

**OREGON COUNTY, MISSOURI  
HAZARD MITIGATION PLAN  
2021 UPDATE**

# Table of Contents

<b>Contributors</b> .....	ii
<b>Executive Summary</b> .....	iii
<b>Prerequisites</b> .....	vi
<b>1 - Introduction and Planning Process</b> .....	1.1
1.1 - Purpose .....	1.2
1.2 - Background and Scope .....	1.2
1.3 - Plan Organization .....	1.3
1.4 - Planning Process .....	1.5
1.4.1 – Multi-Jurisdictional Participation .....	1.7
1.4.2 – The Planning Steps .....	1.9
<b>2 – Planning Area Profile and Capabilities</b> .....	2.1
2.1 – Douglas County Planning Area Profile .....	2.2
2.1.1 – Geography, Geology, and Topography .....	2.3
2.1.2 - Climate .....	2.3
2.1.3 - Demographics .....	2.4
2.1.4 - History .....	2.5
2.1.5 - Occupations .....	2.6
2.1.6 - Agriculture .....	2.6
2.1.7 – FEMA Hazard Mitigation Assistance Grants in Planning Area .....	2.7
2.1.8 – FEMA Public Assistance (PA) Grants in Planning Area .....	2.7
2.2 – Jurisdictional Profiles and Mitigation Capabilities .....	2.10
2.2.1 – Unincorporated Douglas County, Missouri .....	2.11
2.2.2 – City of Alton .....	2.15
2.2.3 – City of Koshkonong .....	2.17
2.2.4 – City of Thayer .....	2.19
2.2.5 – Public School District Profiles and Mitigation Capabilities .....	2.23
2.2.6 – Alton R-IV School District .....	2.24
2.2.7 – Couch R-I School District .....	2.25
2.2.8 – Oregon-Howell R-III School District .....	2.26

2.2.9 – Thayer R-II School District .....	2.27
<b>3 – Risk Assessment .....</b>	<b>3.1</b>
3.1 – Hazard Identification.....	3.3
3.1.1 – Review of Existing Mitigation Plans .....	3.3
3.1.2 – Review of Disaster Declaration History.....	3.4
3.1.3 – Research Additional Sources.....	3.7
3.1.4 – Hazards Identified .....	3.9
3.1.5 – Multi-Jurisdictional Risk Assessment .....	3.10
3.2 – Assets at Risk.....	3.10
3.2.1 – Total Exposure of Population and Structures .....	3.11
3.2.2 – Critical and Essential Facilities and Infrastructure .....	3.13
3.2.3 – Other Assets.....	3.14
3.3 – Land Use and Development .....	3.16
3.3.1 – Development Since Previous Plan Update.....	3.16
3.3.2 – Future Land Use and Development .....	3.18
3.4 – Hazard Profiles, Vulnerability, and Problem Statements.....	3.19
3.4.1 - Flooding .....	3.21
3.4.2 - Dam Failure.....	3.31
3.4.3 - Earthquakes .....	3.40
3.4.4 – Land Subsidence / Sinkholes.....	3.46
3.4.5 – Drought .....	3.49
3.4.6 – Extreme Temperatures .....	3.54
3.4.7 – Severe Thunderstorms (including high wind, hail & lightning).....	3.60
3.4.8 – Severe Winter Weather .....	3.67
3.4.9 - Tornado.....	3.73
3.4.10 - Wildfire .....	3.79
<b>4 – Mitigation Strategy.....</b>	<b>4.1</b>
4.1 - Goals .....	4.2
4.2 – Identification and Analysis of Mitigation Actions .....	4.3
4.3 – Implementation of Mitigation Actions.....	4.6
<b>5 – Plan Maintenance Process .....</b>	<b>5.1</b>

