Multi-Jurisdictional Hazard Mitigation Plan for Wapello County, Iowa

April 2021 Update

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Multi-Jurisdictional

Hazard Mitigation Plan for Wapello County, Iowa

Adopted: XX/XX/2021

Expires: XX/XX/2026

Prepared by: Area 15 Regional Planning Commission

Special thanks to the Wapello County Emergency Management Commission, Wapello County Emergency Management Agency, and the Wapello County Hazard Mitigation Planning Team

This plan was developed in coordination with the Federal Emergency Management Agency and Iowa Homeland Security and Emergency Management

www.wapelloready.org

www.area15rpc.com

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[1] *Current as of the date of adoption. Information is subject to change without notice.*

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Contents

Section 1 – Introduction to Mitigation Planning **1**
Background **1**
Purpose **3**
Plan Organization **3**
Section 2 – Mitigation Planning Process **5**
Planning Meetings & Local Involvement **5**
Plan Review **7**
Section 3 – Planning Area Profile **9**
Historic Overview **9**
Population, Demographics, & Economics **12**
Geography **13**
Land Use 13
Surface Water & Floodplains 13
Infrastructure **16**
Streets & Highways 16
Air, Rail, & Public Transportation 16
Utility Systems 18
Local Media 18
Schools **18**
Recreational, Historical, & Cultural Areas **20**
Emergency Response Services **21**
Law Enforcement 21
Ambulance & Hospital 21
Fire Departments 21
Structures, Community Assets, & Critical Facilities **22**
Section 4 – Hazard Analysis & Risk Assessment **25**
Wapello County Hazard Analysis **25**
2015 Wapello County Plan 25
2018 State of Iowa Plan 26
2021 Wapello County Plan Update 27

DRAFT

Hazard Profiles **28**
Dam/Levee Failure 29
Drought 34
Earthquake 37
Expansive Soils 40
Extreme Heat 42
Flash Flood 45
Landslides 48
River Flood 50
Severe Winter Storms 54
Sinkholes 57
Thunderstorms, Lightning, & Hail 59
Tornadoes & Windstorms 63
Risk Assessment **69**
History of Hazard Occurrence 69
Methodology 70
Risk Assessment 70
Section 5 – Mitigation Strategy **73**
Mitigation Goals **73**
Mitigation Actions **73**
Categories of Mitigation Actions 74
Review of 2015 Mitigation Actions 74
Updated Mitigation Actions 79
Section 6 –Implementation **85**
Plan Adoption & Implementation 85
Plan Maintenance & Updates 86
Continued Public Participation 87
County Adoption Resolution 89
Section 7 – Local Focus **91**
City of Agency **92**
Planning Process 93

DRAFT

Hazard Risk Assessment 94
Review of Existing Plans 94
Mitigation Strategy 95
Plan Adoption Resolution 97
City of Blakesburg 99
Planning Process 100
Hazard Risk Assessment 101
Review of Existing Plans 101
Mitigation Strategy 102
Plan Adoption Resolution 103
City of Chillicothe 105
Planning Process 106
Hazard Risk Assessment 107
Review of Existing Plans 107
Mitigation Strategy 108
Plan Adoption Resolution 109
City of Eddyville 111
Planning Process 112
Hazard Risk Assessment 113
Review of Existing Plans 113
Mitigation Strategy 114
Plan Adoption Resolution 115
City of Eldon 117
Planning Process 118
Hazard Risk Assessment 119
Review of Existing Plans 119
Mitigation Strategy 120
Plan Adoption Resolution 121
City of Kirkville 123
Planning Process 124
Hazard Risk Assessment 125

DRAFT

Review of Existing Plans 125
Mitigation Strategy 126
Plan Adoption Resolution 127
City of Ottumwa 129
Planning Process 130
Hazard Risk Assessment 131
Review of Existing Plans 131
Mitigation Strategy 132
Plan Adoption Resolution 133
Wapello County School Districts 135
Planning Process 136
Mitigation Strategy 136
Section 8: Appendices 137
Appendix A – 44 CFR § 201.6 – Local Mitigation Plans 137
Appendix B – Glossary 137
Appendix C – FEMA Preparedness List 137
Appendix D – Disaster Declarations in Iowa: 1990-2019 137
Appendix E – Planning Meeting Participation 137
Appendix F – Image Credits 137
Appendix G – Local Plan Data & Information 137
Appendix H – Information for Future Plan Updates 137
Appendix I – Mitigation Actions Addendum 137

DRAFT

Section 1 – Introduction to Mitigation Planning

Thunderstorms, flooding, tornadoes, blizzards – these are examples of natural hazards that may affect Iowans each year. These events threaten to cause millions of dollars in property damage annually and can be fatal to humans and animals that are in harm's way. To protect lives and property from natural and man-made hazards, it is vital for citizens and local leaders to identify potential losses and take measures to reduce them. This process is known as mitigation planning.

Hazard mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to human life and property from hazards.[2] Hazards can be natural, such as those mentioned above, or man-made, such as a radiological incident or transportation accidents involving hazardous materials. Hazard mitigation planning encourages long-term reduction of vulnerability to natural and man-made hazards, with the overarching goal of saving lives and reducing property damage. Mitigation actions should provide a cost-effective and environmentally sound methods to reduce the potential financial impacts of disasters to property owners and governmental entities. Mitigation should also minimize disruption to communities by protecting critical resources and infrastructure systems such as water, food, shelter, energy, medical treatment, and transportation.

A variety of mitigation actions can be undertaken to help curb the potential impacts of any hazard. Examples of mitigation measures can include infrastructure improvements, purchasing emergency response equipment, and outfitting a community shelter with a back-up power supply. Warning sirens can be installed to notify residents of an approaching storm and NOAA radios or cell phone alerts could be utilized to inform the public of information during the storm including shelter locations. Proactive mitigation measures help save lives and protect property.

Background

44 CFR § 201.6 – The local mitigation plan is the representation of the jurisdiction's commitment to reduce risks from natural hazards, serving as a guide for decision makers as they commit resources to reducing the effects of natural hazards. Local plans will also serve as the basis for the State to provide technical assistance and to prioritize project funding.

The response to, and mitigation of, natural disasters has been a subject of increasing focus for the federal government throughout the past few decades. The Federal Emergency Management Agency (FEMA) provides assistance to local governments for disaster response and recovery through the Stafford Disaster Relief and Emergency Assistance Act of 1988 (Stafford Act). The Stafford Act amended the original Disaster Relief Act of 1974, which created a system triggering financial and physical assistance upon the issuance of a Presidential

[2] 44 CFR §201.2

Disaster Declaration. This program was amended again with the passage of The Disaster Mitigation Act of 2000 (DMA2K). This legislation established a pre-disaster hazard mitigation program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP). DMA2K increased the amount of funds available to states, and requires state and local governments to have adopted an approved hazard mitigation plan in order to qualify for post-disaster HMGP funding. This document was developed in accordance with FEMA's plan requirements, which are outlined under Code of Federal Regulations, Title 44, Part 201.6, *Local Mitigation Plans* (44 CFR §201.6). The full text of 44 CFR §201.6 may be found in Appendix A.

44 CFR § 201.6(a)(1) – A local government must have a mitigation plan approved to receive HMGP project grants. A local government must have a mitigation plan approved in order to apply or and receive mitigation project grants under all other mitigation grant programs.

Local governments are required to have a FEMA-approved Local Mitigation Plan in place in order to apply for and receive grant funding under FEMA's several mitigation-related programs.[3] The number of projects eligible for grant funding changes annually and is based on recent Presidential Disaster Declarations and priorities determined at the state level. Each of the following FEMA grant programs provides funding opportunities for pre- and post-disaster mitigation activities.[4]

- **Hazard Mitigation Grant Program (HMGP):** HMGP assists in implementing long-term hazard mitigation measures following Presidential Disaster Declarations. Funding is available to implement projects in accordance with state, tribal, and local priorities.
- **Pre-Disaster Mitigation (PDM):** PDM provides funds on an annual basis for hazard mitigation planning and the implementation of mitigation projects prior to a disaster. The goal of the PDM program is to reduce overall risk to the population and structures, while also reducing reliance on federal funding from actual disaster declarations.
- **Flood Mitigation Assistance (FMA):** FMA provides funds on an annual basis to reduce or eliminate the risk of flood damage to buildings insured under the National Flood Insurance Program (NFIP).
- **Repetitive Flood Claims (RFC):** RFC provides funds on an annual basis to reduce the risk of flood damage to individual properties insured under the NFIP that have had one or more claim payments for flood damages. RFC provides up to 100% federal funding for projects in communities that meet the reduced capacity requirements.
- **Severe Repetitive Loss (SRL):** SRL provides funds on an annual basis to reduce the risk of flood damage to residential structures insured under the NFIP that are qualified as severe repetitive loss structures. SRL provides up to 90% federal funding for eligible projects.

[3] 44 CFR §201.6
[4] FEMA Hazard Mitigation Assistance

Purpose

44 CFR § 201.6(d)(3) – A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within 5 years in order to continue to be eligible for mitigation project grant funding.

A hazard mitigation plan is intended to accomplish several goals and objectives. Most importantly, the mitigation planning process provides a platform for the community to recognize and address the hazards that may impact them. The local mitigation plan is the representation of a jurisdiction's commitment to reduce risks associated with natural hazards, serving as a guide for decision makers as they commit resources toward such a reduction of the effects of hazards. The purpose of this plan is to engage citizens, public officials, and other local leaders in a planning process that will formulate strategies to address the hazards that could occur in Wapello County.[5]

This document is an update of the Wapello County, Iowa Hazard Mitigation Plan, which was originally completed and adopted in 2015. Data collected during this process was used to identify means to reduce the effects of disasters upon residents, property, and resources. There are three parts of this particular plan that accomplish the purpose:

1. Identifying, profiling, and ranking hazards that may affect Wapello County;
2. Assessing local capabilities, developing goals, and identifying mitigation actions to reduce vulnerability to hazards; and
3. Implementing the plan and associated mitigation actions while continuously monitoring, evaluating, and updating the plan.

Plan Organization

The Multi-Jurisdictional Hazard Mitigation Plan for Wapello County is organized as follows:

- Section 1: Introduction to Mitigation Planning
- Section 2: Mitigation Planning Process
- Section 3: Planning Area Profile
- Section 4: Hazard Identification & Risk Assessment
- Section 5: Mitigation Strategy
- Section 6: Implementation
- Section 7: Local Focus
- Section 8: Appendices

[5]*This hazard mitigation plan is not to be confused with the Wapello County Emergency Support Functions (ESFs). The major difference between this plan and the ESFs is that the hazard mitigation plan addresses hazards before they occur. The ESFs are designed to be a guide on how to respond in the case of an emergency or disaster.*

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Section 2 – Mitigation Planning Process

44 CFR § 201.6(b) – An open public involvement process is essential to the development of an effective plan.

In 2019, the Wapello County Emergency Management Commission and Emergency Management Agency initiated this project with the assistance of the Area 15 Regional Planning Commission. The Commission chose to pursue a 5-year Plan Update, as their existing plan (completed in 2015) was set to expire in 2020. Wapello County enlisted the services of the Area 15 Regional Planning Commission as a consultant to facilitate the planning process and to draft the updated hazard mitigation plan document. Final plan development was delayed approximately 11 months due to the shift of focus to address and respond to the Covid-19 pandemic needs in Wapello County.

The hazard mitigation planning process is outlined by FEMA as a series of somewhat sequential tasks. The tasks for mitigation planning are outlined below.[6]

1. Determine the Planning Area & Resources
2. Build the Planning Team
3. Create an Outreach Strategy
4. Review Community Capabilities
5. Conduct a Risk Assessment
6. Develop a Mitigation Strategy
7. Keep the Plan Current
8. Review & Adopt the Plan
9. Create a Safe & Resilient Community

Planning Meetings & Local Involvement

44 CFR § 201.6(c)(1) – [The plan shall include] documentation of the planning process used to develop the plan, including who was involved in the process, and how the public was involved.

44 CFR § 201.6(b)(2) – [The plan shall include] an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process.

Seven cities, three school districts, and the unincorporated areas of Wapello County were identified as participants in this plan update. From the beginning of the planning process, Area 15 staff worked with representatives from Wapello County and its Emergency Management Agency to determine the appropriate outreach strategy. Planning and EMA staff contacted each community and school directly to inform them about the planning process. A data collection guide was

[6] FEMA Local Mitigation Planning Handbook

distributed to each city and school within the planning area to survey documents, services and inventory assets. This aided in identifying existing plans and critical facilities, providing the important information that was used to assess the vulnerability of each community to hazards. The information is located in Appendix G.

Through discussions at local levels between jurisdictional representatives and Wapello County EMA staff, hazards were re-examined to determine which pose the biggest threat for each jurisdiction.

The countywide planning team included emergency management staff, elected officials, city and county personnel, public safety officers, and school representatives. Representatives from each jurisdiction were expected to provide necessary information and feedback through personal communications and surveys with RPC staff. Additional assistance from outside volunteers also contributed to the development of this plan, including data gathering from city or school staff and various County offices. A list of plan participants may be found in Appendix E.

Area 15 RPC is the council of governments for a six-county region in southeast Iowa. The RPC board of directors is comprised of County Supervisors from Wapello and five surrounding counties, as well as at-large members representing small businesses and economic development agencies. Updates on the plan's status were provided monthly in the RPC board meeting agenda information packets. Board Members are invited to share this information with their communities and citizens, as well as any other interested parties in neighboring counties.

Similar information was also made available to the members of Opportunity[2], a regional marketing group which is serves as the region's Comprehensive Economic Development Strategy (CEDS) committee. The CEDS is a document is a tool that aids in formulating goals and strategies that guide economic growth and physical development in the region.

Additionally, the Wapello County Emergency Manager during the planning stages—Tim Richmond—reached out to several other potential stakeholders to encourage their participation.

44 CFR § 201.6(b)(1) – [The planning process shall include] an opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.

Before this plan was adopted within each local jurisdiction it was made available for public review and comment at the Wapello County Court House and on the Area 15 RPC website for a period of thirty days. Area 15 staff compiled this document and completed the associated plan review tool and then submitted to Iowa Homeland Security and FEMA for review. Each of the participating jurisdictions adopted the plan pending comments from the State and Federal review process, and upon the completion of the plan, a final draft was provided to each participating jurisdiction.

Plan Review

44 CFR § 201.6(b)(3) – [The planning process shall include] review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

Existing plans, studies, reports, and other technical information were reviewed by Area 15 RPC staff with each jurisdiction during the plan development process. This was done in an effort to be consistent with the goals and priorities previously identified by the Commission and each jurisdiction.

The following documents were reviewed during the development of this plan:

- 2018 State of Iowa Hazard Mitigation Plan
- 2015 Wapello County Multi-Jurisdictional Hazard Mitigation Plan
- Wapello County Ordinances
- Wapello County Emergency Support Functions
- Area 15 Region Comprehensive Economic Development Strategy: 2017-2022
- Annual hazard mitigation jurisdictional surveys

Other documents referenced that are specific to each individual jurisdiction may be found in each of the local jurisdiction profiles in Section 7.

It is intended that this multi-jurisdictional hazard mitigation plan be incorporated into the existing and future plans of all the participating jurisdictions, where appropriate. The actions identified in this plan should be considered during the development processes of any future planning activities, including: capital improvement plans, budgets, comprehensive plans, and emergency management and operations plans.

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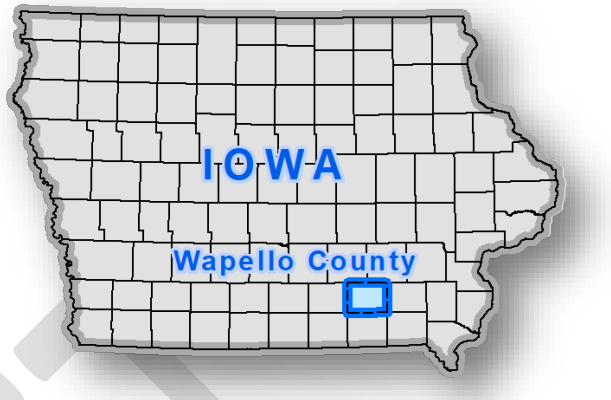
Section 3 – Planning Area Profile

Wapello County is located in southeast Iowa, encompassing approximately 436 square miles. It is bordered by Mahaska and Keokuk Counties on the north, Jefferson County on the east, Monroe County on the west and Davis County on the south. Seven incorporated cities lie within the county: Agency, Blakesburg, Chillicothe, Eddyville, Eldon, Kirkville, and Ottumwa.



The following communities and educational institutions within Wapello County are officially represented in this plan:

Agency	Eldon	Cardinal Community Schools
Blakesburg	Kirkville	Eddyville-Blakesburg-Fremont Schools
Chillicothe	Ottumwa	Ottumwa Community Schools
Eddyville	Unincorporated Areas	

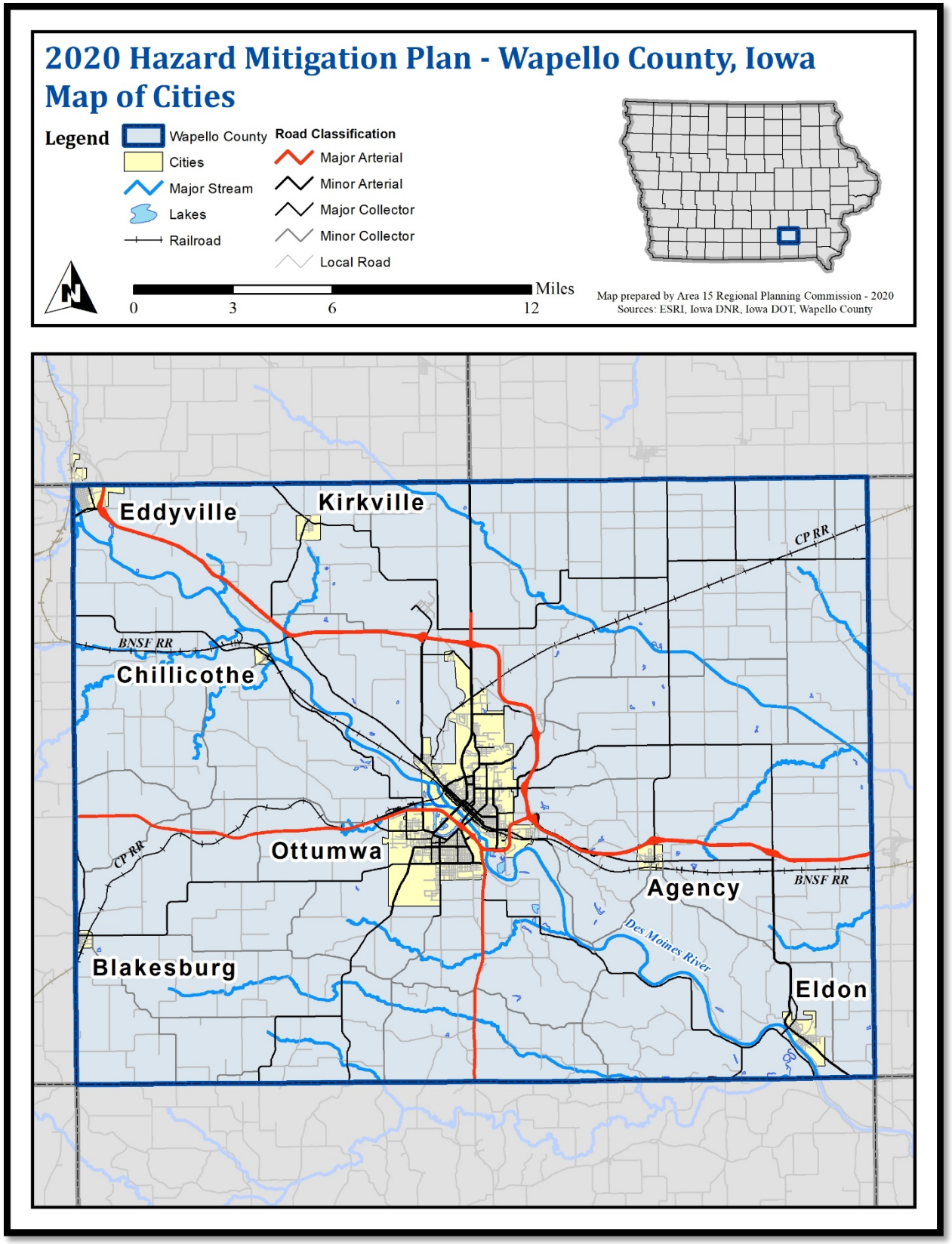
Historic Overview[7]

Wapello County was established February 17, 1843. Wapello County opened for settlement at midnight of April 30, 1843, and by June over 5,000 people resided in the county. Wapello County was formally organized on March 1, 1844.

Ottumwa was surveyed and laid out by the Appanoose Rapids Company in 1842 in anticipation of development. In May 1844 commissioners selected Ottumwa as the county seat. "Ottumwa" is derived from a Fox and Sac word meaning "rippling waters". The commissioners had appointed the town name as Louisville but was later reverted to the more popular, Ottumwa.

Ottumwa became a prominent city in southwest Iowa early in its existence. The city's location along the Des Moines River allowed it to become an important riverboat port. Likewise, proximity to the river aided in the early development of Eddyville, Eldon, and Chillicothe. The population of the county grew steadily, reaching its peak of 47,397 in 1950. Since that time, the population has decreased to 35,625 in 2010.

[7] Wapello County


2020 Hazard Mitigation Plan - Wapello County, Iowa
Map of Cities
Legend
Wapello County
Cities
Major Stream
Lakes
Railroad
Road Classification
Major Arterial
Minor Arterial
Major Collector
Minor Collector
Local Road
Miles
0
3
6
12
Map prepared by Area 15 Regional Planning Commission - 2020
Sources: ESRI, Iowa DNR, Iowa DOT, Wapello County
Eddyville
Kirkville
Chillicothe
Ottumwa
Agency
Blakesburg
Eldon
BNSF RR
CP RR
Des Moines River

Wapello County at a Glance

Demographics		Workforce	
Population	35,321	Total Labor Force	20,849
Median Age	39.5	Employed	16,269
65 Years and Over	5,980	Unemployment Percentage	3.4%

Race	Number	Percent
White Alone	31,131	88.1%
Black or African American Alone	1,061	3.0%
American Indian and Alaska Native Alone	42	0.1%
Asian Alone	330	0.9%
Native Hawaiian or Other Pacific Islander Alone	97	0.3%
Hispanic or Latino	3,703	10.5%
Some Other Race Alone	2,057	5.8%
Two or More Races	603	1.7%

Household Income		Total Property Valuations	
Median Household Income	$43,329	Residential	$1,175,421,094
Per Capital Income	$23,413	Commercial	$240,764,613
Individuals Below Poverty Level	17.0%	Industrial/Agricultural	$288,061,530

Housing		Regulatory Information	
Total Housing Units	16,076	Flood Insurance Rate Map	Yes
Occupied Housing Units	14,531	NFIP Participant	Yes
Vacancy Rate	9.6%	Comprehensive Plan	No
Owner-occupied Housing Units	10,413 (71.7%)	Zoning Ordinance	Yes

Occupation	Number	Percent
Agriculture, forestry, fishing and hunting, and mining	349	2.1%
Construction	1,289	7.9%
Manufacturing	3,733	22.9%
Wholesale trade	281	1.7%
Retail trade	1,936	11.9%
Transportation and warehousing, and utilities	668	4.1%
Information	158	0.1%
Finance and insurance, and real estate and rental and leasing	848	5.2%
Professional, scientific, and management, and administrative and waste management	805	4.9%
Educational services, and health care and social assistance	4,255	26.2%
Arts, entertainment, and recreation, and accommodation and food services	946	5.8%
Public administration	378	2.3%
Other services	623	3.8%

Sources: U.S. Census Bureau (2010), Wapello County Assessor (2020)

Population, Demographics, & Economics

According to the U.S. Census Bureau, the 1850 population of Wapello County was 8,471.[8] Wapello County grew rapidly until 1950, when it had a peak population of 47,397. Since then, the population has continued to decline each decade. The 2010 decennial census estimated the countywide population at 35,625, which represents a 1.2% decrease from its 2000 population. Table 3.1 shows a detailed chronology of State and County populations while Table 3.2 shows the population trends for each city within Wapello County.

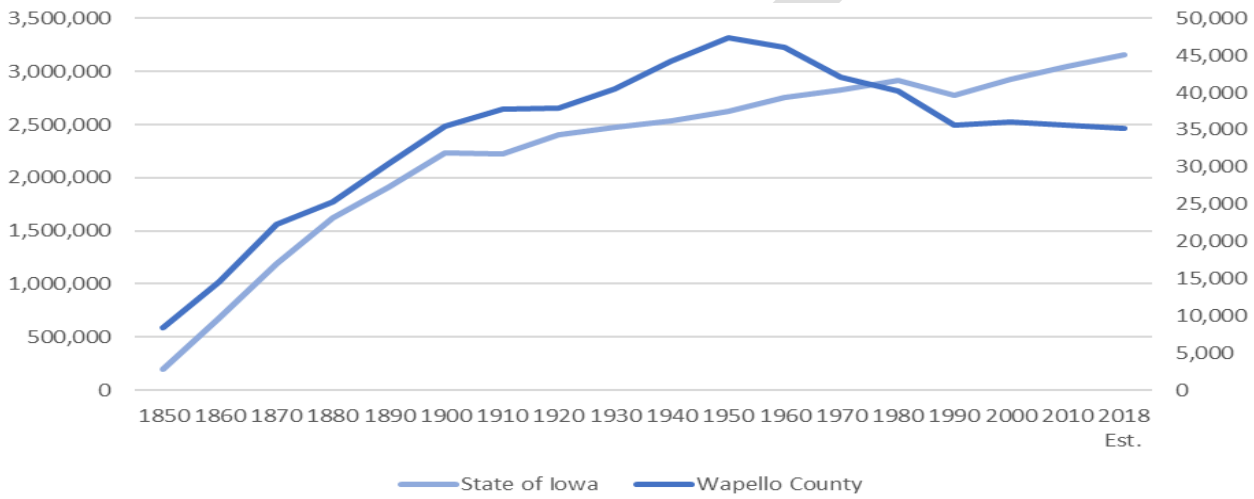


Figure 3.1. Historical Population: State of Iowa & Wapello County

Table 3.1. Historical Population: State of Iowa & Wapello County

Jurisdiction	1850	1860	1870	1880	1890	1900
State of Iowa	192,214	674,913	1,194,020	1,624,615	1,912,297	2,231,853
Wapello County	8,471	14,518	22,346	25,285	30,426	35,426
	1910	1920	1930	1940	1950	1960
State of Iowa	2,224,771	2,404,021	2,470,939	2,538,268	2,621,073	2,757,537
Wapello County	37,743	37,937	40,480	44,280	47,397	46,126
	1970	1980	1990	2000	2010	2018 Est.
State of Iowa	2,824,376	2,913,808	2,776,755	2,926,324	3,046,355	3,156,145
Wapello County	42,149	40,241	35,696	36,051	35,625	35,205

Sources: U.S. Census Bureau, American Community Survey (2018 estimates)

Since 2014, the population age of Wapello County reduced slightly from a median age of 40.0 to a median age of 39.6, which is higher than the median age of 38.1 for the State (2018 American Community Survey Estimates). In that time, the population's diversity has increased, from 92.9% of the population identifying as White Alone in 2014 to 88.1% in 2017 ACS estimates. Immigrants from Asian and African countries comprise most new residents in the county.

[8] U.S. Census Bureau

Table 3.2. Historical Population: Wapello County Cities

Jurisdiction	1960	1970	1980	1990	2000	2010
Wapello County	46,126	42,149	40,241	35,696	36,051	35,625
Agency	702	610	657	616	622	638
Blakesburg	401	403	404	333	374	296
Chillicothe	148	126	131	119	90	97
Eddyville	1,014	945	1,116	1,036	1,064	1,024
Eldon	1,386	1,319	1,255	1,070	998	927
Kirkville	203	222	220	177	214	167
Ottumwa	33,871	29,610	27,381	24,888	24,998	24,023

Source: U.S. Census Bureau

From the early years of its existence, manufacturing has been a chief source of employment for residents of Wapello County. Major occupations for the county today include: education and social services (26.2%), manufacturing (22.9%), and retail trade (11.9%).

At $43,329, the median household income for Wapello County is about 23.4% lower than the statewide median household income of $56,570. Approximately 3.4% of workers are unemployed compared to 2.9% in the state. Approximately 17% are living below the designated poverty level, compared to the state average of 12%. More demographic and economic details can be found in the "Wapello County at a Glance" table on Page 11.

Geography

Land Use

Wapello County is located in an area known as the Southern Iowa Drift Plain. The land surface is characterized by steep rolling hills, level alluvial lowlands, and table-like upland divides. Wapello County's landscape is continually changing from erosion and weathering. It has excellent soil that is derived from a deep deposit of drift and is excellent for agricultural uses such as corn, small grains, grass, fruits and vegetables. A land cover map may be found on Page 14.

There are five main land use categories in Wapello County: agricultural, commercial, industrial, residential and public uses of the land. The land use taking up most of the county is agricultural property.

Surface Water & Floodplains

Wapello County contains a variety of surface water features, including rivers, creeks, intermittent streams, and small water bodies. The county does not contain any large natural lakes. The majority of water bodies are primarily soil conservation structures, farm ponds, reservoirs, wetlands, and old quarries. Water travel within the county is primarily limited to recreational uses. A map of streams may be found on Page 15.

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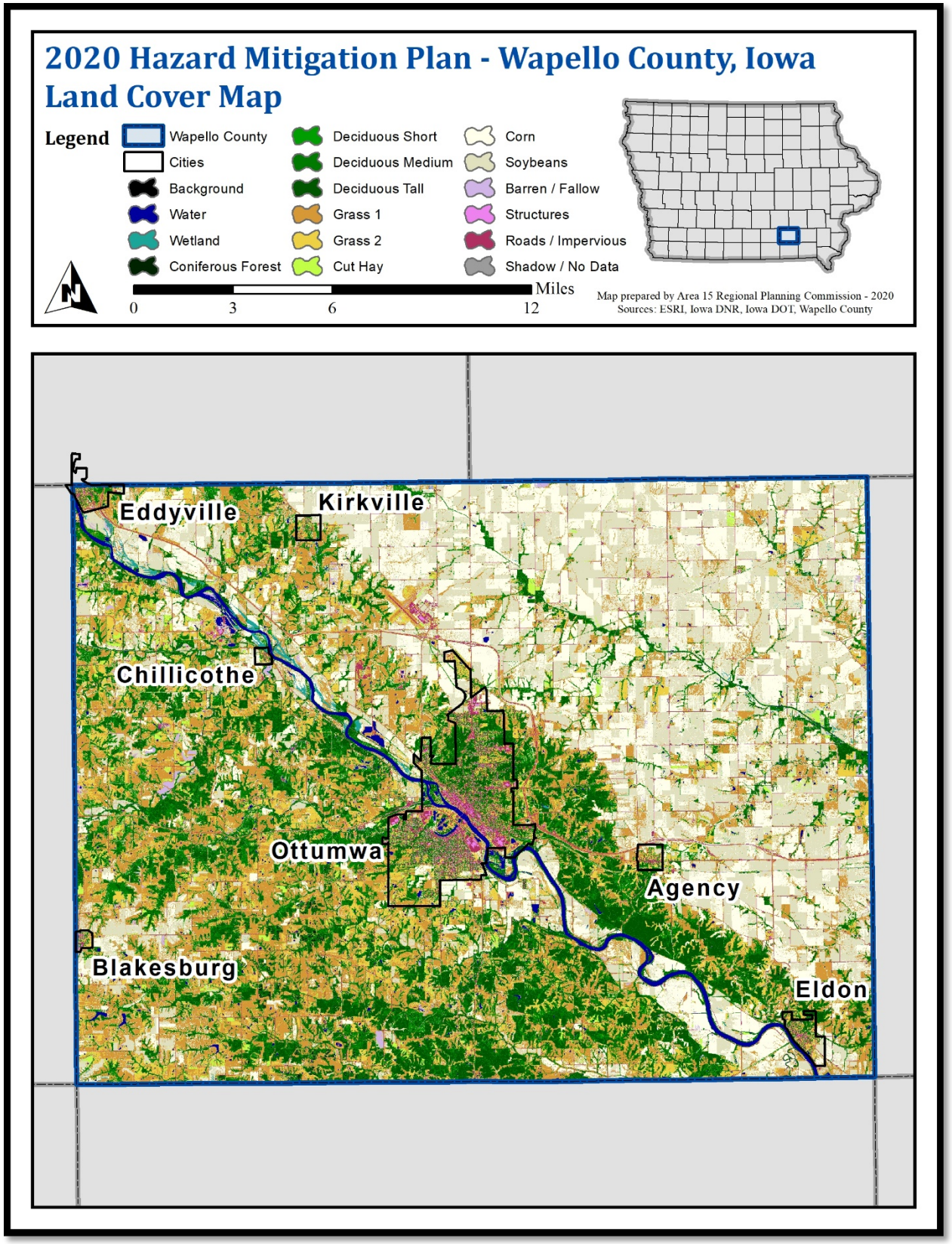
2020 Hazard Mitigation Plan - Wapello County, Iowa
Land Cover Map
Legend
Wapello County
Cities
Background
Water
Wetland
Coniferous Forest
Deciduous Short
Deciduous Medium
Deciduous Tall
Grass 1
Grass 2
Cut Hay
Corn
Soybeans
Barren / Fallow
Structures
Roads / Impervious
Shadow / No Data
Miles
0
3
6
12
Map prepared by Area 15 Regional Planning Commission - 2020
Sources: ESRI, Iowa DNR, Iowa DOT, Wapello County
Eddyville
Kirkville
Chillicothe
Ottumwa
Agency
Blakesburg
Eldon

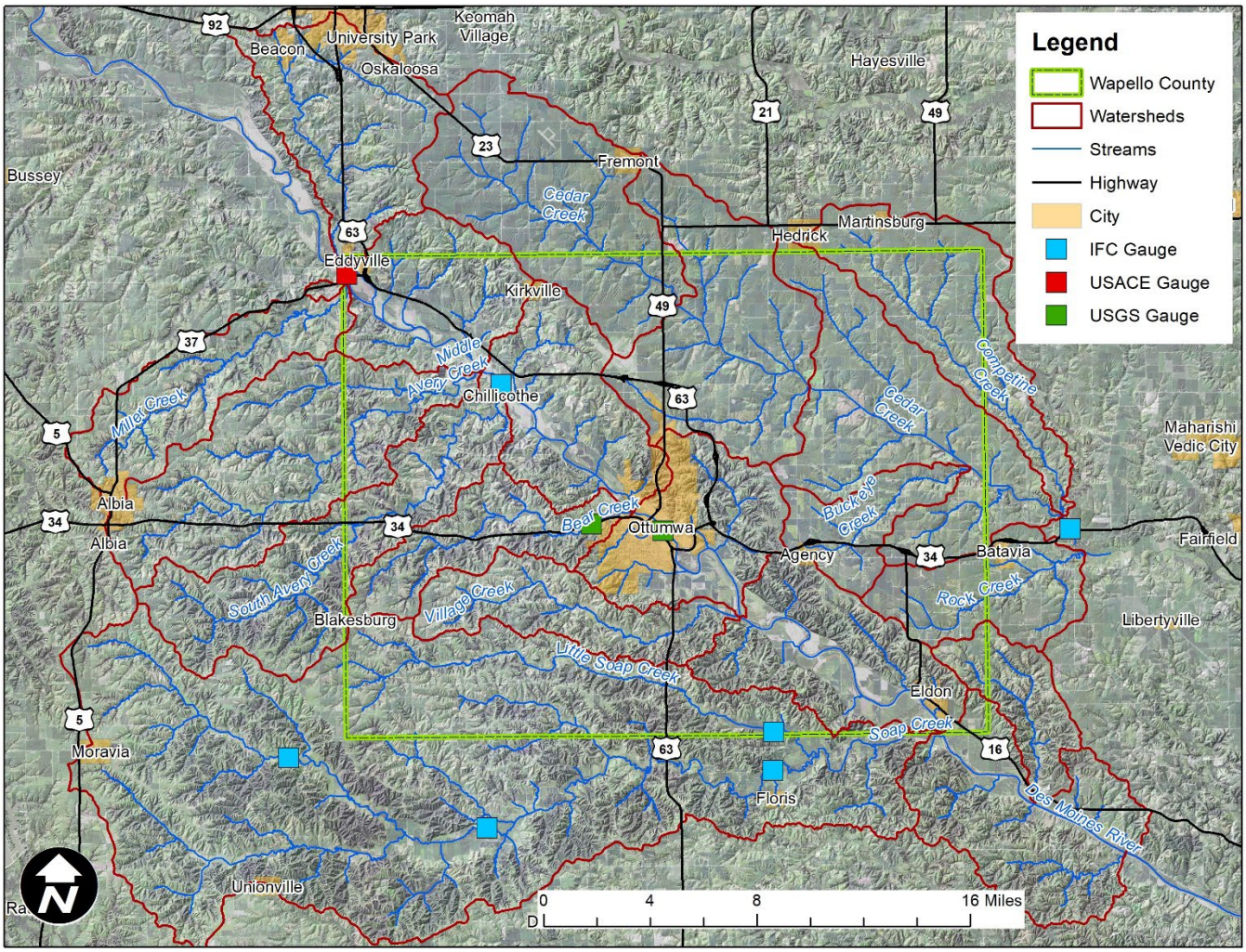

Figure 3.2 Wapello County Watersheds Map. Courtesy Iowa Flood Center.

