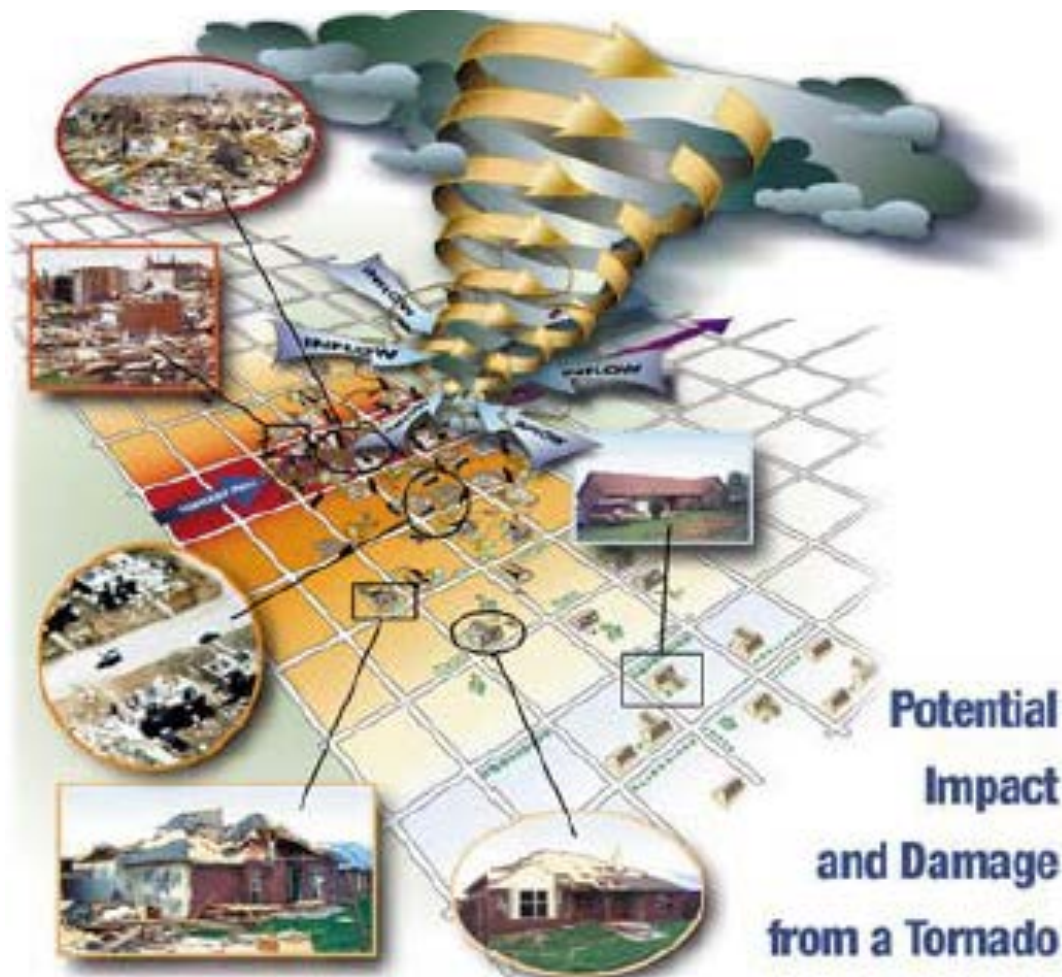
In 1973 Dr. Fujita and Dr. Allen Pearson added in factors related to the width and length of the tornado path and called the scale the Fujita-Pearson Scale. This additional information helps estimate the area that may be impacted and the number of people and property that could be affected.

Figure 3.96: Tornado Damage Path Information by Intensity

Scale	Wind Speed (mph)	Pearson Path Length (miles)	Pearson Path Width
F0	40-72	0.3-0.9	6-17 yards
F1	73-112	1.0-3.1	18-55 yards
F2	113-157	3.2-9.9	56-175 yards
F3	158-206	10-31	176-566 yards
F4	207-260	32-99	0.3-0.9 miles
F5	261-318	100-315	1.0-3.1 miles

Figure 3.97: Tornado Damage Path Graphic

The graphic to the right shows possible damage as it relates to the tornado path. Based on the size of communities and the distances from the center of a tornado, small towns could easily be devastated by one tornado. As shown, a few blocks from even an EF-3's center can experience significant damage. Clearly, the area that could be impacted varies greatly depending on the intensity of the tornado. Storms can also spawn additional tornadoes and other damaging phenomenon that extend the area of impact.



Unlike tornadoes, windstorms may have a destructive path that is tens of miles wide and several hundred miles long. Wind speed can vary greatly in the affected area, but damage can be found throughout the windstorm area if exposure to wind below 64 knots continues for hours unabated. Certainly, entire individual buildings and properties will be impacted. The rural county will feel widespread impacts but not necessary the entire area. Adams County is part of Wind Zone IV, which includes winds up to 250 MPH, the highest wind zone in the nation. This wind zone covers most of the interior Midwest from northern Texas to western Pennsylvania.

Score for Rural Adams County: 5	Score for Corning: 7	Score for Nodaway: 7	Score for Prescott: 7
Score for SW Valley Schools: 8	Score for CHI Health: 8		

Tornado/Windstorm Severity of Impact:

Severity of a tornado relates to the size, wind speed, length of time and distance traveled on the ground, and the assets and population in the exposed area where the tornado occurs. Generally, no matter the size and strength of the twister, if people are exposed and the area has many weak and poorly built buildings, severity is greatly increased.

Tornadoes are very unique in that they can vary greatly in size, strength, and damage path. The rating scale used to rate tornado intensity is called the Enhanced Fujita Scale. The Enhanced Fujita Scale (EF) is used to assign a tornado a 'rating' based on estimated wind speeds and related damage. When tornado-related damage is surveyed, it is compared to a list of Damage Indicators and Degrees of Damage, which helps estimate better the range of wind speeds the tornado likely produced. From that, a rating (from EF0 to EF5) is assigned. The National Weather Service is the only federal agency with authority to provide 'official' tornado EF Scale

ratings. The following chart shows the relationship between structure damage and wind speeds as it pertains to EF tornado ratings.

Figure 3.98: Tornado Damage Potential by Intensity

EF Rating	Wind Speeds	Expected Damage	
EF-0	65-85 mph	'Minor' damage: shingles blown off or parts of a roof peeled off, damage to gutters/siding, branches broken off trees, shallow rooted trees toppled.	
EF-1	86-110 mph	'Moderate' damage: more significant roof damage, windows broken, exterior doors damaged or lost, mobile homes overturned or badly damaged.	
EF-2	111-135 mph	'Considerable' damage: roofs torn off well constructed homes, homes shifted off their foundation, mobile homes completely destroyed, large trees snapped or uprooted, cars can be tossed.	
EF-3	136-165 mph	'Severe' damage: entire stories of well constructed homes destroyed, significant damage done to large buildings, homes with weak foundations can be blown away, trees begin to lose their bark.	
EF-4	166-200 mph	'Extreme' damage: Well constructed homes are leveled, cars are thrown significant distances, top story exterior walls of masonry buildings would likely collapse.	
EF-5	> 200 mph	'Massive/incredible' damage: Well constructed homes are swept away, steel-reinforced concrete structures are critically damaged, high-rise buildings sustain severe structural damage, trees are usually completely debarked, stripped of branches and snapped.	

The following table gives more details about the relative frequency of each EF scale in Iowa.

Figure 3.99: Tornado Frequency by Intensity

Scale	Wind Speed (mph)	Relative Frequency	Potential Damage
EF0	65-85	53.5%	Light. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. NOTE: Confirmed tornadoes with no reported damage (i.e. those that remain in open fields) are always rated EF0).
EF1	86-110	31.6%	Moderate. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	10.7%	Considerable. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light object missiles generated; cars lifted off ground.
EF3	136-165	3.4%	Severe. Entire stores 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.
EF4	166-200	0.7%	Devastating. Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.

Scale	Wind Speed (mph)	Relative Frequency	Potential Damage
EF5	>200	<0.1%	Explosive. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 300 ft.; steel reinforced concrete structure badly damaged; high rise buildings have significant structural deformation; incredible phenomena will occur.

In this profile, the local planning team performed analysis based on a scenario. The team considers a risk due to a typical EF3 tornado because buildings are generally able to survive smaller tornadoes, and larger tornadoes are quite rare. Larger tornados are less common but are much more severe.

Severity of a windstorm depends primarily on a) wind speed, b) duration, c) size of area of impact, and d) existing conditions of the area where the windstorm occurs. Higher wind speeds produce more damage, as does the size of impact area, which causes damage to more properties. Sustained winds tend to exacerbate conditions, even if below the threshold of a windstorm, because the continuous strain on power lines, trees, and buildings over hours or even days weakens them. Delays in business and construction activities caused by high wind, i.e., wind is too strong to allow work to continue, also have economic impacts. Existing conditions, such as excessive debris, old structures, and exposed hazardous materials can exacerbate windstorm severity by exposing people and surrounding properties to those conditions.