5.1 – Monitoring, Evaluating, and Updating the Plan .....	5.2
5.1.1 – Responsibility for Plan Maintenance .....	5.2
5.1.2 – Plan Maintenance Schedule.....	5.3
5.1.3 – Plan Maintenance Process .....	5.3
5.2 – Incorporation into Existing Planning Mechanisms.....	5.4
5.3 – Continued Public Involvement.....	5.5
<b>Appendix A – Planning Participation Documentation .....</b>	<b>A1</b>
<b>Appendix B – Completed &amp; Deleted Mitigation Actions.....</b>	<b>A10</b>
<b>Appendix C – Public Engagement.....</b>	<b>A12</b>
<b>Appendix D – Jurisdictional Adoption Documentation.....</b>	<b>A19</b>



# Table of Contents

*CONTRIBUTORS* ..... *ii*  
*EXECUTIVE SUMMARY* ..... *iii*  
*PREREQUISITES* ..... *vi*

## CONTRIBUTORS

### Douglas County, Missouri Hazard Mitigation Planning Committee

#### Jurisdictional Representatives

Name	Title	Department	Jurisdiction
David Stubblefield	Presiding Commissioner	County	Oregon County
Rusty Warren	Police Chief/EMD	City	City of Alton
George Hunt	Mayor	City	City of Koshkonong
Mark Arnold	EMD/Fire Chief	City	City of Thayer
Eric Allen	Superintendent	School	Alton Schools
Jean Meyer	Superintendent	School	Couch Schools
Seth Bryant	Superintendent	School	Oregon-Howell Schools
Tonya Woods	Superintendent	School	Thayer Schools

Based upon the risk assessment, the MPC updated goals for reducing risk from hazards. The goals are:

- (1) Protect the lives and property of all citizens;
- (2) Preserve functioning of civil government during natural disasters; and
- (3) Maintain economic activities essential to the recovery from natural disasters.

To advance the identified goals, the MPC developed recommended mitigation actions, which are detailed in Chapter 4 of this plan. The MPC developed an implementation plan for each action, which identifies priority level, background information, ideas for implementation, responsible agency, timeline, cost estimate, potential funding sources, and more

#### Stakeholder Representatives

Name	Title	Department	Jurisdiction
Rusty Warren	Police Chief	City	City of Alton
Terry Cline	Associate Commissioner	County	Oregon County
Jason Kemper	Associate Commissioner	County	Oregon County
Kent Edge	SEMA Regional Representative	State	State Emergency MGMT
Jessica Paulk	RHSOC Coordinator	Regional	Regional Planning Agency
Brent Collins	Clerk	City	City of Thayer
Tracy Bridges	Clerk	County	Oregon County
David Weyland	Utilities Chief	City	City of Alton
Amy Harrington	Clerk	City	City of Alton
Kathleen Crivello	Clerk	City	City of Koshkonong
Jack Reed	Public Works	City	City of Koshkonong

The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from hazards. County A and participating jurisdictions and school/special districts developed this multi-jurisdictional local hazard mitigation plan update to reduce future losses from hazard events to the County and its communities and school/special districts. The plan is an update of a plan that was approved on [insert date]. The plan and the update were prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 to result in eligibility for the Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance Grant Programs.

The County Multi-Hazard Mitigation Plan is a multi-jurisdictional plan that covers the following jurisdictions that participated in the planning process:

- Oregon County Commission
- City of Alton
- City of Koshkonong
- City of Thayer
- Alton R-IV
- Couch R-I
- Oregon-Howell R-III
- Thayer R-II

Oregon County and the entities listed above developed a Multi-Jurisdictional Hazard Mitigation Plan that was approved by FEMA on January 6, 2017 (hereafter referred to as the *2016 Hazard Mitigation Plan*). This current planning effort serves to update that previously approved plan.

The plan update process followed a methodology in accordance with FEMA guidance, which began with the formation of a Mitigation Planning Committee (MPC) comprised of representatives from County A and participating jurisdictions. The MPC updated the risk assessment that identified and profiled hazards that pose a risk to County A and analyzed jurisdictional vulnerability to these hazards. The MPC also examined the capabilities in place to mitigate the hazard damages, with emphasis on changes that have occurred since the previously approved plan was adopted. The MPC determined that the planning area is vulnerable to several hazards that are identified, profiled, and analyzed in this plan. Riverine and flash flooding, winter storms, severe thunderstorms/hail/lightning/high winds, and tornadoes are among the hazards that historically have had a significant impact.