Below is a list of rivers and creeks that are in Wapello County.

Rivers in Wapello County: Des Moines.

Creeks in Wapello County: Bear, Brush, Buckeye, Cedar, Competine, Comstock, Coon, Fudge, Harrows Branch, Jordan, Kettle, Little Cedar, Little Soap, Menneika, Miller, North Avery, Rock, South Avery, Spring, Spring Branch, Sugar, Turkey, Twomile, Village, and Wolf.

Flooding is a common occurrence along the Des Moines River, which passes through the cities of Eddyville, Chillicothe, Ottumwa, and Eldon. A map of floodplains may be found on Page 33.

Infrastructure

Streets & Highways

Streets & Highways

As the map on the Page 17 illustrates, transportation exists primarily through on-road travel. The Iowa Department of Transportation oversees maintenance for State and U.S. Highways. Wapello County Secondary Roads handles maintenance on all other roads and bridges in the county excluding cities of Ottumwa, Eldon, and Eddyville.

The following roadways are the main transportation routes in Wapello County:

- US-163
- US-34
- US-63
- IA-16
- IA-149

Air, Rail, & Public Transportation

The Ottumwa Industrial Airport is classified as an "enhanced service airport". Traffic at this airport includes cargo, business and personal travel, medical transport, and law enforcement. Currently the airport sees 2,500 flights on an annual basis, with half classified as "local operations" (the aircraft is based at Ottumwa or is traveling to/from Ottumwa). In 2020, an extension project was completed to extend the runway to 6,001 feet, which allows any size plan to land in an emergency. The Ottumwa Regional Health Center has a helipad to serve the air medical transportation needs of the area.

Wapello County is served by five railroads with BNSF Railway running from east to west across the county and Canadian Pacific Railway running from northeast to southwest through the county—with these two lines intersecting in Ottumwa. The Norfolk Southern Railway provides freight services through the area by a haulage agreement with the BNSF. Amtrak utilizes the BNSF tracks to serve Wapello County via an Ottumwa stop on its *California Zephyr* route between Chicago, IL and Emeryville, CA. The Burlington Junction Railway provides contract-switching services in the BNSF yard west of the JBS pork processing facility in Ottumwa.

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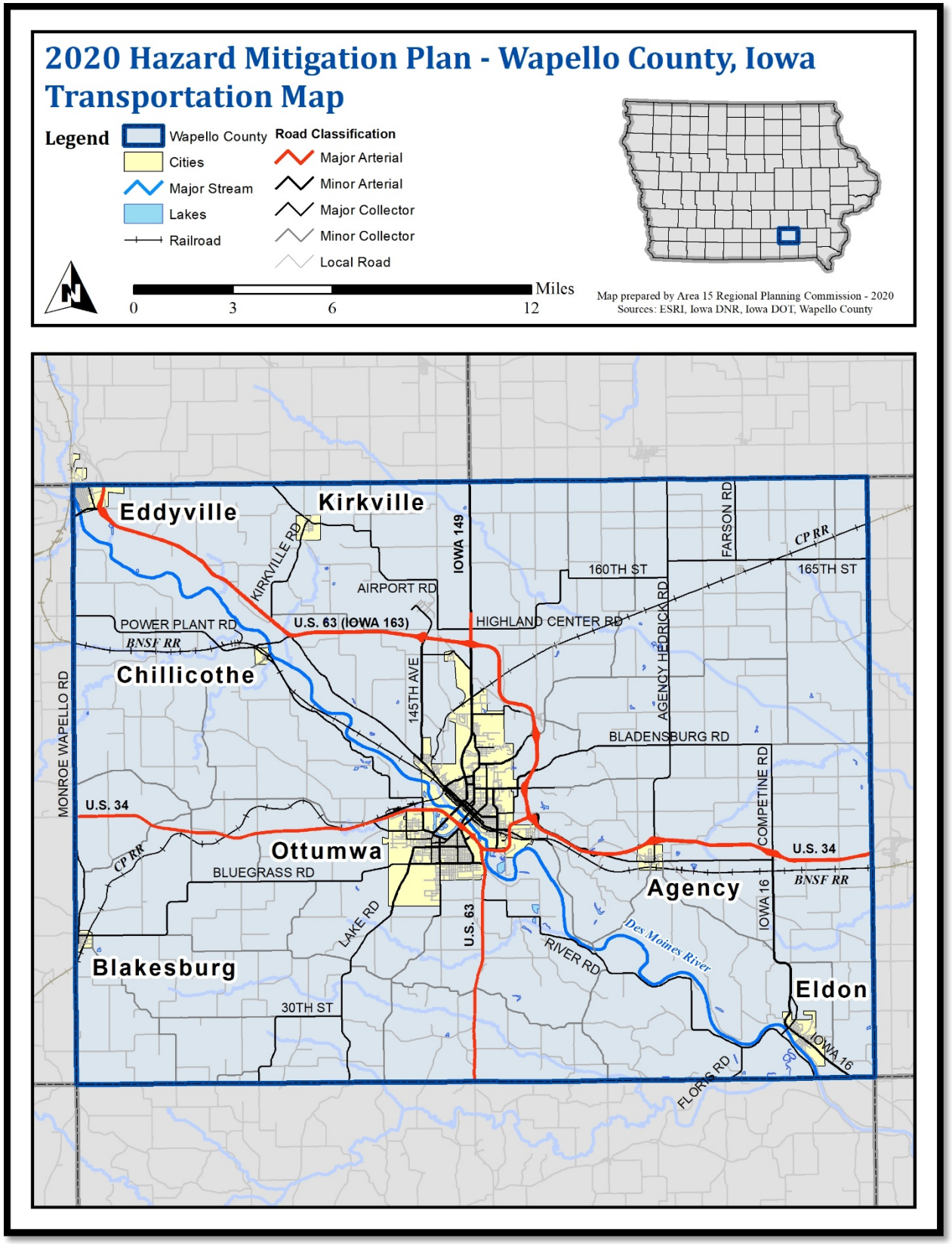
2020 Hazard Mitigation Plan - Wapello County, Iowa
Transportation Map
Legend
Wapello County
Cities
Major Stream
Lakes
Railroad
Road Classification
Major Arterial
Minor Arterial
Major Collector
Minor Collector
Local Road
Miles
0
3
6
12
Map prepared by Area 15 Regional Planning Commission - 2020
Sources: ESRI, Iowa DNR, Iowa DOT, Wapello County
Eddyville
Kirkville
Chillicothe
Ottumwa
Agency
Eldon
Blakesburg
KIRKVILLE RD
IOWA 149
AIRPORT RD
160TH ST
FARSON RD
CP RR
165TH ST
POWER PLANT RD
BNSF RR
U.S. 63 (IOWA 163)
HIGHLAND CENTER RD
AGENCY HEDRICK RD
145TH AVE
MONROE WAPELLO RD
BLADENSBURG RD
COMPETINE RD
U.S. 34
BLUEGRASS RD
LAKE RD
U.S. 63
RIVER RD
Des Moines River
IOWA 16
30TH ST
FLORIS RD

Public transportation is available through 10-15 Transit, a federally funded public transportation system that serves Wapello County and nine other counties in southeast Iowa. The system provides fixed-route service in Ottumwa as well as on-demand and paratransit service. Trips must be scheduled by the previous business day and are subject to driver and vehicle availability. Ottumwa is also served by That Cab, LLC for on-demand service and intercity service is available through Burlington Trailways which stops in Ottumwa.

Utility Systems

- Electric: Alliant Energy, Southern Iowa Electric Cooperative, Access Energy Cooperative, Mid-American Energy.
- Natural Gas: Mid-American Energy, Alliant Energy.
- Water: Municipal water systems, Wapello Rural Water Association.
- Sewer: Cities, Wapello Rural Water Association, municipal sewer systems, privately maintained septic systems
- Telephone/Internet: CenturyLink, Lisco, Mediacom, Windstream

Local Media

There are several media sources that serve the citizens of Wapello County. The local newspaper is the *Ottumwa Courier*, which is published multiple times per week and is also available online. Two local television stations operate out of Ottumwa, including KTVO, the ABC and CBS affiliate, and KYOU, the FOX affiliate. The local radio stations include KISS 101.5FM, KRKN 104.3FM, KBIZ 1240AM/102.7FM, KTWA 92.7FM, KLEE 1040AM/107.7FM, and TOM 97.7FM.

Schools

The county is served by three public school districts. Table 3.3 provides a list of all school districts which show total school enrollment of the educational institutions serving Wapello County. The map on Page 19 outlines the boundaries of the public school districts in Wapello County. The Cardinal, Eddyville-Blakesburg-Fremont, and Ottumwa School Districts are headquartered within Wapello County. The Pekin School District is headquartered outside of, but services a portion of Wapello County.

Table 3.3. Wapello County Schools

School District	School Sites	Enrollment
Cardinal Community School District	Eldon	925
Eddyville-Blakesburg-Fremont Community School District	Eddyville, Blakesburg, Fremont	1,017
Ottumwa Community School District	Thornburg	4,285
Pekin Community School District*	Packwood	683

*District does not have a school within Wapello County
Source: Iowa Department of Education (2020)

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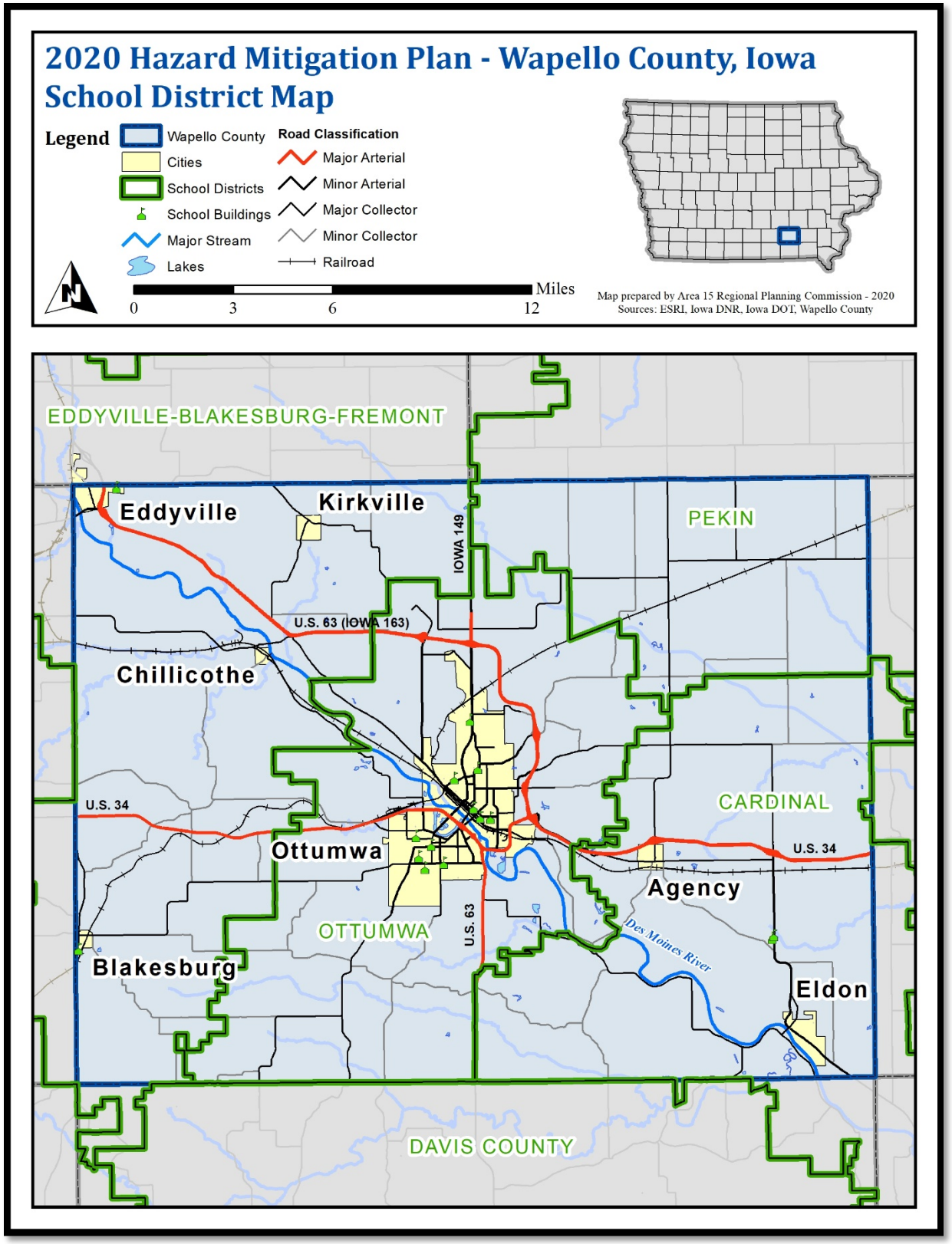
2020 Hazard Mitigation Plan - Wapello County, Iowa
School District Map
Legend
Wapello County
Cities
School Districts
School Buildings
Major Stream
Lakes
Road Classification
Major Arterial
Minor Arterial
Major Collector
Minor Collector
Railroad
Miles
0
3
6
12
Map prepared by Area 15 Regional Planning Commission - 2020
Sources: ESRI, Iowa DNR, Iowa DOT, Wapello County
EDDYVILLE-BLAKESBURG-FREMONT
Eddyville
Kirkville
IOWA 149
PEKIN
U.S. 63 (IOWA 163)
Chillicothe
U.S. 34
CARDINAL
Ottumwa
U.S. 34
Agency
OTTUMWA
U.S. 63
Des Moines River
Blakesburg
Eldon
DAVIS COUNTY

Recreational, Historical, & Cultural Areas

Wapello County is home to a variety of City and County recreation areas. There are no State Parks in the county, but twelve recreational areas lie within the purview of Wapello County Conservation Board. A variety of parks and recreational areas also lie within each local jurisdiction.

Table 3.4. Wapello County Recreational Areas

County Recreation Areas		
Bluewing Marsh	Garrison Rock Resource Management Unit	Kirkville Wildlife Area
Cardinal Wildlife Area	Gray Eagle Wildlife Preserve	Pioneer Ridge Nature Area
DeVol Wildlife Area	Johnson/Noel Buckeye Wildlife Area	Rock Bluff Park
Eddyville Sand Dunes Prairie	Pearson Park	Sycamore Wildlife Area

Source: Wapello County Conservation Board

Wapello County is home to a variety of historical and cultural facilities. Several buildings, structures, or districts appear on the National Register of Historic Places. Historic places appear in Table 3.5, Historic Districts appear in Table 3.6.

Table 3.5. Wapello County Historic Places

Property Name	Use	Location
Chief Wapello's Memorial Park	Civic	Agency
Big 4 Art Fair Hall	Entertainment	Eldon
Dibble House (American Gothic House)	Civic	Eldon
Eldon Carnegie Public Library	Civic	Eldon
McHaffey Opera House	Entertainment	Eldon
Administration Building, U.S. Naval Air Station	Civic	Ottumwa
Benson Block	Commercial	Ottumwa
B'nai Jacob Synagogue	Entertainment	Ottumwa
Burlington Depot	Transportation	Ottumwa
Dahlonega School #1	Not in use	Ottumwa
First National Bank	Not in use	Ottumwa
Foster/Bell House	Residential	Ottumwa
J.W. Garner Building	Commercial	Ottumwa
Hofmann Building	Commercial	Ottumwa
Hotel Ottumwa	Commercial	Ottumwa
Jay Funeral Home	Entertainment	Ottumwa
Jefferson Street Viaduct	Bridge	Ottumwa
Mars Hill	Church	Ottumwa
Ottumwa Public Library	Civic	Ottumwa
Ottumwa Young Women's Christian Association	Commercial	Ottumwa
U.S. Post Office	Civic	Ottumwa
Wapello County Courthouse	Civic	Ottumwa

Source: National Register of Historic Places

Table 3.6. Wapello County Historic Districts

Property Name	Use	Location
Court Hill Historic District	District	Ottumwa
Fifth Street Bluff Historic District	District	Ottumwa
Greater Second Street Historic District	District	Ottumwa
Historic Railroad District	District	Ottumwa
North Fellows Historic District	District	Ottumwa
Ottumwa Cemetery Historic District	District	Ottumwa
Vogel Place Historic District	District	Ottumwa

Source: National Register of Historic Places

Emergency Response Services

Various support agencies exist to respond to any of the many hazards that could occur within the County. These agencies include the Wapello County/Ottumwa Communications Center/E911, Wapello County Emergency Management, the Ottumwa Regional Health Center, the Wapello County Sherriff's Office, the Ottumwa Police Department, the Southern Iowa Response Group Haz-Mat Team (SIRG), and 6 fire departments. Locations of each facility are depicted on each local map.

Law Enforcement

The Wapello County Sheriff is the principal peace officer of the county. The Sheriff's Office serves as the primary law enforcement for the unincorporated Wapello County, as well as the cities of Agency, Blakesburg, Chillicothe, Eddyville, Eldon, and Kirkville. The Ottumwa Police Department is the primary law enforcement agency for the City of Ottumwa.

Ambulance & Hospital

The ambulance service in Wapello County operates out of the Ottumwa Regional Health Center. The primary hospital is the Ottumwa Regional Health Center, which is located in Ottumwa and services the residents of Wapello County.

Fire Departments

Wapello County supports the following fire departments: Agency Volunteer Fire and Rescue, Blakesburg Fire and Rescue, Eddyville Volunteer Fire and Rescue, Eldon Fire and Rescue, Ottumwa Fire Department, and Wapello County Rural Fire Department. These departments serve their associated cities and the rural and unincorporated areas of Wapello County. Each department has mutual aid agreements with other nearby departments, including Batavia Volunteer Fire Department and Benton Township/Hedrick Fire Department outside of Wapello County, to assist in response efforts.

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Structures, Community Assets, & Critical Facilities

44 CFR § 201.6(c)(2)(ii) – [The risk assessment shall include] a description of [each] jurisdiction's vulnerability to [each hazard]. This description shall include an overall summary of each hazard and its impact on the community. The plan should describe vulnerability in terms of: (A) The types and numbers of existing and future buildings, infrastructure, and facilities located in the identified hazard areas; (B) An estimate of the potential dollar losses to the vulnerable structures and a description of the methodology used to prepare the estimate; and (C) Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

It benefits all communities to be prepared for the direct and indirect effects of hazards. It is especially important to minimize the risk of exposure to hazards for all future development. No drastic shifts in land use have occurred in Wapello County over the last decade which would cause a shift in vulnerability to natural hazards. As plans for development arise, Wapello County and its communities should be vigilant in considering potential hazard areas—particularly in low lying areas near streams—prior to allowing any construction to occur. Targeted areas for development throughout the county are strategically identified and are typically low-risk areas.

To better target investments for mitigation activities, it is important to be cognizant of community assets, including: critical structures, facilities, and infrastructure within the county. Section 4 provides a detailed profile for each hazard that was determined to be a potential threat. Each hazard profile includes a vulnerability assessment section in which the potential damages within the county are highlighted. This section establishes a generalized inventory of the community assets and critical facilities that could be exposed to such risks. Table 3.6 shows a generalized breakdown of the existing structural assets within the county and their approximate total values.

Table 3.7. Wapello County Structures & Property Valuations

Jurisdiction	Residential		Commercial		Industrial & Ag.	
	No.	Value	No.	Value	No.	Value
Agency	262	$22,336,814	16	$1,066,960	0	$72,950
Blakesburg	135	$6,123,296	12	$731,430	0	$35,810
Chillicothe	41	$1,691,770	3	$114,330	0	$62,640
Eddyville	291	$2,744,588	28	$2,731,950	0	$27,477
Eldon	396	$15,579,846	27	$2,083,550	0	$101,130
Kirkville	71	$3,629,530	2	$9,180	0	$210,520
Ottumwa	9,151	$699,469,811	540	$210,755,653	11	$35,601,031
Unincorporated Area	3,152	$404,941,155	46	$23,271,560	9	$251,949,972
TOTAL						

Source: Wapello County Assessor (2020)

Members of each community were asked to identify critical facilities within their jurisdiction. These facilities, if impacted by a hazard, could have significant adverse effects on the county and its communities.

Many of these facilities are public works facilities, which provide essential services and functions. Others are hubs of community activity and have the potential to inflict significant structural damage and present risks to injury and loss of life. Each jurisdiction was responsible for identifying its own community facilities and assets. Table 3.8 outlines the number of critical facilities that were identified in each jurisdiction and shows an estimated cumulative replacement value. This data was aggregated from surveys and local insurance documents. Appendix G is reserved for survey and insurance information that is specific to each individual jurisdiction.

Table 3.8. Wapello County Public Structures & Property Valuations

Jurisdiction	Community Facilities	
	No.	Value
Agency	8	$210,843
Blakesburg	5	$227,116
Chillicothe	3	$25,719
Eddyville	19	$1,300,249
Eldon	18	$798,746
Kirkville	4	$33,303
Ottumwa	154	$57,909,190
TOTAL	**211**	**$60,505,166**

Source: Local Insurance Documents, Wapello County Assessor (2020)

Data limitations keep the actual total loss values from being determined, as valuation extends beyond just the structures themselves. It is important to consider the values of items within a particular facility that have the potential to be damaged or destroyed, along with functional losses due to breakdowns in communications, electricity, transportation, and/or other utility networks. Losses of these functions have the ability to further threaten a community and can significantly add to the economic impacts a particular hazard can cause.

It is also important to be aware of other areas in the county where high concentrations of people live, work, learn, and gather. Schools, residential areas, primary employers, and economic/cultural centers concentrate populations and can increase the numbers of people affected by a particular hazard event. Areas with high concentrations of people should be given extra attention when it comes to risks from hazards, particularly cities and large employers within the county.

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Section 4 – Hazard Analysis & Risk Assessment

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

Wapello County Hazard Analysis

Threat and hazard identification and risk assessment (THIRA) is a tool utilized in mitigation planning to identify hazards to which a jurisdiction is susceptible and then to analyze the impact those hazards may have on the jurisdiction. In order to perform this task, the planning team consulted both the *2015 Wapello County Multi-Jurisdictional Hazard Mitigation Plan* and the *2018 State of Iowa Hazard Mitigation Plan*. These documents provided a good starting point for the latest analysis.

2015 Wapello County Plan

In total, twenty hazards were identified, scored, and ranked in the previous planning effort. Eleven natural hazards and nine man-made hazards were discussed. When the 2015 Plan for Wapello County was completed, the State Hazard Mitigation Plan suggested a THIRA that included six categories for the evaluation of risk for each hazard: historical occurrence, severity of impact, probability of future events, vulnerability, maximum threat, and speed of onset. Each category was evaluated for each hazard identified to determine the biggest threats to Wapello County. The twenty hazards that were profiled appear in rank order in Table 4.1.

Table 4.1. Hazards Analyzed: *2015 Wapello County Hazard Mitigation Plan*

Ranking of Hazards Identified in the *2015 Wapello County Hazard Mitigation Plan*			
1	Tornado	11	River Flood
2	Windstorm	12	Transportation Hazardous Materials Incident
3	Structure Fire	13	Rail Transportation Incident
4	Severe Winter Storm	14	Grass or Wildland Fire
5	Energy Failure	15	Drought
6	Fixed Facility Hazardous Materials Incident	16	Air Transportation Incident
7	Flash Flood	17	Communications Failure
8	Hailstorm	18	Active Shooter/School Violence
9	Highway Transportation Incident	19	Dam Failure
10	Thunderstorm & Lightning	20	Levee Failure

2018 State of Iowa Plan[9]

The State of Iowa's foundation for hazard mitigation is based on a hazard analysis and risk assessment that is comprehensive and multi-hazard. This recognizes that multiple hazards that can occur simultaneously in the state, and the risk that each hazard poses is assessed in terms of a disaster or emergency that can be created from that hazard. The comprehensive planning approach seeks a clear understanding of what hazards exist, risks they pose, who and what can be impacted.

The HARA in the 2018 State Plan describes the hazards identified through the process along with their resulting priority rank. It is also the primary vehicle in documenting and distributing concise yet informative results of the process to emergency management professionals and stakeholders in Iowa. The following four-step process was followed in the 2018 State Plan:

1. **Identify Hazards** – determine which hazards can affect each community.
2. **Community Profile** – determine if/to what extent hazards will affect community assets.
3. **Profile Hazard Events** – determine how bad a hazard can get.
4. **Prioritizing Hazards** – determine which hazards need to be addressed.

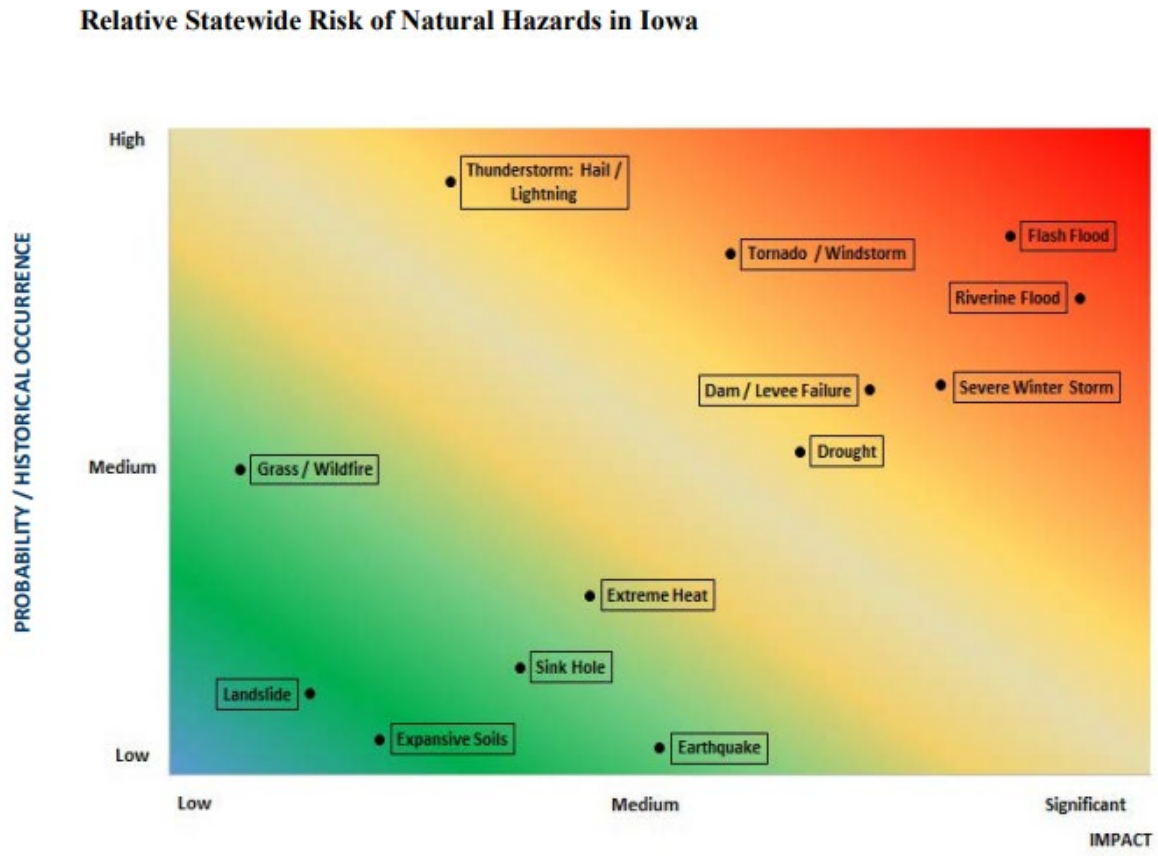
The State Hazard Mitigation Team (SHMT) developed a list of potentially significant hazards. Current HARAs from local jurisdictions were used to accumulate a list of hazards that occur in the State. A survey of local hazard mitigation plans from across the State contributed to the State's hazard analysis and risk assessment. The hazard identification portion of the HARA consists of an inventory of those threats and hazards that have the potential to impact the State of Iowa. FEMA recognizes several additional hazards that do not affect Iowa because of its geographic location, including: avalanches, volcanoes, coastal erosion, coastal storms, hurricanes, and tsunamis. These hazards were discussed, but ultimately left out of the hazards list for the State. Previously, the SHMT elected to combine several events because of their similarity and likelihood of concurrence, including: combining hailstorms with thunderstorms/lightning, windstorms with tornadoes, and levee failure with dam failure. The 2018 planning processed included twenty hazards to assess. Of these, thirteen are natural hazards and were profiled in this plan. The thirteen threats are listed in Table 4.2 below.

Table 4.2. Hazards Analyzed: *2018 State of Iowa Hazard Mitigation Plan*

Natural Hazards	
Dam/Levee Failure	Grass or Wildland Fire
Drought	Landslides
Earthquake	Severe Winter Storms
Expansive Soils	Sinkholes
Extreme Heat	Thunderstorm-Hail and Lightning
Flooding-River	Tornado/Windstorm
Flooding-Flash	

[9] Iowa Homeland Security & Emergency Management

Once the list of hazards was compiled, they were sorted based on probability/historical occurrence and impact. The metrics used for the *2018 State of Iowa Hazard Mitigation Plan* were also used for this plan update.



2021 Wapello County Plan Update

FEMA released the *Local Mitigation Planning Handbook*, which has helped provide guidance on how to develop the risk assessment section of local hazard mitigation plans. Additionally, the State chose to consolidate and update its master list of profiled hazards in the *2018 State of Iowa Hazard Mitigation Plan*. These sources were used to initiate discussions on hazards.

Following the State and discussed a consolidated list of hazards, the Wapello County planning team discussions centered on the natural hazards identified in the State Plan, not including human, animal, or plant diseases or grass or wildland fires. Additionally, the technological hazard of dam/levee failure was discussed. The hazards to be profiled in this Wapello County plan update appear in Table 4.4 on the next page. Previous mitigation actions related to human, animal, and/or plant diseases were placed in Addendum I for reference.

Table 4.4. Hazards Profiled: *2021 Wapello County Plan Update*

Natural Hazards			
Thunderstorm/Lightning/Hail	River Flood	Landslide	Extreme Heat
Tornado/Windstorm	Flash Flood	Sinkhole	Drought
Severe Winter Storm	Earthquake	Expansive Soils	
Technological Hazards			
Dam/Levee Failure			

Hazard Profiles

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

44 CFR § 201.6(c)(2)(iI) – [The risk assessment shall include] a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i). This description shall include an overall summary of each hazard and its impact on the community. The plan should describe vulnerability in terms of: (A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas; (B) An estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate; and (C) Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

The hazards addressed in this plan were determined by the planning team. In an effort to streamline the planning process and maintain consistency across plans and future planning efforts, it was decided to analyze hazards and their associated risks in a manner similar to the *2018 State of Iowa Hazard Mitigation Plan*, tailoring it to be locally significant. Previous plans, presidential disaster declarations, historical events data, and local knowledge of the area were consulted to base the decision-making process in fact.

The following is a series of profiles for each hazard identified in the plan, arranged alphabetically. Each hazard profile includes a detailed description of the event and is analyzed for historic occurrences and the probability and potential severity of an occurrence. A vulnerability assessment accompanies each hazard profiled if sufficient information was available. Wherever possible, maps and other tools were used to help in the analysis of each particular hazard.

Vulnerability assessments were included to offer loss estimates when reasonable structural information could be obtained. In many cases, loss estimates from the State Plan were used. Then, using exposure values provided by the County Assessor, it was possible to provide a rough appraisal of each jurisdiction's share of those estimated damages. Since there are no universally established means of estimating potential loss, these estimates should not be used for official agency action.

It is simpler to quantify vulnerabilities with hazards that have certain amount of spatial limitations. Several contextual factors increase the vulnerability of a particular facility to certain hazards—specifically river flooding, landslides, sinkholes, dam failure, and levee failure. Such hazards only occur in the area that contains the associated spatial features [i.e. a major stream or steep slope]. Conversely, other hazards identified by the planning team can affect all properties—specifically severe winter storms, tornadoes, windstorms, thunderstorms, lightning, hail, flash floods, drought, extreme heat, wildfires, earthquakes, and expansive soils. Defining specific hazard areas for this second group of hazards is troublesome, since they may and often do affect many areas of the county simultaneously.

Dam/Levee Failure

The National Dam Safety Program defines a dam as an artificial barrier that has the ability to impound water, wastewater, or any liquid-borne material for the purpose of water control or storage.[10] Dams are used to regulate the flow of water and usually contain a reservoir upstream. Dams are also used for erosion control, hydroelectric power generation, and recreation.

The National Levee Safety Program defines a levee as an embankment—including floodwalls—whose primary purpose is to provide storm and flood protection relating to seasonal high water, precipitation, and other weather events that is subject to water loading for only a few days or weeks during a year.[11] Levees reduce the risk of temporary flooding; however, they do not eliminate the risk. Levees are constructed from the earth, compacted soil, or artificial materials (i.e. concrete or steel). To protect against erosion and scouring, earthen levees can be covered with grass and gravel or hard surfaces like stone, asphalt, or concrete.

A dam or levee failure occurs when the structural integrity is compromised, and large volumes of water are allowed to flow uncontrolled downstream into inundation areas. A dam or levee failure can result from flooding, poor construction, poor maintenance, earthquakes, terrorism, vandalism, or burrowing animals.