The Land Beaufort Scale was originally developed in 1805 by Sir Francis Beaufort as a system for estimating wind strength without the use of instruments. It is currently still in use for this same purpose as well as to tie together various components of weather (wind strength, sea-state, observable effects) into a unified picture. This table details the scale.

Figure 3.100: Windstorm Potential Damage by Wind Speed

Force	Speed (knots)	Speed (MPH)	Land Conditions
0	<1	<1	Calm, smoke rises vertically
1	1-3	1-3	Light air, direction of wind shown by smoke drift only
2	4-6	4-7	Light breeze, wind felt on face, leaves rustle, vanes moved by wind
3	7-10	8-12	Gentle breeze, leaves and small twigs in constant motion, wind extends light flag
4	11-16	13-18	Moderate breeze, raises dust and loose paper, small branches move
5	17-21	19-24	Fresh breeze, small trees in leaf begin to sway
6	22-27	25-31	Strong breeze, large branches in motion, umbrellas used with difficulty
7	28-33	32-38	Near gale, whole trees in motion, inconvenience felt walking against the wind
8	34-40	39-46	Gale, breaks twigs off trees, impedes motion
9	41-47	47-54	Strong gale, slight structural damage occurs
10	48-55	55-63	Storm, trees uprooted, considerable damage occurs
11	56-63	64-73	Violent storm, widespread damage
12	64+	74+	Hurricane, extreme destruction

In this profile, the planning team looks at the severity of a widespread windstorm that lasts a few hours and includes at least one gust over 64 knots.

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 is 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.

The following provides a summary of the severity of impact throughout the county.

Figure 3.101: Tornado and High Wind Severity of Impact Scoring Matrix

Severity Criteria	Discussion	Score
Health and safety of the public	Injury or death related to tornadoes and windstorms most often occurs when buildings collapse, people are hit by flying objects, or when they are caught trying to escape in a vehicle. From 1950-2006, Iowa has had 2007 injuries related to tornadoes and 67 deaths over the same time period. There were 12 deaths and 561 injuries from 1980-2006. Over a dozen people died in several tornadoes in 2008. All people not within a reinforced building are at risk. High winds can blow trucks and cars off highways, causing severe injury and death. People are more likely to be exposed to the hazards from straight-line winds because they can precede a storm or occur on an otherwise “nice” day.	4
Health and safety of responders	Response personnel are exposed to the same risk as the general public when caught in the storm without shelter. Typically, responders will be aware of conditions and will be in shelter during the initial storm but could be at risk to the secondary effects, such as fire, downed power lines, traffic accidents, lightning, and follow-up tornadoes. They may be more prepared than the average person and alert that the event is approaching, but many responders are also active storm watchers, so they are exposed as the storm approaches.	4
Continuity of operations	Tornadoes and windstorms can destroy government facilities just as they could other property. Disruption of critical services can also affect operations. Employees may be affected and unable to attend to work-related issues. The widespread loss of utilities and facilities can stop numerous government and other essential operations. Power lines and emergency equipment can be blown down and lost. Extended windstorm events can delay response and repair for hours to days.	4
Property, facilities, infrastructure	Impacts can range from broken tree branches, shingle damage to roofs, and some broken windows all the way to complete destruction and disintegration of well-constructed structures, infrastructure, and trees. While not likely due to an EF3 storm, entire neighborhoods can be destroyed. Based on the level of destruction due to an EF3 tornado and the size of its path, its impact could be catastrophic in some cases, if the tornado impacts areas of highly vulnerable structures. Windstorms are likely to cause less damage to an individual structure but their widespread impact could be critical to catastrophic.	4
Delivery of services	Tornadoes can impact many critical services, mainly electrical power and communications. Buried services are not as vulnerable, but can be affected by their system components that are above ground. Because of the extent of damage and lack of funds and resources to repair facilities, areas can be off-limits and systems may be off-line for days or more. Roads can be closed and bridges can be destroyed, so deliveries can be slowed. Items like bottled water and basic supplies may need to be brought in, and roads can be clogged with response vehicles.	4
Environmental impacts	Tornadoes and windstorms are naturally occurring phenomena. Damages to the environment could result from spills and other contaminants from the built environment. Debris can fly for tens of miles, delivering substances to areas not in the direct path of the storm. Sometimes debris is not spotted for some time, so leaks can persist. Damage to infrastructure can cause persistent environmental damage.	3
Economic/financial conditions	Whole towns have been destroyed. Economic impacts can result from direct damages to facilities or business disruption from the lack of critical services such as power, gas, or water. If a tornado causes great damage to a residential area away from the business, and many workers are dramatically affected, it can cause excessive loss in employee productivity, even if the business is not hit. Crop damage is often associated with windstorms; laying down crops, breaking stalks, and twisting plants, reducing crop yield and making it difficult to harvest. Wind-related road closures are rare but can delay business road, rail, and air travel.	4
Regulatory/contractual obligations	Debris removal is a vital service that is often too vast for the jurisdiction to do without contractual assistance. These plans should be in place and monitored. When services and response are postponed too long, lawsuits are likely due to the failure to provide contractual services. When property is destroyed, it is difficult to maintain any level of service in the immediate aftermath of a storm.	3
Reputation	Adequate warning is key to the positive reputation of the jurisdiction. Responding in a timely manner and reconstructing the community is also important. Bringing critical services back on line quickly will ensure the residents can recover.	2

Score for Rural Adams County: 32

Score for Corning: 32

Score for Nodaway: 32

Score for Prescott: 32

Score for SW Valley Schools: 32 Score for CHI Health: 32

Tornado/Windstorm Speed of Onset:

Tornadoes can form and strike in seconds. Wind speeds may exceed 300 miles per hour and the storm can travel across the ground at more than 70 mph. These winds turn harmless objects into deadly missiles in a matter of seconds. The advancement in weather forecasting has allowed watches to be delivered to those in the path of these storms up to hours in advance. The best lead-time for a specific tornado 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 due to blowing dust or driving rain and hail.

The NWS has developed a windstorm warning system similar to other events such as tornado, winter storm, and thunderstorm watches that are issued when conditions are favorable for high winds to develop; these are often issued 12 to 24 hours in advance. Advisories are issued when existing or imminent high winds cover part or all of the area and pose a mere inconvenience. High wind warnings are issued when existing or imminent high winds cover part or all of the forecast area and pose a threat to life and property.

While warning times might be nearly a day, the best warning lead-time for a specific severe storm is about 30 minutes, because these storms can precede a parent thunderstorm by tens of miles and can move across the ground at or exceeding 50 MPH. Further, in Iowa, high winds are associated with strong air pressure gradients, which means that winds can pick up with no warning (not a cloud in the sky) and can change speed and direction rather rapidly.

Score for Rural Adams County: 8 Score for Corning: 8 Score for Nodaway: 8 Score for Prescott: 8
Score for SW Valley Schools: 8 Score for CHI Health: 8

Tornado/Windstorm Duration of Event:

Tornado events last up to 1 hour, with the passing of a supercell or line of storms containing multiple tornadoes taking up to 2 hours on rare occasions. FEMA tornado safe rooms are designed to house people for two hours.

Windstorms typically last from a few minutes to a few hours with damaging winds at or above 64 knots, but the storm can last a day or longer with occasional wind gusts approaching or even exceeding 64 knots. The total duration of the severe part of a windstorm might be 6 hours, with rare exceptions.

Score for Rural Adams County: 4 Score for Corning: 4 Score for Nodaway: 4 Score for Prescott: 4
Score for SW Valley Schools: 4 Score for CHI Health: 4

Tornado/Windstorm Total Scores:

The following total scores for tornado/windstorm indicate high risk to the public and the planning area where incidents can occur.

Score for Rural Adams County: 61 Score for Corning: 63 Score for Nodaway: 63 Score for Prescott: 63
Score for SW Valley Schools: 63 Score for CHI Health: 63

Tornado/Windstorm Vulnerability/Assets at Risk:

All structures, property, and people in the county, as outlined in Section 3.2, could suffer from the effects of tornadoes and windstorms. Severity can vary greatly depending on the actual wind speed and other factors.

All critical assets in the county, as outlined in Section 3.2.

Tornado/Windstorm Loss Estimation:

Structural loss can be very severe, as tornadoes are considered one of the greatest causes for structural loss among the hazards listed. Although death is less likely than structural loss, tornadoes are more likely than almost any other hazard to cause death and serious injury.

In Adams County, the NCEI estimate for past property damage resulting from tornadoes from 1950-2020 was nearly \$30 million. This averages \$425,000 per year in property damage. In Adams County, the NCEI estimate for past property damage resulting from windstorms from 1996-2020 was \$953,000. This averages \$38,000 per year in property damage. The total average annual structural loss would be \$463,000. Keep in mind that much of the historical loss data might not reflect modern inflation values, but it provides a basis for future loss estimates. According to the State's HM Viewer, tornado tab, accessed in July 2020, the average annual loss due to tornadoes is \$932,858.

Crop insurance payments for the period from 2016-2020 were \$491,548.75 for wind damage (10 claims). Considering that 90.5 percent of insurable crops are insured in Iowa (2013 Iowa Crop Insurance Profile, USDA, RMA), the adjusted losses calculate to just over \$543,000 for all insurable crops for the period. This results in an average annual loss of \$108,600 to insurable crops as a result of wind damage.