Based upon the risk assessment, the MPC updated goals for reducing risk from hazards. The goals are listed below:

- (1) Protect the lives and property of all citizens;
- (2) Preserve functioning of civil government during natural disasters; and
- (3) Maintain economic activities essential to the recovery from natural disasters.

To advance the identified goals, the MPC developed recommended mitigation actions, as summarized in the table on the following pages. The MPC developed an implementation plan for each action, which identifies priority level, background information, ideas for implementation, responsible agency, timeline, cost estimate, potential funding sources, and more. These additional details are provided in Chapter 4.

**Table 1. Mitigation Action Matrix**

#	Action	Jurisdiction	Priority	Goals Addressed	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
1.1	Develop a coordinated plan to test outdoor warning sirens on a consistent basis	City of Alton	Medium	1	Tornado	✓	✓	✓
1.2	The city will attempt to improve floodplain management efforts by identification of map amendments/updates	City of Alton	Low	1	Flooding	✓	✓	✓
1.3	Work with city and county emergency management agencies and the local Red Cross to establish strategies for short term mass-care sheltering utilizing available school facilities	Alton R-IV School District	High	1	Tornado, Earthquake, Extreme Temp, Wildfire	✓	✓	
1.4	Construct a 361 design tornado saferoom on the school campus	Couch School District	High	1	Tornado	✓	✓	
1.5	Construct a 361 design tornado saferoom on the school campus	Oregon-Howell School District	High	1	Tornado	✓	✓	
1.6	Develop a coordinated plan to test outdoor warning sirens on a consistent basis	City of Thayer	Medium	1	Tornado	✓	✓	
1.7	Install three new outdoor warning sirens at strategic locations throughout the city	City of Alton	High	1	Tornado	✓	✓	
1.8	The city will attempt to improve floodplain management by identification of map amendments/updates	City of Thayer	Medium	1	Flooding	✓	✓	✓
1.9	Install four new outdoor warning sirens at strategic locations throughout the city	City of Thayer	High	1	Tornado	✓	✓	
1.10	Construct a 361 design tornado saferoom on the school campus	Thayer School District	High	1	Tornado	✓	✓	

#	Action	Jurisdiction	Priority	Goals Addressed	Hazards Addressed	Address Current Development	Address Future Development	Continued Compliance with NFIP
2.1	Purchase and install a backup generator at the sewage treatment facility	City of Alton	High	2	Thunderstorm/High Winds/Lightning/Hail	✓	✓	
2.2	Purchase and install a backup generator at the sewage treatment facility	City of Koshkonong	High	2	Thunderstorm/High Winds/Lightning/Hail	✓	✓	
2.3	Purchase and install a backup generator at the public well and pump house	City of Koshkonong	High	2	Thunderstorm/High Winds/Lightning/Hail	✓	✓	
2.4	Purchase and install a backup generator at the County Headquarters	Oregon County Commission	High	2	Thunderstorm/High Winds/Lightning/Hail	✓	✓	
2.5	Purchase and install a backup generator at City Hall	City of Alton	High	2	Thunderstorm/High Winds/Lightning/Hail	✓	✓	
2.6	Encourage school officials to participate in National Incident Management System (NIMS) training and compliance programs	Alton R-IV School District	Low	2	All natural disaster events	✓	✓	
3.1	Elevate the roadway east of the Eleven Point River bridge in southeastern Oregon County	Oregon County Commission	High	3	Flooding (Flash and River)	✓	✓	
3.2	Bridge replacement or bank stabilization to protect the structural stability of the Barren Fork Bridge on US Highway 160	Oregon County Commission	High	3	Flooding (Flash and River)	✓	✓	
3.3	Continuously identify funding sources to update buildings and infrastructure to ensure that community assets are resilient to natural disaster	Oregon County Commission	High	3	All natural disaster events	✓	✓	
3.4	Replacement of 14 box and metal culverts. Mitigation for undersize culverts within the community. Locations flood easily creating difficult situation for emergency access and response	City of Thayer	High	2	Flooding (Flash and River)	✓	✓	