[10] 33 U.S.C. § 467
[11] 33 U.S.C. § 3301

Historic Occurrences

Figure 4.1. Dam Failure at Lake Delhi

According to the Iowa DNR, no dams in Wapello County have ever been reported to have failed.[12] Only two major dam failures have occurred in Iowa. In 1968 the Virden Creek Dam in Waterloo was breached, resulting in one fatality. The other and more severe dam failure in Iowa occurred in July of 2010, when the Lake Delhi Dam failed (Figure 4.1). The Saylorville Dam just north of Des Moines nearly breached during the floods of 1993. The outflow was at full capacity as the Des Moines River continued to rise. In this case, however, the water did not overtop the dam, which would have affected a large portion of Des Moines and other downstream communities.

Probability/Extent

The Iowa DNR is responsible for tracking all dams that are greater than twenty-five feet high and/or have storage capacities of at least fifty acre-feet of water. Their inventory excludes all dams that are less than six feet high regardless of storage capacity and dams that store less than fifteen acre-feet of water regardless of height.

Dams in Iowa are not evaluated based on structural condition, rather they are characterized based on their potential risk to life and property if a failure were to occur. The Iowa DNR categorizes dams into three categories:

- **High Hazard Dam**: failure creates a serious threat to loss of human life.
- **Moderate Hazard Dam:** failure may damage isolated homes or cabins, industrial or commercial buildings, moderately traveled roads, interrupt major utility services, but are without substantial risk of loss of human life. This also includes dams that are of public importance, such as dams associated with public water supply systems, industrial water supply, or public recreation, or which are an integral feature of a private development complex.
- **Low Hazard Dam:** failure would result in loss of the dam, livestock, farm buildings, agricultural lands, and lesser used roads. Loss of human life is unlikely.

Wapello County contains five dams classified as High Hazard: Jefferson Park Watershed Site 1, 3, 4, 5 and 10. The Ottumwa Water Works Dam is classified as Significant. All Significant and

[12] Iowa DNR Dam Safety Program

High Hazard dams have been assessed as Satisfactory. Based on conditions and on past events, the chances of a devastating dam failure are very slim. The severity of damage could range from limited crop and property damage to multiple deaths, injuries, and extensive property damage if a dam failure event was to affect a heavily populated area. Operations and response could be affected by communication loss or critical facility damage/destruction.

Vulnerability

A dam can give little or no warning time prior to failure. During periods of heavy rains, dams should be monitored for weak areas or potential breaching to warn people located downstream in the areas at risk for inundation. During the Lake Delhi Dam failure, residents downstream were notified in advance as water levels began to rise, and as a result nobody was killed or injured. People and property downstream of dams along streams are most vulnerable, particularly in a dam's inundation area. Depending on the volume of the reservoir, as well as channel characteristics, a flash flood resulting from a dam failure can travel a long distance.

Vulnerable Jurisdictions	
	Agency
	Blakesburg
	Chillicothe
X	Eddyville
	Eldon
	Kirkville
X	Ottumwa
	Wapello County (Unincorporated)

Dam owners have the primary responsibility for the safe design, operation, and maintenance of dams. Federal, state, and local governments own a significant number of dams, but private citizens also own a large number, as well. The Iowa DNR has a permitting process required of anyone interested in constructing a dam. All dams that meet any of the following criteria are required to obtain a permit:[13]

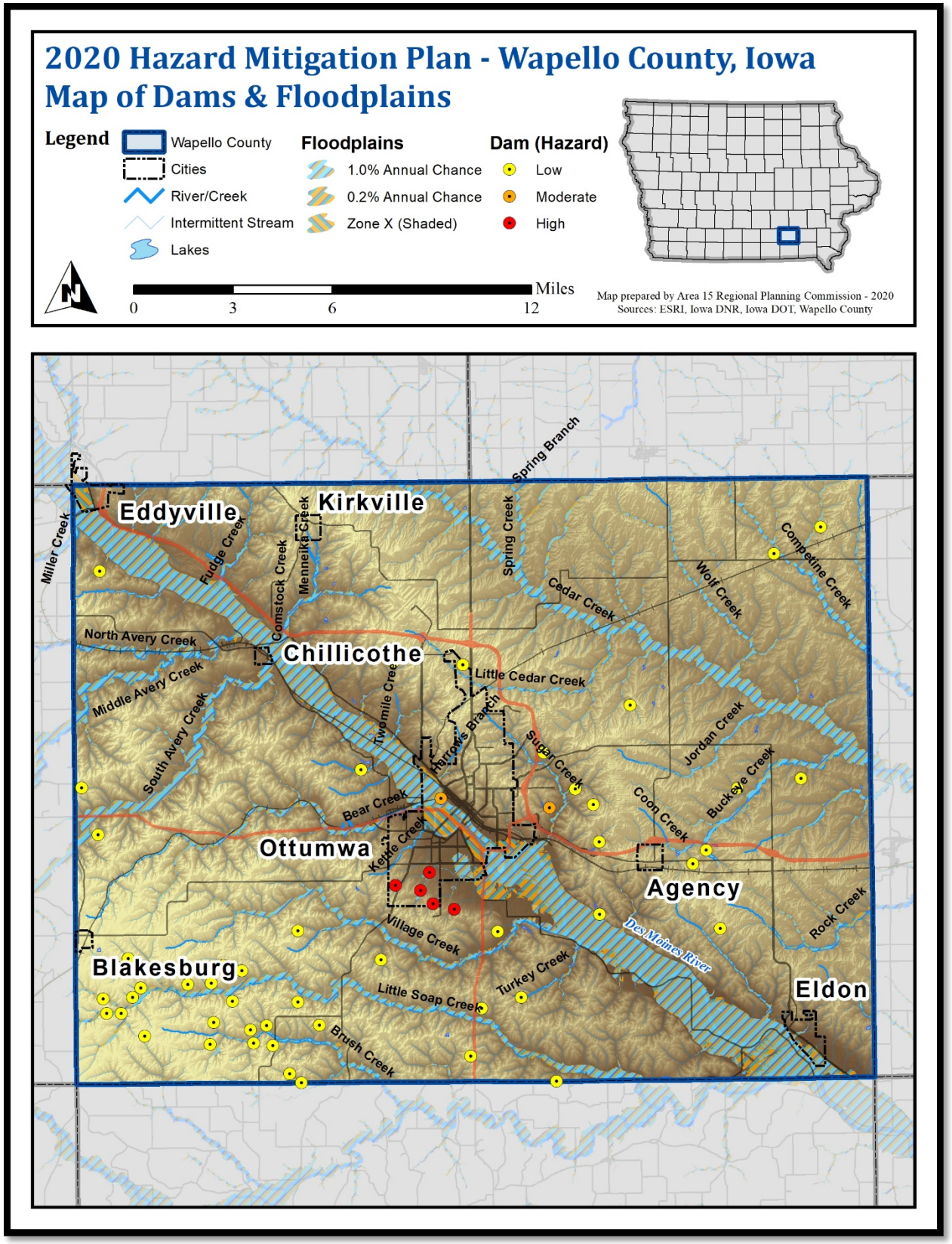
- Any dam designed to provide a sum of permanent and temporary storage exceeding fifty acre-feet at the top of dam elevation, or twenty-five acre-feet if the dam does not have an emergency spillway, and which has a height of five feet or more;
- Any dam designed to provide permanent storage in excess of eighteen acre-feet and which has a height of five feet or more;
- Any dam across a stream draining more than ten square miles;
- Any dam located within one mile of an incorporated municipality, if the dam has a height of ten feet or more, stores ten acre-feet or more at the top of dam elevation, and is situated such that the discharge from the dam will flow through the incorporated area.

The Iowa DNR also gives guidance for proper operations and maintenance, inspections, and tips for developing emergency action plans. There are currently 321 dams in the state that require formal inspections every two or five years, depending on classification. It is important to note that there is no system in place to routinely evaluate any of the other that the DNR has inventoried. One must use caution when assuming the quantity of unregulated dams is accurate.

[13] Iowa DNR Dam Safety Program

Dam failure is a hazard with clear implications for land use as it relates to future development. While there currently are no countywide zoning regulations prohibiting development in potential inundation areas, it is in the best interest of property owners to minimize construction activities within areas that could be flooded. The map on Page 33 provides an overview of identified locations of dams throughout Wapello County. The ability to accurately assess potential losses in Wapello County is limited because of the absence of inundation studies. Ideally, future inundation studies will be carried out to help the County be more cognizant of inundation zones and regulate development in those areas.

Jurisdictions participating in this plan expressed a minimal amount concern with dam failure, indicating a low vulnerability rating for this hazard. Any dam failure in Wapello County would affect only very localized areas and cause minimal infrastructure damage.


2020 Hazard Mitigation Plan - Wapello County, Iowa
Map of Dams & Floodplains
Legend
Wapello County
Cities
River/Creek
Intermittent Stream
Lakes
Floodplains
1.0% Annual Chance
0.2% Annual Chance
Zone X (Shaded)
Dam (Hazard)
Low
Moderate
High
Miles
0
3
6
12
Map prepared by Area 15 Regional Planning Commission - 2020
Sources: ESRI, Iowa DNR, Iowa DOT, Wapello County
Eddyville
Kirkville
Chillicothe
Ottumwa
Agency
Blakesburg
Eldon
Miller Creek
Fudge Creek
Comstock Creek
Menneiki Creek
Spring Branch
Spring Creek
Cedar Creek
Wolf Creek
Competine Creek
North Avery Creek
Middle Avery Creek
South Avery Creek
Little Cedar Creek
Jordan Creek
Buckeye Creek
Sugar Creek
Coon Creek
Bear Creek
Village Creek
Turkey Creek
Little Soap Creek
Brush Creek
Rock Creek
Des Moines River

Drought

A drought is a deficiency in precipitation over an extended period of time. Droughts are normal, recurring climactic events that occur nearly everywhere on earth. They can last from a few weeks to a few months. In rare cases, they may last for several years. Droughts can result in poor crop yields (Figure 4.2), increased soil erosion, water supply shortages, and an elevated potential for wildfires. The effects of a drought may be worsened by extreme heat and/or excessive wind. Even though droughts are generally associated with extreme heat, they may occur during cooler months, as well. Additionally, human factors, such as water consumption, can exacerbate the impact of a natural drought on the area. There are four common types of drought:[14]

Figure 4.2. Drought-affected Cornfield

- **Meteorological:** refers to a precipitation deficiency;
- **Agricultural:** refers to soil moisture deficiencies;
- **Hydrological:** refers to declining surface and groundwater supplies; and
- **Socioeconomic:** refers to when physical water shortages begin to affect people.

Historic Occurrences

Meteorological and agricultural droughts are the most frequent occurrences of drought conditions in Iowa and occur as a result of low soil moisture and/or a lack of precipitation. Hydrological and socioeconomic droughts tend to be more severe and long-term than meteorological and agricultural droughts, and thus occur less frequently. The NCDC lists 17 drought events for Wapello County since 1999. These incidents resulted in crop damages totaling approximately $97,650,000 and property damages of $12,650,000.

Probability & Severity

Based on an analysis of past events, Wapello County should expect to be affected by a drought in any given year. Droughts can have a serious impact on a community's water supply and economy. In Iowa, the most direct impact of a drought would be to agricultural producers and associated industries. Because of the Iowa's reliance on the agricultural industry, the effects of a drought would certainly extend to other sectors. Extensive droughts can cause food shortages if agricultural

[14] NWS Drought Fact Sheet

production is damaged or destroyed by a loss of crops or livestock. Areas affected by drought have the potential to be more vulnerable to wildfire due to the dryness of the vegetation.

An extreme drought could lead to a lowering of the water table, potentially drying-up public and private wells. Industries that use a lot of water in their production processes may be affected in such a case. Concurrently, these industries may accelerate the depletion of a well or aquifer, exacerbating the problems. Fire suppression can become a problem if there is a lack of available water. Though it is possible in the most extreme cases; droughts typically do not cause structural damage, infrastructure damage, or loss of life.

The magnitude of a drought is difficult to measure as the impacts of a drought vary between geographic regions. The National Integrated Drought Information System (NIDIS) has created the U.S. Drought Portal. The website presents weekly updates for drought monitoring, including: current conditions (Figure 4.3), impact assessments, and seasonal forecasts.[15] The site also links to the National Drought Mitigation Center (NDMC) which maintains a Drought Impact Reporter, an interactive tool that allows users to submit their own drought impact reports.[16]

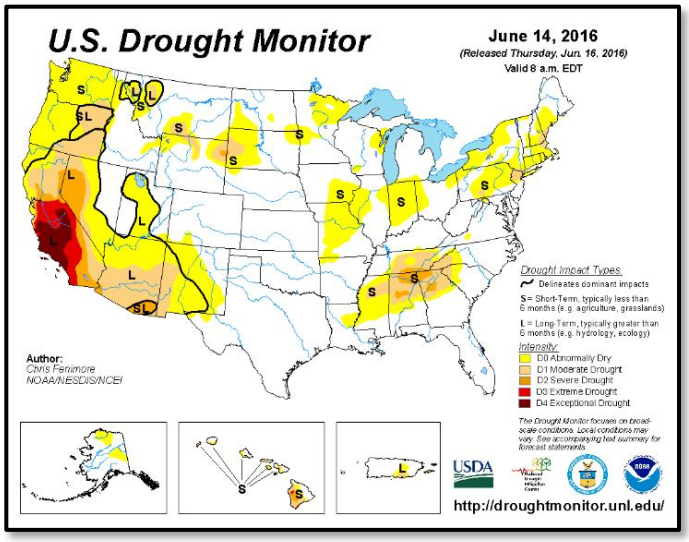


Figure 4.3. Example of the U.S. Drought Monitor

Vulnerability

Aside from short-term weather forecasts, drought events are difficult to predict as they generally rely on the parameters of precipitation and temperature. Droughts do follow a rough cyclical pattern, and more recent research into interacting global systems is resulting in more predictable long-range climatic forecasts. Scientists still cannot accurately predict a drought more than a month in advance for most locations. Historically the driest months in Iowa are July and August.

Vulnerable Jurisdictions	
X	Agency
X	Blakesburg
X	Chillicothe
X	Eddyville
X	Eldon
X	Kirkville
X	Ottumwa
X	Wapello County (Unincorporated)

As with the rest of Iowa, Wapello County is very dependent on the agricultural industry, and the effects of a drought would indirectly affect other populations. Most farms are covered by some form of crop insurance, which helps to mitigate some of the potential losses in the

[15] U.S. Drought Portal
[16] NCMC Drought Reporter

event of drought, though uninsured agricultural producers would be the most vulnerable population.

Drought is a hazard which affects the agricultural sector much more than it influences land use. Drought has relatively few land use implications in the region, and its impact on future development is negligible, as drought typically does not affect structures in Iowa. Outside of the agricultural industry, residents with shallow wells that do not extend deep into the water table run the risk of having a well dry up, and consumers may see food prices rise as a result of the decrease in supply of food availability. A prolonged drought may affect municipal water rates as well.

Each of the jurisdictions participating in this plan expressed a limited amount concern with drought. Each of the jurisdictions is somewhat vulnerable to this hazard, however the potential for losses is minimal within cities and schools. Rural residents—especially farmers—are most vulnerable to the effects of a drought.

Earthquake

An earthquake is a sudden, rapid shaking or vibrating in the earth's crust as a result of tectonic activity. It is caused by the breaking and shifting of subterranean rock as it releases strain that has accumulated over an extended period of time.

Historic Occurrences

Iowa has experienced very few earthquakes in its recorded history.[17] The epicenters of only thirteen earthquakes have been located within the state; most being located along the Mississippi or Missouri Rivers. No recorded earthquakes had an epicenter within Wapello County nor have any seriously impacted the County. The New Madrid Fault earthquakes of 1811-1812 in Southeast Missouri were the first reported earthquakes to be felt in Iowa. The absence of historical records from the territory, prevents an accurate assessment of the effects from these earthquakes.

The closest recorded event occurred near Oxford, IA, on April 20, 1948. The approximate epicenter would have been as close as thirty miles to the northeast of Wapello County, and was estimated to have produced Mercalli Scale intensity 4 effects. A 1965 earthquake in eastern Missouri reportedly produced intensity 5 effects as close as Ottumwa. Another in 1968, centered in Illinois resulted in intensity 5 reports in Wapello and Monroe Counties. An earthquake measuring 5.6 on the Richter Scale occurred in Pawnee, Oklahoma, on September 3, 2016, producing tremors which were felt in Wapello County.

Table 4.5: Explanation of the Modified Mercalli Scale & the Richter Scale

Mercalli Scale		Description of Typical Damage	Richter Scale
#	Strength		
1-4	Instrumental to Moderate	No Damage	≤ 4.3
5	Rather Strong	Damage negligible. Small, unstable objects displaced or upset; some dishes and glassware broken.	4.4 - 4.8
6	Strong	Damage slight. Windows broken. Furniture moved or overturned. Weak plaster and masonry cracked.	4.9 - 5.4
7	Very Strong	Damage slight-moderate in well-built structures; considerable in poorly-built structures. Furniture and weak chimneys broken. Masonry damaged. Loose bricks, tiles, plaster, and stones will fall.	5.5 - 6.1
8	Destructive	Considerable structural damage. Chimneys, towers, elevated tanks may fail. Frame houses moved. Trees damaged. Cracks in wet ground and steep slopes.	6.2 - 6.5
9	Ruinous	Structural damage severe. General damage to foundations. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground.	6.6 - 6.9
10	Disastrous	Most masonry and frame structures/foundations destroyed. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Sand and mud shifting on beaches and flat land.	7.0 - 7.3
11	Very Disastrous	Few or no masonry structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely bent. Widespread earth slumps and landslides.	7.4 - 8.1
12	Catastrophic	Damage nearly total. Large rock masses displaced. Lines of sight distorted.	> 8.1

[17] Iowa Geological Survey

Probability & Severity

The National Seismic Hazard Maps produced by the United States Geological Survey (USGS) are nationwide maps that display the potential peak ground acceleration for various probability levels. These maps are an assessment of the best available science related to earthquake hazards and were last updated in 2014. The maps are derived from calculations of data collected from a grid of monitoring sites across the United States and depict the probabilistic ground motion with a two-percent probability of exceedance within a certain period of time. Wapello County is in a very low risk category for earthquake (Figure 4.4) and the odds of any significant earthquake occurring in the County are highly unlikely.[18]

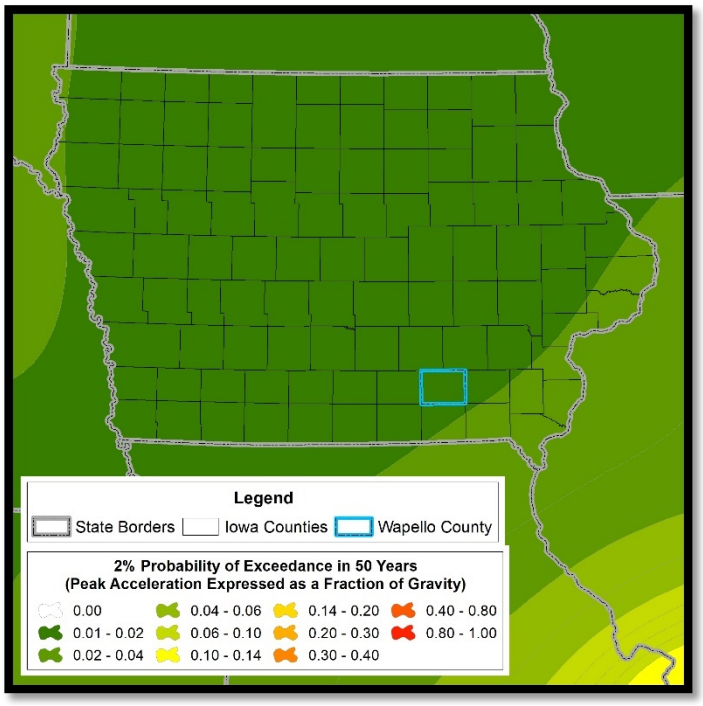


Figure 4.4. National Seismic Hazard Map for Iowa

Magnitude and intensity are the two primary methods that measure the strength of an earthquake. Magnitude is a measure of the amount of energy released at the source of the earthquake and is determined with seismographs. Intensity, on the other hand, is a measure of the physical effects produced by an earthquake. The Richter Scale is used to measure magnitude while the Mercalli Scale is used to measure intensity. These scales are outlined in Table 4.5 on the previous page. A magnitude 6.5 earthquake at the New Madrid Fault Zone, would create effects comparable to a magnitude 4 quake in the southeastern portion of Iowa, resulting in little or no damage. The effects of such an earthquake would be similar to the vibrations created by the passing of a heavy truck—rattling dishes, shaking walls, and swinging suspended objects. Delivery services such as water, wastewater, electricity, and communications may suffer minor, short-term impacts.

[18] USGS Earthquake Hazards Program

Vulnerability

Earthquake is a hazard that has relatively few land use implications in the State of Iowa, and its impact on future development is negligible. Any earthquake in the region most likely will be more intense south and east of Wapello County, primarily along the Mississippi River in Southeast Missouri. Damage from such an earthquake would typically be minimal in Iowa. The most vulnerable structures would be those built on poorly consolidated substrate and in floodplains. Deteriorating and poorly constructed buildings are more vulnerable as well.

Vulnerable Jurisdictions	
X	Agency
X	Blakesburg
X	Chillicothe
X	Eddyville
X	Eldon
X	Kirkville
X	Ottumwa
X	Wapello County (Unincorporated)

Encouraging communities to adopt building codes is one way to ensure that new development will be structurally protected. Development regulations which discourage construction on poor soils will create more resilient structures as well. A few communities within Wapello County enforce building codes that help structures be more resilient to natural disasters.

Each of the jurisdictions participating in this plan expressed a minimal amount concern with earthquakes. Each community may be potentially vulnerable to the effects should a major earthquake occur; however, the risk of a damaging tectonic event is extremely low. The lack of any historic events affecting Wapello County and the nonexistence of damage data limits the opportunity to assess potential losses from earthquakes.

Expansive Soils

Soils and soft rocks that swell or shrink excessively due to changes in moisture content are known as expansive soils. Expansive soils are most prevalent in regions with moderate to high amounts of precipitation; where prolonged periods of drought are followed by long periods of rainfall. It is the change in soil volume that presents a hazard to structures built on top of expansive soil. Roadways, foundations, and walls are most at risk to structural damage. Because expansive soil conditions develop slowly, damages occur gradually and rarely pose a threat to human life. As a result, this phenomenon receives little attention.

Historic Occurrences

In Iowa, expansive soil events are infrequent and are hard to predict. Most events involve cracking damage to building foundations, floors, walls, doors/windows, and retaining walls (Figure 4.5). Premature cracking in roadways is another common effect of expansive soils. Because of its low visibility and negligible risk to public safety, damages due to expansive soils are vastly underreported. Moreover, many of these problems may not be recognized as soil-related. Other, minor damages may be ignored, written off as a nuisance not worth fixing. Though high-clay soil does exist in Wapello County, there have been no major events reported due to expansive soils.

Probability & Severity

There are two major groups of rocks that serve as parent materials for expansive soils in the United States. One group is more commonly found in the western states, while the other is present in Iowa. That second group consists of sedimentary rocks which contain clay materials. It is the clay content which is susceptible to swelling and shrinking and why expansive soils are often referred to as "swelling clays".[19] The primary concern with expansive soil is the cumulative effects of the shrinking and swelling over many years.

Figure 4.5. Cracked wall from a shifting foundation

Expansive soils generally do not create a situation that makes development unsuitable, but certain measures can be taken to ensure that foundations and roadways are protected in high-risk areas. The best means of preventing or minimizing damage from expansive soil is to identify suspect ground and avoid building on it. If that is not possible,

[19] FEMA Geologic Hazards

engineers can design structures that are more resistant to the effects of swelling and shrinking ground. Water management features that reduce the variability of the soil's water content may also be constructed to minimize the potential for ground swelling. To help mitigate any significant effects of this hazard, structural reinforcement of all structures new and old is important in areas with suspect soils. Foundations of and base layers of future developments should be constructed to resist ground swell.

The highly localized and moisture-dependent nature of the hazard make it nearly impossible to determine the probability and magnitude of an event. The USGS Swelling Clays Map (Figure 4.6) identifies the areas of the state that are susceptible to expansive soils. All jurisdictions within Wapello County are likely to contain soils with slight to moderate swelling potential, and thus are at risk to this hazard. The risk is relatively low, however.

Vulnerability

Vulnerable Jurisdictions	
X	Agency
X	Blakesburg
X	Chillicothe
X	Eddyville
X	Eldon
X	Kirkville
X	Ottumwa
X	Wapello County (Unincorporated)

The most significant threat that expansive soils pose is damage to buildings, streets, and infrastructure. Houses and one-story commercial buildings are more likely to be damaged by swelling clays than are heavier, taller buildings.

While expansive soils are unlikely to pose risks to human life, they are likely to produce economic losses as a result of structural damages—particularly where development is located on soils with high clay content. Accordingly, each of the jurisdictions expressed limited amount of concern with this hazard and indicated a low risk rating for it.

The lack of available data limits the opportunity to accurately assess potential losses from expansive soils. In most cases, structural values depreciate over the course of time for a variety of reasons. There are no current plans to take a more detailed inventory of the locations in the county where expansive soils exist.

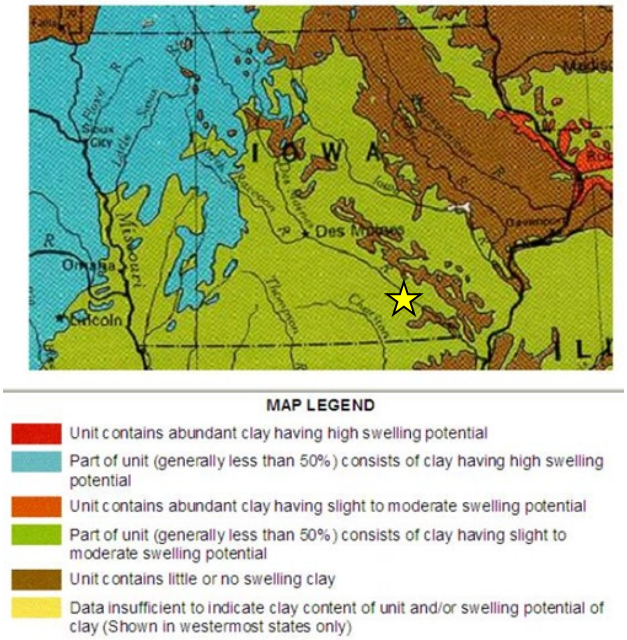


Figure 4.6. Swelling Clays Map of Iowa

Extreme Heat

Extreme heat is defined by weather that is substantially warmer and/or more humid than average for a particular location at that time of year. A heat wave is an extended period of extreme heat and is often accompanied by high humidity. Periods of extreme heat may occur concurrently with droughts, which often amplifies the issue. These conditions can be dangerous and even life-threatening for humans and livestock. A power outage may increase problems as it may prevent people from running cooling systems.

Figure 4.7. Sun rising on a muggy morning.

Historic Occurrences

Between 1995 and 2010, the State of Iowa experienced 30 extreme heat events.[20] The NCDC storm events database no longer reports extreme heat events, the closest similar item is "excessive heat." Although documentation for excessive heat covers a much shorter time series, it is the best data available. The only excessive heat report for Wapello County occurred on July 18, 2021. [21]

Probability & Severity

Excessive heat can stress humans, plants, and animals. Heatstroke, dehydration, cramps, exhaustion, and fatigue are possible with prolonged exposure and/or activity. Extreme heat can also compromise structures and cause buckling in roadways and railroad tracks. Additional economic costs from extreme heat include decreased agricultural yields, increased energy consumption, transportation issues, and infrastructure failure. These direct costs can impact other sectors indirectly.

Heat index values typically determine heat alerts. The heat index is a scale that factors in the relative humidity as well as the temperature. The human body cools itself by perspiring, and the evaporation of the perspiration carries excess heat from the body. High humidity inhibits this evaporation and interferes with this natural cooling mechanism, making the heat index a more accurate reflection of danger than temperature alone. Figure 4.8 shows how heat index is measured. To find the heat index and the associated category of heat risk, find the intersection of the

[20] Iowa Hazard Mitigation Plan – 2013 Risk Assessment
[21] NCDC Storm Events Database

temperature and the percentage of relative humidity. The NWS will initiate alerts when the heat index is expected to exceed 105 degrees Fahrenheit for at least two consecutive days.[22]

Figure 4.8: NOAA Heat Index Chart

Relative Humidity (%) \ Temperature (°F)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

Source: NOAA Office of Climate, Water, and Weather Services

Vulnerability

Vulnerable Jurisdictions	
X	Agency
X	Blakesburg
X	Chillicothe
X	Eddyville
X	Eldon
X	Kirkville
X	Ottumwa
X	Wapello County (Unincorporated)

Weather forecasts can fairly accurately predict extreme heat events several days in advance. Many sources for weather forecasts exist. The National Weather Service issues heat advisories via radio, television, and weather alert radios when the heat index is expected to exceed 105 degrees Fahrenheit for at least two consecutive days.

Extreme heat events can occur anywhere. The elderly, small children, chronic invalids, those on certain medications or drugs, persons with weight and alcohol issues, livestock, and pets are the most vulnerable. Outside of these groups, any healthy person with prolonged exposure to the heat is susceptible to heatstroke, sunstroke, dehydration, or exhaustion. People in older homes, apartments, or those with lower budgets often do not have access to air conditioning and therefore put themselves at greater risk.

Extreme heat remains a hazard which has relatively few land use implications in the region, and its impact on future development is negligible. However, there are ways to mitigate effects of heat. Use of air conditioning is one direct way in which such extreme temperatures can be mitigated. Additionally, the planting of shade trees, especially on the south and west sides of buildings helps

[22] NOAA Office of Climate, Water, and Weather Services

to significantly lower the inside temperatures of buildings. Impervious surfaces such as streets and parking lots in urbanized areas can also intensify the effects of heat.

Each of the jurisdictions participating in this plan expressed concern with extreme heat events and indicated a moderate vulnerability rating for this hazard. The greatest vulnerabilities to this hazard include functional losses (i.e. power failure and infrastructure damage), as well as individual risks (i.e. heatstroke). Extreme heat events typically do not put structures at risk, and their effect on the general population is extremely unpredictable, making loss estimates particularly challenging.

Flash Flood

Floods are one of the most common hazards in the United States; however, not all floods are alike. Flash floods occur when water levels accumulate and rise at an extremely fast rate and can happen anywhere. Though flash floods can occur at the same time as a river flood, they are two different types of hazards. Flash flooding typically results from intense rainfall over a brief period, sometimes combined with rapid snowmelt, ice jam release, high water tables, frozen ground, saturated soil, and/or impermeable surfaces. Most flash flooding is caused by slow-moving thunderstorms or thunderstorms repeatedly moving over the same area in a short period of time.

Figure 4.9. Intense rain and suddenly warmer temperatures on heavy snowpack caused an ice jam on the Des Moines River that led to flash flooding in Wapello County in March 2019.

Historic Occurrences

Flooding is a very regular and frequent hazard in Iowa, and unlike river flooding, flash floods can occur virtually anywhere. The NCDC identifies 19 flash flood events that have been reported in Wapello County since 2001. These incidents resulted in property damages totaling approximately $4,215,000 and crop damages of $460,000. [23]

Probability & Severity

Many human-caused factors contribute to flash flooding and the land's ability to absorb rainfall. Iowa has lost a significant amount of wetlands primarily through agricultural use conversion, which has reduced the land's ability to detain water. Water that had been allowed to percolate in a wetland is now directed into streams as a result of tiling, ditching, and other means. In addition, urbanized areas have a high density of impervious surfaces, which limits infiltration and increases runoff. Often, aging storm sewer systems are not designed to carry high capacities of water and unless measures are taken to reduce the amount of runoff or at least slow its movement, flash floods will continue to occur and potentially increase in frequency.

Floods are among the most common and widespread of all-natural disasters, particularly in Iowa. Based on the analysis of past events, there is an approximately 60% chance that a flash flood will

[23] NCDC Storm Events Database

affect Wapello County in any given year. Flash flooding can result in human injury and death; property damage; transportation, communication, and utility disruption; and losses to crops and livestock. Flash floods can cause significant property and infrastructure damage as a result of rapid erosion and undercutting (Figure 4.9). These hazards can move waters at very fast speeds and can move boulders, tear out trees, scour channels, destroy buildings, obliterate bridges, and wash out roads.

Vulnerability

Typically, flash flooding occurs with little or no warning. Since flash flooding most often results from intense rainfall or snowmelt, weather forecasts can give some indication of the potential for flash flooding. However, flash flooding is also associated with sudden events such as the release of water during dam failure, levee failure, or from an ice jam. Weather surveillance radar is being used to improve monitoring capabilities during periods of intense rainfall. The NWS often issues flash flood watches and warnings when conditions appear favorable for flash flooding. Additionally, local knowledge of watershed characteristics can help to lengthen the warning time of a potential hazard and often results in avoiding construction in areas that are prone to flooding.

Vulnerable Jurisdictions	
X	Agency
X	Blakesburg
X	Chillicothe
X	Eddyville
X	Eldon
X	Kirkville
X	Ottumwa
X	Wapello County (Unincorporated)

Flash floods usually occur in localized areas; particularly near streams, in low-lying areas, close to creek beds or drainage ditches, on poorly drained soils, in areas with a high water table, in urbanized areas, or downstream from a dam, levee, or storage basin. People and places in areas with insufficient storm sewers, sump pumps, and other water management infrastructure may also be at risk. Flash flooding tends to result in higher loss of life than river and stream flooding because it is less predictable and much more rapidly developing.

Future developments should be constructed with the potential effects of flash floods in mind. Proper mitigation starts with well-designed infrastructure. Adequate storm water management is essential to the prevention of flash floods. Communities should be aware of which areas have a tendency to flood and have the ability to encourage development of flood-prevention infrastructure such as ditching, culverts, tiling, and the expansion of storm sewers. New construction and infill development can mitigate potential flood damage through foundation waterproofing, installation of sump pumps, and reducing the area of impervious surfaces constructed. Additionally, communities should take the necessary steps to participate in the National Flood Insurance Program, through the adoption of floodplain regulations. This will help to minimize the risks associated with development in or near floodplains.

Unlike river flooding, flash flooding has the potential to affect all communities. In some of the planning meetings, certain members noted some of the more susceptible areas of their community

and were very aware of the potential threat that exists. Each of the jurisdictions participating in this plan expressed a significant concern with flash floods.

Flash flooding is highly dependent on the location and quantity of a precipitation event which makes estimating vulnerability in terms of loss estimates a difficult task. In reading through the NCDC storm events reports, the majority of reported flash flooding in Wapello County was limited to short-term road closures; however, it was noted that a few of the events did cause localized basement flooding, farm field flooding, and culvert wash outs. Below is a list of the roads that have been previously impacted by flash flooding according to the NCDC reporting.

- Highway 63
- Highway 149
- Rock Bluff Road
- 74th Street near Albia Road
- Harrows Branch Road
- Eddyville Road
- Pennsylvania/Jefferson Streets in Ottumwa

Landslides

Landslides occur when masses of rock, earth, or debris move down a slope. Landslides can be caused by a variety of factors and vary in size and speed. They can occur because of erosion, rainstorms, overly saturated soils, fires, earthquakes, and human modification of the land's slope and drainage characteristics. Landslide problems can be exacerbated by poor land management, particularly near hills and streams. Areas that have had grass or forest fires are at increased risk for a landslide.