A useful way to analyze the potential losses for a tornado is through a potential scenario. As described earlier, the planning team used an EF3 as a basis for this risk assessment. This scenario involves a tornado track through the middle of each jurisdiction at a 45-degree angle, such as southwest to northeast, a common angle. Since school districts and the hospital own relatively few structures all in one place, school and hospital loss data in this scenario are included in the town in which they are located. As much as possible, parcel and public building/asset value, as outlined in Section 3.2, are utilized to determine possible losses.

With the infinite variables associated with tornado occurrences such as wind speed, direction, length, width, and time on the ground, etc., it is not possible to accurately estimate future losses. However, this methodology provides loss estimates for a defined scenario. Utilizing GIS data with associated building values considers variations in density of the built environment as well as variations in values. Again, it makes it possible for local jurisdictions to imagine or picture their risks in defined values to allow for some level of comparison.

An EF3 tornado is used here but most of the tornadoes will be smaller and cause less damage. However, some will be even larger, so it is realistic to use this scenario. Once the number of buildings within the hypothetical tornado track is determined, a 50% damage calculation was made within the base. The base is defined as within 566 yards (roughly 1,700 feet or one-third of a mile) of width of the tornado. A 10-mile long track was used. This damage percent is based on information from the NOAA Storm Prediction Center, which estimates and EF-3 tornado can do "severe" damage: entire stories of well-constructed homes destroyed, significant damage done to large buildings, homes with weak foundations blown away, cars thrown, and significant tree damage. Clearly the amount of damage to a structure will vary within the path, but this provides a reasonable scenario for planning purposes.

The following table provides the results of the analysis in terms of the number and value of buildings in the scenario tornado path and estimated losses in Adams County. A planning area total was not calculated, as this scenario is not meant to indicate that these damages would occur simultaneously. Notice that in each of the tornado track scenarios, a portion of the county is impacted along with each incorporated city. This is due to the 10-mile average length, which exceeded the city boundaries at the approximate center and 45-degree angle for all tracks.

Figure 3.102: Tornado/Windstorm Loss Estimate

Jurisdiction and Track Location	Property Type	Number of Impacted Properties	Estimated Values	Estimated Contents Values	50% Loss Estimate
Rural County (No Cities)	Residential	25	\$2,500,000	\$1,250,000	\$2,250,000
	Commercial	1	\$100,000	\$50,000	\$75,000
	Industrial	1	\$250,000	\$125,000	\$187,500
	Agricultural	25	\$4,000,000	\$2,000,000	\$3,000,000
	Taxable Infrastructure	1	\$2,500,000	\$500,000	\$1,500,000
	Government/Institutional	1	\$5,000,000	\$2,500,000	\$3,750,000
	Totals	54	\$14,350,000	\$6,425,000	\$10,387,500
Corning	Residential	250	\$18,000,000	\$9,000,000	\$1,350,000
	Commercial	50	\$10,000,000	\$5,000,000	\$7,500,000
	Industrial	1	\$250,000	\$125,000	\$187,500
	Agricultural	1	\$100,000	\$50,000	\$75,000
	Taxable Infrastructure	2	\$1,000,000	\$500,000	\$750,000
	Government/Institutional	12	\$25,000,000	\$12,500,000	\$18,750,000
	Totals	316	\$54,350,000	\$27,175,000	\$40,762,500
Rural and Corning	Residential	24	\$2,400,000	\$1,200,000	\$1,800,000
	Commercial	1	\$100,000	\$50,000	\$75,000
	Industrial	1	\$250,000	\$125,000	\$187,500
	Agricultural	25	\$4,000,000	\$2,000,000	\$3,000,000
	Taxable Infrastructure	1	\$2,000,000	\$500,000	\$1,250,000
	Government/Institutional	1	\$1,000,000	\$500,000	\$750,000
	Totals	53	\$9,750,000	\$4,375,000	\$7,062,500
Nodaway	Residential	25	\$1,000,000	\$500,000	\$750,000
	Commercial	1	\$100,000	\$50,000	\$75,000
	Industrial	0	\$0	\$0	\$0
	Agricultural	1	\$50,000	\$25,000	\$37,500
	Taxable Infrastructure	1	\$500,000	\$250,000	\$375,000
	Government/Institutional	1	\$100,000	\$50,000	\$75,000
	Totals	29	\$1,750,000	\$875,000	\$1,312,500
Rural and Nodaway	Residential	20	\$1,800,000	\$900,000	\$1,350,000
	Commercial	0	\$0	\$0	\$0
	Industrial	0	\$0	\$0	\$0
	Agricultural	25	\$4,000,000	\$2,000,000	\$3,000,000
	Taxable Infrastructure	1	\$2,000,000	\$500,000	\$1,250,000
	Government/Institutional	1	\$1,000,000	\$500,000	\$750,000
	Totals	47	\$8,800,000	\$3,900,000	\$6,350,000
Prescott	Residential	60	\$3,500,000	\$1,750,000	\$2,625,000
	Commercial	2	\$100,000	\$50,000	\$75,000
	Industrial	0	\$0	\$0	\$0
	Agricultural	1	\$100,000	\$50,000	\$75,000
	Taxable Infrastructure	1	\$500,000	\$100,000	\$300,000
	Government/Institutional	2	\$1,000,000	\$500,000	\$750,000
	Totals	66	\$5,200,000	\$2,450,000	\$3,825,000
Rural and Prescott	Residential	20	\$1,800,000	\$900,000	\$1,350,000
	Commercial	0	\$0	\$0	\$0
	Industrial	0	\$0	\$0	\$0
	Agricultural	25	\$4,000,000	\$2,000,000	\$3,000,000
	Taxable Infrastructure	1	\$2,000,000	\$500,000	\$1,250,000
	Government/Institutional	1	\$1,000,000	\$500,000	\$750,000
	Totals	47	\$8,800,000	\$3,900,000	\$6,350,000

The above table shows that, if an EF-3 tornado makes a path through the county, it will cause millions or tens of millions of dollars of damages to properties in the county. The actual losses will be directly affected by its path. Fortunately, only about 10% of the future projected tornadoes will reach or exceed the EF-3 intensity.

Overhead power lines and infrastructure are also vulnerable to damages from windstorms. Windstorm 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. Other potential losses 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. The electric power loss of use estimates can be 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 Adams County's jurisdictions. The loss of use estimates for power failure associated with windstorms is provided as the loss of use cost per person, per day of loss, totaling \$126. 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 consider physical damages to utility equipment and infrastructure. For the entire planning area, with a population of approximately 4,000, this loss would amount to \$50,400 per day.

Windstorm is primarily a public safety and economic concern, and the planning area is located in a region with a high frequency of occurrence. Both windstorm and tornado are hazards that can have substantial economic impacts, including business building destruction, power loss shutdown, inability for people to get to work, and inability to make and receive shipments. Economic losses can be very severe.

The loss due to human life and health is not high for the typical windstorm and even for most tornadoes. However, in the event of an EF-3 tornado, the risk could be high for multiple deaths and injuries, especially if the tornado makes a direct hit on a municipality. The chance of death and serious injury greatly increases with no or limited warning, if warning is not heeded, or if people are exposed with nowhere to go, such as in a campground. There is an estimated 5% chance of death, 20% of serious injury, and 40% of a minor injury in a given year directly as a result of a storm.

Future Development and Tornado/Windstorm:

As long as the population growth is slow or modest, it is unlikely that future development will increase exposure or risk of loss in a notable way. New homes and other buildings are being built, but most of them are strong and meet modern building standards. In the past five to ten years, FEMA and the State of Iowa have made great effort to promote the use of public safe rooms as part of construction of new projects where vulnerable populations will be. Assuming that some organizations building new structures heed this advice and take advantage of funding, the new development might actually reduce the risk to human life and limit the increase of risk to buildings.

Transportation Incident Profile

Type: Technological

Definition: An accident involving any mode of transportation that directly threatens life, property damage, injury, or adversely impacts a community's capabilities to providing emergency services.

Transportation Incident Description:

This hazard encompasses air transportation, highway transportation, railway transportation, and waterway incidents. The following paragraphs describe each mode of transportation.

An air transportation incident may involve a military, commercial, or private aircraft. Airplanes, helicopters, and other modes of air transportation 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, including mechanical failure, pilot error, weather conditions, or an on-board fire could all lead to an incident.

A highway transportation incident can be single or multi-vehicle, requiring responses exceeding normal day-

to-day capabilities. If the designed capacity of the roadway is exceeded, the potential for a major highway incident increases. Weather conditions play a major factor in the ability of traffic to flow safely as does the time of day and week. Incidents involving buses and other high-occupancy vehicles could trigger a response that exceeds the normal day-to-day capabilities of response agencies.

A railway transportation incident is a train accident that directly threatens life, property, or adversely impacts a community's capabilities ability to provide emergency services. Railway incidents may include derailments, collisions, and highway/rail crossing accidents. Train incidents can result from a variety of causes, including human error, mechanical failure, faulty signals, or problems with the track. Results of an incident can range from minor "track hops" to catastrophic hazardous material incidents with human/animal casualties.