## PREREQUISITES

**44 CFR requirement 201.6(c)(5): The local hazard mitigation plan shall 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.**

This plan has been reviewed by and adopted with resolutions or other documentation of adoption by all participating jurisdictions and schools/special districts. The documentation of each adoption is included in Appendix D, and a model resolution is included below. The jurisdictions listed in the Executive Summary participated in the development of this plan and have adopted the multi-jurisdictional plan.

*(LOCAL GOVERNING BODY/SCHOOL DISTRICT), Missouri RESOLUTION NO. \_*

*A RESOLUTION OF THE (LOCAL GOVERNING BODY /SCHOOL DISTRICT) ADOPTING THE (PLAN NAME)*

*WHEREAS the (local governing body/school district) recognizes the threat that natural hazards pose to people and property within the (local governing body/school district); and*

*WHEREAS the (local governing body/school district ) has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the (plan name), hereafter referred to as the Plan, in accordance with the Disaster Mitigation Act of 2000; and*

*WHEREAS the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the (local governing body/school district) from the impacts of future hazards and disasters; and*

*WHEREAS the (local governing body) recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the (local governing body/school district) will endeavor to integrate the Plan into the comprehensive planning process; and*

*WHEREAS adoption by the (local governing body/school district) demonstrates their commitment to hazard mitigation and achieving the goals outlined in the Plan.*

*NOW THEREFORE, BE IT RESOLVED BY THE (LOCAL GOVERNMENT/SCHOOL DISTRICT), in the State of Missouri, THAT:*

*In accordance with (local rule for adopting resolutions), the (local governing body/school district) adopts the final FEMA-approved Plan.*

*ADOPTED by a vote of \_\_\_\_\_ in favor and \_\_\_\_\_ against, and \_\_\_\_\_ abstaining, this day of \_\_\_\_\_.*

*By (Sig):  
Print name:*

*ATTEST:  
By (Sig.):  
Print name:*

*APPROVED AS TO FORM:  
By (Sig.):  
Print name:*

# 1 INTRODUCTION AND PLANNING PROCESS

---

1	INTRODUCTION AND PLANNING PROCESS .....	1.1
1.1	PURPOSE .....	1.2
1.2	BACKGROUND AND SCOPE.....	1.2
1.3	PLAN ORGANIZATION .....	1.3
1.4	PLANNING PROCESS.....	1.5
1.4.1	<i>Multi-Jurisdictional Participation</i> .....	1.7
1.4.2	<i>The Planning Steps</i> .....	1.9

## 1.1 PURPOSE

---

Hazard Mitigation is the process of preparing for and taking action in order to reduce the long-term risk of natural disasters to financial and human consequences. Mitigation actions may be implemented prior to, during, or after a hazard event. However, it has been demonstrated that hazard mitigation is most effective when based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs (<http://www.fema.gov/what-mitigation>).

By participating in the planning process and meeting the necessary requirements to do so, communities, school districts, and other special districts become eligible to apply for mitigation grant funding. FEMA has implemented the various hazard mitigation provisions through the Code of Federal Regulations (CFR) at 44 CFR Part 201. The CFR provisions set forth the mitigation plan requirements for local and tribal governments as a condition of receiving FEMA hazard mitigation assistance. Local governments, schools, or other publicly funded districts that do not participate or adopt a hazard mitigation plan will not be eligible to apply for grants as stated under 44 CFR §201.6. Section 322 of the Robert T. Stafford Relief and Emergency Assistance Act (P.L. 93-288), as amended by the Disaster Mitigation Act of 2000 (DMA) (P.L. 106-390), provides for States, Tribes and local governments to undertake a risk-based approach to reducing risks to natural hazards through mitigation planning.