Historic Occurrences

There have been no reported injuries or deaths in the State of Iowa as a result of landslides. There have been no documented occurrences of landslides in Wapello County. Although no reported events have been recorded, minor slides most likely have occurred and will continue to occur as isolated, non-severe events.

Probability & Severity

The highest risk for landslides within the State exists near the Mississippi River Valley in the northeastern portion of Iowa and the Loess Hills in western Iowa. Additional susceptibility exists where steep terrain is present in major river valleys, such as the Des Moines River.[24]

The map from U.S. Geological Society data in Figure 4.11 shows that there is a low risk potential for landslides in Wapello County. The county has little in terms of steep terrain; therefore, most landslides would affect only localized areas. Damages resulting likely would be limited to minor structural/infrastructure damage and may include the short-term interruption of essential services.

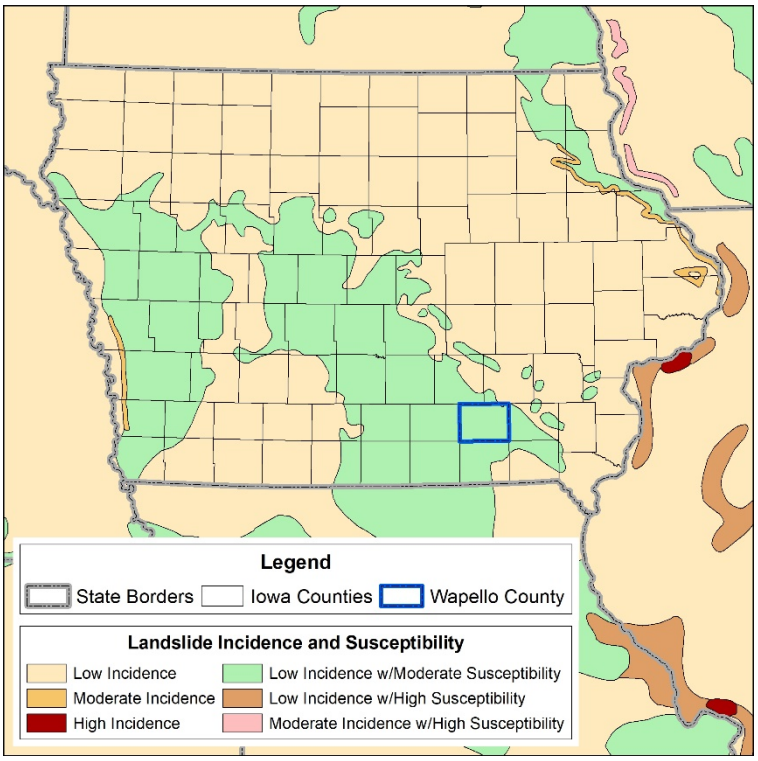


Figure 4.9. Map of Landslide Incidence & Susceptibility

[24] Iowa Hazard Mitigation Plan – 2013 Risk Assessment

Vulnerability

Though a landslide often occurs without notice, susceptible areas can be identified well in advance of an incident. Steep slopes, stream banks, slopes devoid of vegetation, and recently disturbed soils

Vulnerable Jurisdictions	
X	Agency
X	Blakesburg
X	Chillicothe
X	Eddyville
X	Eldon
X	Kirkville
X	Ottumwa
X	Wapello County (Unincorporated)

all are at risk of having a landslide. A large rain—which can be forecast days in advance—increases the probability of a landslide in these areas. Nearby structures and infrastructure would be most susceptible to damage should the ground nearby fail. Steep slopes exist in areas throughout Wapello County, and these areas are most likely to be affected. Nearby structures and infrastructure would be most susceptible. Zoning and building permits help prevent development in unsuitable locations.

All jurisdictions are potentially vulnerable to this hazard, but such incidents may only occur in an isolated area. A lack of historic events and available data limits the opportunity to assess potential losses from landslides. There are no current plans to take a more detailed inventory of the locations in the county where landslides could occur.

River Flood

Floods are one of the most common hazards in the United States; however, not all floods are alike. River flooding—the most common type of flooding event—is the rising of any stream [including creeks] that overflows its banks onto adjacent land that is not typically covered by water. River flooding occurs when the amount of water exceeds the carrying capacity of the stream channel. This can occur after prolonged periods of rainfall, after rapid snowmelt, or from dam or levee failures.

Figure 4.10. Flooding from an overflowing creek.

Many human-caused factors contribute to river flooding. Iowa has lost a significant amount of its natural wetlands through conversion to agricultural uses. These wetlands previously detained water that is now released into streams through tiling, ditching, and other means. In addition, urbanized areas have a high amount of impervious surface area, which limits infiltration and increases storm water runoff. Unless measures are taken to reduce the amount of runoff or slow its movement, river floods will continue to occur and could increase in frequency and magnitude.

Historic Occurrences

Flooding is a very regular and frequent hazard in Iowa. The National Climatic Data Center lists over 500 floods occurring between 1995 and 2010. Iowa has been included in 68 flood-related Presidential Disaster Declarations since 1953. Even though most of the County's more populated areas are not in or near floodplains, six Presidential Disaster Declarations have been issued for Wapello County since 1990. The most severe flood events occurred recently in 1993, 1998, and 2010. The NCDC identifies 50 flood events that have been recorded in Wapello County between 2005 and 2019. These incidents resulted in property damages totaling approximately $6,151,000 and crop damages totaling approximately $22,540,000.[25]

Probability & Severity

Floods are among the most common and widespread of all natural disasters, particularly in Iowa. Based on the analysis of past events, in any given year, the probability that Wapello County will sustain approximately one river flood event each year. It is very likely that a major flooding event needing federal assistance will occur in the next five years. Floods are the most common and widespread of all natural disasters, with the exception of fire.

[25] NCDC Storm Events Database

Floodwaters can erode the landscape, inundate buildings, and cover roads. River flooding most directly affects personal property, structures, and land located in the floodplain. Floodwaters can be extremely dangerous; in fact, the force of just six inches of swiftly moving water can knock a person off his/her feet and two feet of water can float a car.

Though loss of life can occur during river floods, the risk is not as high as what is associated with flash flooding because of the generally slower onset and better predictability of the event. Floods are a natural and regular phenomenon in which potentially inundated areas can be predicted on a fairly accurate basis. The National Oceanic and Atmospheric Administration (NOAA) issues flood warnings when certain geographic areas are considered to be at a high risk.

River flooding can affect communication, transportation, electric service, and community facilities. Unfortunately, public and private facilities and infrastructure are commonly located in floodplains and are frequently at a high risk of flooding.

Roads have been identified by local authorities to have been impacted by flooding. Those located in unincorporated Wapello County include:

- Walnut
- 28th Street
- Cemetery Road
- Rabbit Run
- 155th Avenue
- Rock Bluff Road
- River Road
- Blackhawk Road
- Cliffland Road
- Eldon Floris Road

The National Flood Insurance Program

44 CFR § 201.6(c)(2)(ii) – All plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods.

44 CFR § 201.6(c)(2)(ii) – All plans approved after October 1, 2008 must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.

The National Flood Insurance Program (NFIP) is a federal program enabling property owners in participating communities to purchase insurance protection against flood losses. If a community chooses to adopt and enforce adequate floodplain development and management regulations, the Federal Government will make flood insurance available to property owners.

The U.S. Congress created the NFIP in 1968 with the passage of the National Flood Insurance Act of 1968 and has further been modified with through other legislative measures. The intent was to reduce future flood damage by promoting the adoption of community floodplain management ordinances. Without community oversight of building activities in the floodplain, the best efforts of some to reduce future flood losses could be undermined or nullified by the careless building of others. Unless the community as a whole participates, the potential for loss will not be reduced sufficiently to affect disaster relief efforts. Insurance rates would then reflect the probable higher losses that would result without local floodplain management enforcement activities.

In support of the NFIP, FEMA identifies flood hazard areas through the U.S. and its territories by producing Flood Insurance Rate Maps (FIRMs), Flood Hazard Boundary Maps (FHBMs), and Flood Boundary and Floodway Maps (FBFMs). Several flood hazard zones are commonly identified on these maps. One of these areas is the Special Flood Hazard Area (SFHA), a high risk area defined as any land that would be inundated by a flood having a 1% chance of occurring any given year (also referred to as the base flood or 100-year flood).

Table 4.6. NFIP Participants in Wapello County

Jurisdiction	Wapello County	Agency	Chillicothe	Eddyville	Eldon	Ottumwa
CID	190911	190539	190269	190270	1920271	190272#
Initial FHBM	10/25/77	09/05/75	11/08/74	06/28/74	12/17/73	03/15/74
Initial FIRM	06/01/87	1/21/21	1/29/21	08/01/87	05/01/87	08/15/80
Effective Map Date	01/29/21	01/29/21	01/29/21	01/29/21	01/29/21	01/29/21
Policies in Force	27	0	0	13	1	26
Insurance in Force	$3,827,600	0	0	$3,880,000	$280,000	$10,253,700

Sources: FEMA Community Status Book Report, NFIP Policy Status Report

States have the liberty to require NFIP participation and to enforce more stringent regulations. In 2009, the Iowa Legislature passed House File 759 which ties a community's eligibility for certain post-disaster state assistance to its participation in the NFIP. This bill required NFIP participation by those communities that had an existing FIRM identifying a SFHA. The bill also stipulated that communities which previously were not mapped have twenty-four months to participate in the NFIP if a FIRM is developed that identifies a SFHA within the boundaries of the community. Table 4.6 outlines the NFIP participants in Wapello County. None of these properties is a severe repetitive loss (SRL) property.

Following the floods of 2008, in which eighty-five Iowa counties were declared Presidential Disaster Areas, the State of Iowa launched a statewide floodplain mapping initiative.[26] The Iowa DNR has partnered with the Iowa Flood Center (IFC) and U.S. Army Corps of Engineers (USACE) to begin the process of developing updated flood maps called, draft flood hazard products (DFHPs). Much like existing FIRMs, DFHPs will show predicted floodplain boundaries for 100-year and 500-year floods. LiDAR and hydrological data is being used to generate the DFHPs that predict flood inundation. LiDAR is much more detailed and accurate than the original elevation data that was used to develop FIRMs.

Over time, streams erode banks and their course changes somewhat. These draft flood hazard products not only should be more accurate than original FIRMs, but they also will reflect the changes in landform over time. As these new maps are delivered, each jurisdiction plans to review the information to see how it may affect the communities they represent. The IFC is responsible for developing DFHPs for the eighty-five counties which were declared disaster areas. The USACE was charged with developing DFHPs using Section 22 Planning Assistance to States (PAS) funding for the remaining fourteen counties.

Vulnerability

Floods can be slow or fast rising, but typically develop over a period of several days or weeks and can last for a few hours or a few months. The incident period for the 1993 Disaster Declaration was just short of six months. Flood waters have the potential to destroy anything in their path. While most homes and businesses located in the floodplain have been removed or abandoned over time, many remain.

Vulnerable Jurisdictions	
X	Agency
	Blakesburg
X	Chillicothe
X	Eddyville
X	Eldon
	Kirkville
X	Ottumwa
X	Wapello County (Unincorporated)

Based on Flood Insurance Rate Maps (FIRMs), Eddyville, Eldon, Ottumwa, and certain portions of rural Wapello County are the cities most susceptible to river flooding. FIRMs for Wapello County can be seen on page 33. Based on these maps, the largest floodplains exist on the land adjacent to the Des Moines River.

Future developments—especially near streams in unincorporated areas—should be constructed with the potential effects of river flooding in mind. Communities are very aware of which areas have a tendency to flood and with flood maps available, they can prohibit development within floodplains. The County and its communities also have the ability to encourage development of flood-prevention infrastructure such as ditching, culverts, and the expansion of storm sewers. Additional efforts may be taken to revert flood-prone areas to wetland, particularly through watershed management programs available from the USDA.

[26] Iowa Flood Center: Statewide Floodplain Mapping Project

Severe Winter Storms

Winter storms occur every winter and across all jurisdictions within Wapello County. Winter storms can range from large accumulations of moderate snowfall over a prolonged period of time to a blizzard with blinding, wind-driven snow. Most winter storms are accompanied by some combination of dangerously low temperatures, high winds, snow, sleet, icing, and freezing rain.

The National Weather Service refers to winter storms as the "deceptive killers" because most deaths associated with winter storms are indirectly related to the storm event itself. People die in traffic accidents on slick roadways or of hypothermia from prolonged exposure to the cold. One of the primary concerns of a winter storm is the weather's ability to knock out power which, in turn, can knock out heat sources and communications services. Heavy snowfall and ice (Figure 4.13) can immobilize entire regions for days at a time, making any effort to restore power or communication failures difficult.

Figure 4.11. Ice and snow cling to trees and power lines the morning after a winter storm. Several large tree limbs which fell from the weight of the snow are piled up in the foreground.

Historic Occurrences

Since 1990, seven Presidential Disaster Declarations have been issued in Iowa related to winter storms, of which, two were issued for Wapello County. The National Climatic Data Center's Storm Events Database lists 32 winter-related events affecting Wapello County since 2005; including five blizzard events, four heavy snow events, seven ice storms, and twelve winter storms. Total property damage from these events is estimated at $1,035,000 and no crop damage reported.[27] There were no injuries or fatalities reported as a result of those incidents; however, it is very likely that minor injuries may have been sustained as a result of vehicle accidents, falling on slick sidewalks, and cold weather conditions.

Probability & Severity

Based on the analysis of past events, Wapello County can expect several winter-related events each year; however, the State Plan estimates no associated annual losses for Wapello County due to extreme cold, snow, and ice.[28]

[27] NCDC Storm Events Database
[28] Iowa Hazard Mitigation Plan – 2013 Risk Assessment

Winter storms have the ability to disrupt travel, damage property and infrastructure, cause power outages, and lead to human, livestock, and crop casualties. The majority of the losses and disruptions caused by winter storms are associated with infrastructure. Power outages are commonly created by the buildup of ice on trees and power lines. Water mains may burst as a result of the freezing and thawing of the soil. Winter storms necessitate the pre-treating of major roadways and the removal of snow and ice from streets during and after a storm. Mobility issues that may arise due to the ice and snow on the roadways can slow or stop vital supply lines, can hamper the response of emergency services, and may prevent repairs to utility line damages.

The National Weather Service has several different watches, advisories, and warnings that they may issue in the winter.[29] A Winter Storm Watch is issued when conditions are favorable for the development of severe winter weather. When issued, a watch should prompt residents, businesses, and communities to prepare for a storm. A Winter Weather Advisory means that winter weather conditions are expected to cause significant inconveniences and that conditions outdoors are potentially hazardous. A Winter Storm Warning is more severe and indicates that the weather outside is hazardous to human and animal safety and that conditions are unsafe for travel.

Additional winter-related NWS advisories include freezing rain/fog, high wind, and wind chill. Freezing fog and rain create unsafe conditions for travel and may impact utility infrastructure if ice builds up on trees and power lines.[30] High wind can also impact travel and utility infrastructure and can create a hazardous situation for humans and animals when combined with very cold temperatures. The Wind Chill Index is a measure of how cold it feels outside when wind is factored in with the ambient air temperature.[31] Figure 4.14 identifies the wind chill and the likely amount of time it would take to get frostbite at a given temperature and wind velocity.

Figure 4.12. NOAA Wind Chill Chart

Wind Speed (MPH) \ Air Temperature (°F)	Calm	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35
5		31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52
10		27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59
15		25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64
20		24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68
25		23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71
30		22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73
35		21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76
40		20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78
45		19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79
50		19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81
55		18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82
60		17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84

Wind Chill (°F) = 35.74 + 0.6215T – 35.75($V^{0.16}$) + 0.4275T($V^{0.16}$) where T = Air Temperature, V = Wind Speed

Frostbite Times	30 Minutes		10 Minutes		5 Minutes

Source: NOAA National Weather Service

[29] National Weather Service – Winter Warnings
[30] National Weather Service – Ice & Frost
[31] National Weather Service – Wind Chill

Vulnerability

Vulnerable Jurisdictions	
X	Agency
X	Blakesburg
X	Chillicothe
X	Eddyville
X	Eldon
X	Kirkville
X	Ottumwa
X	Wapello County (Unincorporated)

Traffic accidents are the most common hazard and leading cause of death in winter storms. A power outage during a significant cold weather period has the potential to impact a significant number of people and might require assistance and shelter accommodations for the homeless. Though modern buildings make the current population significantly less vulnerable than the first settlers, deaths may still occur as a result of severely cold temperatures. The particularly vulnerable populations are the homeless, elderly, and very young. Modern furnaces require electricity to function. An estimated 48.1% of Wapello County residents use utility gas as their source of heat, 38.5% use electricity, and 4.8% use LP Gas.[32] Other significant dangers are the risks placed on livestock, whose needs for food, water, and shelter can often be put in jeopardy.

Winter storms have little impact on future development; however, any new development is likely to increase demand for infrastructure which may increase overall exposure. Each of the jurisdictions participating in this plan expressed an extreme amount of concern for winter storms. With the exception of the school districts, each jurisdiction indicated a high vulnerability rating for the hazard. The school districts have the ability to delay or cancel school in the event that any significant winter weather hazard threatens the area.

[32] U.S. Census Bureau

Sinkholes

A sinkhole is the loss of surface elevation due to the removal of subsurface support. Land subsidence can occur slowly over time or abruptly and can be the result of natural processes or human activities. "Karst" is a type naturally occurring terrain that is composed of carbonates, or slowly dissolving types of rock that form the uppermost portion of the bedrock. Wapello County is not in the portion of the state in which these types of sinkholes pose the biggest risk.[33] The primary causes of human-caused incidents involve mining activities, the extraction of petroleum and groundwater, or leaking underground utility lines (i.e. water mains and storm sewer lines). Sinkholes have the potential to cause localized damage to buildings, roads, and other infrastructure.

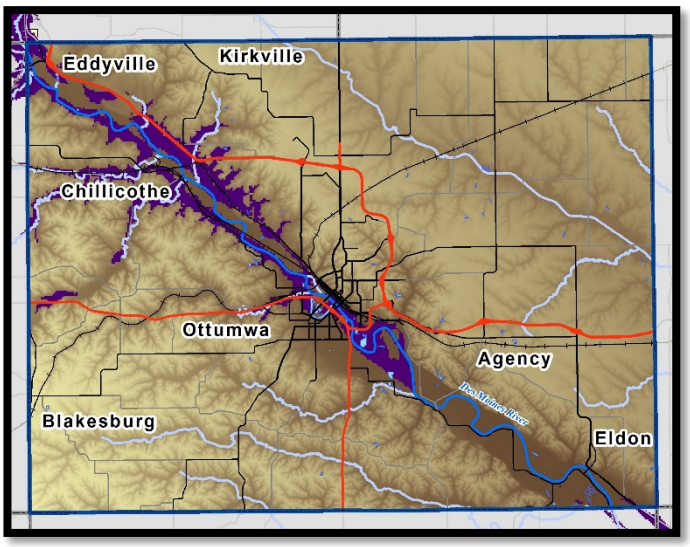


Figure 4.13. Map of karst terrain in Wapello County

Historic Occurrences

The majority of documented sinkholes in Iowa have occurred along the Upper Iowa River watershed in the northeast portion of the state.[34] Iowa has a rich history of coal mining, though most operations ceased in the 1930s. [35]

There have been no reported occurrences of major sinkholes or mine subsidence in Wapello County according to the Iowa DNR and the planning team. While carbonate soils (Figure 4.15) and abandoned mines (Figure 4.16) do exist in Wapello County, sinkholes related to these features have not been reported.

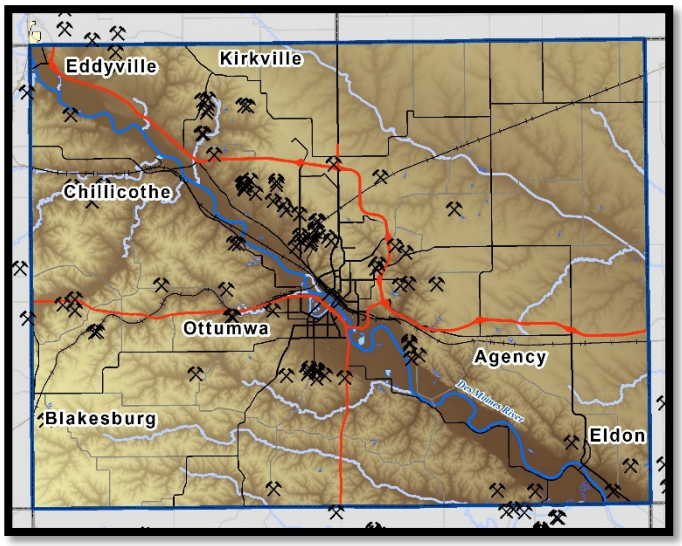


Figure 4.14. Map of known coal mines in Wapello County

[33] Iowa Geological Survey
[34] Iowa Hazard Mitigation Plan – 2013 Risk Assessment
[35] University of Northern Iowa

Probability & Severity

Although no reported events have occurred, there is always a chance that a sinkhole could occur. Land subsidence occurs at different rates throughout the state and does occur in Wapello County, though historically not at significant rates. There are identified and unidentified abandoned mines and wells throughout the county that could potentially cause problems, as well. Sinkholes primarily pose structural risks to buildings as well as roads and infrastructure. The most likely cause of a sinkhole in Wapello County would be associated with a water main break or a broken storm sewer that has allowed water to flow beneath the surface of the ground and erode the substrate. There may be the potential for a very limited interruption of essential facilities and services, but the risk to human life is negligible.

Vulnerability

Land subsidence occurs gradually over time, while the collapse of mines and voids in soil layers can occur suddenly. Slowly occurring land subsidence can be addressed early to prevent extensive structural damage when vulnerable soils are identified. Measures can be taken below the ground to address the potential damages that abandoned mines can create.

Vulnerable Jurisdictions	
X	Agency
X	Blakesburg
X	Chillicothe
X	Eddyville
X	Eldon
X	Kirkville
X	Ottumwa
X	Wapello County (Unincorporated)

All jurisdictions could potentially be vulnerable to sinkholes to some extent, although such incidents are rare and are unpredictable. Sinkholes are a hazard that has relatively few land use implications in the region, and its impact on future development is negligible. The lack of available data limits the opportunity to assess potential losses from sinkholes. The highly isolated character of a sinkhole further complicates the ability to assess potential losses. There are no current plans to take a more detailed inventory of the locations in the county where sinkholes may occur.

Thunderstorms, Lightning, & Hail

Thunderstorms develop in cumulonimbus clouds and are created from a combination of moisture, rapidly rising warm air, and often the collision of warm and cold air masses. Lightning is an electrical discharge that results from the buildup of positive and negative charges within a thunderstorm. When the buildup becomes strong enough, lightning appears as a "bolt", which can occur within a cloud or between the clouds and the ground. Cloud to ground lightning is most dangerous to humans and property.

Figure 4.15. Lightning

Thunderstorms are typically characterized by rain, thunder, lightning, strong gusts of wind, and often hail. Other potential hazards may accompany a thunderstorm; including flash floods, river floods, hail, windstorms, and tornadoes. Thunderstorms primarily occur during the warmer months of the year but can occur in the winter (i.e. "thundersnow"). A thunderstorm may occur as a single isolated storm or may occur as part of a system of storms hundreds of miles long.

Hail are bits of ice that fall along with rain during a precipitation event. Hail is produced by strong rising currents of air carrying water droplets to a height where freezing occurs. While suspended, the ice particles grow in size until they are too heavy to be supported by the updraft and fall down to earth. The State Plan considers a hailstorm as being one that produces hail greater than one inch in diameter. Hailstorms can occur at any time of the year, though typically occur in conjunction with a severe thunderstorm or tornado. While most hail pellets are typically small, they can reach the size of a softball. Damage to property, crops, and people are likely in a severe hailstorm.

Figure 4.16. Hail-damaged corn.

Thunderstorms typically can be forecast several days in advance. The NWS issues different watches and warnings regarding thunderstorms and storms which have the potential to produce hail, damaging winds, tornadoes, or floods. Storm systems are monitored by trained weather spotters and information is broadcast over local radio and television stations, as well as on NOAA weather radios. Advances in cellular technology now allow weather alerts to be sent directly to cell phones and other mobile devices.

Historic Occurrences

Between 1955 and 2019, over 15,000 severe thunderstorms, lightning, and/or hail events impacted Iowa.[36] Since 1950, four deaths have occurred in Iowa due to hail. Since 1997, thirty-five injuries and seven deaths have resulted from lightning statewide. For Wapello County between 2005 and 2019, the NCDC identifies 120 thunderstorm wind events, one lightning event, and fifty-four hail events. Twenty-eight of those hail events produced stones greater than one inch in diameter. The cumulative amount of property damages resulting from these incidents totals approximately $1,698,000 in property damages and approximately $115,000 in crop damages. Since 2005, only one injury and zero injuries and deaths have been associated with thunderstorms, lightning, or hail in Wapello County.

Probability & Severity of Thunderstorms/Lightning

Based on the analysis of past events, Wapello County will experience several severe thunderstorm events each year. Although storm prediction technologies are continuously improving, thunderstorms and lightning can develop quickly with little notice. The greatest danger to people and livestock during a thunderstorm is lightning. A lightning strike can cause significant environmental and structural damages and casualties, as well. The number of fatalities due to lightning has declined significantly over the last century; however, lightning still has been responsible for an average of thirty-three deaths per year nationwide over the last decade.[37]

Even with the number of casualties that occur annually, the direct impact of thunderstorms and lightning to communities is limited. There is the potential for minor injuries and illnesses, minor property damage with little threat to structural stability, minor short-term environmental impacts, and the possible shutdown of essential facilities. Lightning can create power outages which can cut off communication. This can affect electrical warning systems—such as television and radio—which can be dangerous if a thunderstorm is also associated with strong winds, tornadoes, flooding, or large hail. Based on information provided in the Iowa Hazard Mitigation Plan, associated structural losses for Wapello County as a result of thunderstorms, lightning, and hail are estimated to be less than $100,000 annually.[38]

Probability & Severity of Hail

Based on the analysis of past events, Wapello County will experience at least one hailstorm in any given year. Severe hailstorms have the potential to damage structures, vehicles, and other property and threaten lives. Hail may cause power outages, leaving people without a source of heating or cooling. Transportation issues may also arise due to hail, ice, and snow on the roads. This may create hazardous driving conditions and delay response time for emergency vehicles.

[36] NCDC Storm Events Database
[37] NWS Weather Fatalities
[38] 2018 Iowa Hazard Mitigation Plan

Hail is often described relative to other similar-sized round or spherical objects. The NCDC size comparison appears in Table 4.7. Other factors besides hail size contribute to the damage potential of a storm. These include the accompanying wind speed, fall speed, texture, and number of stones. The Tornado and Storm Research Organisation (TORRO) in the United Kingdom has developed a Hailstorm Intensity Scale to approximate the magnitude of a hailstorm (Table 4.8). This scale categorizes storms from H0 to H10, with intensity related to the typical damages associated with the event. Evidence indicates that maximum hailstone size is the most important variable relating to structural damage, especially toward the larger end of the scale.

Table 4.7: Hail Size Comparison

Diameter (in.)	Description
< 0.50	Pea
0.75	Penny
0.88	Nickel
1.00	Quarter
1.25	Half-Dollar
1.50	Ping-Pong Ball
1.75	Golf Ball
2.00	Hen Egg
2.50	Tennis Ball
2.75	Baseball
3.00	Tea Cup
4.00	Grapefruit
4.50	Softball

Source: NCDC Storm Events Database

Table 4.8. TORRO Hailstorm Intensity Scale

Size Code	Intensity Category	Diameter*	Typical Damage Impacts
H0	Hard Hail	< 0.2 in.	No damage
H1	Potentially Damaging	0.2 - 0.6 in.	Slight damage to plants, crops
H2	Significant	0.4 - 0.8 in.	Significant damage to fruit, crops, vegetation
H3	Severe	0.8 - 1.2 in.	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	1.0 - 1.6 in.	Widespread glass damage, vehicle bodywork damage
H5	Destructive	1.2 - 2.0 in.	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	1.6 - 2.4 in.	Bodywork of grounded aircraft dented, brick walls pitted
H7	Destructive	2.0 - 3.0 in.	Severe roof damage, risk of serious injuries
H8	Destructive	2.4 - 3.5 in.	Severe damage to aircraft bodywork
H9	Super Hailstorms	3.0 - 4.0 in.	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	> 4.0 in.	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

*Approximate range since other factors affect severity of damages. Converted from metric (mm) to imperial (in).
Source: The Tornado and Storm Research Organszation

Vulnerability

Vulnerable Jurisdictions	
X	Agency
X	Blakesburg
X	Chillicothe
X	Eddyville
X	Eldon
X	Kirkville
X	Ottumwa
X	Wapello County (Unincorporated)

With Iowa's location in the interior of the U.S., there is a near certainty that several of these storms will occur and cause damage each year. Iowa's typically humid climate enhances the opportunities for severe thunderstorms to develop. People and livestock who are caught outside during a thunderstorm—particularly those on hills, under trees, in open areas, or on the water—are at higher risk to lightning. Those in mobile homes, older homes, or automobiles are also at risk.

Hailstorms can happen anywhere. Crops, plants, livestock, pets, and those left without shelter are the most vulnerable, but larger hail has the potential to damage personal property and cause structural damage. Residents that live in mobile homes are especially vulnerable to damage due to the structure and design of the units. Residents that live in mobile homes are especially vulnerable to damage due to the structure and design of the units. There are approximately 1,200 occupied mobile homes in Wapello County. People who live in older homes built before 1960 are also vulnerable due to their weaker structural integrity. Nearly 39% of the houses in Wapello County were built before 1960.[39] Additionally, campgrounds and other recreational areas are also particularly vulnerable due to a lack of shelter.

Future developments should be constructed with the potential effects of thunderstorms, lightning, and hail in mind. The potential for such a hazard is an important consideration in the design of all structures, but particularly tall and metal structures. It is necessary to ensure that all buildings are adequately grounded to protect against lightning strikes. Also, since these storm events are often associated with power outages, it is important to ensure that essential facilities and functions have the support of a backup power generator.

Each of the jurisdictions participating in this plan expressed a significant concern with thunderstorms, lightning, and hail, indicating a high vulnerability rating for this hazard.

[39] U.S. Census Bureau

Tornadoes & Windstorms

A tornado is characterized as a violent, rotating, funnel-shaped cloud that extends from a cloud to the ground with whirling winds that can reach 300 miles per hour. Tornadoes are typically associated with super-cell thunderstorms and are often accompanied by hail. The base of a tornado can range from just a few feet wide to well over one-mile wide, creating a range of damage paths can be localized or many miles long. The damages from a tornado are the result of the high winds and associated rainfall that may inundate a damaged structure. Although tornadoes can come and go in a matter of seconds, damages can be severe and potentially deadly.

Figure 4.17. Rain-wrapped tornado in Monroe County.

Tornadoes are unpredictable in nature as they can occur one at a time or in groups and vary in travel direction and distance, velocity, and width. Being geographically located where warm/moist, and cool/dry air masses meet, Iowa and other Midwestern states are extremely susceptible to tornadic activity. The collision of these air masses creates the very favorable conditions for the development of super-cell thunderstorms and tornadoes. Tornadoes most often occur during the spring and summer months—particularly April, May, and June. Although tornadoes can occur at any time of the day, they are most commonly seen during the late afternoon and evening hours.

Windstorms are characterized as sustained winds in excess of thirty miles per hour. Windstorms tend to occur in greater force when associated with large expanses of open land. As such, the landscape of Iowa yields particularly strong surface winds. High winds can occur in all types of weather and are most notably associated with severe thunderstorms, tornadoes, severe winter storms, downbursts, and steep pressure gradients.

Figure 4.18. Straight-line winds toppled this dead tree into a power line and onto the adjacent county road.

The most significant non-tornadic wind damage typically is caused by derechos, which produce straight-line winds [Figure 4.19]. Unlike tornadoes, these winds generally produce destruction in a single direction along a relatively straight path, may have a footprint that is several miles wide, and the duration of these events typically is much longer.

Historic Occurrences

Since 1950, Wapello County has experienced twenty-six tornadoes. Ten of the tornadoes were EF-0, eight were EF-1, and eight were EF-2. The NCDC lists four high wind events that have been recorded in Wapello County since 2005. It also lists 47 thunderstorm wind events recorded in this same time frame. Since 2005, tornadoes resulted in approximately $175,000 in total property damages while the high wind incidents resulted in approximately $65,000 in property damages. Tornado events resulted in $15,000 in crop damages reported, however, additional crop damage likely did occur. No deaths were reported with these high wind and tornado incidents.[40]

According to NCDC data, the most costly tornado recorded in Wapello County occurred in May of 1988 in the southeast portion of the county. The tornado caused $25,000,000 in property damage.

Probability & Severity of a Tornado

According to NOAA, the State of Iowa experienced an average of fifty-one tornadoes per year between 1991 and 2010.[41] Based on the analysis of past events for Wapello County, there is approximately a 40% chance that the county will experience a tornado in a given year.

Table 4.9: Enhanced Fujita Scale for Tornado Intensity

Category	Wind Speeds	Damage Examples
EF0	65-85 mph	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards
EF1	86-110 mph	The lower limit is the beginning of hurricane-wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed
EF2	111-135 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
EF3	136-165 mph	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
EF4	166-200 mph	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
EF5	>200 mph	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel reinforced concrete structures badly damaged

Source: NOAA Storm Prediction Center

Between 1971 and 2007, the magnitude of a tornado was determined by the Fujita-Pearson Scale (F-Scale). Since 2007, the Enhanced Fujita Scale (EF-Scale) in Table 4.9 has been used to determine the strength of a tornado. Tornadoes are categorized on an ascending scale of wind

[40] NCDC Storm Events Database
[41] NOAA Tornado Climatology

intensity from EF-0 to EF-5. This measurement scale is largely subjective, since measurements are made based on sustained damage.