A waterway incident is an accident involving any water vessel that threatens life, property, or adversely affects a community's capability to provide emergency services. Waterway incidents primarily involve pleasure craft on rivers and lakes. Waterway incidents may also include events in which a person, persons, or object falls through the ice on partially frozen bodies of water. Impacts include fuel spillage, drowning, and property damage.

Transportation Incident Historical Occurrence:

There have been or can be air, rail, and highway transportation incidents in Adams County.

From 1962 to 2010, there were approximately 2,035 (around 40 per year) air transportation incidents/accidents in Iowa according to the National Transportation Safety Board. Since the year 2000 only 214 air transportation incidents (around 16 per year), so the number of incidents is dropping due to advances in air transportation safety. The vast majority of fatalities are from large airline crashes, but the vast majority of crashes, including those in rural Adams County, have been small planes. The local planning team indicates there have been small plane crashes near Corning and in the rural areas, both at least 7 years ago, with no record of more recent crashes in the county. No fatalities have been reported.

According to the Iowa Department of Transportation (IDOT), there were 314 auto crashes with 336 fatalities in 2019 in Iowa, most of them involving passenger and commercial vehicles, motorcycles, and pedestrians. From 2011-mid 2021 (<https://icat.iowadot.gov/>), there were 9 fatalities, 21 serious injuries, and 74 minor injuries in Adams County from a total of 381 total crashes involving 692 people and 545 vehicles. Most of these incidents were not of the magnitude of exceeding local first response agencies, but some incidents have exceeded capabilities. All county fire departments have responded to highway transportation incidents. Most of the other crashes have occurred in rural areas, but they can occur almost anywhere where highway speeds exceed 35 MPH, including the cities. They do not have a direct effect on schools and the hospital properties but can impact vehicles owned by all jurisdictions when traveling on highways. The planning team provided no details about remembered or documented incidents.

Rail incidents have occurred in the rural part of the county but have been relatively minor in nature, with no extensive property or economic loss. However, one incident is on the minds of the public. Approximately ten years ago, an Amtrak derailment near Prescott resulted in dozens of injuries, multiple deaths, and closure of the track for over 24 hours. Federal Railroad Administration data at <https://safetydata.fra.dot.gov/OfficeofSafety/publicsite/Query/TenYearAccidentIncidentOverview.aspx> was consulted but not available. The planning team outlines that minor derailments have occurred in recent years but with minor and short-term impacts. Causes of past incidents have included driver fatigue, animals and vehicles caught in front of the train, and severe weather, such as heavy snow and high wind. Local response agencies have been trained in rail transportation incident response and response to hazardous materials involving railroads. Rail lines do not affect the school or hospital directly, although bus and response route crossings can be cut off by trains, thereby delaying access to other areas.

There are significant waterways and water bodies in Adams County, consisting of several lakes and a few rivers. Lake Icaria is quite popular for water recreation (pleasure boats and other personal watercraft as well as swimming at a beach. The planning team notes that boating and drowning incidents do occur up to once every two years on Lake Icaria but very rarely elsewhere. Other incidents include vehicles and anglers falling through the ice. These have occurred as people were recreating in conditions where they should not have been on the ice. There are no navigable rivers, so commercial/transportation incidents have not occurred.

When asked about the past occurrence of this hazard in the online survey, 23 persons responded. Two indicated it happens more than once a year, four indicated it happens most years, 11 indicated it happened once or twice in the last five years, and 6 responded that it has not occurred or they do not recall an incidence.

Transportation Incident Future Probability:

Corning Airport handles a relatively small number of planes and the likelihood is small in a given year that an incident will occur, despite the popularity of the local airport for recreational flying. Air traffic overall is limited and any planes that crash are likely to be small planes with no more than a pilot and one passenger. However, since there are many commercial planes that fly over the county, there is always a chance for a major crash. More people are utilizing air travel now than in the past (with the dip caused by COVID excepted). Once COVID's impacts abate, it is likely that air travel will reach new records.

Although traffic engineering, inspection of traffic facilities, land use management of areas adjacent to roads and highways, and the readiness of local response agencies have increased, highway incidents continue to occur. As the volume of traffic on the state's streets, highways, and interstates increases, the number of traffic accidents will likely also increase. The combination of large numbers of people on the road, wildlife, unpredictable weather conditions, potential mechanical problems, and human error always leaves open the potential for a transportation accident. Local jurisdictions continue to look at where traffic signals and speed limit changes are needed in order to protect the public. Greatest risks are on US Highway 34, Iowa Highway 148, and paved county roads for major incidents that require more than local response.

The BNSF Railway continues to handle large volumes of railway freight. The twice-a-day AMTRAK service adds the risk of a crash with large loss of life. Anywhere from 30 to 50 trains pass through the county each day, most of them at 50 MPH or greater. Some of the trains handle hazardous materials, while most of them are very heavy with loads of coal.

Several ponds, rivers, and lakes are used for recreation, including angling, boating, and swimming. The number of users of Iowa lakes and rivers is increasing. Minor incidents involving one or two boats and/or individuals can occur that tie up response resources and cause death and injury are possible but unlikely in a given year. Incidents will be recreational-related, as opposed to transportation-related, because the waterways are too small to support barges. While rural areas, and especially Lake Icaria, are most at risk, all incorporated cities could be impacted by waterway incidents.

When asked about the likelihood that the incidence of this hazard will increase in the future compared to today in the online survey, 22 persons responded. Three indicated it is more likely, 11 indicated no change in likelihood, four indicated less likely, and four indicated they were unsure or unconcerned.

The following probabilities are based on incidents that cause fatalities and/or require response beyond local capabilities. The potential for an incident is virtually impossible on school and hospital property due to the slow speeds involved, with the exception of air transportation incidents.

Score for Rural Adams County: 6	Score for Corning: 4	Score for Nodaway: 2	Score for Prescott: 3
---------------------------------	----------------------	----------------------	-----------------------

Score for SW Valley Schools: 2	Score for CHI Health: 2
--------------------------------	-------------------------

Transportation Incident Vulnerability to the Population:

People aboard airplanes are the most vulnerable to air transportation incidents. Statistics from the National Transportation Safety Board and the airline industry show that the majority (over 75%) of airplane crashes and accidents occur during the takeoff or landing phases of a flight. As a result, developed areas adjacent to the airports and in airport flight paths are particularly vulnerable to this hazard. The Corning Airport is surrounding row crop fields, pastures, and a few buildings. Airport zoning is now being implemented to ensure that development will be limited and low-impact near the airport. For areas away from the airport, a smaller percentage of the population would be directly in the area of impact. However, because of the concentration of populations in smaller areas, especially for schools and the hospital, the percentage of persons in the impact area of an incident would be higher even though the probability of an incident is actually less than the immediate area around an airport.

Those who use the surface transportation system are most vulnerable to highway transportation incidents. Travelers, truckers, delivery personnel, and commuters are at risk at all times when they are on the road. During rush hours and holidays, the number of people on the road in Iowa is significantly higher. This is also true before and after major gatherings such as sporting events, concerts, and conventions. Pedestrians and bystanders of the community are less vulnerable unless they are in the roadway. Any individual incident will have a direct impact on only a few people.

People and property in close proximity to the railway lines, crossings, sidings, switching stations, and loading/unloading points are most at risk of rail transportation incidents. Those away from railroad tracks and facilities are vulnerable only to large-scale incidents including those in which hazardous materials are involved. The railroad travels through the more populated parts of the county. Ethanol production near Nodaway and its susceptibility to a rail accident was a concern for the planning team.

Operators and passengers of pleasure craft are vulnerable to a waterway incident. The environment is vulnerable to contents and fuels that come from boats and vehicles/equipment on the top of winter ice; however, only a very small percentage of the population is at risk of a single incident. Vulnerability may be reduced by the improved water rescue training and equipment capabilities of regional first response departments. Warning signs and law enforcement are also important mitigation measures.

Score for Rural Adams County: 4	Score for Corning: 4	Score for Nodaway: 5	Score for Prescott: 4
Score for SW Valley Schools: 6	Score for CHI Health: 6		

Transportation Incident Area of Extent:

While the area of extent can vary greatly based on materials involved, size of plane, and location of crash, compared to many other hazards, an air transportation accident would occupy a relatively small area. The extent to which the impacts would be felt would depend on the materials involved. For example, if a cargo plane transporting volatile or hazardous substances were involved in an accident, the area of concern would be significantly larger than the area for an accident involving a small personal aircraft carrying stable materials. The most severe of accidents would likely affect only a few city blocks. In any case, only a small part of most jurisdictions would be directly affected.

Highway incidents are usually contained to areas on the roadway or directly adjacent to the roadway. Very few highway incidents affect areas outside the traveled portion of the road and the right-of-way. Extensive segments of the transportation system can be impacted during significant weather events, such as a large snowstorm, when multiple separate accidents occur. While incidents may affect a larger part of a small jurisdiction, like a small town, generally a typical crash will affect only 1% of the area. This does not consider

impacts caused by hazardous materials.

Vehicle/train collisions could impact areas within a few hundred feet of the railroad. It might include pedestrians, automobiles, and buildings near the tracks. While incidents may affect a larger part of a small jurisdiction, like a small town, generally a typical crash will affect only 1% of the area. This does not consider impacts caused by hazardous materials.