## 1.2 BACKGROUND AND SCOPE

---

As required by 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 every five (5) years in order to continue to be eligible for mitigation project grant funding. The 2021 Oregon County Multi-Jurisdictional Natural Hazard Mitigation Plan, from here on referred to as the Plan, is a revision of the previous five-year update approved by FEMA on January 6, 2017, which was the first five year update of the original plan completed in 2005.

The Plan is a major rewrite of the 2016 Plan and reflects changes in priorities and development, and the continued commitment of local governments to mitigate the impact of natural hazards in Oregon County. Local jurisdictions that participated in the 2016 Plan and are continuing participation in this 2021 Plan include:

- Oregon County Commission
- City of Alton
- City of Koshkonong
- City of Thayer
- Alton R-IV
- Couch R-I
- Oregon-Howell R-III
- Thayer R-II



All jurisdictions received letter and email communications notifying representatives of upcoming meetings and participation requirements. Jurisdictions listed above were not represented during the planning process and did not meet the minimum participation requirements.

The local mitigation plan is the representation of the jurisdictions' 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. Information in the Plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future.

## 1.3 PLAN ORGANIZATION

---

The Plan is organized into five chapters. The 2016 Plan included a chapter dedicated to local jurisdiction capabilities. This information has been incorporated into the Planning Area Profile and Capabilities Chapter. The format of the Plan was changed to conform to the local hazard mitigation plan outline template released by the Missouri State Emergency Management Agency (SEMA) in September, 2017. The Plan chapters include:

- Chapter 1: Introduction and Planning Process
- Chapter 2: Planning Area Profile and Capabilities
- Chapter 3: Risk Assessment
- Chapter 4: Mitigation Strategy
- Chapter 5: Plan Implementation and Maintenance
- Appendices

Table 1.1 below summarizes the changes made in the Plan by chapter:

**Table 1.1. Changes Made in Plan Update**

Plan Chapter	Summary of Changes Made
Introduction	<ul style="list-style-type: none"> <li>• General Format Changes</li> </ul>
Profile & Capabilities	<ul style="list-style-type: none"> <li>• Added Geological and Karst features map</li> <li>• Critical features moved to Ch.3</li> <li>• Added table showing Unemployment, Poverty, education, and language percentages</li> <li>• Historic Sites and endangered species list moved to Ch. 3.</li> <li>• Added table showing FEMA HMA grants approved.</li> </ul>
Risk Assessment	<ul style="list-style-type: none"> <li>• General format updates</li> <li>• Expanded introduction section</li> <li>• Added Assets at Risk of exposure to current population and structures</li> <li>• Added Critical Facilities inventory of all included jurisdictions</li> <li>• Added inventory of parks, historical sites, and endangered species.</li> <li>• Added table for agricultural-related jobs and information and Major employers</li> <li>• Added Land Use Development section for development since previous plan and future land use expected.</li> <li>• Expanded Community profiles for each jurisdiction.</li> <li>• Added low-watercrossing information</li> </ul>
Mitigation Strategy	<ul style="list-style-type: none"> <li>• Updated mitigation actions development process</li> <li>• Included actions eliminated and reason for removal</li> <li>• Updated progress made towards mitigation goals from earlier plan</li> <li>• Updated cost benefit review method using STAPLEE and simple scores</li> <li>• Discussed funding sources, lead agencies and status of continuing, revised and new actions</li> </ul>
Plan Maintenance	<ul style="list-style-type: none"> <li>• Updated the responsibilities for plan monitoring, evaluation, and implementation.</li> </ul>

# 1.4 PLANNING PROCESS

**44 CFR Requirement 201.6(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.**

For the update of the 2016 Oregon County Hazard Mitigation Plan, the County and SEMA has contracted with the South Central Ozark Council of Governments (SCOCOG) and has participated fully in the update process. Once this plan receives final approval from the Federal Emergency Management Agency, Oregon County, and the participating cities and school districts within will be eligible for future mitigation assistance from FEMA and will be able to more effectively carry out the identified mitigation activities in an effort to lessen the adverse impact of future natural disasters that take place in the county.