Probability & Severity of a Windstorm

Based on an analysis of past events [including thunderstorm wind events], Wapello County will face nearly one or two high wind events in a given year. According to NCDC data, the highest recorded non-tornadic winds affecting the county were nearly seventy miles per hour in November 1988. Windstorms have the potential to cause extensive damage (Figure 4.19). Considering the geographic area that a windstorm may affect, damages from a severe incident can be very significant. Based on the NCDC reports, structural losses for Wapello County from windstorms are estimated to be approximately $1,400 annually.[42]

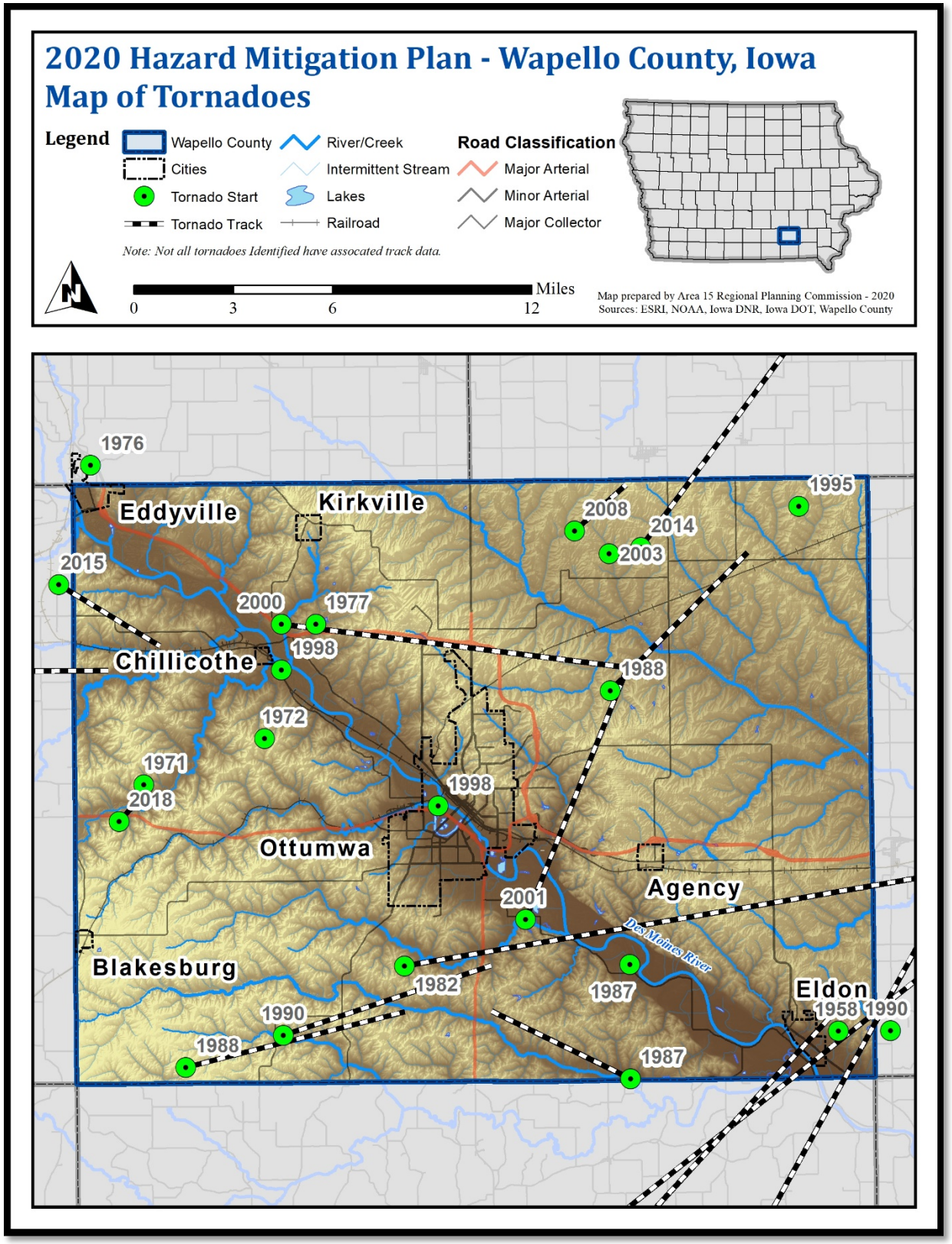
The magnitude of a windstorm is typically measured by wind speed. The Beaufort Wind Scale is comprised of thirteen classes of wind severity and has descriptions for typical effects (Table 4.10). If the winds of a particular storm are associated with a tornado, the Enhanced Fujita Scale is used to determine its magnitude.

Table 4.10: Beaufort Wind Scale

Force	Wind Speed (MPH)	Description	Land Conditions
0	<1	Calm	Calm. Smoke rises vertically.
1	1-3	Light Air	Smoke drift indicates wind direction, wind vanes don't move.
2	4-7	Light Breeze	Wind felt on exposed skin. Leaves rustle, vanes begin to move.
3	8-12	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended.
4	13-17	Moderate Breeze	Dust, leaves, and loose paper lifted. Small tree branches begin to move.
5	18-24	Fresh Breeze	Branches of a moderate size move. Small trees begin to sway.
6	25-30	Strong Breeze	Large branches in motion. Whistling heard in overhead wires. Empty garbage cans tip over.
7	31-38	High Wind, Near Gale	Whole trees in motion. Effort needed to walk against the wind.
8	39-46	Fresh Gale	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	47-54	Strong Gale	Some branches break off trees, and some small trees blow over. Slight structural damage.
10	55-63	Storm, Whole Gale	Trees are broken off or uprooted, saplings bent and deformed. Asphalt shingles may peel off roofs.
11	64-72	Violent Storm	Widespread damage to vegetation; many roofing surfaces are damaged.
12	≥ 73	Hurricane-Force	Some windows may break; mobile homes and many sheds/barns are damaged; debris hurled about.

Source: NOAA Storm Prediction Center

[42] NCDC Storm Events Database


2020 Hazard Mitigation Plan - Wapello County, Iowa
Map of Tornadoes
Legend
Wapello County
Cities
Tornado Start
Tornado Track
River/Creek
Intermittent Stream
Lakes
Railroad
Road Classification
Major Arterial
Minor Arterial
Major Collector
Note: Not all tornadoes Identified have assocated track data.
Miles
0
3
6
12
Map prepared by Area 15 Regional Planning Commission - 2020
Sources: ESRI, NOAA, Iowa DNR, Iowa DOT, Wapello County
1976
Eddyville
Kirkville
2015
2000
1977
1998
Chillicothe
1972
1971
2018
1998
Ottumwa
2001
Agency
Des Moines River
Blakesburg
1982
1987
Eldon
1958
1990
1990
1988
1987
1995
2008
2014
2003
1988

Vulnerability

Vulnerable Jurisdictions	
X	Agency
X	Blakesburg
X	Chillicothe
X	Eddyville
X	Eldon
X	Kirkville
X	Ottumwa
X	Wapello County (Unincorporated)

Tornadoes are extremely dangerous because of their ability to form rapidly with little notice and cause great destruction. Often a tornado watch will be issued along with a severe thunderstorm watch if forecasters feel the environment is ripe for the potential development of a tornado. Typically, trained storm spotters will monitor severe storms and notify county officials of storms or presence of funnel clouds and county officials typically then handle dispatching of the appropriate response. The National Weather Service sends out tornado warnings via radio, television, and NOAA weather radios when a tornado is spotted or indicated on radar. Increasingly, cellular devices are equipped with weather applications that can alert to a developing weather condition.

Though windstorms can happen quickly without notice, the National Weather Service has developed a windstorm warning system similar to other events such as thunderstorms, tornadoes, and winter storms. Watches are issued when conditions are favorable for windstorms to develop, and typically come twelve to twenty-four hours in advance. Advisories are issued when existing or imminent windstorms cover part or all of the area and pose inconvenience. Wind warnings are issued when existing or imminent high winds threaten part or all the forecast area and pose a threat to life and property.

Tornadoes and windstorms can affect any place in Wapello County. Wooded areas can threaten life and property because of falling tree limbs. Campgrounds and parks are also vulnerable due to lack of shelter. High-profile vehicles are susceptible to being blown off of the road. Windstorms have the potential to knock down power lines, leaving citizens without power and disrupting communication capabilities, potentially complicating response efforts. While tornadoes do not always affect a large spatial area, those areas they do hit could sustain a significant amount of structural damage, injuries and loss of life. Population centers are particularly vulnerable.

Residents that live in mobile homes are especially vulnerable to damage limitations of their structural design. They are typically not secured to any kind of permanent foundation, which makes them very susceptible to complete destruction. There are approximately 1,200 occupied mobile homes in Wapello County. People who live in older homes built before 1960 are also vulnerable due to their weaker structural integrity. Nearly 39% of the houses in Wapello County were built before 1960.

Future developments should be constructed with the potential effects of wind and tornadoes in mind. The danger reaffirms the importance of structural integrity for all types of construction. It is important to consider mitigation strategies for tornadoes and high winds for any significant development projects. The inclusion of safe rooms and/or storm shelters increase protection of human life against such a hazard.

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Risk Assessment

The planning area is relatively uniform in terms of climate and building characteristics, and the occurrence of weather-related hazards does not vary greatly. For this plan, the risk for each hazard was assessed for each jurisdiction where its situation deviated from that of the county.

To evaluate the risk of each hazard, the planning team and each jurisdiction considered a number of factors when analyzing the potential for disasters. The risk was determined as a function of both the probability of the hazard occurring in a given time period and the potential severity of an event. These ratings considered many factors including perceived threat, geographic location, previous incidents (as identified in the Storm Events Database maintained by the National Climactic Data Center[43]), and potential losses. The data limitations of NCDC information were considered, which include: potential for multiple reports of the same event, information received from outside reporting entities, lack of reporting of hazard events prior to 1993, and death reports are shown on an area-wide basis and may not necessarily occur in the planning area.

History of Hazard Occurrence

FEMA maintains a database of declared disasters and emergencies. As of October 2020, Iowa had experienced 46 presidential-declared disasters since 1990. Of these disasters, nine affected Wapello County.[44] Table 4.11 shows the declarations which included Wapello County (a complete list may be found in Appendix D). The majority of the disaster declarations involved severe storms and flooding, while the others were winter storm events.

DR No.	Incident Date Range	Description of Declaration	Assistance	
			Public	Individual
4483	1/22/2020-Ongoing	Iowa Covid-19 Pandemic	Yes	No
4421	3/12/2019-6/15/2019	Severe Storms, Flooding	Yes	Yes
4126	5/19/2013-6/14/2013	Severe Storms, Tornadoes, & Flooding	Yes	No
4119	4/17/2013-4/30/2013	Severe Storms, Straight-line Winds, & Flooding	Yes	No
1930	6/1/2010-8/31/2010	Severe Storms, Flooding, & Tornadoes	Yes	Yes
1763	5/25/2008-8/13/2008	Severe Storms, Tornadoes, & Flooding	Yes	Yes
1737	12/10/2007-12/11/2007	Severe Winter Storm	Yes	No
1727	8/17/2007-9/5/2007	Severe Storms & Flooding	Yes	No
1688	2/23/2007-3/2/2007	Severe Winter Storms	Yes	No

Table 4.11. Disaster Declarations including Wapello County, 1990-2020
Source: FEMA

In addition, the Iowa Department of Homeland Security and Emergency Management maintains a database of disaster proclamations in the state issued by the Governor. Since 2008, Wapello

[43] NCDC Storm Events Database
[44] FEMA Presidential Disaster Declarations

County has been included in declarations related to eight natural disasters, where financial assistance was available, as highlighted in Table 4.12.

Number	Date	Description of Declaration
2019-18	5/30/2019	Severe Storms and Flooding, May 17 and continuing
2019-10	4/2/2019	Flooding and Flash Flooding, March 13 and continuing
2015-09	6/30/2015	Severe Storms, June 20 and continuing
2013-07	5/29/2013	Severe Storms and Flooding, May 19 and continuing
2013-04	5/7/2013	Severe Storms, April 17 and continuing
2010-33, 19	8/18 & 6/29/2010	Severe Storms, June 1 and continuing
2008-47, 34	7/22 & 6/26/2008	Severe Storms, May 25 and continuing

Table 4.12. State natural disaster proclamations including Wapello County, 2008-2021
Source: Iowa Department of Homeland Security and Emergency Management

Methodology

The methodology to evaluate hazard risk for this plan update mirrors that which was followed in the *2018 State of Iowa Hazard Mitigation Plan*. Profiled hazards were assessed by probability/historical occurrence and level of impact. Responses from participants were collected and averaged for countywide and municipality results.

Risk Assessment

These were placed into three categories of risk: Low, Moderate, and High as shown in Table 4.13.

Table 4.13. Countywide Hazard Risk Assessment

Rank	Hazard	Risk
1	**Tornado/Windstorm**	High
2	**Severe Winter Storm**	High
3	**Flash Flood**	High
4	**Thunderstorm/Lighting/Hail**	High
5	**River Flood**	Moderate
6	**Drought**	Moderate
7	**Extreme Heat**	Moderate
8	**Dam/Levee Failure**	Low
9	**Earthquake**	Low
10	**Expansive Soils**	Low
11	**Landslide**	Low
12	**Sinkhole**	Low

Each individual jurisdiction was given an opportunity to review and amend these scores to make them more locally relevant. Scores for each jurisdiction may be found in their respective section in Section 7. Table 4.14 displays a summary risk assessment of each hazard as determined by each jurisdiction.

Table 4.14. Hazard Risk Assessment Summary

Hazard	Wapello County	Agency	Blakesburg	Chillicothe	Eddyville	Eldon	Kirkville	Ottumwa
Tornadoes/Windstorms	M	H	H	H	H	H	H	M
Severe Winter Storms	H	M	H	H	H	H	H	M
Flash Flood	M	M	M	H	H	H	H	M
Thunderstorms/Lightning/Hail	H	H	H	H	H	H	H	M
River Flood	H	L	L	L	H	H	L	M
Drought	M	M	M	H	M	M	H	M
Extreme Heat	M	M	M	H	M	H	H	L
Dam/Levee Failure	M	L	L	L	H	L	L	L
Earthquake	L	L	L	L	L	L	L	L
Expansive Soils	L	L	L	L	L	L	L	L
Landslide	L	L	L	L	L	L	L	L
Sinkhole	L	L	L	L	L	M	M	L

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Section 5 – Mitigation Strategy

44 CFR § 201.6(c)(3) – [The plan shall include a] mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing tools.

Mitigation Goals

44 CFR § 201.6(c)(3)(i) – [The mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Once the list of potential hazards had been discussed and prioritized, the planning team addressed mitigation goals and actions. Participants reviewed the goals from the 2015 plan:

1. Prevent loss of life and minimize property damage.
2. Decrease impact of potential hazards.
3. Ensure continued government and emergency functions in the event of a disaster.

The planning team adjusted these goals to add specificity and clarity which appear below.

1. Prevent loss of life.
2. Minimize property damage.
3. Decrease the impact of potential hazards on daily life for residents.
4. Ensure continuity of government and government services (ESFs).

Mitigation Actions

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

Mitigation is one of four phases of emergency management. Many steps can be taken to help mitigate potential effects of the many hazards that threaten Wapello County. When implemented appropriately, mitigation projects save lives, reduce property damage, save public money, and enhance the natural environment. Mitigation can reduce the potential cost of disasters to property owners and all levels of government. In addition, mitigation actions protect critical community facilities, reduce exposure to liability, and minimize community disruption during and after an event.

Categories of Mitigation Actions

Mitigation actions can be grouped into six categories: prevention, property protection, public education and awareness, natural resource protection, emergency services, and structural projects. These actions can be simple or complex, low-cost or expensive, and can have local or widespread benefits. Each of the categories is described briefly below:

- **Prevention** actions include government, administrative, or regulatory measures that influence future land development and building construction. These actions aim to reduce risk or exposure to hazards. These measures also include public activities to reduce hazard losses.
- **Property protection** actions involve the modification of existing structures and/or their surroundings to protect them from hazards, the removal of buildings or structures from hazard-prone areas or providing insurance to cover potential losses.
- **Public education and awareness** measures inform and educate citizens, property owners, and elected officials about hazards and the means by which they may be mitigated.
- **Natural resource protection** minimize damage and losses and also preserve or restore the functions of natural systems.
- **Structural projects** involve the construction or maintenance of structures that will reduce the impact of a hazard or direct the impact away from people or property.
- **Emergency services** are measures taken before, during, and after a hazard event to protect people and property; although these measures are not typically considered "mitigation", they significantly minimize the events impact and preserve the community's health and safety.

Review of 2015 Mitigation Actions

44 CFR § 201.6(d)(3) – A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities.

The following tables detail the mitigation actions that were identified in the *2015 Wapello County Multi-Jurisdictional Hazard Mitigation Plan*, separated by category. Participants in the planning process were asked to review these mitigation measures and discuss if and how they may have been addressed since 2015. Their assessment of each mitigation action's status and/or whether it should remain in the plan update going forward as indicated in the "Status" column. Actions related to non-natural hazards were moved to Addendum I to reference in other planning efforts.

Affected Community(ies)	Mitigation Project/Activity	Primary Hazard	Planning/ Implementation	Responsible Entities	2021 Action Status	ESF	Goal
All	Provide public education on hazards	All	Public information campaign	EMA, Fire Departments	In progress	ESF 15	1, 2 ,3
All	Maintain Emergency Operations Center with 24 hr capability and backup location	All	Capital Improvement Plan	EMA	In progress	ESF 5	1, 2 ,3
All	Encourage the use of NOAA All Hazards Alert Radios	All	Hazard Mitigation Plan	EMA	In progress	ESF 2	1, 2, 3
All	Encourage citizens to create a family preparedness kit	All	Hazard Mitigation Plan & Public info campaign	EMA	In progress	ESF 15	1,2
All	Designate shelters with backup power	All	Hazard Mitigation Plan, ESF 6	EMA	In progress	ESF 6	1, 2, 3
All	Improve process for reporting utility outages between utilities and public safety	All	Hazard Mitigation Plan	EMA, Police and Fire Departments	In progress	ESF 2	1, 2
All	Implement MABAS (Mutual Aid Box Alarm System)	All	Hazard Mitigation Plan	EMA, Police and Fire Departments	In progress	ESF 4, 10	1,2
All	Promote active public participation including efforts to check in on elderly populations during an event.	All	Public information campaign	EMA	In progress	ESF 2, 15	1,2
All	Acquire backup generators for shelters to be used in event of a power loss	Tornado	Hazard Mitigation Plan	EMA	In progress	ESF 6	1, 2
All	Develop debris disposal sites	All	Hazard Mitigation Plan	EMA, Municipalities	In progress	ESF 5	1, 2, 3
Agency, Blakesburg, Chillicothe, Eldon, Ottumwa, Indian Hills CC, Cardinal Schools	Enforce burning restrictions to lower fire risk	Drought	Hazard Mitigation Plan	Police and Fire Departments	In progress	ESF 4	1, 2, 3
Unincorporated county, Agency, Blakesburg, Chillicothe, Eddyville, Eldon, Ottumwa	Install buffer strips against river/flash flooding	River flood & Flash Flood	Hazard Mitigation Plan	NRCS	In progress	ESF 11	1, 2
Unincorporated county, Agency, Blakesburg, Chillicothe, Eddyville, Eldon, Ottumwa	Develop soil erosion stabilization projects	River Flood & Flash Flood	Hazard Mitigation Plan	Municipalities, NRCS	In progress	ESF 11	1
Unincorporated county, Agency, Blakesburg,	Develop stream modification	River Flood & Flash Flood	Hazard Mitigation Plan	Municipalities, NRCS	In progress	ESF 11	1

Chillicothe, Eddyville, Eldon, Ottumwa							
Unincorporated county, Agency, Blakesburg, Chillicothe, Eddyville, Eldon, Ottumwa	Implement channel improvement projects	River Flood & Flash Flood	Hazard Mitigation Plan	Municipalities, NRCS	In progress	ESF 11	1
All	Maintain snowplow/snow removal equipment and enact policies for access to emergency services during extreme weather events	Severe Winter Storm, Tornado	Hazard Mitigation Plan	EMA, Municipalities	New/Merged	ESF 3,4,8, 13	1, 2, 3
Unincorporated county, Eddyville, Ottumwa	Continue to monitor river levels and forecasts	Levee Failure	Hazard Mitigation Plan	EMA, Municipalities	In progress	ESF 15	1, 2
Eddyville, Ottumwa	Maintain levee maintenance programs and inspections	Levee Failure	Hazard Mitigation Plan	EMA, Municipalities	In progress	ESF 3	1, 2
Unincorporated county, Eddyville, Ottumwa	Maintain watershed. Ensure that drainage flow is not disrupted	Dam failure	Hazard Mitigation Plan	Municipalities	In progress	ESF 3	1, 2
Unincorporated county, Eddyville, Ottumwa	Maintain dam inspections & maintenance as required	Dam failure	Hazard Mitigation Plan	Municipalities	In progress	ESF 3	1, 2
Eddyville	Install flood gates at railroad crossings	Flooding	Hazard Mitigation Plan	EMA, Municipality	New	ESF 3	1, 2
All	Encourage owners of manufactured housing communities and schools to build shelters	Tornado	Hazard Mitigation Plan	EMA, Municipalities	In progress	ESF 6	1, 2
All	Install hazard signs in county campground	Tornado	Hazard Mitigation Plan	Municipalities	Completed	ESF 2	1, 2
Unincorporated county (Pioneer Ridge Nature Center), Chillicothe, Kirkville	Install outdoor siren	Tornado	Hazard Mitigation Plan	Municipalities	In progress	ESF 2	1, 2, 3
Unincorporated county (Pioneer Ridge Nature Center)	Install recreational area storm shelter	Tornado	Hazard Mitigation Plans	EMA, Municipality	In progress	ESF 6	1, 2
Eddyville	Control flow of water to lessen shifting soil	Drought	Hazard Mitigation Plan	Municipality, NRCS	In progress	ESF 3	1, 2
Eddyville	Construct storm sewer drainage	Levee Failure Flash Flood	Hazard Mitigation Plan	Municipality	In progress	ESF 3	1, 2
Eddyville	Construct storm water pumping station	River Flood Flash Flood Levee Failure	Hazard Mitigation Plan	Municipality	Completed	ESF 3	1, 2
Eddyville	Construct storm water pumping station	Levee Failure Flash Flood	Hazard Mitigation Plan	Municipality	In progress	ESF 3	1, 2
Eddyville	Repair/replace sewer line	Levee Failure Flash Flood	Hazard Mitigation Plan	Municipality	In progress	ESF 3	1, 2

Eddyville	Install backup generator on well pumps	Levee Failure Flash Flood	Hazard Mitigation Plan	Municipality	In progress	ESF 3, 12	1, 2
All	Provide for back up of records and files and an alternate location for storage of backup	River Flood Flash Flood Tornado	Hazard Mitigation Plan	Municipalities, School Districts	In progress	ESF 5	3
Eldon	Provide for backup power supply to sewer lift station	Tornado River Flood Flash Flood	Hazard Mitigation Plan	Municipality	In progress	ESF 3	1, 2
Kirkville	Fill in abandoned mines and wells once discovered	Landslides	Hazard Mitigation Plan	Municipality, NRCS	In progress	ESF 3	1, 2, 3
All	Review security of critical facilities	Waterway Incident	Hazard Mitigation Plan	EMA, Municipalities	Removed	ESF 13	1, 2, 3
Unincorporated county, Agency, Blakesburg, Chillicothe, Eddyville, Eldon, Ottumwa	Discourage development in flood plain areas and areas prone to flash flooding	River Flood & Flash Flood	Hazard Mitigation Plan & Flood Plain Ordinance	Municipalities	Removed	ESF 5	1, 2
All	Pursue funding methods for tearing down structurally failing abandoned buildings and homes	Structural Failure	Hazard Mitigation Plan & Building Code	Municipalities	Removed	ESF 4	1, 2
All	Encourage immunization of general public	Human Disease Incident	Hazard Mitigation Plan	EMA, Public Health, Municipalities, School Districts	Removed	ESF 8	1, 2, 3
Agency, Eddyville, Kirkville, Indian Hills CC	Evaluate effects of new bypass east of Ottumwa with MDST results	Highway Transportation Incident	Hazard Mitigation Plan	EMA, Municipalities, School Districts	Removed	ESF 3	1, 2
Unincorporated county, Agency, Blakesburg, Chillicothe, Eddyville, Ottumwa, Eddyville-Blakesburg Schools, Ottumwa Schools	Improve visibility at railroad crossings	Rail Transportation Incident	Hazard Mitigation Plan		Completed	ESF 3	1, 2, 3
Unincorporated county, Chillicothe, Ottumwa	Establish contact sites or alternate communications methods for the public to utilize during a communications failure	Communications Failure	Hazard Mitigation Plan		Completed	ESF 2	1, 2, 3
Blakesburg, Chillicothe, Eddyville, Eldon, Ottumwa, Cardinal Schools	Maintain wells and alternate sources of water	Energy failure	Hazard Mitigation Plan		Completed	ESF 3	1, 2, 3
Chillicothe	Purchase new tanker	Structure Fire	Hazard Mitigation Plan		Removed	ESF 4	1, 2

Cardinal Schools	Assess the intercom system for communications between school buildings and repair/replace equipment to provide adequate communications	Active Shooter/School Violence	Hazard Mitigation Plan		Completed	ESF 2	1, 2
Cardinal Schools, Ottumwa Schools	Improve video surveillance at high school and install video campus wide	Active Shooter/School Violence	Hazard Mitigation Plan		Completed	ESF 13	1, 2, 3
Cardinal Schools, Eddyville-Blakesburg Schools	Develop & adapt a terrorism response plan/recovery plan to include active shooter training and response	Active Shooter/School Violence	Hazard Mitigation Plan & School Emergency Plan		Completed	ESF 5	1, 2
Cardinal Schools	Maintain ongoing communications with key partners for planning, training, and exercising for school emergencies	Active Shooter/School Violence	Hazard Mitigation Plan		Removed	ESF 2, 5	1, 2, 3
Cardinal Schools	Consider hiring a school resource officer to provide assistance immediately due to the location of the school buildings and the response time of local law enforcement	Active Shooter/School Violence	Hazard Mitigation Plan		Completed	ESF 13	1, 2

Additional Mitigation Actions Since 2015 Plan

The *2015 Wapello County Multi-Jurisdictional Hazard Mitigation Plan* identified a number of mitigation actions that were undertaken prior to adoption of that plan. Additionally, some actions were carried out that were not identified in the 2015 plan. These types of projects came about when certain unforeseen opportunities and demands surfaced. Below is a list of mitigation actions that have been carried out since the adoption of the 2015 mitigation plan.

- Weather stations were installed in the cities of Agency, Blakesburg, Chillicothe, Eddyville, Eldon, and Ottumwa.
- Weather stations were installed at Cardinal Community Schools and Pioneer Ridge Nature Center.
- Installation of a stream gauge on the Des Moines River near Chillicothe in partnership with the Iowa Flood Center.
- Development of the Wapello County Emergency Management website which allows for increased communication to residents. The site includes weather, river levels and predictions, and other critical information.

Updated Mitigation Actions

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

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

Many of the recommendations that follow address important actions to put forth on a continual basis, while others address a specific need. There are many examples of mitigation actions that were identified in the previous plan which fall in line with the general operations of county, city, or district staff and have been eliminated from the lists of proposed mitigation actions that follow.

Most of the following mitigation actions carry over from the previous plan, with slight revisions and/or consolidation. Many of the jurisdictions highlighted in this plan have many projects in mind which could loosely be considered hazard-related, but do not fall in line with projects commonly associated with the Hazard Mitigation Assistance grant programs or IHSEMD's current list of priority actions.

The tables on Pages 81-84 present an examination of mitigation actions identified for the 2021 Wapello County plan update. Each mitigation action identifies the applicable hazards it addresses,

which communities it affects, prioritization of the project, generalized cost estimates, potential funding sources, responsible parties, and an estimated timeline for implementation.

Mitigation Project/Activity	Hazard(s) Addressed	Applicable Jurisdiction(s)	Priority	Responsible Entity(ies)	Cost Estimates	Potential Funding Sources	Timeline
EMA Lead Projects							
24/7 Situational Awareness for the Public and Officials							
Maintain a dedicated Emergency Operations Center with 24 hr capability and backup location	All	All	High	EMA	>$250,000	Local funds, Federal grants	Ongoing
Development and promotion of the Wapello Ready Alerts program that is part of the statewide Alert Iowa system	All	All	High	EMA	<$1,000	Local funds	Ongoing
Continual monitoring of river levels and forecasts. Maintain situational awareness in EOC	Levee Failure	Unincorporated county, Eddyville, Ottumwa	High	EMA, Municipalities	<$1,000	Local funds	Ongoing
Provide a public accessible data center online for the public	Flooding	Unincorporated county, Eddyville, Ottumwa	High	EMA, Municipalities	<$1,000	Local funds	Ongoing
EMA Equipment Acquisition							
Acquire backup generators for shelters to be used in event of a power loss	Tornado	All	High	EMA	$10,000-$25,000	Local funds, Federal grants	1-5 years
Policy Development - Process Improvement							
Improve process for reporting utility outages between utilities and public safety	All	All	High	EMA, Police and Fire Departments	<$1,000	Local funds	1-5 years
Implement MABAS (Mutual Aid Box Alarm System)	All	All	High	EMA, Police and Fire Departments	<$1,000	Local funds	1-5 years
Public Education							
Provide public education on hazards	All	All	High	EMA, Fire Departments	<$1,000	Local Funds	Ongoing
Encourage the use of NOAA All Hazards Alert Radios	All	All	High	EMA	<$1,000	Local funds	Ongoing
Encourage citizens to create a family preparedness kit	All	All	High	EMA	<$1,000	Local funds	Ongoing

Promote active public participation including efforts to check in on elderly populations during an event	All	All	High	EMA	<$1,000	Local funds	Ongoing
Develop debris disposal sites	All	All	Medium	EMA, Municipalities	<$1,000	Local funds	1-5 years
Enforce burning restrictions to lower fire risk	Drought	Agency, Blakesburg, Chillicothe, Eldon, Ottumwa, Indian Hills CC, Cardinal Schools	Medium	Police and Fire Departments	<$1,000	Local funds	Ongoing
Maintain snowplow/snow removal equipment and enact policies for access to emergency services during extreme weather events	Severe Winter Storm, Tornado	All	Medium	EMA, Municipalities	$10,000-$25,000	Local funds	Ongoing
Severe Storm Facility Hardening, Shelters and Outdoor Warning							
Install recreational area storm shelter	Tornado	Unincorporated county (Pioneer Ridge Nature Center)	Medium	EMA, Municipality	$25,000-$100,000	Local funds, Federal and local grants	1-5 years
Install outdoor siren	Tornado	Unincorporated county (Pioneer Ridge Nature Center), Chillicothe, Kirkville	Medium	Municipalities	$10,000-$25,000	Local funds, Federal and local grants	1-5 years
Designate shelters with backup power	All	All	Medium	EMA	<$1,000	Local funds	1-5 years
Encourage owners of manufactured housing communities and schools to build shelters	Tornado	All	Low	EMA, Municipalities	<$1,000	Local funds	5-10 years

Information sharing on processes in place

Levee, Dam and Watershed Maintenance programs (Primarily Ottumwa & Eddyville) Share information with EMA							
Maintain levee maintenance programs and inspections	Levee Failure	Eddyville, Ottumwa	High	EMA, Municipalities	$10,000-$25,000	Local funds	Ongoing
Maintain dam inspections & maintenance as required	Dam Failure	Unincorporated county, Eddyville, Ottumwa	High	Municipalities	$10,000-$25,000	Local funds	Ongoing
Maintain watershed. Ensure that drainage flow is not disrupted	Dam Failure	Unincorporated county, Eddyville, Ottumwa	Medium	Municipalities	>$250,000	Federal grants	Ongoing

Community Specific Initiatives

Eddyville Specific Projects							
Construct storm sewer drainage	Levee Failure, Flash Flood	Eddyville	High	Municipality	>$250,000	Local funds, Federal grants	5-10 years
Repair/replace sewer line	Levee Failure, Flash Flood	Eddyville	High	Municipality	>$250,000	Local funds, Federal grants	5-10 years
Install backup generator on well pumps	Levee Failure, Flash Flood	Eddyville	Medium	Municipality	$25,000-$100,000	Local funds, Federal grants	5-10 years
Install flood gates at railroad crossings	Flooding	Eddyville	Medium	EMA, Municipality	>$250,000	Federal grants	5-10 years
Control flow of water to lessen shifting soil	Drought	Eddyville	Low	Municipality, NRCS	>$250,000	Local funds, Federal grants	Ongoing
Eldon Specific Projects							
Provide for backup power supply to sewer lift station	Tornado, River Flood, Flash Flood	Eldon	Medium	Municipality	$25,000-$100,000	Local funds, Federal grants	5-10 years
Kirkville Specific Projects							
Fill in abandoned mines and wells once discovered	Landslides	Kirkville	Low	Municipality, NRCS	>$250,000	Federal grants	Ongoing

Lower Priority Initiatives to be Developed

County-Wide Engineering/NRCS Projects Related to Flooding							
Install buffer strips against river/flash flooding	River Flood & Flash Flood	Unincorporated county, Agency, Blakesburg, Chillicothe, Eddyville, Eldon, Ottumwa	Low	NRCS	>$250,000	Federal grants	5-10 years
Develop soil erosion stabilization projects	River Flood & Flash Flood	Unincorporated county, Agency, Blakesburg, Chillicothe, Eddyville, Eldon, Ottumwa	Low	Municipalities, NRCS	>$250,000	Federal grants	5-10 years

Develop stream modification	River Flood & Flash Flood	Unincorporated county, Agency, Blakesburg, Chillicothe, Eddyville, Eldon, Ottumwa	Low	Municipalities, NRCS	>$250,000	Federal grants	5-10 years
Implement channel improvement projects	River Flood & Flash Flood	Unincorporated county, Agency, Blakesburg, Chillicothe, Eddyville, Eldon, Ottumwa	Low	Municipalities, NRCS	>$250,000	Federal grants	5-10 years
IT/Public Records Protection From Storm Damage							
Provide for back up of records and files and an alternate location for storage of backup	River Flood, Flash Flood, Tornado	All	Low	Municipalities, School Districts	<$1,000	Local funds	Ongoing

Section 6 –Implementation

Plan Adoption & Implementation

44 CFR § 201.6(c)(5) – [The plan shall include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan.

Once this plan was completed, Area 15 Regional Planning Commission (RPC) staff presented an adoption resolution to the Wapello County Emergency Management Commission, each local community, and each of the school districts. The Commission formally adopted the *2021 Multi-Jurisdictional Hazard Mitigation Plan for Wapello County, Iowa* at its board meeting on, 2021. This resolution may be found on Page 89. Local adoption resolutions appear in Section 7.

Wapello County Supervisors and local officials for each of the participating jurisdictions (mayors/councils and superintendents/school boards) are responsible for overseeing the implementation of this plan, with assistance from the Wapello County Emergency Management Agency. The mitigation actions identified on Pages 81-84 were prioritized by the planning teams through discussions, evaluations of costs and benefits. Generalized cost estimates were developed to help determine which mitigation actions best aligned with the economic goals of each jurisdiction. Discussions with the plan participants reaffirmed that budgets are tight and available funding is scarce. The prioritization of identified mitigation actions was based on minimizing costs while maximizing benefits.

The availability of grant funding will play a significant role in the implementation of mitigation actions. Upon the adoption of this plan local governments and schools will be eligible for pre-disaster funding assistance from FEMA for mitigation strategies identified above. While many of the mitigation actions have little or no additional costs associated with them, the majority do. When dealing with a rural county made up of small schools and communities that have constricted local budgets, it will be important to utilize grant opportunities as they come available and to seek out cost-share opportunities (i.e. public-private partnerships) whenever possible. The mitigation actions appearing in this plan will be considered when developing local budgets and making public improvements and will be incorporated if possible. The implementation of any single mitigation strategy on its own; however, is likely to be impeded by fiscal constraints.

Area 15 RPC will monitor for the availability of grant funds that may become available for eligible projects and notify the Wapello County Emergency Management Commission, the Emergency Management Coordinator, and all participating jurisdictions of their availability. If desired, the RPC may provide grant application and administration assistance to eligible jurisdictions if funding opportunities become available. Area 15 RPC is also researching the establishment of a regional, multi-county Hazard Mitigation Plan as recommended by IHSEMD.