The maximum extent of a waterway incident would be limited. Impacts would not extend beyond the immediate incident scene. The only exception would include a search and rescue event that could expand downstream. In the case of a hazardous material being released to the waterway, the impact could expand considerably but still would be a very small part of any jurisdiction.

Score for Rural Adams County: 3	Score for Corning: 4	Score for Nodaway: 4	Score for Prescott: 4
Score for SW Valley Schools: 5	Score for CHI Health: 5		

Transportation Incident Severity of Impact:

The level of severity would depend on the type of transportation mode used. Air transportation incidents are likely to be the most destructive. Severity depends aircraft involved, the type of cargo being transported, and the area on the ground on which the accident occurred. Because of the limited number of response personnel in Adams County, a crash of a major airliner would very quickly exceed local capabilities. For this assessment, the planning team looks at a mid-sized passenger plane flying over the county and crashing in a random location.

Highway transportation incidents claimed more lives in Adams County than any other of the profiled hazards during the past 25 years. Often, they can be prevented through education, roadway improvements, law enforcement, and restrictions during severe weather, but some fatal accidents will still occur. The following severity assessment considers the worst types of incidents found in the county's history: a fatal multiple-vehicle incident during severe weather and rush hour traffic that results in closure of a main highway (US 34) and a detour through the county.

A rail transportation incident, especially one involving AMTRAK, could cause mass casualties of dozens to hundreds of people. In most past derailments or collisions, only a small percentage have died, but injuries have been tremendous and it has shut down the railroad tracks for hours to days, thereby delaying commerce.

The following is the severity assessment that considers the impacts of a waterway or water body incident involving multiple pleasure boats in adverse weather conditions that complicate response, search, and rescue. Because there are no high traffic lakes with high-speed boats and no cargo ships using waterways in the county, this risk is fairly low.

The following provides a summary of the severity of impact throughout the county. For the sake of discussion, it is assumed that no large quantities of hazardous materials are involved, as these are profiled elsewhere. If hazardous materials were involved, the severity would increase.

Figure 3.103: Transportation Incident Severity of Impact Scoring Matrix

Severity Criteria	Discussion	Score
Health and safety of the public	Multiple deaths and injuries are likely to almost any form of transportation incident. The lives and health of the pilot, crew, passengers, and the population on the ground would be at risk. There are very few injuries and fatalities when compared to the number of people involved in travel as a whole, but if there is an accident, it is very likely that injuries will be serious or fatal. During adverse weather conditions, people may not see a crash in front of them and may run into it, causing a big pile-up. Fires in vehicles, planes, and trains can cause more deaths and injuries.	4

Severity Criteria	Discussion	Score
	Exposure to cold and other conditions can exacerbate the problem until they are rescued and able to be taken in an ambulance. People are also at risk of further crashes on busy detour routes. In adverse weather conditions, people are more likely to drown or suffer hypothermia after an incident on a body of water.	
Health and safety of responders	Response personnel would likely be exposed to fire hazards and other hazards associated with crashes such as sharp objects, glass, and entrapment. Responders are at risk while traveling to the scene and while dealing with traffic, including directing detours. The sheer number of vehicles in the incident area presents increasing risk to those responding. Gawkers and other distracted drivers passing through can add to risk. Responders are also exposed to the severe weather that caused the crash. Because of the number of hours that law enforcement is on the road, they have a higher risk than do other response personnel in a given year. During cold weather or storms, water rescue personnel engaged in a rescue attempt are at even greater risk. Fuel spills can result in health and safety (fire or explosion) issues for those involved.	3
Continuity of operations	In all forms of transportation incidents, local government and partners are able to continue operating, but things like closed roads, exhausted rescue teams, and damaged infrastructure and facilities will have a short-term effect. A long-term effect is likely if a critical asset essential for continuity of operations takes a direct hit. Access to the site or the community as a whole may be restricted until the rescue, salvage or possible cleanup/decontamination operations have been completed. For example, salvage operations may not be able to get underway until a successful testing and decontaminating operation is completed.	3
Property, facilities, infrastructure	Significant damage can also occur to property on the ground as well as the vehicles that crashed. Often buildings, fences, utility lines, and trees are damaged or destroyed in the event of a plane crash. The cargo aboard a plane, truck, or train that has crashed can also sustain damage or destruction. This too can be extremely costly. Property damage would be limited to vehicles and cargo involved; roads, bridges, and other infrastructure; utilities such as light and power poles; and other property adjacent to the accident scene such as buildings and yards. Bridges can be damaged and thus disrupt other transportation modes.	3
Delivery of services	In all forms of transportation incidents, services can be delayed if transportation routes are blocked, bridges are destroyed, or lengthy detours are required. Often local emergency responders suffer when response capabilities are tied up. There may be short term localized impacts if utility poles are affected and the like. Also, major routes, like US 34, can be closed down, thus slowing transportation of people and materials for up to several hours. Cargo will be delayed significantly and services that depend on cargo can be diminished or delayed. Water search and rescue efforts could tie up considerable first response and medical resources. The area's only water rescue team, based in Ringgold County (40 minutes away), is composed of volunteers from all over the region.	3
Environmental impacts	Fuel and other fluids can be spilled from the affected vehicles and affect the environment, including air, water, and soil. When no HAZMAT is involved, the impacts are negligible in the long-term.	2
Economic/financial conditions	Damage would be much localized, and the economic impact to the local economy will be mostly due to damage of business property at the crash site. Damage to the aircraft itself is costly to the owner in terms of direct value lost and amount lost because the airplane is now out of commission. The area impacted could be isolated for weeks or months, thus hindering economic activity in the area. Business and traffic disruptions could last several days until the cleanup efforts are complete. In a waterway, if major contamination results or a lake were closed for recreation, the costs of cleanup and lost tourism spending could be considerable.	3
Regulatory/contractual obligations	Generally, transportation infrastructure, traffic regulations, vehicle regulations, and investigations are handled by agencies outside of the county or other local jurisdictions, including the FAA, US DOT, IDOT, IDNR, Iowa Highway Patrol, and Army Corps of Engineers. Therefore, the regulatory and contractual obligations issues should have minimal direct impact on the county.	1
Reputation	Reputation is based on effective and timely response. Crashes occur often enough that reputations will not be damaged unless the responders do a poor job, such as respond too slowly or without adequate resources or the detour and closure time is too excessive. When State and Federal agencies get involved, it is essential that a chain of command is established early, but if there is a failure, it can harm multiple agencies.	2

Score for Rural Adams County: 24

Score for Corning: 24

Score for Nodaway: 24

Score for Prescott: 24

Score for SW Valley Schools: 24	Score for CHI Health: 24
---------------------------------	--------------------------

Transportation Incident Speed of Onset:

Most transportation incidents involving any of the modes included here (highway, air, rail, or waterway) will be unanticipated. Had they been anticipated, in most cases they would have been prevented. Because of this, these incidents will usually occur with no warning. There may be no or a limited amount of time to warn those in the pathway of the harmful effects.

Score for Rural Adams County: 9	Score for Corning: 9	Score for Nodaway: 9	Score for Prescott: 9
Score for SW Valley Schools: 9	Score for CHI Health: 9		

Transportation Incident Duration of Event:

Transportation incidents will likely occur rather quickly from the time the incident begins until motion stops. Stopping oncoming trains and other immediate actions may prolong the incident up to several minutes to an hour. Securing the site and ensuring secondary crashes/cascading events don't occur will add minutes to even hours. The real immediate impact, to where responders have "things under control" might be 1 to 6 hours for incidents such as a major airliner crash or a train derailment. Cascading impacts may increase this to 12 hours in the most complicated incidents.

Score for Rural Adams County: 5	Score for Corning: 5	Score for Nodaway: 5	Score for Prescott: 5
Score for SW Valley Schools: 5	Score for CHI Health: 5		

Transportation Incident Total Scores:

The following total scores for transportation incident indicate moderate risk to the public and the planning area where incidents can occur.

Score for Rural Adams County: 51	Score for Corning: 50	Score for Nodaway: 49	Score for Prescott: 49
Score for SW Valley Schools: 51	Score for CHI Health: 51		

Transportation Incident Vulnerability/Assets at Risk:

All structures, property, and people in the county, as outlined in Section 3.2, could suffer from the effects of transportation incidents. This is because an air transportation incident can occur anywhere. Rail transportation incidents, highway transportation incidents, and waterway incidents will only occur on those facilities or directly adjacent to them.

All critical assets in the county, as outlined in Section 3.2, are at risk of an air transportation incident. Generally, none of them are at direct risk from the other assessed modes, other than bridges and some buildings adjacent to major transportation routes.

Transportation Incident Loss Estimation:

The bulk of the losses from transportation incidents will be to human life and injury. Those at risk include drivers, pilots, engineers, and passengers of vehicles, trains, boats, and airlines as well as pedestrians and bystanders. During response, responders can also be injured or killed. In a plane crash, one or more people can be killed inside buildings or while exposed outdoors if they cannot get out of the way of the falling plane.