SCOCOG’s role as contractor includes the following elements:

- Assist in establishing a Mitigation Planning Committee (MPC) as defined by the Disaster Mitigation Act (DMA),
- Ensure the updated plan meets the DMA requirements as established by federal regulations and follows the most current planning guidance of the Federal Emergency Management Agency (FEMA),
- Facilitate the entire plan development process,
- Identify the data that MPC participants could provide and conduct the research and documentation necessary to augment that data,
- Assist in soliciting public input,
- Produce the draft and final plan update in a FEMA-approvable document, and Coordinate the Missouri State Emergency Management Agency (SEMA) and (FEMA) plan reviews.

The plan update process followed a methodology prescribed by FEMA, which began with the formation of a Mitigation Planning Committee (MPC) comprised of representatives from Oregon County and participating jurisdictions. The MPC updated the risk assessment that identified and profiled hazards that pose a risk to the County and analyzed jurisdictional vulnerability to these hazards. The MPC also directed the planner-in-charge to analyze the capabilities in place to mitigate the hazard damages, with emphasis on changes that have occurred since the previously approved plan was adopted. The planner-in-charge determined that the planning area is vulnerable to several hazards that are identified, profiled, and analyzed in this plan. Flash flooding, winter storms, and tornadoes are among the hazards that historically have had the most significant impact.

**Table 1.2. Jurisdictional Representatives of Oregon County Mitigation Planning Committee**

Name	Title	Department	Jurisdiction
David Stubblefield	Presiding Commissioner	County	Oregon County
Rusty Warren	Police Chief/EMD	City	City of Alton
George Hunt	Mayor	City	City of Koshkonong
Mark Arnold	EMD/Fire Chief	City	City of Thayer
Eric Allen	Superintendent	School	Alton Schools
Jean Meyer	Superintendent	School	Couch Schools
Seth Bryant	Superintendent	School	Oregon-Howell Schools
Tonya Woods	Superintendent	School	Thayer Schools

Table 1.3 below demonstrates the expertise of the Oregon County MPC members in the six mitigation categories (Preventive Measures, Property Protection, Natural Resource Protection, Emergency Services, Structural Flood Control Projects and Public Information.

**Table 1.3. MPC Capability with Six Mitigation Categories**

Office	Preventive Measures	Structure and Infrastructure Projects		Natural Resource Protection	Public Information	Emergency Services
		Property Protection	Structural Flood Control Projects			
Presiding Commissioner	✓	✓	✓	✓	✓	
Police Chief/EMD	✓		✓			✓
Mayor	✓			✓		
EMD/Fire Chief	✓		✓			✓
Superintendent	✓	✓			✓	
Superintendent	✓	✓			✓	
Superintendent	✓	✓			✓	
Superintendent	✓	✓			✓	

## 1.4.1 Multi-Jurisdictional Participation

**44 CFR Requirement §201.6(a)(3): Multi-jurisdictional plans may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the plan.**

The South Central Ozark Council of Governments, on behalf of Oregon County, invited all incorporated cities, all school districts, and many non-profit entities located within the county to participate in the Oregon County Hazard Mitigation Plan update planning meetings. FEMA accepts multi-jurisdictional plans which meet all the requirements of 44CFR §201.6(a)(3):

- The risk assessment must assess each jurisdiction’s risk where they may vary from the risks facing the entire planning area.
- There must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.
- Each jurisdiction requesting approval of the plan must document that itself has formally adopted the plan.