Plan Maintenance & Updates

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

Most of the recommendations within this plan are for the use of the Wapello County Emergency Management Agency, emergency responders, and the county's local elected officials—county supervisors, mayors, city councils, and school board members. In order to ensure consistency, minimize risk, and better coordinate mitigation activities; the governing bodies of the local jurisdictions are should reference this plan when relevant planning decisions are to be made. Since few of the communities in the county have comprehensive plans or formal capital improvement plans, the opportunity to incorporate these recommendations into existing planning mechanisms is very limited. Wherever possible, the mitigation actions identified in this plan should be incorporated into planning-related activities, such as annual local budgets.

44 CFR § 201.6(c)(4)(i) – [The plan shall include a maintenance process that includes a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a 5-year cycle.

Plan maintenance involves taking action to ensure that the plan stays current with information, that priorities are still in order, and that goals and objectives are maintained and updated as necessary. The progress and status of the activities included in the *2021 Multi-Jurisdictional Hazard Mitigation Plan for Wapello County, Iowa,* will be re-evaluated annually by each jurisdiction in a public setting, such as a city council meeting or work session where annual budgets are developed. All participating jurisdictions in this plan receive the Area 15 RPC quarterly newsletter. In addition to noting when mitigation funding is available, planning staff will be sure to include an annual reminder in the newsletter for cities, counties, and schools to review this plan when developing their respective annual budgets.

This plan will be monitored based on the mitigation strategies identified in the plan and associated status updates. Wapello County EMA and Area 15 RPC staff will work to conduct annual surveys of each municipality and school district to ensure information for each jurisdiction is current. As damaging hazard events occur, documentation (i.e. photographs, newspaper articles, or insurance claims) should be added to Appendix H of the plan to help provide better information regarding actual occurrences and experiences. Minutes of meetings or work sessions where capital projects, infrastructure budgeting, or changes in land use are discussed should also be included in Appendix H to assist in the update of future mitigation plans. Mitigation projects that are completed will be documented in Appendix H and should be monitored for effectiveness. Any strategies that are removed from the plan will also be documented. These items will be reviewed when annual surveys are conducted.

Current FEMA guidelines mandate that a comprehensive update to this plan be completed at least once every five years to maintain eligibility for pre-disaster grant funds. Area 15 RPC staff will continue to act as a liaison with staff at Iowa Homeland Security and Emergency Management and communicate any changes in federal laws related to mitigation planning.

Continued Public Participation

44 CFR § 201.6(c)(4)(iii) – [The plan shall include a maintenance process that includes a] discussion on how the community will continue public participation in the plan maintenance process.

Public participation is an essential part of the planning process. The public will be involved in the implementation of the plan through meetings with the Wapello County Board of Supervisors, city councils, and other public meetings. When mitigation actions and implementation strategies will be discussed, the public will be encouraged to provide input. When necessary, each jurisdiction will notify the public by emails, newspapers notices, and other methods to citizens in the area to participate in the mitigation planning process. Additional avenues by which the county can pursue public engagement is through the increased usage of social media sites and/or public surveys to gauge overall community support. All residents are invited and encouraged to participate in any such meetings that are to be held.

The opportunity for the public to take part in updates and reviews of this plan will comply with Iowa's Open Meetings Law (Iowa Code, Chapter 21). For each major (currently, five-year) plan update, the plan will be presented to the public for a thirty-day comment and review period prior to FEMA approval. For each recommended annual review, public notices will be released. At minimum, the plan shall be available for review in each community's City Hall and at the Wapello County Courthouse. A copy will always be available for public review at the Area 15 RPC office.

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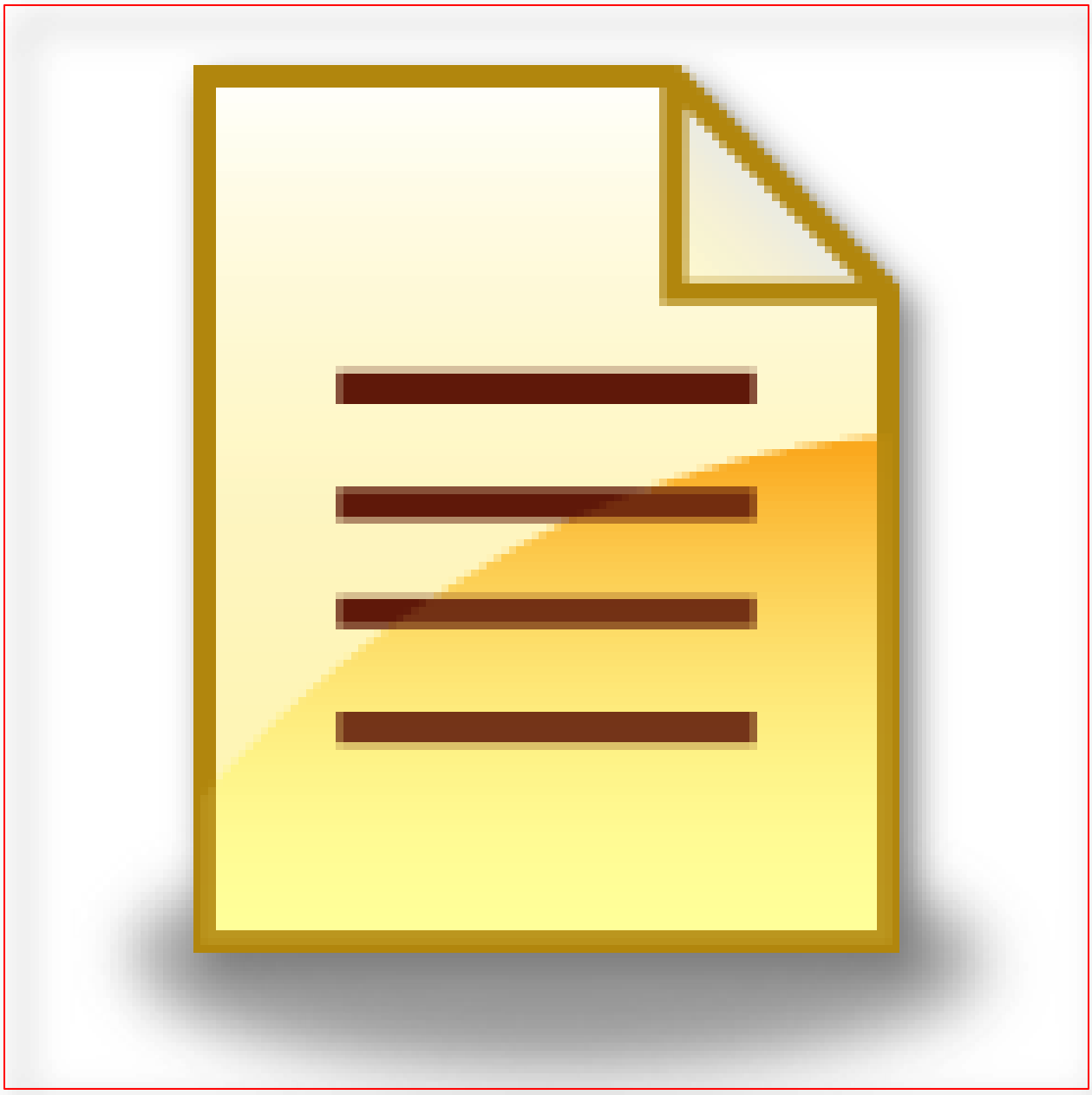
County Adoption Resolution



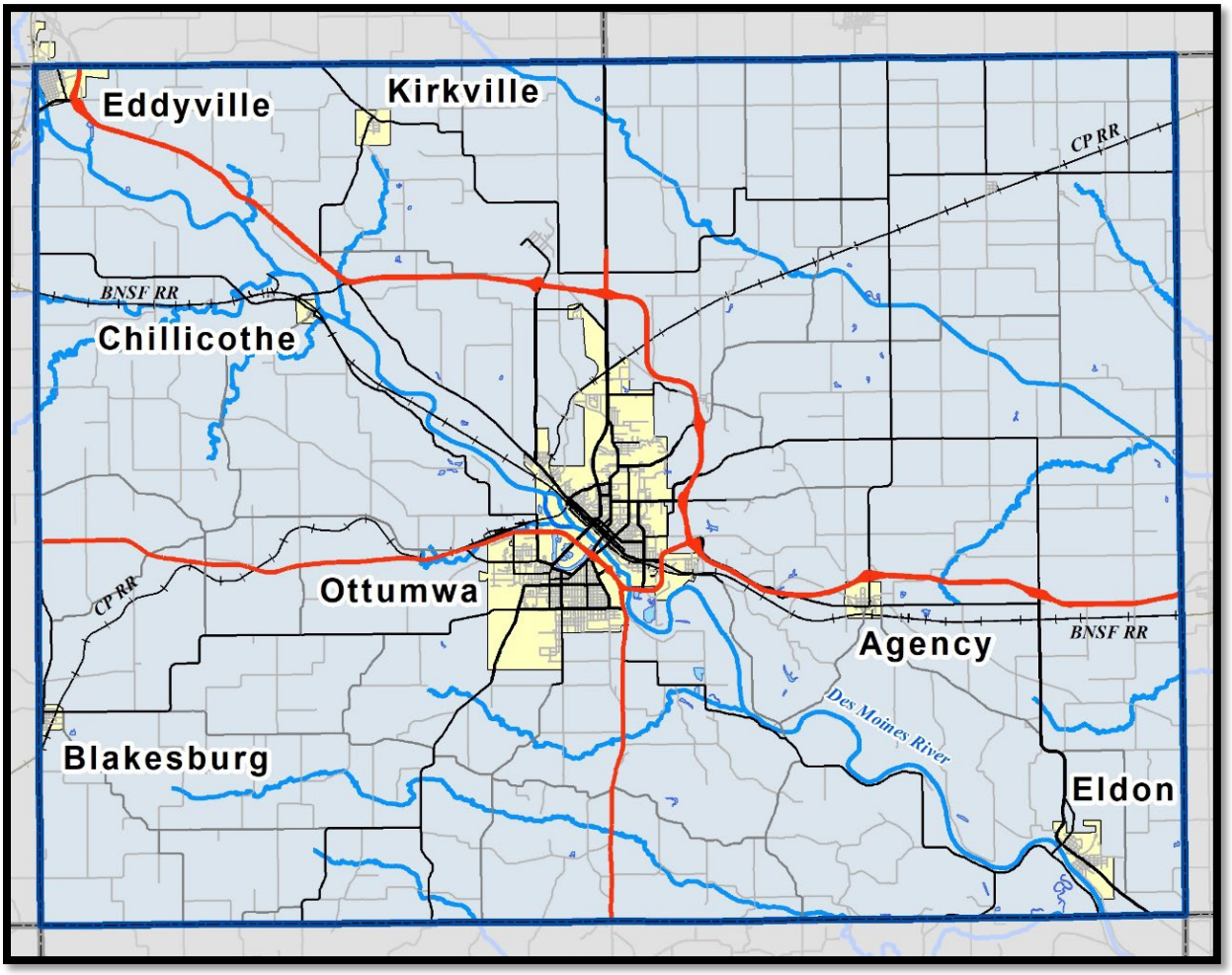
Section 7 – Local Focus

44 CFR § 201.6(a)(4) – Multi-jurisdictional plans may be accepted as long as each jurisdiction has participated in the process and has officially adopted the plan.

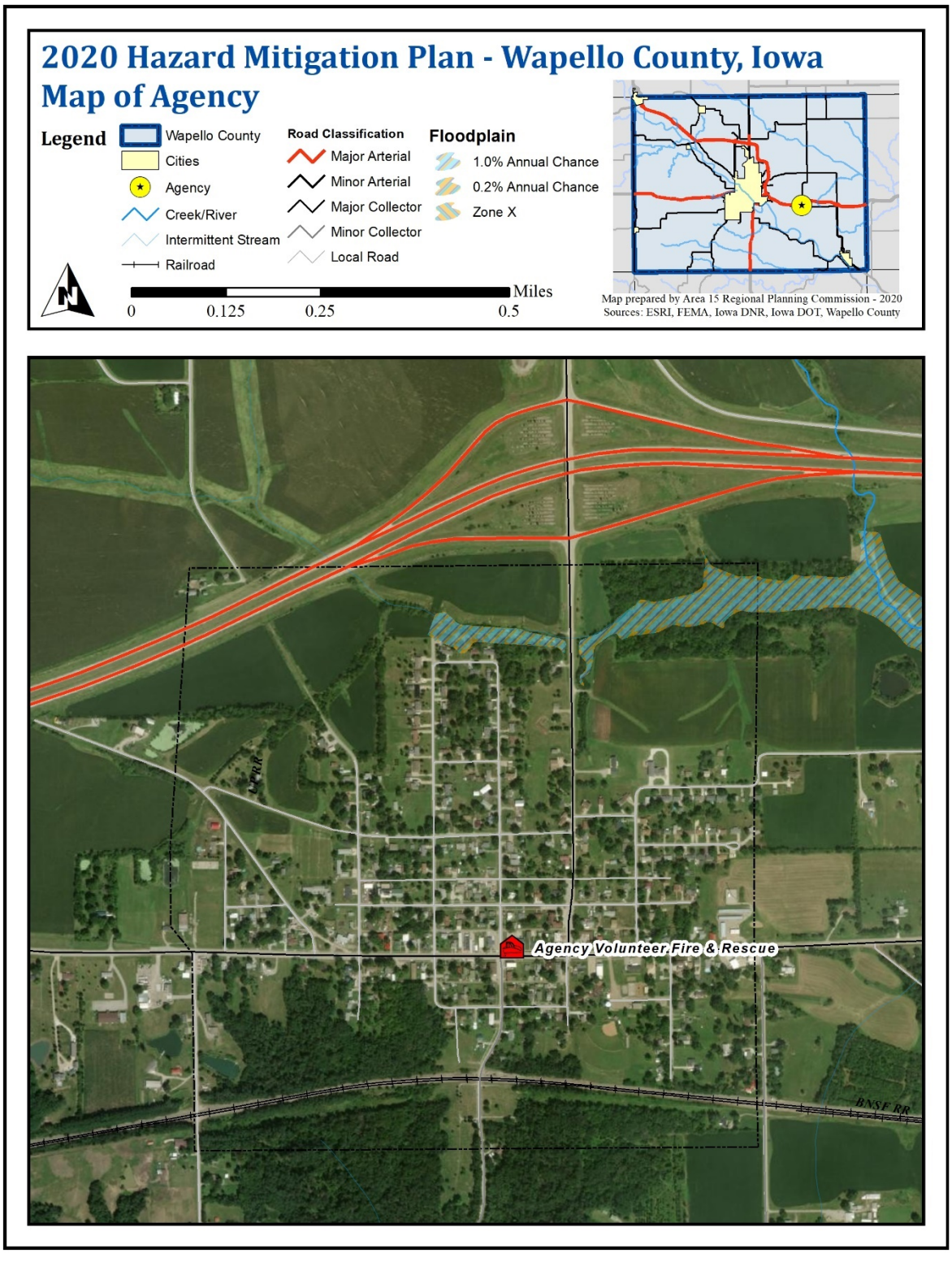
44 CFR § 201.6(c)(2)(iii) – For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

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

44 CFR § 201.6(c)(5) – [The plan must include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan. For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.



City of Agency



Agency at a Glance

Demographics		Workforce	
Total Population	638	Total Labor Force	282
Median Age	43.2	Employed	533 (90.7%)
65 Years and Over	21.5%	Time Travel to Work	19 min.

Household/Income		Property Valuations	
Median Household Income	$28,625	Residential	$22,336,814
Per Capita Income	$19,511	Commercial	$1,066,960
Average Household Size	3.07	Industrial/Agricultural	$72,950

Housing		Regulatory Information	
Total Housing Units	306	Flood Insurance Rate Map	Yes
Occupied Housing Units	277	NFIP Participant	Yes
Housing Units removed/demolished since 2015	5	Comprehensive Plan	No
Building Permits	Yes	Zoning/Land Use Ordinance	Yes
New Building Permits Since 2015	59	Subdivision Ordinance	Yes

Service	Provider(s)
Electric	Alliant Energy
Natural Gas	MidAmerican Energy
Water	Wapello Rural Water Association
Sewage Treatment	City of Agency
Telephone	Mediacom; Windstream
Internet	Windstream
Ambulance	ORMICS
Fire Protection	Agency Volunteer Fire Dept.
Police/Law Enforcement	Wapello County Sheriff

Structures			
Residential	Commercial	Industrial	Public
59	0	0	0

Sources: U.S. Census Bureau (2010), City of Agency (2020), Wapello County Assessor (2020)

Planning Process

The planning team utilized the public input gathered for the 2015 plan as the basis of this plan update. The 2015 Risk Assessment and Mitigation Strategies were reviewed by representatives from Agency. The planning team reviewed and collected new information from Agency representatives via email, phone, and surveys.

Hazard Risk Assessment

The Wapello County Hazard Mitigation planning team determined the countywide hazard rankings. The countywide hazard ranking was presented to the City. The City was asked to review the information from the countywide rankings and determine if highest risk hazards for the County applied to Agency, and if not, how the city's situation differs from that of the county.

Based on this discussion, relevant hazards were determined for Agency, which included changes from the County rankings, as shown in Table 7.1. Agency may be susceptible to other hazards, but those hazards are not considered to be high-risk and were not examined in detail. However, if circumstances change and it is determined that a hazard does pose a risk to Agency, it will be examined at that time or when the plan is updated.

Table 7.1. Agency Hazard Risk Assessment

Rank	Hazard	Risk
1	**Thunderstorm/Lighting/Hail**	High
2	**Tornado/Windstorm**	High
3	**Severe Winter Storm**	Moderate
4	**Drought**	Moderate
5	**Flash Flood**	Moderate
6	**Extreme Heat**	Moderate
7	**River Flood**	Low
8	**Sinkhole**	Low
9	**Landslide**	Low
10	**Dam/Levee Failure**	Low
11	**Expansive Soils**	Low
12	**Earthquake**	Low

Review of Existing Plans

In the preparation of this plan, existing plans and other technical information was considered. The purpose of this review was to consider existing information before setting future mitigation goals. The following local documents were identified and reviewed by the City of Agency to evaluate current mitigation efforts underway:

- Agency Municipal Codebook of Ordinances, 2012

Mitigation Strategy

The City reviewed the mitigation actions identified in the 2015 plan, the mitigation actions carried out since its adoption, and potential mitigation actions to be undertaken in the future and discussed this with the planning team.

Future Mitigation Actions

The City's priority list of future mitigation actions appears in Table 7.2. Actions will be undertaken as funding becomes available. Realistically, the priority of the projects is dynamic and is largely dependent on the time, place, imminent need, feasibility, and opportunity.

Table 7.2. Agency Hazard Mitigation Actions

Mitigation Project/Activity	Hazard(s) Addressed	Priority
Maintain a dedicated Emergency Operations Center with 24 hr capability and backup location	All	High
Development and promotion of the Wapello Ready Alerts program that is part of the statewide Alert Iowa system	All	High
Acquire backup generators for shelters to be used in event of a power loss	Tornado	High
Improve process for reporting utility outages between utilities and public safety	All	High
Implement MABAS (Mutual Aid Box Alarm System)	All	High
Provide public education on hazards	All	High
Encourage the use of NOAA All Hazards Alert Radios	All	High
Encourage citizens to create a family preparedness kit	All	High
Promote active public participation including efforts to check in on elderly populations during an event	All	High
Develop debris disposal sites	All	Medium
Enforce burning restrictions to lower fire risk	Drought	Medium
Maintain snowplow/snow removal equipment and enact policies for access to emergency services during extreme weather events	Severe Winter Storm, Tornado	Medium
Designate shelters with backup power	All	Medium
Encourage owners of manufactured housing communities and schools to build shelters	Tornado	Low
Install buffer strips against river/flash flooding	River Flood & Flash Flood	Low
Develop soil erosion stabilization projects	River Flood & Flash Flood	Low
Develop stream modification	River Flood & Flash Flood	Low
Implement channel improvement projects	River Flood & Flash Flood	Low
Provide for back up of records and files and an alternate location for storage of backup	River Flood, Flash Flood, Tornado	Low

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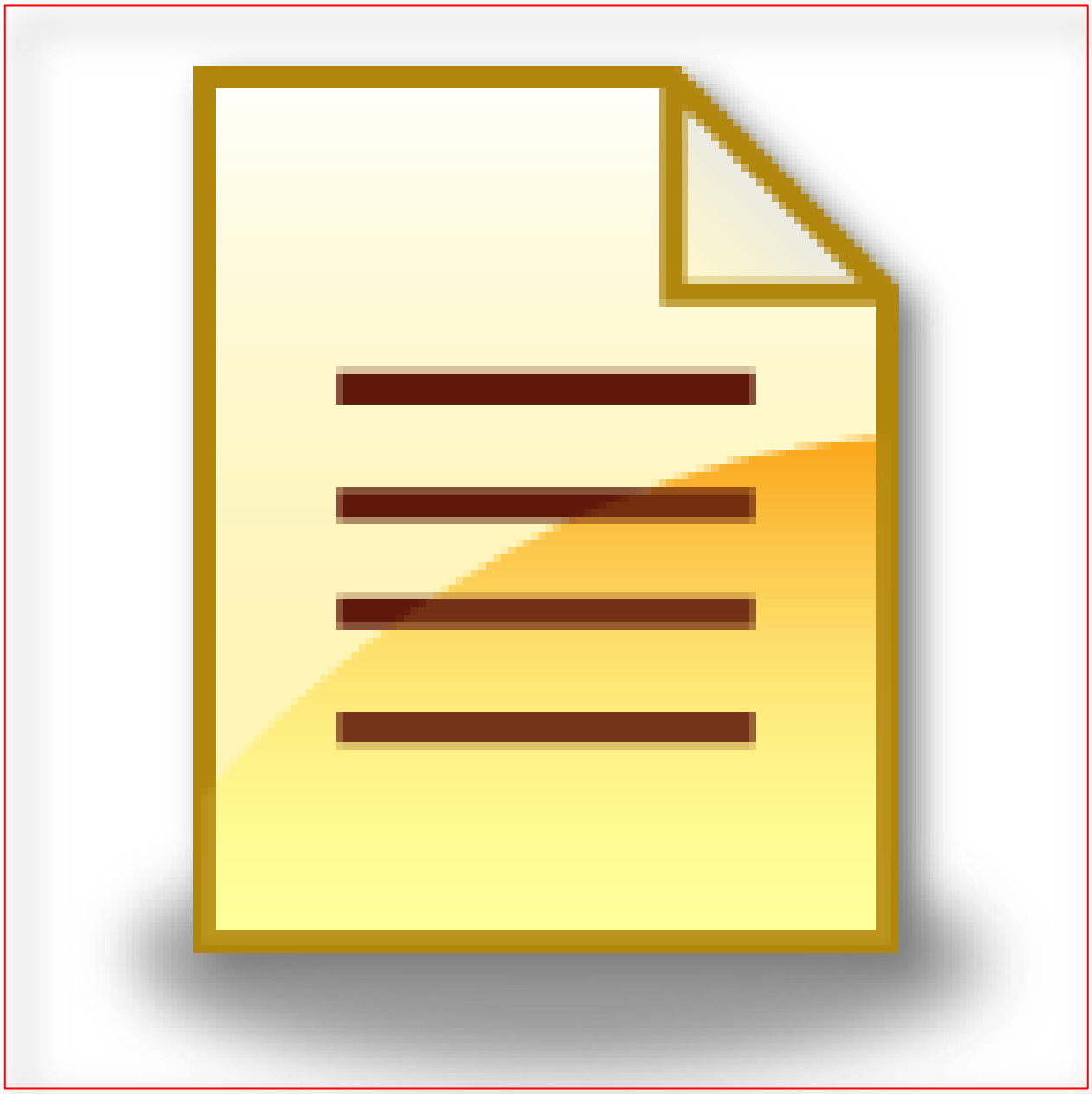
Plan Adoption Resolution



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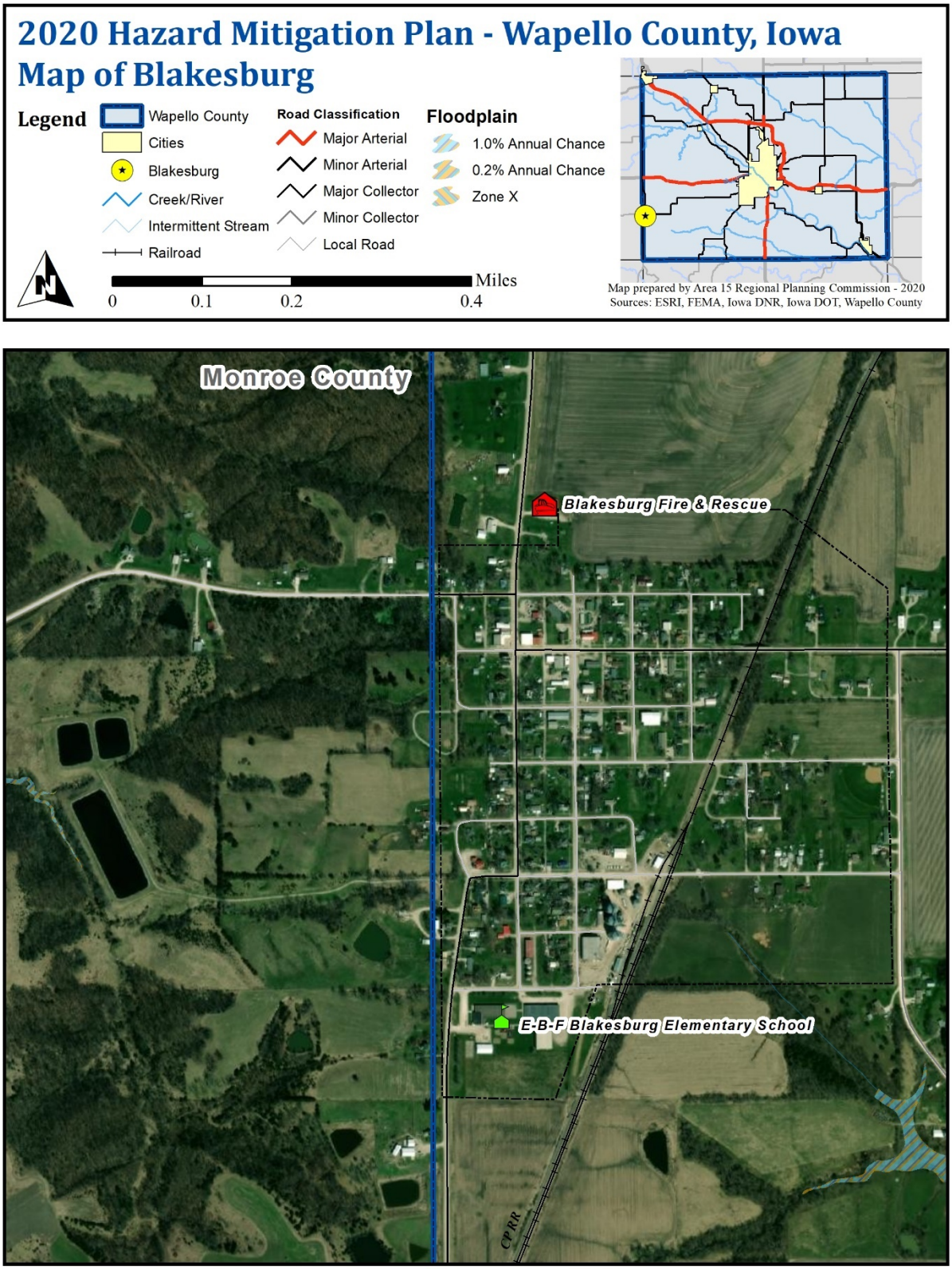
City of Blakesburg



Blakesburg at a Glance

Demographics		Workforce	
Total Population	296	Total Labor Force	115
Median Age	43.5	Employed	96 (96.5%)
65 Years and Over	32.3%	Time Travel to Work	23.4 min.

Household/Income		Property Valuations	
Median Household Income	$31,250	Residential	$6,123,296
Per Capita Income	$15,776	Commercial	$731,430
Average Household Size	2.04	Industrial/Agricultural	$35,810

Housing		Regulatory Information	
Total Housing Units	169	Flood Insurance Rate Map	No
Occupied Housing Units	145	NFIP Participant	No
Housing Units removed/demolished since 2015	0	Comprehensive Plan	No
Building Permits	No	Zoning/Land Use Ordinance	No
New Building Permits Since 2015	N/A	Subdivision Ordinance	No

Service	Provider(s)
Electric	Alliant Energy
Natural Gas	B&B Propane
Water	Rathbun Rural Water
Sewage Treatment	City of Blakesburg
Telephone	Mediacom; Windstream
Internet	Windstream
Ambulance	ORMICS
Fire Protection	Wapello Rural/Blakesburg Volunteer
Police/Law Enforcement	Wapello County Sheriff

Structures			
Residential	Commercial	Industrial	Public
135	12	12	2

Sources: U.S. Census Bureau (2010), City of Blakesburg (2020), Wapello County Assessor (2020)

Planning Process

The planning team utilized the public input gathered for the 2015 plan as the basis of this plan update. The 2015 Risk Assessment and Mitigation Strategies were provided and reviewed with representatives from Blakesburg. The planning team reviewed and collected new information from Blakesburg representatives via email, phone, and survey.

Hazard Risk Assessment

The Wapello County Hazard Mitigation planning team determined the countywide hazard rankings. The countywide hazard ranking was presented to the City. The City was asked to review the information from the countywide rankings and determine if highest risk hazards for the County applied to Blakesburg, and if not, how the city's situation differs from that of the county.

Based on this discussion, relevant hazards were determined for Blakesburg, which included changes from the County rankings, as shown in Table 7.3. Blakesburg may be susceptible to other hazards, but those hazards are not considered to be high-risk and were not examined in detail. However, if circumstances change and it is determined that a hazard does pose a risk to Blakesburg, it will be examined at that time or when the plan is updated.

Table 7.3. Blakesburg Hazard Risk Assessment

Rank	Hazard	Risk
1	**Thunderstorm/Lighting/Hail**	High
2	**Tornado/Windstorm**	High
3	**Severe Winter Storm**	High
4	**Flash Flood**	Moderate
5	**Extreme Heat**	Moderate
6	**Drought**	Moderate
7	**River Flood**	Low
8	**Sinkhole**	Low
9	**Landslide**	Low
10	**Dam/Levee Failure**	Low
11	**Expansive Soils**	Low
12	**Earthquake**	Low

Review of Existing Plans

In the preparation of this plan, existing plans and other technical information was considered. The purpose of this review was to consider existing information before setting future mitigation goals. The following local documents were identified and reviewed by the City of Blakesburg to evaluate current mitigation efforts underway:

- Blakesburg Municipal Codebook of Ordinances, 2017

Mitigation Strategy

The City reviewed the mitigation actions identified in the 2015 plan, the mitigation actions carried out since its adoption, and potential mitigation actions to be undertaken in the future and discussed this with the planning team.

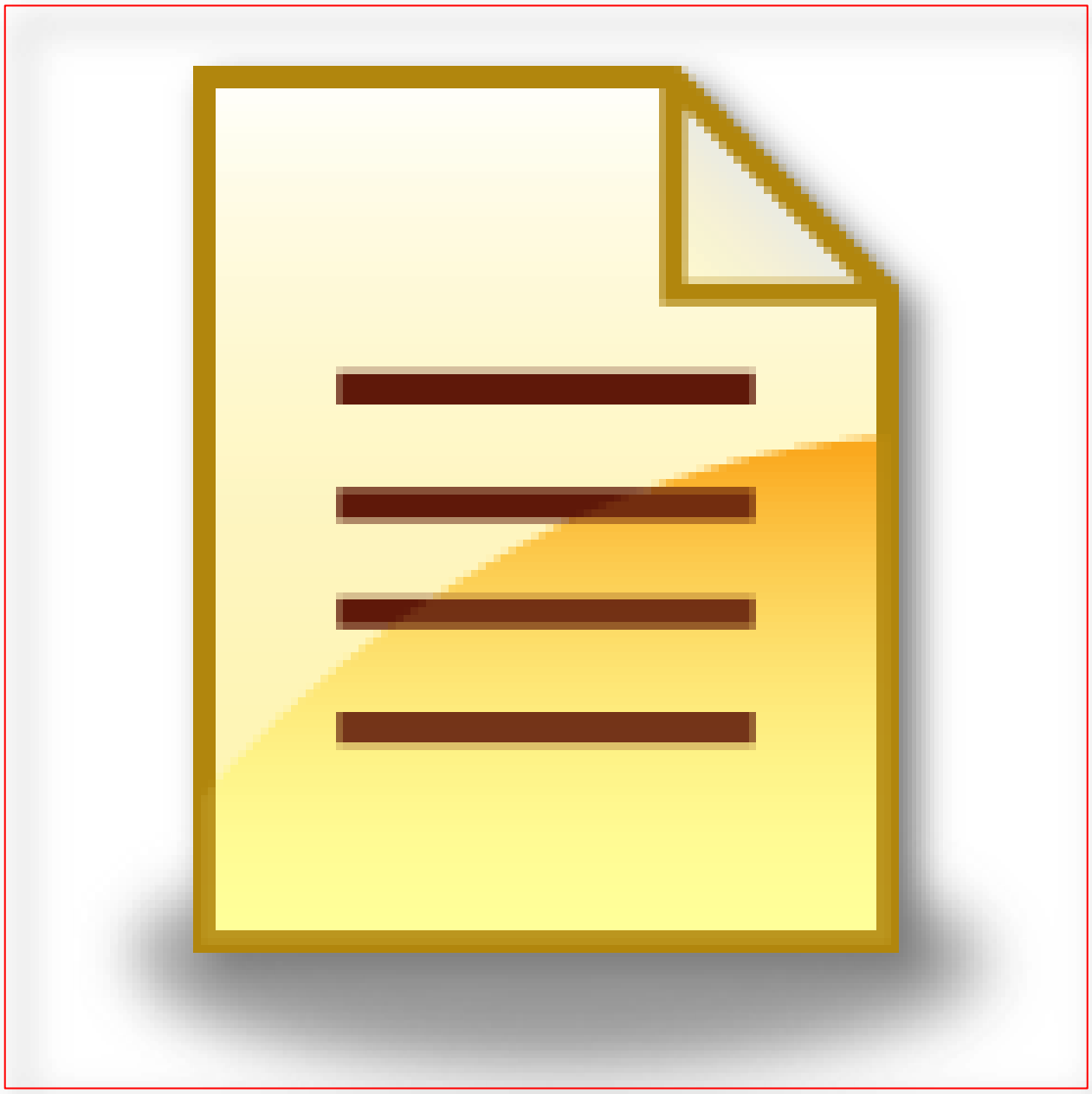
Future Mitigation Actions

The City's priority list of future mitigation actions appears in Table 7.4. Actions will be undertaken as funding becomes available. Realistically, the priority of the projects is dynamic and is largely dependent on the time, place, imminent need, feasibility, and opportunity.