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 2014 dollars using an annual inflation rate of 2.85 percent. The costs are listed below.

Figure 3.104: Loss Estimate by Transportation Incident Matrix

Severity	Cost Per Injury (in 2014 dollars)
Fatal	\$4,171,814
Evident Injury	\$57,782
Possible Injury	\$30,487
Property Damage Only	\$3,209 (mostly the vehicle(s) involved)

Source: U.S. Department of Transportation Federal Highway Administration Technical Advisory T 7570.2, 1994. Adjusted to 2014 dollars

Using this crash severity data combined with historical crash data outlined in the “historical occurrence” section of this profile, the planning team estimates the following loss data per year for the planning area:

- Fatalities (2.0 per year): \$8,343,628.
- Major injuries (5.0 per year): \$288,910.
- Minor injuries (8.0 per year): \$243,896.
- Property damage (50 per year): \$160,450.

Based on this analysis, the estimated average annual cost of traffic accidents for the planning area is \$9,036,884. Virtually all the losses will occur in rural areas, with 5% of losses in Corning. At least half of the annual losses are anticipated on Highways 34 and 148.

Associated costs of a highway transportation incidents include the economic cost of detours, the cost of response and cleanup, and possible environmental costs if hazardous materials are spilled or released. These costs can translate to functional use losses for local governments, response agencies, and businesses. In a given year, these costs can exceed \$1 million.

Waterway incidents involving watercraft are moderate, given the popularity of Lake Icaria for boating and swimming. Other than this lake, the risk is low, but a drowning or destructive boat collision can be anticipated every few years in the county. Anglers falling through the ice is also possible, resulting in death and hypothermia. Again, loss of life is the greatest impact, where each fatality has a “value” of over \$4.1 million.

Airplane crashes involving more than a single-seated plane are more likely to cause significant casualties and destroy property but rarely occur. When they occur, up to and over 100 people on the plane can perish along with dozens or even hundreds on the ground, depending, of course, on where the plane crashes. Because of many risks involved in response to major airliner crashes, it is very possible that responders could also die.

Future Development and Transportation Incident:

According to the *Impacts of Rural Development on Iowa’s Secondary Road System*, September 2010, completed by Iowa State University, Institute for Transportation, the development of new rural agricultural and residential uses in rural areas, and now the development of wind turbines, increases construction-related and long-term new traffic patterns on secondary roads. Local development will not have a great impact in other local modes of transportation, and there are no plans to build new airports or railroads. Development is not likely to result in new railroad-road crossings.

3.6: Risk Assessment Summary

As can be seen, the various hazards can/will affect any or all of the population and assets in the county, depending on the nature of the impacts and locational restrictions placed on them. This section provides a summary of the potential impact. Please note that more information, such as flooding base floor elevations (BFEs) and soil types, is needed to identify specific risks and magnitude of impact on a particular property. This mitigation plan provides only the basic information that is known for the hazards and assets that are impacted.

This part of the plan addresses the following Stafford Act requirement:

Section 201.6I(2)(ii): [The risk assessment shall include a] description of the jurisdiction’s vulnerability to the hazards described in paragraph I(2)(i) of this section. The description shall include an overall summary of each hazard and its impact on the community.

Total Scores and Hazard Priority Groupings

The following matrix shows the total scores for each profiled hazard as it impacts each jurisdiction.

Figure 3.105: Total Hazard Risk Assessment Scoring

Hazard	Rural Adams Co.	Corning	Nodaway	Prescott	SW Valley Schools	CHI Health
Animal/crop/plant disease	47	44	44	44	43	43
Dam/levee failure	44	44	--	45	--	--
Drought	56	51	51	51	50	50
Expansive soils	45	43	42	42	41	41
Extreme heat	55	55	55	55	51	51
Flood, flash	54	54	53	54	50	50
Flood, river	45	47	43	43	38	--
Grass and wildland fire	46	41	40	40	--	--
Hazardous materials incident	54	53	51	51	54	54
Infrastructure failure	63	64	63	63	63	63
Pandemic human disease	50	51	51	51	52	52
Radiological incident	48	52	53	53	53	52
Severe winter storm	58	57	57	57	56	56
Sinkhole	43	42	42	42	43	43
Terrorism	51	59	58	58	63	61
Thunderstorm/Lightning/Hail	55	55	55	55	55	55
Tornado/Windstorm	61	63	63	63	63	63
Transportation incident	51	50	49	49	51	51

-- Hazard does not affect/occur in the jurisdiction.

The above table is simply a snapshot that allows the reader to compare the relative risks from various hazards by jurisdiction. It is not perfect. First, it only considers the direct impact of a hazard event, but in reality hazard events often occur simultaneously and consecutively, causing triggered hazards. Second, the table shows the scores based on fixed criteria for each hazard without consideration of the differences among hazards. In other words, the scores are not meant to compare the hazards. Third, the results are based on available information combined with planning team opinions of risk. Despite these factors, the scores in the table paint a picture of relative risk.

Using the State Hazard Mitigation Plan for guidance, the local planning team created a three-tier system to prioritize the hazards in terms of which should receive the most attention and resources in the hazard mitigation process over the next five years. The following illustrates the priority groupings.

Figure 3.106: Priority Groupings for Mitigation Actions Graphic

Priority Group 1	Unacceptable Consequences	Maximum possible effort should be given to eliminate unacceptable risk factors, including injury, death, economic loss, property loss, and other damages
Priority Group 2	Risk Reduction	Mitigation actions, when feasible and affordable, should be taken to address these, especially when they can be part of the effort to mitigate Priority 1 hazards.
Priority Group 3	Risk Acceptance	Typically, these hazards are not a focus with the limited resources available but might be addressed incidentally as part of Priority 1 hazard mitigation efforts.

Priority Group 1 hazards, as identified by jurisdiction, should be the focus of sustained and new mitigation actions. Therefore, the remaining part of the hazard mitigation plan focuses on actions to address these hazards. It is important to understand that not all hazards affect individual jurisdictions in the planning area equally; therefore, the Priority 1 hazards vary by jurisdictions. The classifications result from the total individual hazard scores for each jurisdiction, as shown in Figure 3.105.

The following matrix shows the risk assessment ratings and priority groups for all participating jurisdictions. The hazards are listed by jurisdiction alphabetically by type. Natural hazards are *italicized*.

Figure 3.107: Priority Groupings Matrix by Jurisdiction

Jurisdiction	Priority Group 1 Hazards	Priority Group 2 Hazards	Priority Group 3 Hazards
Rural Adams County	<i>Drought</i> <i>Flood, River **</i> Infrastructure failure <i>Severe winter storm</i> <i>Tornado/windstorm</i>	<i>Extreme Heat</i> <i>Flood, Flash</i> <i>Grass and wildland fire</i> Hazardous materials incident Pandemic human disease Terrorism <i>Thunderstorm/lightning/hail</i> Transportation incident	<i>Dam/levee failure</i> Animal/crop/plant disease <i>Expansive soils</i> Radiological incident <i>Sinkhole</i>
Corning	<i>Flood, Flash</i> <i>Flood, River **</i> Hazardous materials incident * Infrastructure failure Pandemic human disease * <i>Severe winter storm</i> <i>Tornado/windstorm</i> Transportation incident *	<i>Drought</i> <i>Extreme Heat</i> Radiological incident Terrorism * <i>Thunderstorm/lightning/hail</i>	<i>Dam/levee failure</i> Animal/crop/plant disease <i>Expansive soils</i> <i>Grass and wildland fire</i> <i>Sinkhole</i>
Nodaway	<i>Extreme Heat</i> <i>Flood, River **</i> Infrastructure failure <i>Severe winter storm</i> <i>Tornado/windstorm</i>	<i>Drought</i> <i>Flood, Flash</i> Hazardous materials incident Pandemic human disease Terrorism <i>Thunderstorm/lightning/hail</i> Transportation incident	Animal/crop/plant disease <i>Expansive soils</i> <i>Grass and wildland fire</i> Radiological incident <i>Sinkhole</i>
Prescott	<i>Dam/Levee Failure *</i> <i>Extreme Heat</i> <i>Flood, Flash</i> <i>Flood, River **</i> Infrastructure failure <i>Severe winter storm</i> <i>Tornado/windstorm</i>	<i>Drought</i> Hazardous materials incident Pandemic human disease <i>Thunderstorm/lightning/hail</i> Terrorism Transportation incident	Animal/crop/plant disease <i>Expansive soils</i> <i>Grass and wildland fire</i> Radiological incident <i>Sinkhole</i>
Southwest Valley Schools	<i>Flood, River **</i> Infrastructure failure Pandemic human disease <i>Severe winter storm</i> <i>Thunderstorm/lightning/hail</i> <i>Tornado/windstorm</i> Transportation incident	<i>Drought</i> <i>Flood, Flash</i> Radiological incident Terrorism	Animal/crop/plant disease <i>Expansive soils</i> <i>Extreme Heat</i> Hazardous materials incident <i>Sinkhole</i>
CHI Health	Infrastructure failure Pandemic human disease <i>Severe winter storm</i> <i>Tornado/windstorm</i>	<i>Drought</i> <i>Extreme Heat</i> <i>Flood, Flash</i> Hazardous materials incident Radiological incident Terrorism <i>Thunderstorm/lightning/hail</i> Transportation incident	Animal/crop/plant disease <i>Expansive soils</i> <i>Sinkhole</i>

* Items moved from another column following discussion at second planning meeting and discussion of local priorities.