DMA 2000 further requires that jurisdictions represented within a multi-jurisdictional hazard mitigation plan participate in the planning process in addition to formally adopting the completed plan. Each participating jurisdiction was required to meet planning participation requirements as defined by SCOCOG at the beginning of the update process. Minimum participation requirements were defined as follows:

Provide information to support the plan update through at least two of the following methods:

- Completion of jurisdiction questionnaire;
- Attendance at public meetings;
- Alternately scheduled meetings for data collection purposes;
- Email correspondence with SCOCOG staff for data collection purposes; and
- Formally adopt the hazard mitigation plan

SCOCOG was contracted by Oregon County to revise and update the 2011 Hazard Mitigation Plan and coordinate planning efforts between the municipalities and school districts of the County. SCOCOG planning staff led the development of the plan update by forming the planning committee, calling and facilitating meetings, compiling data, composing and reviewing drafts, issuing public notices, and drafting correspondence. All of the jurisdictions listed as participants in the plan update met the minimum participation requirements as indicated in the following tables. Documentation of meeting attendance in the form on sign in sheets is included in *Appendix A: Planning Participation Documentation*.

Participating jurisdictions include Oregon County (unincorporated), the City of Alton, the City of Koshkonong, the City of Thayer, and the school districts of Alton, Couch Oregon-Howell, and Thayer. In the 2016 iteration of the Oregon County Hazard Mitigation Plan, all jurisdictions participated fully. Other jurisdictions which participated in the planning process as stakeholders, but are not seeking independent adoption and approval are: local police departments, electric cooperatives, emergency management agencies.

The Plan serves as a written document of the planning process. Active participation of local jurisdiction representatives and stakeholders in the hazard mitigation planning process is essential if the Plan is to have value. To be eligible for mitigation funding, local governments and school districts must adopt the FEMA-approved update of the Plan. The participation of the local government stakeholders in the planning process is considered critical to successful implementation of this plan. Each jurisdiction that is seeking approval for the plan must have its governing body adopt the updated plan, regardless the degree of modifications. SCOCOG collaborated with the local governments in Oregon County to assure participating in the planning process to the greatest extent possible and the development of the plan that represents the needs and interests of Oregon County and its local jurisdictions.

The planning engagement took to the form of individual meetings with each of the participating jurisdictions, who reviewed findings from the updated Risk Assessment and completed a hazard mitigation data collection questionnaire (DCQ) that was developed in tandem with the Missouri SEMA planning outline template. This approach is different from previous plan updates, when county-wide planning meetings were held in an attempt to get input from all jurisdictions in one central location. From these meetings, goal refinement and potential mitigation actions were identified and MPC representatives were decided.

The public was engaged at two points during the development of the plan update. First, a public survey was posted on the SCOCOG website and advertised in the Mountain Grove Standard Journal, the newspaper of widest circulation in the county. Second, the availability of the draft plan for review and comment was announced in the same newspaper in November of 2021. Documentation for both public engagement efforts and results of the public survey are included in Appendix C.

**Table 1.4. Jurisdictional Participation in Planning Process**

Jurisdiction	Kick-off Meeting	Meeting #2	Meeting #3	Data Collection Questionnaire Response	Update/Develop Mitigation Actions
Oregon County Commission	X	X	X	X	X
City of Alton	X	X		X	X
City of Koshkonong	X	X		X	X
City of Thayer	X	X		X	X
Alton R-IV	X	X		X	X
Couch R-I	X	X		X	X
Oregon-Howell R-III	X	X		X	X
Thayer R-II	X	X		X	X

## 1.4.2 The Planning Steps

FEMA’s Local Mitigation Planning Handbook (March 2013), Local Mitigation Plan Review Guide (October 2013), and Integrating Hazard Mitigation into Local Planning: Case Studies and Tools for Community Officials (March 2013) were used as sources for development the Plan update process. The development of the plan followed the 10-step planning process adapted from FEMA’s Community Rating System (CRS) and Flood Mitigation Assistance Programs. The 10-step process allows the Plan to meet funding eligibility requirements of the Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, Community Rating System, and Flood Migration Assistance Program. Table 1.4 shows how the CRS process aligns with the Nine Task Process outlined in the 2013 Local Mitigation Planning Handbook.