Table 7.4. Blakesburg Hazard Mitigation Actions

Mitigation Project/Activity	Hazard(s) Addressed	Priority
Maintain a dedicated Emergency Operations Center with 24 hr capability and backup location	All	High
Development and promotion of the Wapello Ready Alerts program that is part of the statewide Alert Iowa system	All	High
Acquire backup generators for shelters to be used in event of a power loss	Tornado	High
Improve process for reporting utility outages between utilities and public safety	All	High
Implement MABAS (Mutual Aid Box Alarm System)	All	High
Provide public education on hazards	All	High
Encourage the use of NOAA All Hazards Alert Radios	All	High
Encourage citizens to create a family preparedness kit	All	High
Promote active public participation including efforts to check in on elderly populations during an event	All	High
Develop debris disposal sites	All	Medium
Enforce burning restrictions to lower fire risk	Drought	Medium
Maintain snowplow/snow removal equipment and enact policies for access to emergency services during extreme weather events	Severe Winter Storm, Tornado	Medium
Designate shelters with backup power	All	Medium
Encourage owners of manufactured housing communities and schools to build shelters	Tornado	Low
Install buffer strips against river/flash flooding	River Flood & Flash Flood	Low
Develop soil erosion stabilization projects	River Flood & Flash Flood	Low
Develop stream modification	River Flood & Flash Flood	Low
Implement channel improvement projects	River Flood & Flash Flood	Low
Provide for back up of records and files and an alternate location for storage of backup	River Flood, Flash Flood, Tornado	Low

Plan Adoption Resolution



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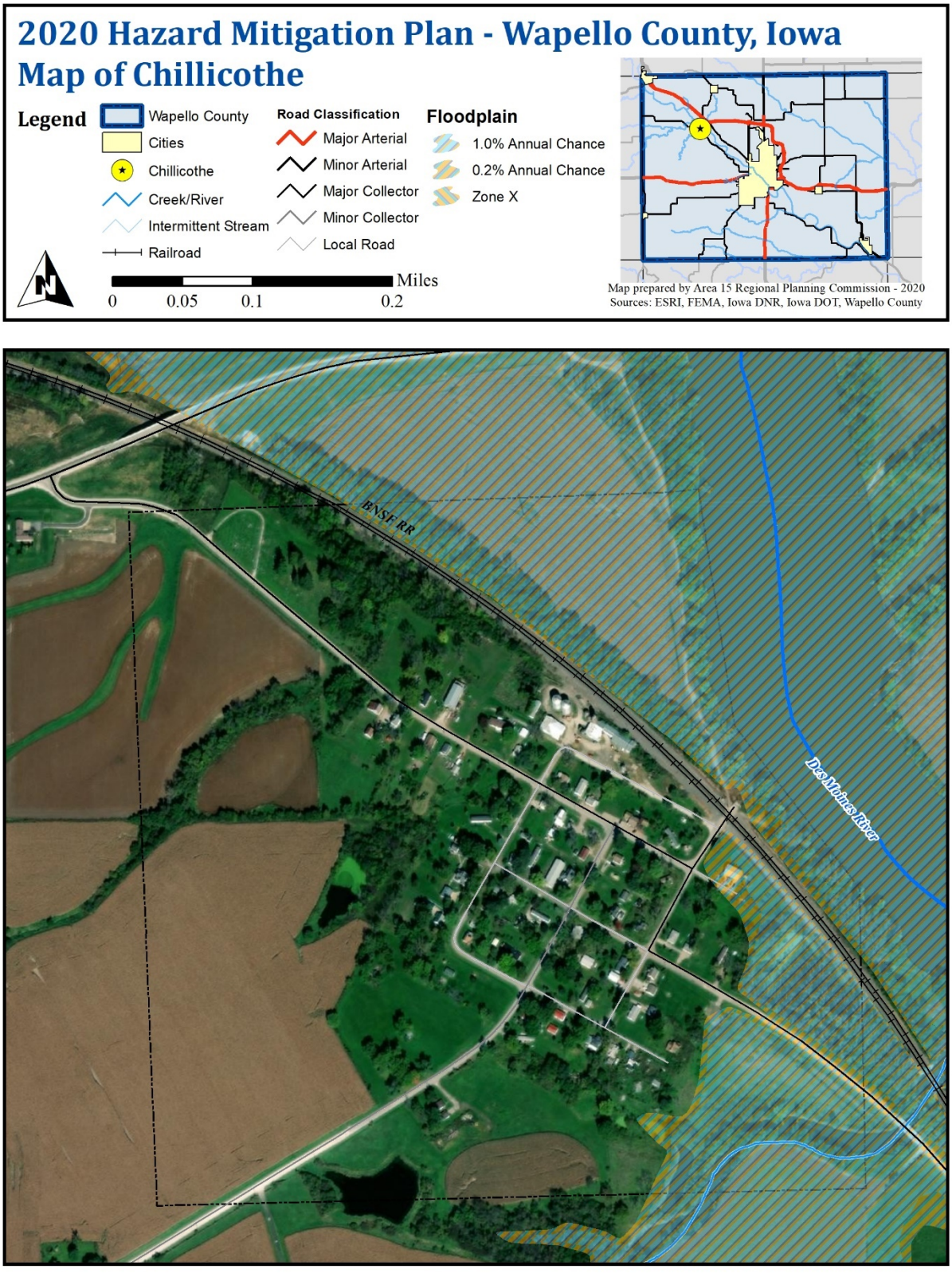
City of Chillicothe



Chillicothe at a Glance

Demographics		Workforce	
Total Population	97	Total Labor Force	28
Median Age	35.5	Employed	26 (98.0%)
65 Years and Over	9.3%	Time Travel to Work	33.5 min.

Household/Income		Property Valuations	
Median Household Income	$53,750	Residential	$1,691,770
Per Capita Income	$20,083	Commercial	$114,330
Average Household Size	2.77	Industrial/Agricultural	$62,640

Housing		Regulatory Information	
Total Housing Units	45	Flood Insurance Rate Map	Yes
Occupied Housing Units	35	NFIP Participant	Yes
Housing Units removed/demolished since 2015	5	Comprehensive Plan	No
Building Permits	No	Zoning/Land Use Ordinance	No
New Building Permits Since 2015	0	Subdivision Ordinance	No

Service	Provider(s)
Electric	Alliant Energy
Natural Gas	B&B Propane
Water	Wapello Rural Water Association
Sewage Treatment	N/A
Telephone	Windstream
Internet	Windstream
Ambulance	ORMICS
Fire Protection	Wapello Rural
Police/Law Enforcement	Wapello County Sheriff

Structures			
Residential	Commercial	Industrial	Public
4	3	0	1

Sources: U.S. Census Bureau (2010), City of Chillicothe (2020), Wapello County Assessor (2020)

Planning Process

The planning team utilized the public input gathered for the 2015 plan as the basis of this plan update. The 2015 Risk Assessment and Mitigation Strategies were reviewed by representatives from Chillicothe. The planning team reviewed and collected new information from Chillicothe representatives via email, phone, and surveys.

Hazard Risk Assessment

The Wapello County Hazard Mitigation planning team determined the countywide hazard rankings. The countywide hazard ranking was presented to the City. The City was asked to review the information from the countywide rankings and determine if highest risk hazards for the County applied to Chillicothe, and if not, how the city's situation differs from that of the county.

Based on this discussion, relevant hazards were determined for Chillicothe, which included changes from the County rankings, as shown in Table 7.5. Chillicothe may be susceptible to other hazards, but those hazards are not considered to be high-risk and were not examined in detail. However, if circumstances change and it is determined that a hazard does pose a risk to Chillicothe, it will be examined at that time or when the plan is updated.

Table 7.5. Chillicothe Hazard Risk Assessment

Rank	Hazard	Risk
1	**Thunderstorm/Lighting/Hail**	High
2	**Tornado/Windstorm**	High
3	**Severe Winter Storm**	High
4	**Flash Flood**	High
5	**Extreme Heat**	High
6	**Drought**	High
7	**River Flood**	Low
8	**Sinkhole**	Low
9	**Landslide**	Low
10	**Dam/Levee Failure**	Low
11	**Expansive Soils**	Low
12	**Earthquake**	Low

Review of Existing Plans

In the preparation of this plan, existing plans and other technical information was considered. The purpose of this review was to consider existing information before setting future mitigation goals. The following local documents were identified and reviewed by the City of Chillicothe to evaluate current mitigation efforts underway:

- Chillicothe Municipal Codebook of Ordinances, 1994

Mitigation Strategy

The City reviewed the mitigation actions identified in the 2015 plan, the mitigation actions carried out since its adoption, and potential mitigation actions to be undertaken in the future and discussed this with the planning team.

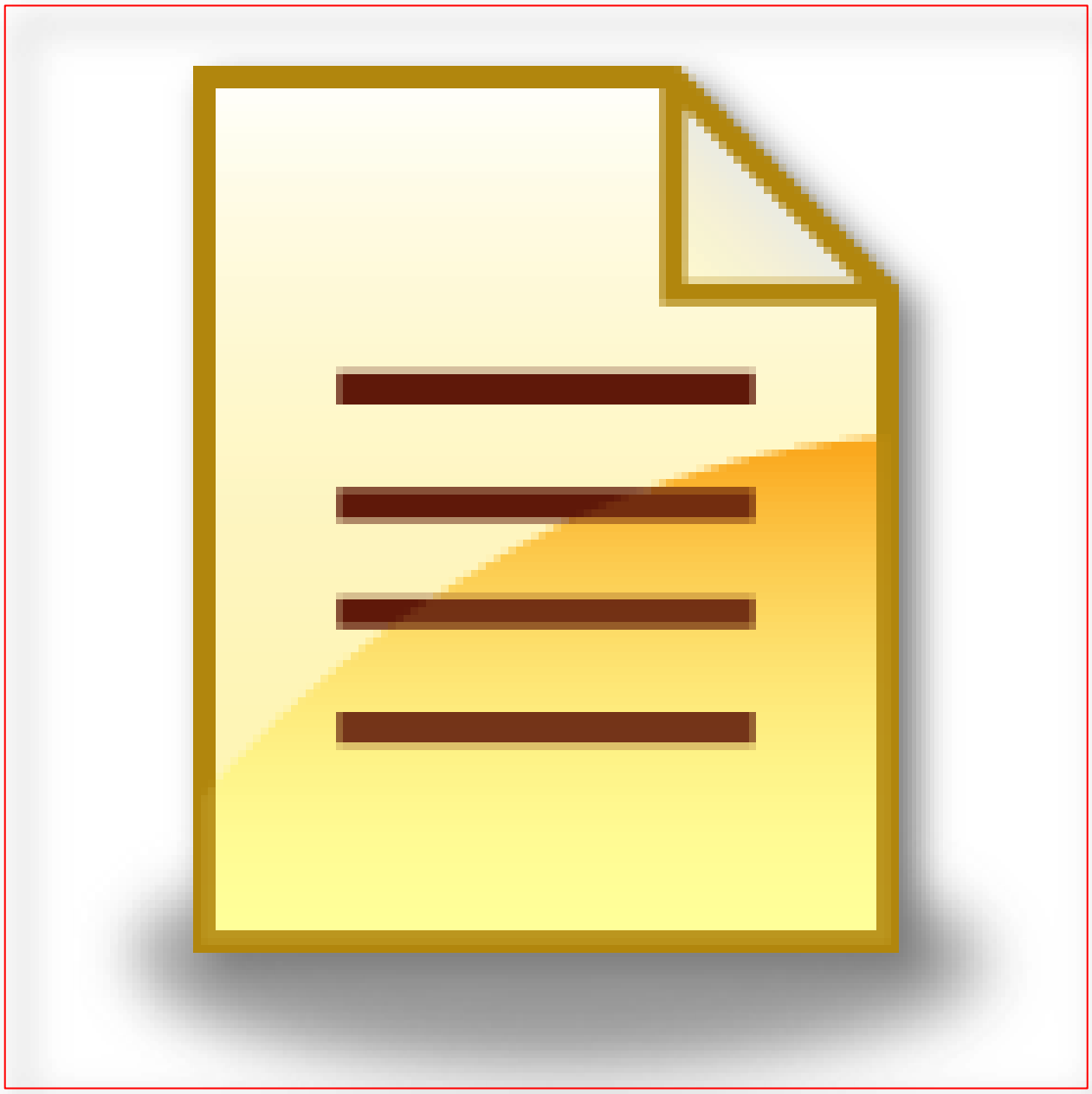
Future Mitigation Actions

The City's priority list of future mitigation actions appears in Table 7.6. Actions will be undertaken as funding becomes available. Realistically, the priority of the projects is dynamic and is largely dependent on the time, place, imminent need, feasibility, and opportunity.

Table 7.6. Chillicothe Hazard Mitigation Actions

Mitigation Project/Activity	Hazard(s) Addressed	Priority
Maintain a dedicated Emergency Operations Center with 24 hr capability and backup location	All	High
Development and promotion of the Wapello Ready Alerts program that is part of the statewide Alert Iowa system	All	High
Acquire backup generators for shelters to be used in event of a power loss	Tornado	High
Improve process for reporting utility outages between utilities and public safety	All	High
Implement MABAS (Mutual Aid Box Alarm System)	All	High
Provide public education on hazards	All	High
Encourage the use of NOAA All Hazards Alert Radios	All	High
Encourage citizens to create a family preparedness kit	All	High
Promote active public participation including efforts to check in on elderly populations during an event	All	High
Develop debris disposal sites	All	Medium
Enforce burning restrictions to lower fire risk	Drought	Medium
Maintain snowplow/snow removal equipment and enact policies for access to emergency services during extreme weather events	Severe Winter Storm, Tornado	Medium
Designate shelters with backup power	All	Medium
Encourage owners of manufactured housing communities and schools to build shelters	Tornado	Low
Install outdoor siren	Tornado	Medium
Install buffer strips against river/flash flooding	River Flood & Flash Flood	Low
Develop soil erosion stabilization projects	River Flood & Flash Flood	Low
Develop stream modification	River Flood & Flash Flood	Low
Implement channel improvement projects	River Flood & Flash Flood	Low
Provide for back up of records and files and an alternate location for storage of backup	River Flood, Flash Flood, Tornado	Low

Plan Adoption Resolution



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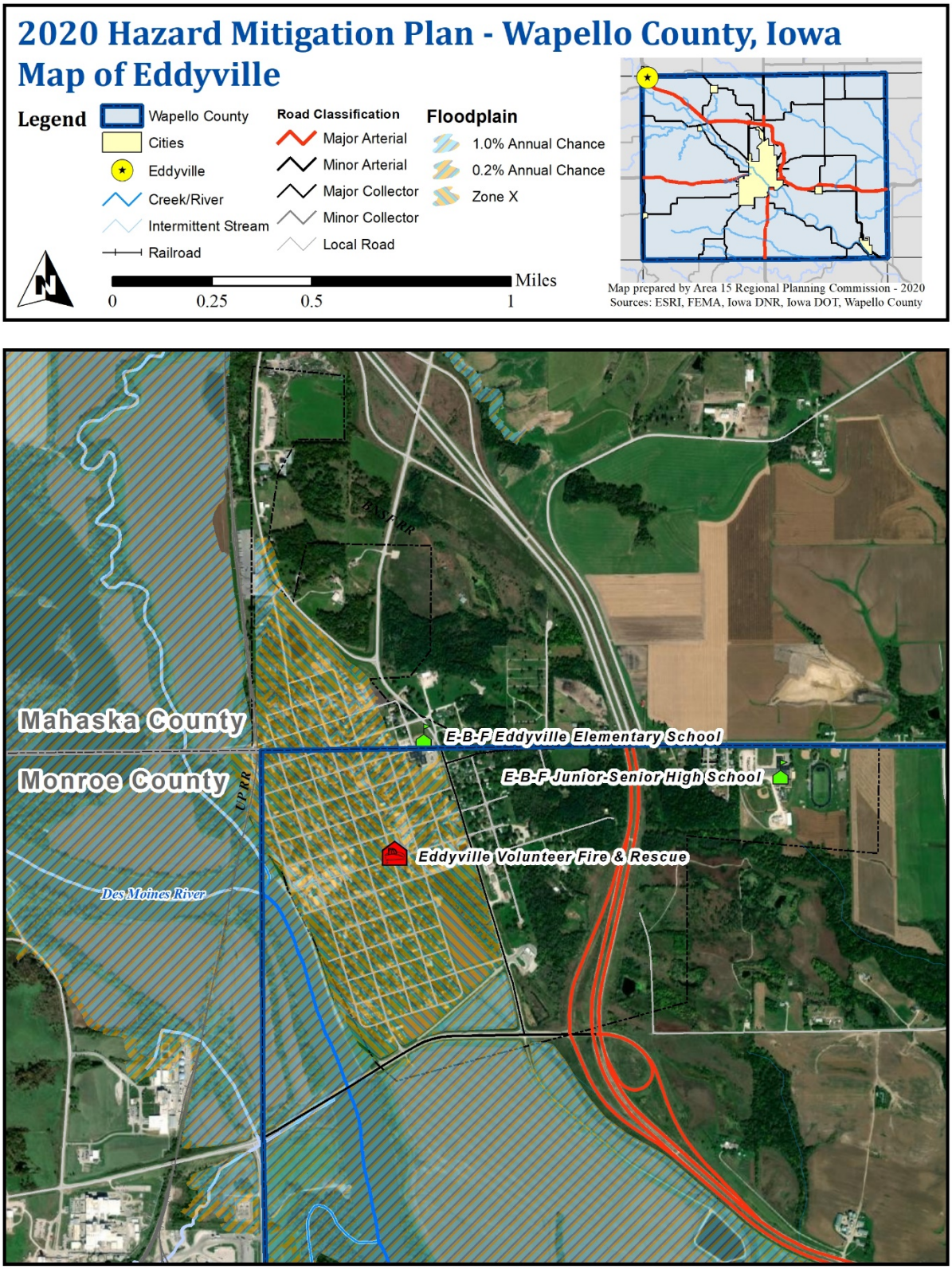
City of Eddyville



Eddyville at a Glance

Demographics		Workforce	
Total Population	1,024	Total Labor Force	409
Median Age	38.4	Employed	371 (90.7%)
65 Years and Over	13.6%	Time Travel to Work	16.6 min.

Household/Income		Property Valuations	
Median Household Income	$35,885	Residential	$2,744,588
Per Capita Income	$20,323	Commercial	$2,731,950
Average Household Size	2.49	Industrial/Agricultural	$27,477

Housing		Regulatory Information	
Total Housing Units	424	Flood Insurance Rate Map	Yes
Occupied Housing Units	411	NFIP Participant	Yes
Housing Units removed/demolished since 2015	0	Comprehensive Plan	No
Building Permits	Yes	Zoning/Land Use Ordinance	Yes
New Building Permits Since 2015	0	Subdivision Ordinance	No

Service	Provider(s)
Electric	Alliant Energy
Natural Gas	MidAmerican Energy
Water	Wapello Rural Water Association
Sewage Treatment	City of Eddyville
Telephone	Mediacom; Windstream
Internet	Windstream
Ambulance	ORMICS
Fire Protection	Eddyville Volunteer Fire Dept.
Police/Law Enforcement	Mahaska/Wapello County Sheriff

Structures			
Residential	Commercial	Industrial	Public
290	28	0	19

Sources: U.S. Census Bureau (2010), City of Eddyville (2020), Wapello County Assessor (2020)

Planning Process

The planning team utilized the public input gathered for the 2015 plan as the basis of this plan update. The 2015 Risk Assessment and Mitigation Strategies were reviewed by representatives from Eddyville. The planning team reviewed and collected new information from Eddyville representatives via email, phone, and surveys.

Hazard Risk Assessment

The Wapello County Hazard Mitigation planning team determined the countywide hazard rankings. The countywide hazard ranking was presented to the City. The City was asked to review the information from the countywide rankings and determine if highest risk hazards for the County applied to Eddyville, and if not, how the city's situation differs from that of the county.

Based on this discussion, relevant hazards were determined for Eddyville, which included changes from the County rankings, as shown in Table 7.7. Eddyville may be susceptible to other hazards, but those hazards are not considered to be high-risk and were not examined in detail. However, if circumstances change and it is determined that a hazard does pose a risk to Eddyville, it will be examined at that time or when the plan is updated.

Table 7.7. Eddyville Hazard Risk Assessment

Rank	Hazard	Risk
1	Thunderstorm/Lighting/Hail	High
2	Tornado/Windstorm	High
3	Dam/Levee Failure	High
4	Flash Flood	High
5	River Flood	High
6	Severe Winter Storm	High
7	Extreme Heat	Moderate
8	Drought	Moderate
9	Sinkhole	Low
10	Landslide	Low
11	Expansive Soils	Low
12	Earthquake	Low

Review of Existing Plans

In the preparation of this plan, existing plans and other technical information was considered. The purpose of this review was to consider existing information before setting future mitigation goals. The following local documents were identified and reviewed by the City of Eddyville to evaluate current mitigation efforts underway:

- Eddyville Municipal Codebook of Ordinances, 2014

Mitigation Strategy

The City reviewed the mitigation actions identified in the 2015 plan, the mitigation actions carried out since its adoption, and potential mitigation actions to be undertaken in the future and discussed this with the planning team.

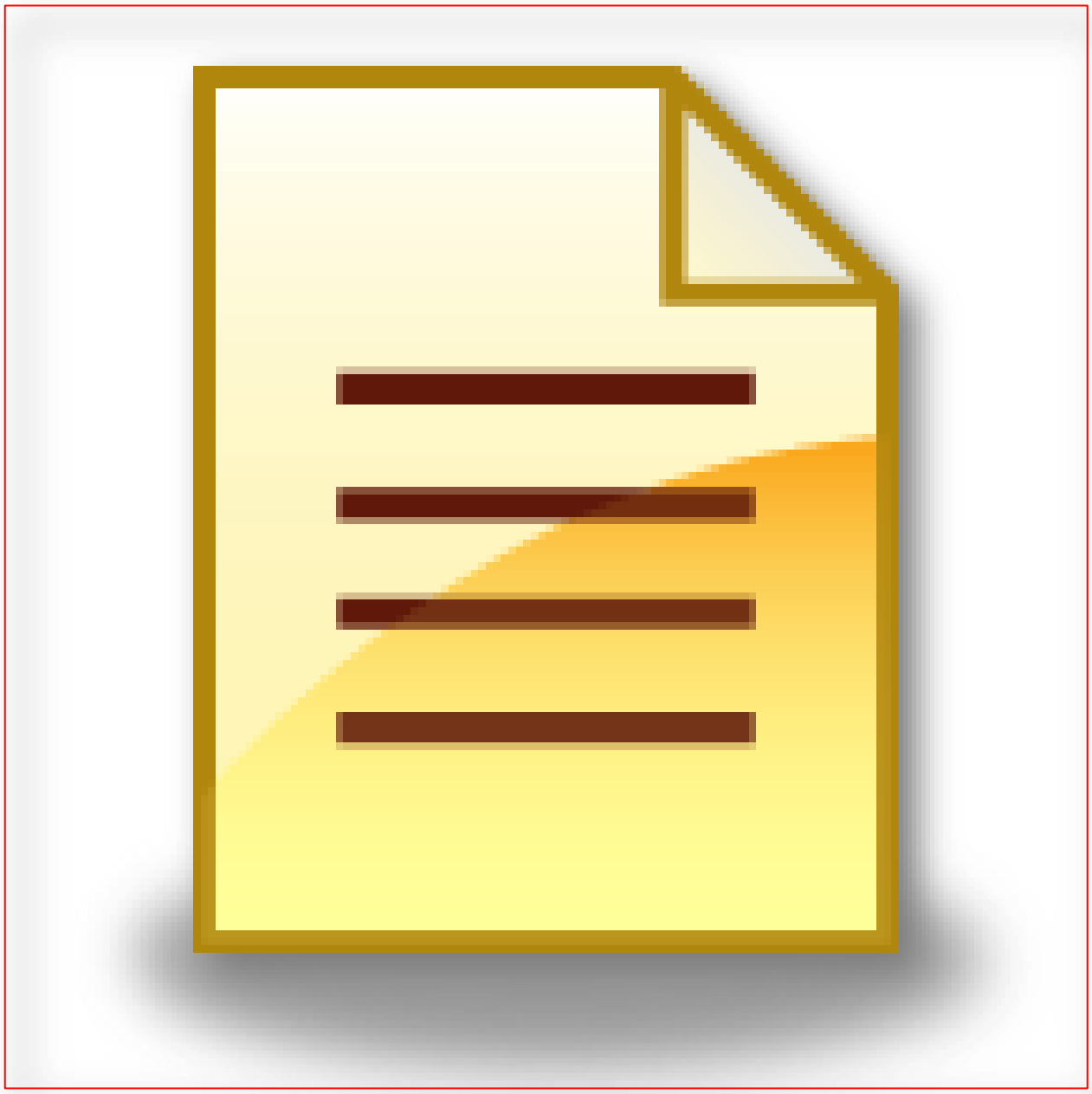
Future Mitigation Actions

The City's priority list of future mitigation actions appears in Table 7.8. Actions will be undertaken as funding becomes available. Realistically, the priority of the projects is dynamic and is largely dependent on the time, place, imminent need, feasibility, and opportunity.

Table 7.8. Eddyville Hazard Mitigation Actions

Mitigation Project/Activity	Hazard(s) Addressed	Priority
Maintain a dedicated Emergency Operations Center with 24 hr capability and backup location	All	High
Development and promotion of the Wapello Ready Alerts program that is part of the statewide Alert Iowa system	All	High
Continual monitoring of river levels and forecasts. Maintain situational awareness in EOC	Levee Failure	High
Provide a public accessible data center online for the public	Flooding	High
Acquire backup generators for shelters to be used in event of a power loss	Tornado	High
Improve process for reporting utility outages between utilities and public safety	All	High
Implement MABAS (Mutual Aid Box Alarm System)	All	High
Provide public education on hazards	All	High
Encourage the use of NOAA All Hazards Alert Radios	All	High
Encourage citizens to create a family preparedness kit	All	High
Promote active public participation including efforts to check in on elderly populations during an event	All	High
Develop debris disposal sites	All	Medium
Enforce burning restrictions to lower fire risk	Drought	Medium
Maintain snowplow/snow removal equipment and enact policies for access to emergency services during extreme weather events	Severe Winter Storm, Tornado	Medium
Designate shelters with backup power	All	Medium
Encourage owners of manufactured housing communities and schools to build shelters	Tornado	Low
Maintain levee maintenance programs and inspections	Levee Failure	High
Maintain dam inspections & maintenance as required	Dam Failure	High
Maintain watershed. Ensure that drainage flow is not disrupted	Dam Failure	Medium
Construct storm sewer drainage	Levee Failure, Flash Flood	High
Repair/replace sewer line	Levee Failure, Flash Flood	High
Install backup generator on well pumps	Levee Failure, Flash Flood	Medium
Install flood gates at railroad crossings	Flooding	Medium
Control flow of water to lessen shifting soil	Drought	Low
Install buffer strips against river/flash flooding	River Flood & Flash Flood	Low
Develop soil erosion stabilization projects	River Flood & Flash Flood	Low
Develop stream modification	River Flood & Flash Flood	Low
Implement channel improvement projects	River Flood & Flash Flood	Low
Provide for back up of records and files and an alternate location for storage of backup	River Flood, Flash Flood, Tornado	Low

Plan Adoption Resolution



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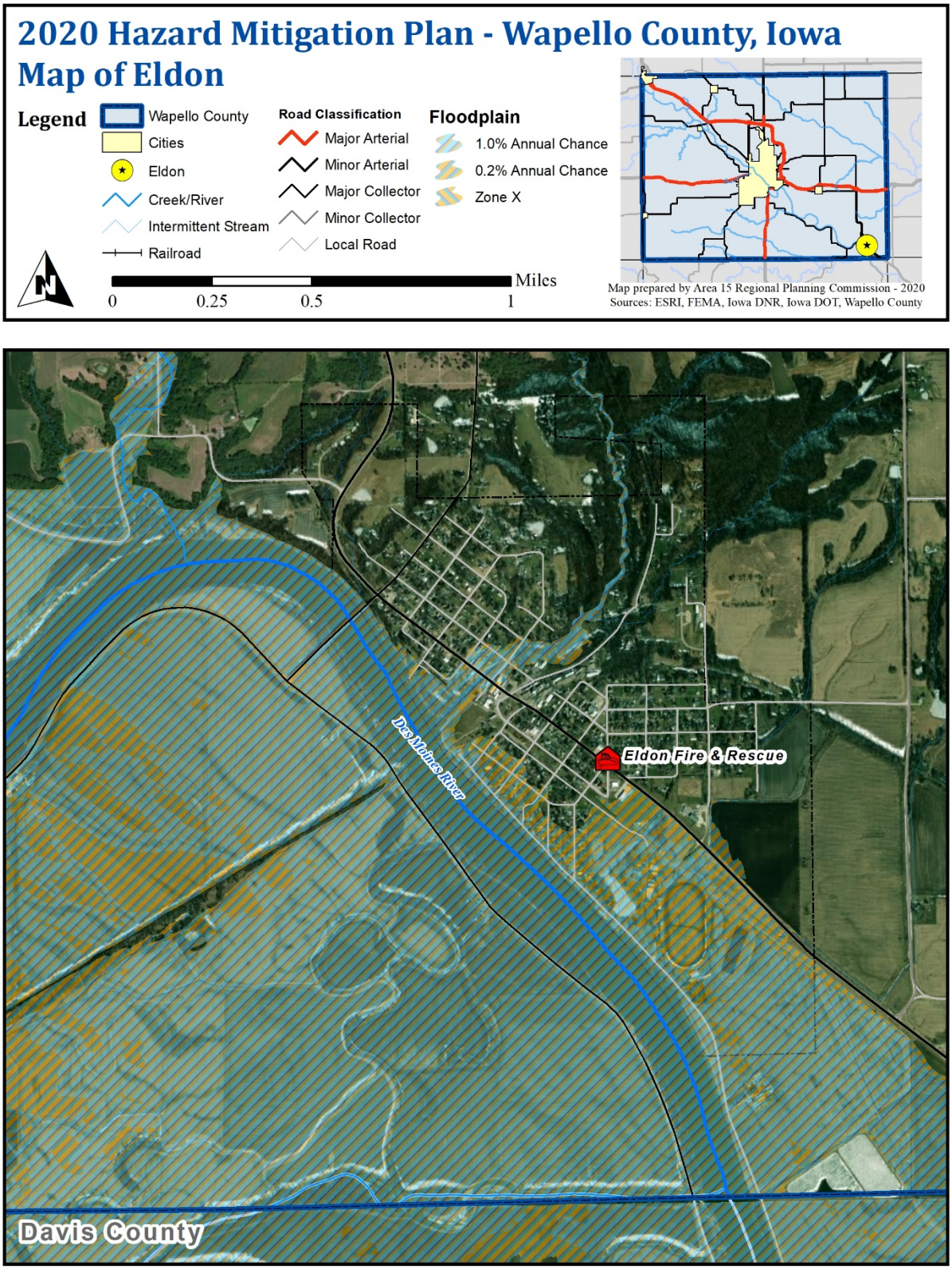
City of Eldon



Eldon at a Glance

Demographics		Workforce	
Total Population	927	Total Labor Force	455
Median Age	42.4	Employed	426 (93.6%)
65 Years and Over	17.5%	Time Travel to Work	29.3 min.

Household/Income		Property Valuations	
Median Household Income	$33,194	Residential	$15,579,846
Per Capita Income	$15,813	Commercial	$2,083,550
Average Household Size	2.16	Industrial/Agricultural	$101,130

Housing		Regulatory Information	
Total Housing Units	429	Flood Insurance Rate Map	Yes
Occupied Housing Units	394	NFIP Participant	Yes
Housing Units removed/demolished since 2015	0	Comprehensive Plan	No
Building Permits	Yes	Zoning/Land Use Ordinance	Yes
New Building Permits Since 2015	0	Subdivision Ordinance	Yes

Service	Provider(s)
Electric	Alliant Energy
Natural Gas	Alliant Energy
Water	Wapello Rural Water Association
Sewage Treatment	City of Eldon
Telephone	Mediacom; Windstream
Internet	Mediacom; Windstream
Ambulance	ORMICS
Fire Protection	Eldon Volunteer Fire Dept.
Police/Law Enforcement	Wapello County Sheriff

Structures			
Residential	Commercial	Industrial	Public
397	27	0	5

Sources: U.S. Census Bureau (2010), City of Eldon (2020), Wapello County Assessor (2020)

Planning Process

The planning team utilized the public input gathered for the 2015 plan as the basis of this plan update. The 2015 Risk Assessment and Mitigation Strategies were reviewed by representatives from Eldon. The planning team reviewed and collected new information from Eldon representatives via email, phone, and surveys.

Hazard Risk Assessment

The Wapello County Hazard Mitigation planning team determined the countywide hazard rankings. The countywide hazard ranking was presented to the City. The City was asked to review the information from the countywide rankings and determine if highest risk hazards for the County applied to Eldon, and if not, how the city's situation differs from that of the county.

Based on this discussion, relevant hazards were determined for Eldon, which included changes from the County rankings, as shown in Table 7.9. Eldon may be susceptible to other hazards, but those hazards are not considered to be high-risk and were not examined in detail. However, if circumstances change and it is determined that a hazard does pose a risk to Eldon, it will be examined at that time or when the plan is updated.

Table 7.9. Eldon Hazard Risk Assessment

Rank	Hazard	Risk
1	**Thunderstorm/Lighting/Hail**	High
2	**Tornado/Windstorm**	High
3	**Flash Flood**	High
4	**River Flood**	High
5	**Severe Winter Storm**	High
6	**Extreme Heat**	High
7	**Drought**	Moderate
8	**Sinkhole**	Moderate
9	**Dam/Levee Failure**	Low
10	**Landslide**	Low
11	**Expansive Soils**	Low
12	**Earthquake**	Low

Review of Existing Plans

In the preparation of this plan, existing plans and other technical information was considered. The purpose of this review was to consider existing information before setting future mitigation goals. The following local documents were identified and reviewed by the City of Eldon to evaluate current mitigation efforts underway:

- Eldon Municipal Codebook of Ordinances, 2015

Mitigation Strategy

The City reviewed the mitigation actions identified in the 2015 plan, the mitigation actions carried out since its adoption, and potential mitigation actions to be undertaken in the future and discussed this with the planning team.