*** River flood is always a Priority 1 hazard due to Stafford Act requirements and NFIP compliance issues.*

Annual Loss Estimation

This section itemizes the results of possible *direct* structural, economic/functional use, and human losses on an annual basis from the hazards outlined in the hazard profile. Direct effects are those resulting from the hazard, not including cascading events. When using the formula, Damage per Event X (multiplied by) Number of Events Per Year, we can come up with the total losses in one year. Doing this provides a clearer picture of which hazards are likely to impact the community in a given year in terms of expected losses in today's dollars.

The following table shows the annual estimate for total losses by hazard inclusive of direct property losses, functional use losses, and losses in terms of human fatalities and injuries. This is very subjective and should only be used for discussion purposes.

Figure 3.108: Total Annual Loss Estimate by Hazard by Jurisdiction

Hazard	Rural Adams Co.	Corning	Nodaway	Prescott	SW Valley Schools	CHI Health	Totals
Animal/crop/plant disease	\$250,000	\$10,000	\$2,000	\$3,500	\$2,000	\$2,000	\$269,500
Dam/levee failure	\$100,000	\$20,000	--	\$10,000	--	--	\$130,000
Drought	\$4,000,000	\$100,000	\$5,000	\$10,000	\$1,000	\$1,000	\$4,117,000
Expansive soils	\$150,000	\$50,000	\$5,000	\$10,000	\$2,000	\$1,000	\$218,000
Extreme heat	\$1,500,000	\$1,000,000	\$100,000	\$200,000	\$25,000	\$25,000	\$2,850,000
Flood, flash	\$1,500,000	\$750,000	\$75,000	\$200,000	\$10,000	\$10,000	\$2,545,000
Flood, river	\$2,000,000	\$1,000,000	\$50,000	\$50,000	\$5,000	--	\$3,105,000
Grass and wildland fire	\$500,000	\$10,000	\$2,000	\$2,500	--	--	\$514,500
Hazardous materials incident	\$500,000	\$100,000	\$2,000	\$2,500	\$1,000	\$1,000	\$606,500
Infrastructure failure	\$2,500,000	\$500,000	\$10,000	\$20,000	\$15,000	\$15,000	\$3,060,000
Pandemic human disease	\$400,000	\$200,000	\$25,000	\$50,000	\$50,000	\$100,000	\$825,000
Radiological incident	\$10,000	\$5,000	\$500	\$1,000	\$500	\$1,000	\$18,000
Severe winter storm	\$2,500,000	\$500,000	\$50,000	\$100,000	\$100,000	\$25,000	\$3,275,000
Sinkhole	\$5,000	\$2,500	\$500	\$1,000	\$500	\$500	\$10,000
Terrorism	\$25,000	\$25,000	\$1,000	\$2,000	\$25,000	\$10,000	\$88,000
Thunderstorm/Lightning/Hail	\$750,000	\$250,000	\$25,000	\$50,000	\$25,000	\$15,000	\$1,115,000
Tornado/Windstorm	\$2,500,000	\$500,000	\$75,000	\$150,000	\$100,000	\$50,000	\$3,375,000
Transportation incident	\$3,000,000	\$300,000	\$20,000	\$25,000	\$10,000	\$5,000	\$3,360,000
Totals	\$22,190,000	\$5,322,500	\$448,000	\$887,500	\$372,000	\$261,500	\$29,481,500

-- Hazard has no direct effect on this jurisdiction.

The total loss in the planning area per year is \$29,481,500. Of this total estimated annualized loss, two-thirds is human loss (fatalities, injuries, and illness), which is what makes transportation incident, extreme heat, and severe winter storm so high. Approximately 70% the overall loss will occur in the rural unincorporated area, mostly due to the massive area and exposure experienced in the rural area. The hazards with the greatest overall loss (over \$3 million) in the planning area are as follows:

- Drought: \$4,117,000
- Tornado/windstorm: \$3,375,000
- Transportation incident: \$3,360,000
- Severe winter storm: \$3,275,000
- River flood: \$3,100,000
- Infrastructure failure: \$3,060,000

See the individual hazard profiles to read more detailed information about hazard losses by type of structure, infrastructure, and other types of losses and how future development may affect the future losses for each hazard.

The above loss table is not created for insurance purposes or detailed planning and budgeting. At best, the table should be used for comparison purposes when developing goals and objectives. Losses that cannot be included in such tables are considerations such as emotional anguish, losses of records and irreplaceable items, losses to pristine forests, water quality deterioration, and pollution creation. For many hazards a large area is at risk, but damage to any property will be very limited, and hazard effects would be mostly economic and operational. Items like water and sewer systems may be damaged but unseen, and it may be difficult to determine whether the deterioration of underground systems is due simply to age or from hazard events over the years.

Description of the Nature of Vulnerability to Key Hazards

It is important to understand the nature of vulnerability that considers the impact of hazards in terms of *how* they affect the community most. While any hazard event can impact a number of asset types, the overall risk varies and is higher in some categories than in others. The following table provides a summary of the relative nature of hazard risk among six categories. The purpose of this table is to illustrate how assets are at risk. This gives the reader an idea that, while one hazard might destroy more property than another, the overall impact of any hazard is significant when we consider sometimes overlooked impacts. This helps fulfill the “overall summary of each hazard and its impact on the community” requirement of Section 201.6(c)(2)(ii) of the Stafford Act.

Figure 3.109: Description of Overall Vulnerability by Hazard

Hazards (<i>natural italicized</i>)	Jurisdictions Affected	Areas at Risk	People	Structures	Land, Resources	Economic	Personal Property	Intangible, Quality of Life *
Animal/crop/plant disease	All	Anywhere where plants, livestock, or wildlife exist			2	1		3
Dam/levee failure	Rural, Corning, Prescott	The impoundment itself and several miles downstream		1	2			3
<i>Drought</i>	All	Widespread/anywhere			2	1	3	
<i>Expansive soils</i>	All	Most areas of the county, but depends on soil type		1		3	2	
<i>Extreme heat</i>	All	Widespread/anywhere	1	3		2		
<i>Flood, flash</i>	All	Widespread, but depends on topography and surface conditions	3	1	2			
<i>Flood, river</i>	Rural, all three cities	Within identified flood hazard areas		2	1	3		
<i>Grass and wildland fire</i>	Rural, all three cities	On or near un-managed vegetation, crop, wildland areas; interface areas		3	1	2		
Hazardous materials incident	All	1,000 feet of fixed sites and transportation routes	1	2		3		
Infrastructure failure	All	Widespread, anywhere where infrastructure is found	2	1		3		
Pandemic human disease	All	Widespread/anywhere	1		2			3
Radiological incident		1,000 feet of fixed sites and transportation routes	1	2		3		
<i>Severe winter storm</i>	All	Widespread/anywhere	2	3		1		
<i>Sinkhole</i>	All	Technically anywhere, but realistically only where past mining or excavation has occurred		1	2		3	
Terrorism	All	Widespread/anywhere	1	2			3	

Hazards (<i>natural italicized</i>)	Jurisdictions Affected	Areas at Risk	People	Structures	Land, Resources	Economic	Personal Property	Intangible, Quality of Life *
<i>Thunderstorm/lightning/hail</i>	All	Widespread/anywhere	2	1		3		
<i>Tornado/windstorm</i>	All jurisdictions	Widespread/anywhere	1	2			3	
Transportation incident	All jurisdictions	Widespread/anywhere (air), on or near transportation routes (others)	1	3			2	

* *Intangibles are things of intrinsic value: vital/financial records, emotional loss, personal financial loss, fear and intimidation, reputation, etc.*

The planning team assessed the risks caused by 18 hazards in the planning area. Many of these hazards have acceptable levels of risk or are already being mitigated using current mitigation measures. However, each jurisdiction used the results from this chapter to select several “Priority 1” hazards that will be the focus of a five-year mitigation strategy, outlined in the next chapter. For this remainder of this plan, only Priority 1 hazards, as selected by each jurisdiction, will be considered. Other hazards, while causing harm to the planning area, are not the focus of the strategy.

In conclusion, it is important to remember that specific assets will be affected by specific hazards depending on factors, such as the type of building materials, roofing, size of site, elevation, soils on which asset is located, slopes, quality of construction, topography, and location related to hazard zones (for fires, floods, etc.). This data is not always readily available, nor can it be analyzed easily, and it is not often needed for the level of planning performed here. What is presented is a basis for prioritizing mitigation actions and ensuring they make sense with the data available. More detailed analysis is necessary for specific mitigation projects involving specific infrastructure. This being said, Adams County has extensive assets that can be impacted by many different hazards, and the remaining part of this plan should be focused on addressing those assets at direct risk due to the hazards that cause the most harm.

Risk Assessment Problem/Issue Statements

Based on the information in this chapter, we have identified statements that summarize the impact of hazards in the county. The following statements lead to the development of goal statements in the next chapter. Only hazards identified as Priority 1 hazards for at least one jurisdiction are included in this statement. Also, there are several statements related to hazards in general.

Issue Statements for All Hazards:

- Because of the limited resources for some jurisdictions, some hazards that may be of concern were not rated as Priority 1 hazards. Some jurisdictions, such as small communities and schools, are forced to focus just on a few hazards in the next five years.
- The need exists to continue to improve severe weather awareness. People seem to become too reliant on their cell phones and no longer observe weather conditions. If cell coverage fails during severe weather, people are not ready to know what is going on.
- The large and growing senior population presents a disadvantage of concern to the committee when it comes to hazard mitigation because of the greater difficulty to alert them, their reduced mobility, and greater risk of spreading human disease.

- We have the key assets in place, such as modern utilities, a modern hospital, and modern emergency services, but keeping the people to serve in these roles in rural areas is very difficult. Keeping training current is a concern for committee members.
- Groups like SICOG can provide valuable help with grant applications for mitigation projects, but obtaining state and federal assistance can be difficult because the programs and funding streams constantly change.
- The extreme competitiveness of funding at the state and federal level in recent years diminishes the incentive to continue this level of future hazard mitigation planning.

Issue Statements for Dam/Levee Failure:

- Prescott listed this hazard as a Priority 1 hazard due to the concern over a privately-owned dam uphill from the city that could fail and cause considerable damage to the community.
- The mayor has reported talking recently to the property owner and to the IDNR about the issue and may pursue a FEMA mitigation grant for this project.

Issue Statements for Drought:

- Drought is a key concern for the county and has the most direct impact on the rural areas, where mitigation measures are most likely to be implemented. It is a Priority 1 hazard in rural Adams County.
- Drought remains a main issue mostly because the county's water supply is projected to fall below sustainable level in the next ten years. A new rural water treatment plant is now under construction and will supply water needs for farmers and communities.
- Drought is one of the most damaging hazards in rural areas and overall in the county (highest in the overall loss estimation), especially in terms of crop and economic losses.
- The county remains very much surface water dependent due to the considerable need for agricultural and industrial process needs.

Issue Statements for Extreme Heat:

- Extreme heat is a Priority 1 hazard in Nodaway and Prescott.
- While the hazard occurs everywhere, these small towns are at slightly greater risk due to the lack of organized and dedicated cooling centers in them and the preponderance of aging homes with limited insulation and modern cooling systems.
- The risk of death and serious illness as a result of extreme heat make it a considerable hazard in these areas.

Issue Statements for Flood, Flash:

- Flash flooding is a Priority 1 hazard for Corning and Prescott.
- Flash flooding is a growing problem due to the increasing risk of extreme rain events and continued development, which makes more of the land in the county impervious.
- Recognizing the problem, Prescott has engineered storm water projects to reduce urban flash flooding, but resources are insufficient to address the scope of the problem.
- Flash flooding is not responsible for as much in overall losses as other hazards but does enhance the level of loss sustained by infrastructure failure, which is among the greatest in the county of the profiled hazards.
- Flash flooding is one of the greatest causes of physical and infrastructure losses.

Issue Statements for Flood, River:

- This is considered a Priority 1 hazard wherever SFHAs exist, because FEMA has a strong interest in implementing the NFIP nationally. These communities include: rural Adams County, Corning, Nodaway, and Prescott. SW Valley School's athletic fields also can flood.
- At \$3.1 million, river flood is the fifth worst hazard in terms of annualized losses, mostly to infrastructure.
- A large part of the county budget is used for maintenance of rural roads, culverts, and bridges, which are damaged by river floods.
- Adopted regulatory maps are in place, which will make mitigation easier over the next five years. However, due to limited demand from property owners to purchase insurance, local jurisdictions have largely been reluctant to join the NFIP.

Issue Statements for Hazardous Materials Incident:

- Corning rated hazardous materials incident as a Priority 1 hazard.
- Annual loss due to hazardous materials incident is in the low range because most incidents are handled quickly without widespread damage. However, the threat of a significant event is very high due to the many busy highways, the railroad, and manufacturing facilities.
- Local capabilities, mainly trained and certified staffing and volunteers, are limited. More sophisticated response is only available from places like Council Bluffs and Des Moines, each well over an hour away.
- Traffic detours and evacuations can tax local responder resources to the limit and increase risk of hazards in other areas where detours and new traffic flow.
- Hazardous materials incidents will also cause or worsen water quality issues, which are a considerable local concern.

Issue Statements for Infrastructure Failure:

- All jurisdictions rated infrastructure failure as a Priority 1 hazard.
- Annual loss due to infrastructure failure is in the middle to high range for the various hazards (just over \$3 million).
- The breadth of infrastructure included in this hazard and that so much of the vital infrastructure is exposed to other hazards elevates its importance for mitigation.
- The local and national population and economy are more dependent on reliable and efficient infrastructure than ever before in our connected world.
- Even a few minutes of energy failure can cause casualties in populations of elderly, sick, or others in special care who rely on oxygen and other technology. Few facilities have fixed power generators.
- The lack of available response personnel is always a concern, and more populated areas are likely to receive the first and most attention in a widespread outage.
- Severe thunderstorms, windstorms, and winter storms damage power lines all over the county nearly every year.
- Energy failure slows local emergency response time and affects communications facilities.
- Many buildings are very old and/or lack proper maintenance and are at higher risk of failure or fire.
- Fire departments rely on limited funding and limited numbers of volunteers, many of which are not available when a fire alarm sounds.
- Transportation incidents, which are estimated to have the greatest annual loss of human life, are often the result of infrastructure failure.

Issue Statements for Pandemic Human Disease:

- Corning, Southwest Valley Schools, and CHI Health listed this as a Priority 1 hazard.

- Because true pandemics do not occur often, the annualized losses are low, but, when they occur, losses can be very high. COVID has taught us that economic losses can be as severe as the “value” of loss of life and sickness.
- Corning’s original assessment score showed Priority 2 status, but the economic problems facing industry, schools, and downtown small businesses elevated the hazard in the mind of local officials.
- It appears that the apparent long-term negative impacts of COVID – inflation, supply chain problems, worker shortages, and social and political issues over widely varying levels of government response – far exceed any other single hazard event in modern history.

Issue Statements for Severe Winter Storm:

- All the jurisdictions rated severe winter storm as a Priority 1 hazard.
- Annual loss due to severe winter storm is the fourth highest for the various hazards (over \$3.2 million).
- Humans are very susceptible to severe winter weather, especially seniors who live in homes that lose power or that go outside when it is slippery and travel on slippery roads.
- Winter weather in general costs local government tens to hundreds of thousands of dollars annually in road clearing and repair costs alone.
- Adams County has many homes built before insulation was used. These homes can be very cold and can pose a hazard to infants, elderly, and sick persons. Weatherization programs are available but cannot possibly meet all the need with funding limitations.
- Ice and snow cause many highway transportation incidents in the county each year, some of them fatal.
- Smaller towns and remote rural areas are affected more because of the lack of alternative power sources and emergency services. Emergency services have difficulty traveling and working in severe winter weather.
- Early and late season (April and September) winter weather can cause extensive crop loss.

Issue Statements for Thunderstorm/Lighting/Hail:

- Southwest Valley Schools rated thunderstorm/lightning/hail as a Priority 1 hazard, mostly due to building exposure.
- Annual loss due to thunderstorm/lightning/hail is in the lower range of the range for the various hazards (just over \$1.1 million).
- It is believed that climate change issues will continue to spawn more damaging severe storms with more large hail and dangerous lightning as well as excessive downpours.
- In an increasingly wired society, the risks of energy and communications failure due to lightning continue to increase. More and more equipment, towers, and utility lines are exposed to lightning, hail, and high winds.

Issue Statements for Tornado/Windstorm:

- All the jurisdictions rated tornado/windstorm as a Priority 1 hazard.
- Annual loss due to tornado/windstorm is second highest for the various hazards (over \$3.3 million).
- Rural recreational areas generally are not served by any kind of outdoor warning system. Cell-based systems work well only where service is available and when towers are not damaged by storms.
- No FEMA safe rooms exist in the county. While there are other sturdy buildings, and most homes have basements and/or cellars, few properties are designed to protect people from large tornadoes that can exist. Most homes are aging no longer sturdy.
- Planning team members continue to point to the seemingly increasing intensity and frequency of severe weather, including tornadoes and high wind events.

Issue Statements for Transportation Incident:

- Corning and Southwest Valley Schools rated transportation incident as a Priority 1 hazard.
- Annual loss due to transportation incident is third highest for the various hazards (over \$3.3 million).
- Originally, this hazard was a Priority 2 hazard for Corning but local officials wanted to elevate it due to the impact it has on the local economy, given the industrial uses in the city, the local airport, and the trains passing through town.
- The school is mostly concerned about safety of buses traveling around the county/district. Older buses still do not have seatbelts.

Certainly, there are risks and problems related to other hazards on the identified hazard list, and some of them are profound. They should not be ignored but rather should be addressed as necessary outside of or incidental to the implementation of this plan. Thankfully, most of the issues caused by other hazards are addressed by other existing plans and mitigation efforts.