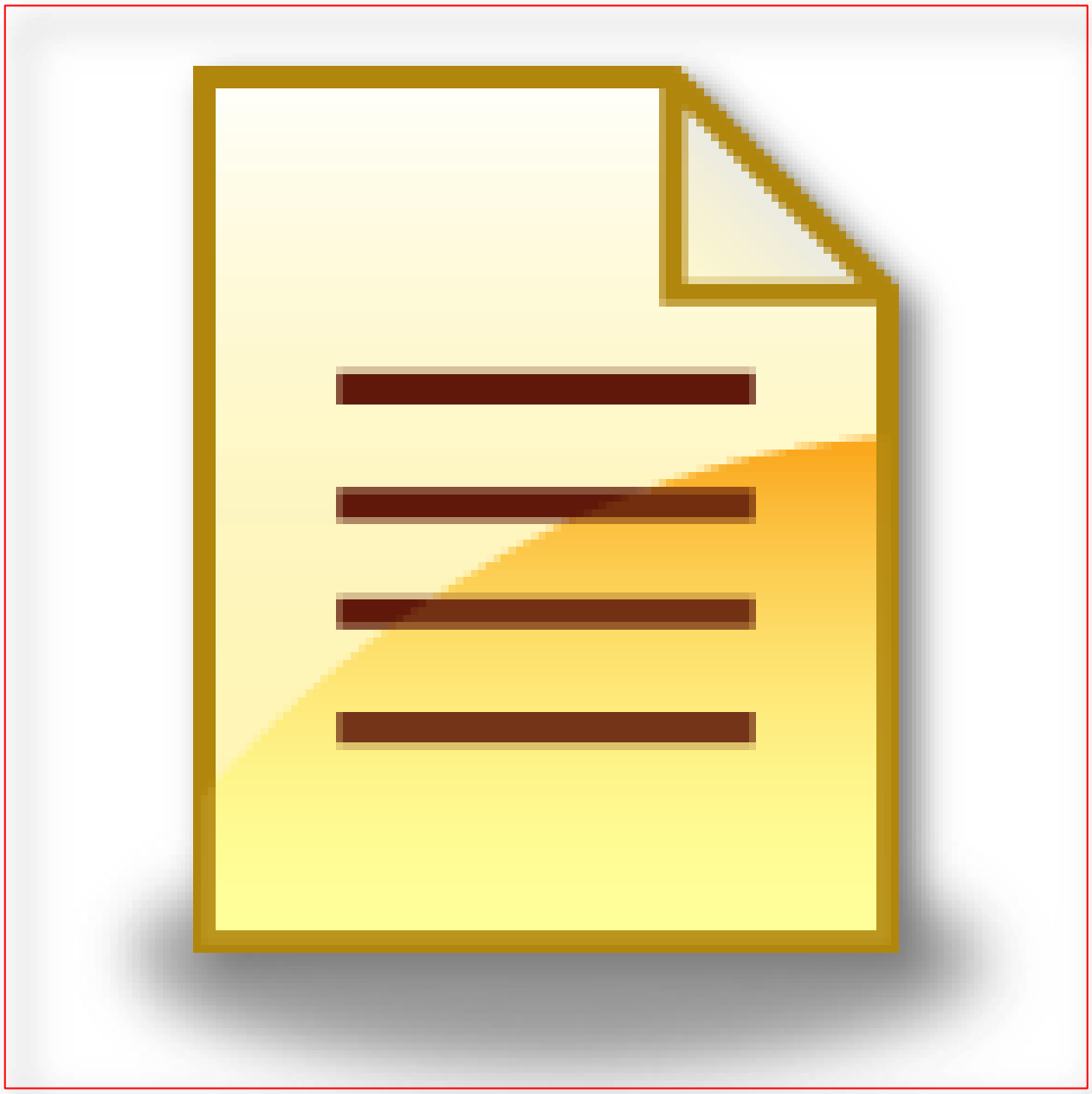
Future Mitigation Actions

The City's priority list of future mitigation actions appears in Table 7.10. Actions will be undertaken as funding becomes available. Realistically, the priority of the projects is dynamic and is largely dependent on the time, place, imminent need, feasibility, and opportunity.

Table 7.10. Eldon Hazard Mitigation Actions

Mitigation Project/Activity	Hazard(s) Addressed	Priority
Maintain a dedicated Emergency Operations Center with 24 hr capability and backup location	All	High
Development and promotion of the Wapello Ready Alerts program that is part of the statewide Alert Iowa system	All	High
Acquire backup generators for shelters to be used in event of a power loss	Tornado	High
Improve process for reporting utility outages between utilities and public safety	All	High
Implement MABAS (Mutual Aid Box Alarm System)	All	High
Provide public education on hazards	All	High
Encourage the use of NOAA All Hazards Alert Radios	All	High
Encourage citizens to create a family preparedness kit	All	High
Promote active public participation including efforts to check in on elderly populations during an event	All	High
Develop debris disposal sites	All	Medium
Enforce burning restrictions to lower fire risk	Drought	Medium
Maintain snowplow/snow removal equipment and enact policies for access to emergency services during extreme weather events	Severe Winter Storm, Tornado	Medium
Designate shelters with backup power	All	Medium
Encourage owners of manufactured housing communities and schools to build shelters	Tornado	Low
Provide for backup power supply to sewer lift station	Tornado, River Flood, Flash Flood	Medium
Install buffer strips against river/flash flooding	River Flood & Flash Flood	Low
Develop soil erosion stabilization projects	River Flood & Flash Flood	Low
Develop stream modification	River Flood & Flash Flood	Low
Implement channel improvement projects	River Flood & Flash Flood	Low
Provide for back up of records and files and an alternate location for storage of backup	River Flood, Flash Flood, Tornado	Low

Plan Adoption Resolution



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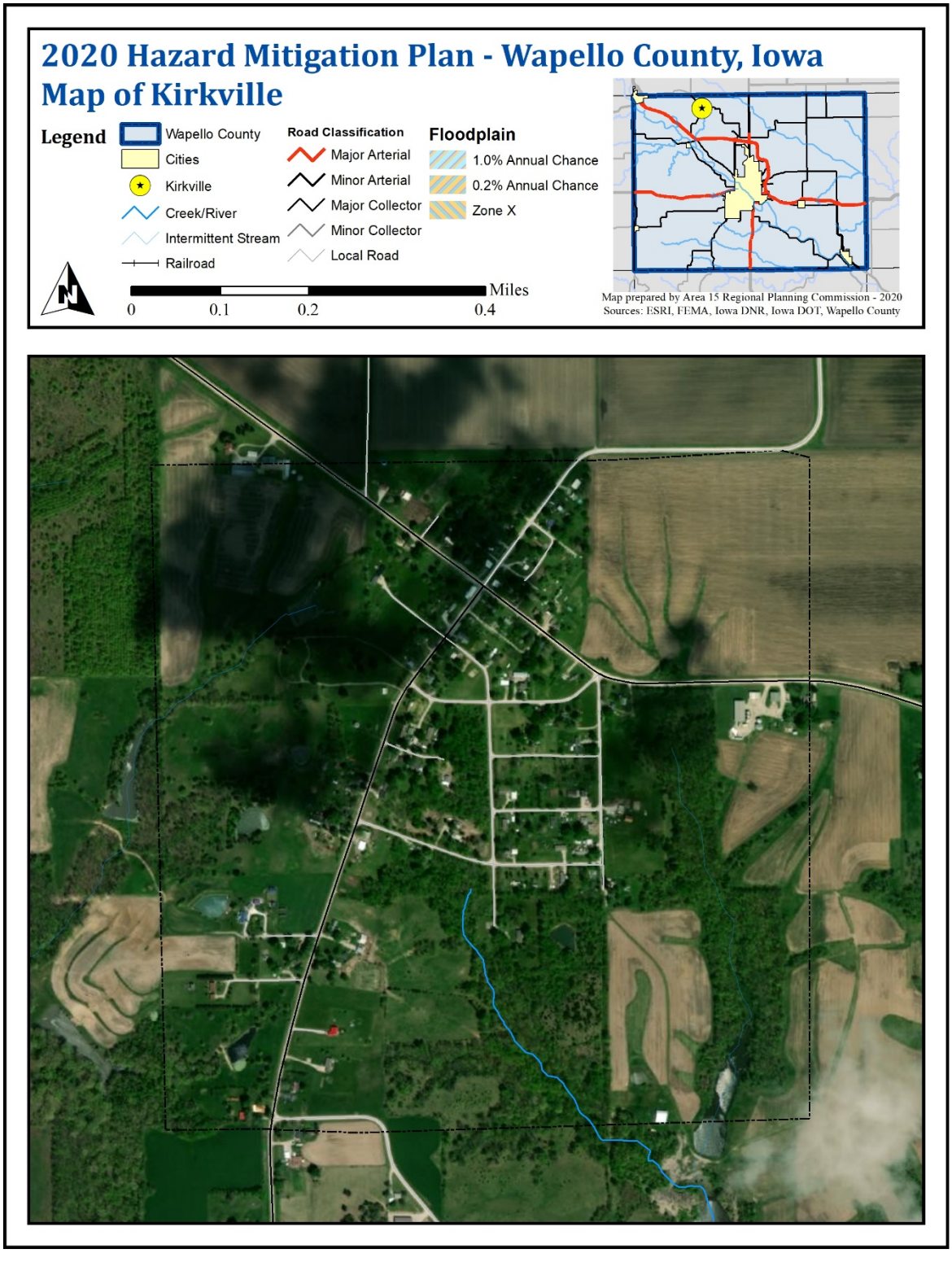
City of Kirkville



Kirkville at a Glance

Demographics		Workforce	
Total Population	167	Total Labor Force	61
Median Age	43.5	Employed	60 (99.9%)
65 Years and Over	10.8%	Time Travel to Work	33.4 min.

Household/Income		Property Valuations	
Median Household Income	$57,857	Residential	$3,629,530
Per Capita Income	$28,568	Commercial	$9,180
Average Household Size	2.93	Industrial/Agricultural	$210,520

Housing		Regulatory Information	
Total Housing Units	74	Flood Insurance Rate Map	No
Occupied Housing Units	68	NFIP Participant	No
Housing Units removed/demolished since 2015	7	Comprehensive Plan	No
Building Permits	Yes	Zoning/Land Use Ordinance	Yes
New Building Permits Since 2015	7	Subdivision Ordinance	Yes

Service	Provider(s)
Electric	MidAmerican Energy
Natural Gas	N/A
Water	Wapello Rural Water Association
Sewage Treatment	Wapello Rural Water Association
Telephone	Windstream
Internet	Windstream
Ambulance	ORMICS
Fire Protection	Eddyville Volunteer Fire Dept.
Police/Law Enforcement	Wapello County Sheriff

Structures			
Residential	Commercial	Industrial	Public
69	2	0	1

Sources: U.S. Census Bureau (2010), Kirkville (2020), Wapello County Assessor (2020)

Planning Process

The planning team utilized the public input gathered for the 2015 plan as the basis of this plan update. The 2015 Risk Assessment and Mitigation Strategies were reviewed by representatives from Kirkville. The planning team reviewed and collected new information from Kirkville representatives via email, phone, and surveys.

Hazard Risk Assessment

The Wapello County Hazard Mitigation planning team determined the countywide hazard rankings. The countywide hazard ranking was presented to the City. The City was asked to review the information from the countywide rankings and determine if highest risk hazards for the County applied to Kirkville, and if not, how the city's situation differs from that of the county.

Based on this discussion, relevant hazards were determined for Kirkville, which included changes from the County rankings, as shown in Table 7.11. Kirkville may be susceptible to other hazards, but those hazards are not considered to be high-risk and were not examined in detail. However, if circumstances change and it is determined that a hazard does pose a risk to Kirkville, it will be examined at that time or when the plan is updated.

Table 7.11. Kirkville Hazard Risk Assessment

Rank	Hazard	Risk
1	**Thunderstorm/Lighting/Hail**	High
2	**Tornado/Windstorm**	High
3	**Flash Flood**	High
4	**Severe Winter Storm**	High
5	**Extreme Heat**	High
6	**Drought**	High
7	**Sinkhole**	Moderate
8	**Dam/Levee Failure**	Low
9	**Landslide**	Low
10	**Expansive Soils**	Low
11	**River Flood**	Low
12	**Earthquake**	Low

Review of Existing Plans

In the preparation of this plan, existing plans and other technical information was considered. The purpose of this review was to consider existing information before setting future mitigation goals. The following local documents were identified and reviewed by the City of Kirkville to evaluate current mitigation efforts underway:

- Kirkville Municipal Codebook of Ordinances, 2015

Mitigation Strategy

The City reviewed the mitigation actions identified in the 2015 plan, the mitigation actions carried out since its adoption, and potential mitigation actions to be undertaken in the future and discussed this with the planning team.

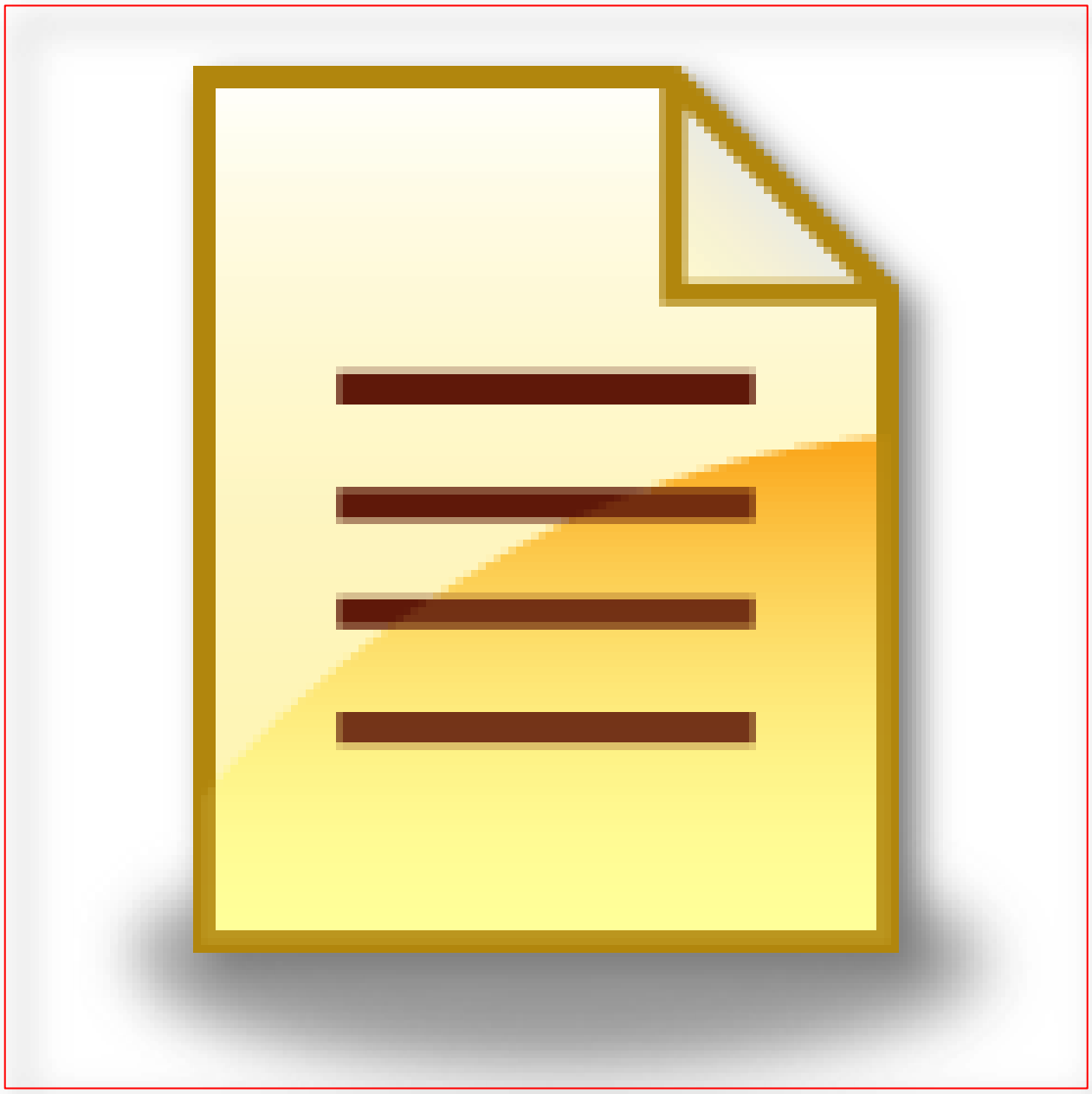
Future Mitigation Actions

The City's priority list of future mitigation actions appears in Table 7.12. Actions will be undertaken as funding becomes available. Realistically, the priority of the projects is dynamic and is largely dependent on the time, place, imminent need, feasibility, and opportunity.

Table 7.12. Kirkville Hazard Mitigation Actions

Mitigation Project/Activity	Hazard(s) Addressed	Priority
Maintain a dedicated Emergency Operations Center with 24 hr capability and backup location	All	High
Development and promotion of the Wapello Ready Alerts program that is part of the statewide Alert Iowa system	All	High
Acquire backup generators for shelters to be used in event of a power loss	Tornado	High
Improve process for reporting utility outages between utilities and public safety	All	High
Implement MABAS (Mutual Aid Box Alarm System)	All	High
Provide public education on hazards	All	High
Encourage the use of NOAA All Hazards Alert Radios	All	High
Encourage citizens to create a family preparedness kit	All	High
Promote active public participation including efforts to check in on elderly populations during an event	All	High
Develop debris disposal sites	All	Medium
Maintain snowplow/snow removal equipment and enact policies for access to emergency services during extreme weather events	Severe Winter Storm, Tornado	Medium
Install outdoor siren	Tornado	Medium
Designate shelters with backup power	All	Medium
Encourage owners of manufactured housing communities and schools to build shelters	Tornado	Low
Fill in abandoned mines and wells once discovered	Landslides	Low
Provide for back up of records and files and an alternate location for storage of backup	River Flood, Flash Flood, Tornado	Low

Plan Adoption Resolution



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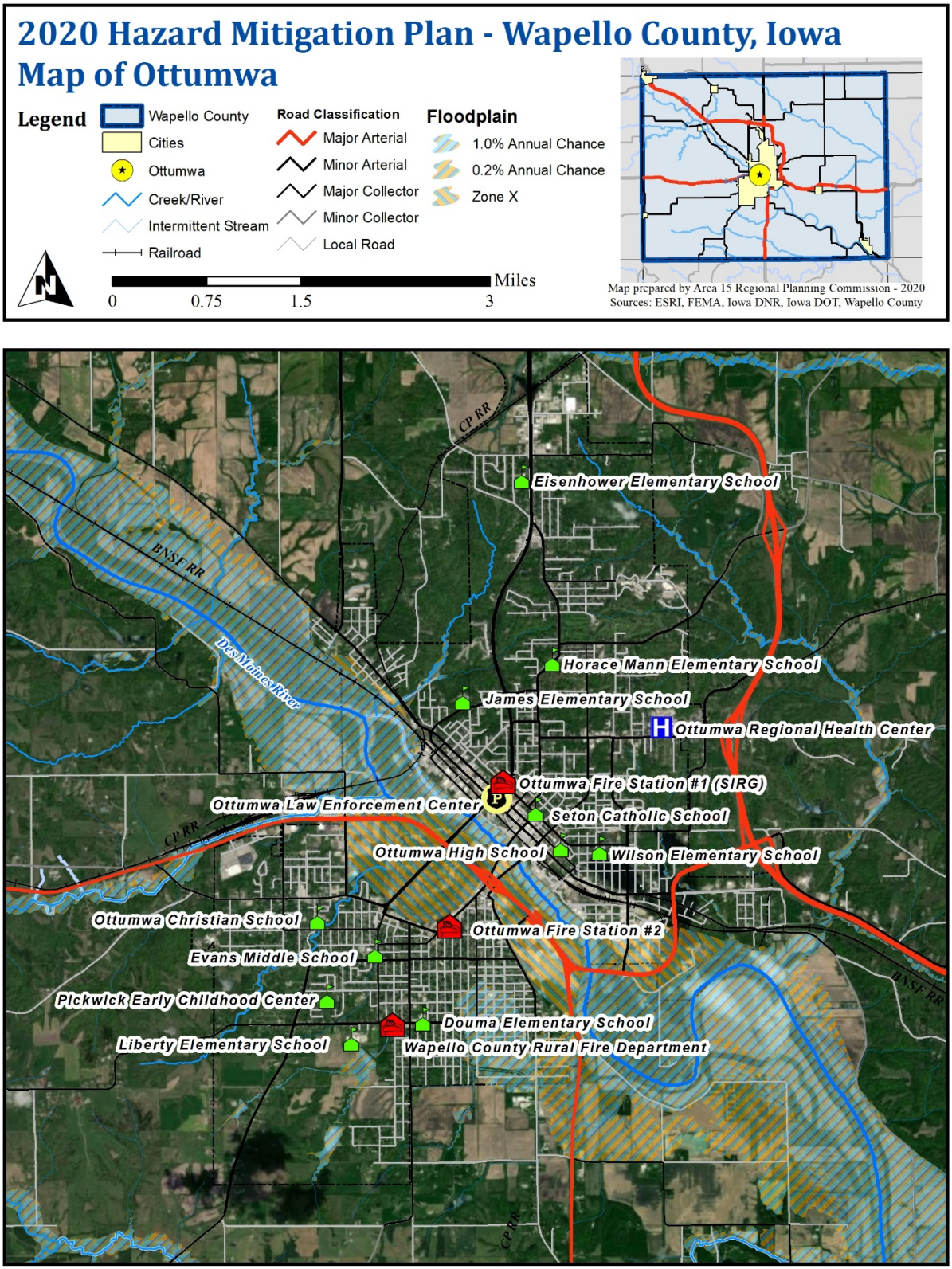
City of Ottumwa



Ottumwa at a Glance

Demographics		Workforce	
Total Population	25,023	Total Labor Force	13,090
Median Age	37.4	Employed	11,861 (90.6%)
65 Years and Over	16%	Time Travel to Work	15.4 min.

Household/Income		Property Valuations	
Median Household Income	$35,540	Residential	$699,469,811
Per Capita Income	$24,889	Commercial	$210,755,653
Average Household Size	2.36	Industrial/Agricultural	$35,601,031

Housing		Regulatory Information	
Total Housing Units	11,564	Flood Insurance Rate Map	Yes
Occupied Housing Units	10,491	NFIP Participant	Yes
Housing Units removed/demolished since 2015	84	Comprehensive Plan	Yes
Building Permits	Yes	Zoning/Land Use Ordinance	Yes
New Building Permits Since 2015	29	Subdivision Ordinance	Yes

Service	Provider(s)
Electric	Alliant Energy
Natural Gas	MidAmerican Energy
Water	Ottumwa Water and Hydro
Sewage Treatment	City of Ottumwa
Telephone	Mediacom; Windstream
Internet	Mediacom; Windstream
Ambulance	ORMICS
Fire Protection	City of Ottumwa
Police/Law Enforcement	City of Ottumwa

Structures			
Residential	Commercial	Industrial	Public
9,135	540	11	29

Sources: U.S. Census Bureau (2010), City of Ottumwa (2020), Wapello County Assessor (2020)

Planning Process

The planning team utilized the public input gathered for the 2015 plan as the basis of this plan update. The 2015 Risk Assessment and Mitigation Strategies were reviewed by representatives from Ottumwa. The planning team reviewed and collected new information from Ottumwa representatives via email, phone, and surveys.

Hazard Risk Assessment

The Wapello County Hazard Mitigation planning team determined the countywide hazard rankings. The countywide hazard ranking was presented to the City. The City was asked to review the information from the countywide rankings and determine if highest risk hazards for the County applied to Ottumwa, and if not, how the city's situation differs from that of the county.

Based on this discussion, relevant hazards were determined for Ottumwa, which included changes from the County rankings, as shown in Table 7.13. Ottumwa may be susceptible to other hazards, but those hazards are not considered to be high-risk and were not examined in detail. However, if circumstances change and it is determined that a hazard does pose a risk to Ottumwa, it will be examined at that time or when the plan is updated.

Table 7.13. Ottumwa Hazard Risk Assessment

Rank	Hazard	Risk
1	**Thunderstorm/Lighting/Hail**	Moderate
2	**Tornado/Windstorm**	Moderate
3	**Flash Flood**	Moderate
4	**Severe Winter Storm**	Moderate
5	**River Flood**	Moderate
6	**Drought**	Moderate
7	**Extreme Heat**	Low
8	**Dam/Levee Failure**	Low
9	**Landslide**	Low
10	**Expansive Soils**	Low
11	**Sinkhole**	Low
12	**Earthquake**	Low

Review of Existing Plans

In the preparation of this plan, existing plans and other technical information was considered. The purpose of this review was to consider existing information before setting future mitigation goals. The following local documents were identified and reviewed by the City of Ottumwa to evaluate current mitigation efforts underway:

- Ottumwa Municipal Codebook of Ordinances, 2018

Mitigation Strategy

The City reviewed the mitigation actions identified in the 2015 plan, the mitigation actions carried out since its adoption, and potential mitigation actions to be undertaken in the future and discussed this with the planning team.

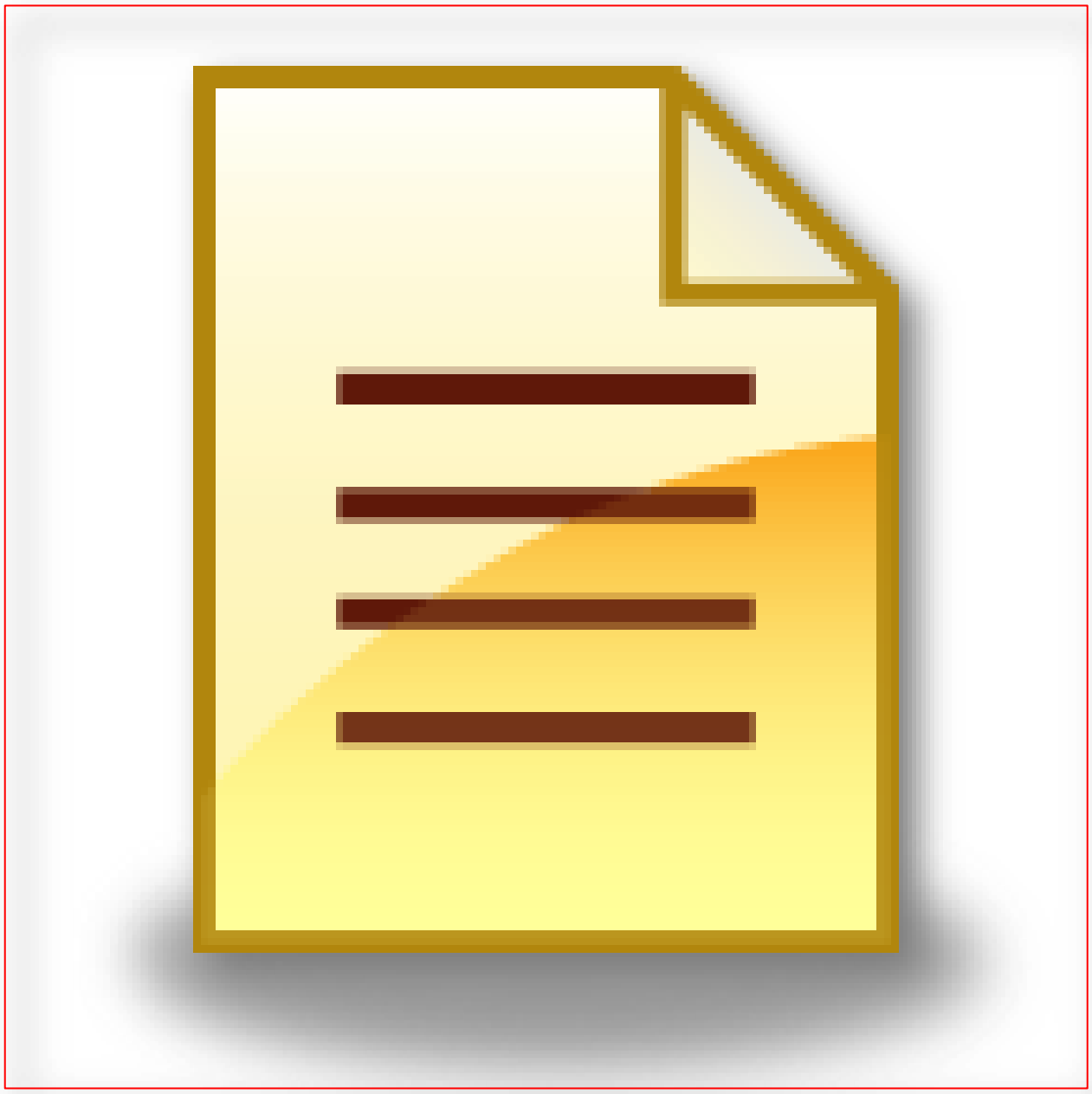
Future Mitigation Actions

The City's priority list of future mitigation actions appears in Table 7.14. Actions will be undertaken as funding becomes available. Realistically, the priority of the projects is dynamic and is largely dependent on the time, place, imminent need, feasibility, and opportunity.

Table 7.14. Ottumwa Hazard Mitigation Actions

Mitigation Project/Activity	Hazard(s) Addressed	Priority
Maintain a dedicated Emergency Operations Center with 24 hr capability and backup location	All	High
Development and promotion of the Wapello Ready Alerts program that is part of the statewide Alert Iowa system	All	High
Continual monitoring of river levels and forecasts. Maintain situational awareness in EOC	Levee Failure	High
Provide a public accessible data center online for the public	Flooding	High
Acquire backup generators for shelters to be used in event of a power loss	Tornado	High
Improve process for reporting utility outages between utilities and public safety	All	High
Implement MABAS (Mutual Aid Box Alarm System)	All	High
Provide public education on hazards	All	High
Encourage the use of NOAA All Hazards Alert Radios	All	High
Encourage citizens to create a family preparedness kit	All	High
Promote active public participation including efforts to check in on elderly populations during an event	All	High
Develop debris disposal sites	All	Medium
Enforce burning restrictions to lower fire risk	Drought	Medium
Maintain snowplow/snow removal equipment and enact policies for access to emergency services during extreme weather events	Severe Winter Storm, Tornado	Medium
Designate shelters with backup power	All	Medium
Encourage owners of manufactured housing communities and schools to build shelters	Tornado	Low
Maintain levee maintenance programs and inspections	Levee Failure	High
Maintain dam inspections & maintenance as required	Dam Failure	High
Maintain watershed. Ensure that drainage flow is not disrupted	Dam Failure	Medium
Install buffer strips against river/flash flooding	River Flood & Flash Flood	Low
Develop soil erosion stabilization projects	River Flood & Flash Flood	Low
Develop stream modification	River Flood & Flash Flood	Low
Implement channel improvement projects	River Flood & Flash Flood	Low
Provide for back up of records and files and an alternate location for storage of backup	River Flood, Flash Flood, Tornado	Low

Plan Adoption Resolution



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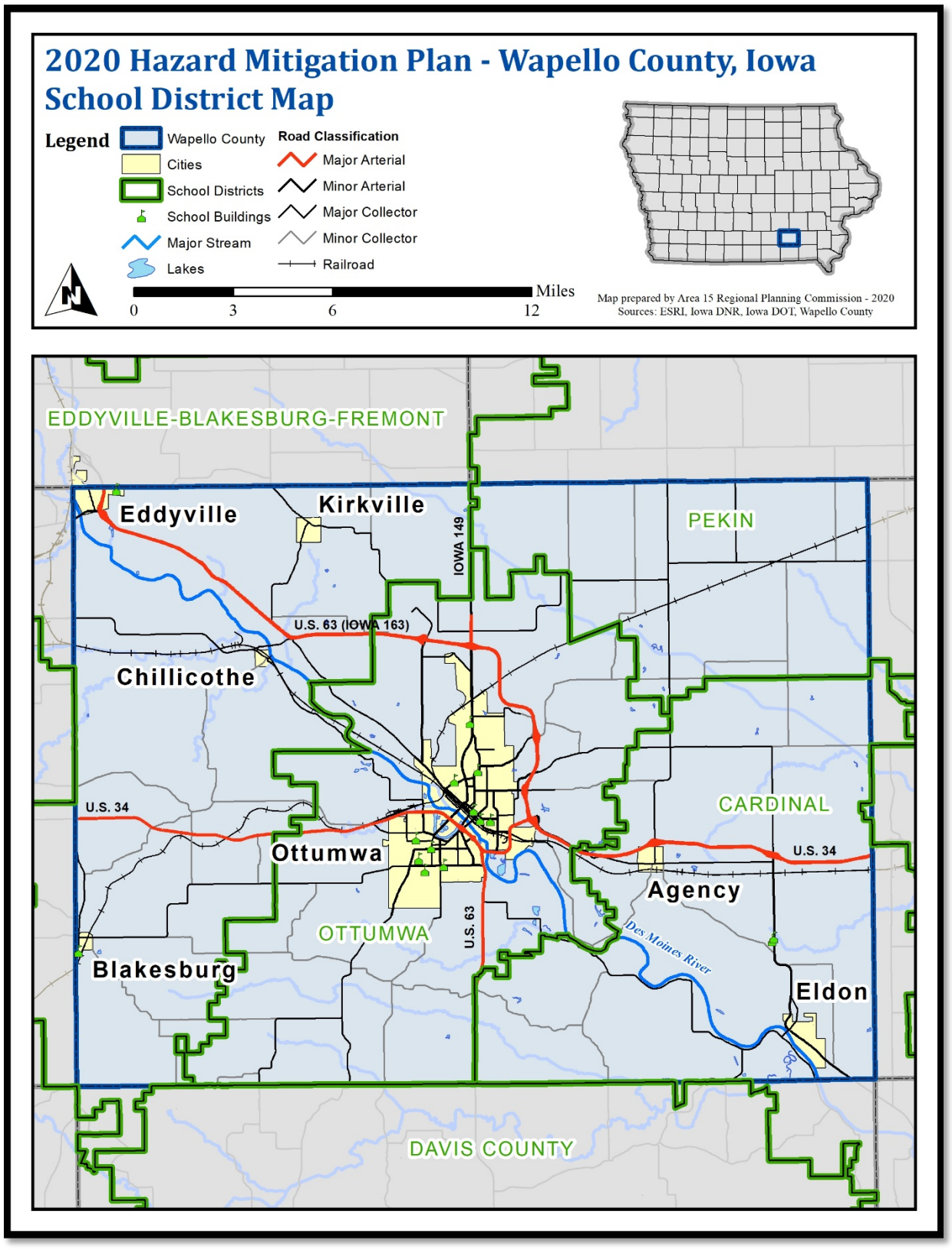
Wapello County School Districts



Planning Process

The planning team utilized the public input gathered for the 2015 plan as the basis of this plan update. The 2015 Risk Assessment and Mitigation Strategies were reviewed by representatives from each school district. The planning team reviewed and collected new information from school district representatives via email, phone, and surveys.

Mitigation Strategy

School district representatives reviewed the mitigation actions identified in the 2015 plan, the mitigation actions carried out since its adoption, and potential mitigation actions to be undertaken in the future and discussed this with the planning team.

Future Mitigation Actions

The list of future mitigation actions for Wapello County school districts appears in Table 7.15. Actions will be undertaken as funding becomes available. Realistically, the priority of the projects is dynamic and is largely dependent on the time, place, imminent need, feasibility, and opportunity.

Table 7.15. Wapello County School District Mitigation Actions

Mitigation Project/Activity	Hazard(s) Addressed	Priority
Maintain a dedicated Emergency Operations Center with 24 hr capability and backup location	All	High
Development and promotion of the Wapello Ready Alerts program that is part of the statewide Alert Iowa system	All	High
Acquire backup generators for shelters to be used in event of a power loss	Tornado	High
Improve process for reporting utility outages between utilities and public safety	All	High
Implement MABAS (Mutual Aid Box Alarm System)	All	High
Provide public education on hazards	All	High
Encourage the use of NOAA All Hazards Alert Radios	All	High
Encourage citizens to create a family preparedness kit	All	High
Promote active public participation including efforts to check in on elderly populations during an event	All	High
Develop debris disposal sites	All	Medium
Enforce burning restrictions to lower fire risk	Drought	Medium
Maintain snowplow/snow removal equipment and enact policies for access to emergency services during extreme weather events	Severe Winter Storm, Tornado	Medium
Designate shelters with backup power	All	Medium
Encourage owners of manufactured housing communities and schools to build shelters	Tornado	Low
Provide for back up of records and files and an alternate location for storage of backup	River Flood, Flash Flood, Tornado	Low

Section 8: Appendices

Appendix A – 44 CFR § 201.6 – Local Mitigation Plans

Appendix B – Glossary

Appendix C – FEMA Preparedness List

Appendix D – Disaster Declarations in Iowa: 1990-2019

Appendix E – Planning Meeting Participation

Appendix F – Image Credits

Appendix G – Local Plan Data & Information

Appendix H – Information for Future Plan Updates

Appendix I – Mitigation Actions Addendum

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