The following Table 1.5 is a summary of how SCOCOG staff used the Nine Task Process to develop the updated for the Oregon County Hazard Mitigation Plan.

**Table 1.5. County Mitigation Plan Update Process**

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

**Step 1: Organize the Planning Team  
(Handbook Tasks 1, 2, and 4)**

The Council of Governments planners began the plan update process by contacting local stakeholders that were identified as key officials who would be valuable to the update of the mitigation plan. County commissioners, city officials, and emergency management personnel were targeted as potential members of the MPC. During an introductory conference call in March 2021, the scope of the plan update was discussed, including planning participation requirements and general methodology. A timeline for completion the update was established and planning meetings were scheduled and given ‘tentative’ dates.

The Data Collection Questionnaires for the county’s school districts and municipalities were distributed at the very beginning of the update process via email along with a follow up phone call to explain the procedure, the need for the data collection, how the data would be used, and to answer any questions the Superintendents may have had regarding the contents of the Data Collection Questionnaires. All participating jurisdictions were informed of an upcoming planning meetings throughout the county where SCOCOG planners would gather and review the questionnaire responses and help shore up any gaps in the data. Eight planning meetings in the county were held during the month of September 2021.

**Table 1.6. Schedule of Planning Meetings**

Meeting	Topic	Date
Kick-off Meeting	Teleconference 9:00 a.m. <ul style="list-style-type: none"> <li>• Prospective participants and stakeholders identified</li> <li>• Raising awareness for mitigation strategy/increase countywide resilience to natural hazards</li> <li>• Natural hazard vulnerability</li> <li>• Local plan participation</li> <li>• Project timeline</li> </ul>	March 24, 2021
Planning Meeting	Various Locations Jurisdictions represented: Alton, Koshkonong, Thayer, All School Districts <ul style="list-style-type: none"> <li>• Review of 2016 Mitigation Goals, Objectives and Actions</li> <li>• Review of Jurisdictional Risk Assessment</li> <li>• Identification of new mitigation actions</li> <li>• Completion of Data Collections Questionnaire, identifying capabilities, assets, vulnerability</li> </ul>	September 1 – September 16 2021
Planning Meeting	County Courthouse 9:00 a.m. Jurisdictions represented: Oregon Co. <ul style="list-style-type: none"> <li>• Review of 2016 Mitigation Goals, Objectives and Actions</li> <li>• Review of Jurisdictional Risk Assessment</li> <li>• Identification of new mitigation actions</li> <li>• Completion of Data Collections Questionnaire, identifying capabilities, assets, vulnerability</li> </ul>	October 7, 2021



Planning Meeting	Teleconference 1:00 p.m. Jurisdictions represented: Thayer School District <ul style="list-style-type: none"> <li>• Review of 2012 Mitigation Goals, Objectives and Actions</li> <li>• Review of Jurisdictional Risk Assessment</li> <li>• Identification of new mitigation actions</li> <li>• Completion of Data Collections Questionnaire, identifying capabilities, assets, vulnerability</li> </ul>	October 21, 2021
MPC Meeting	Mitigation Planning Committee Work Session 1:30 p.m. Video Conference Jurisdictions represented: All participating jurisdictions <ul style="list-style-type: none"> <li>• Discussed changes to the 2016 Plan update</li> <li>• Discussed STAPLEE Criteria</li> <li>• Discussion of lead agencies and funding sources for each mitigation action</li> <li>• Coordinated timing of plan adoption</li> </ul>	October 26, 2021

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

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

Options for soliciting public input on the Plan update were discussed at the Planning Kickoff Meeting held on March 24, 2021. SCOCOG staff explained the importance of public involvement during the planning process.

A plan to engage the public in the plan update process was developed in accordance with 44 CFR Requirement 201.6(b), ensuring the opportunity for the public to comment on the plan during the drafting stage and prior to FEMA approval. The consensus of the group was to (1) develop an online survey instrument which would be publicized in the Mountain Grove Standard Journal and ran concurrent to the drafting of the plan update and (2) post the draft plan on the website of the South Central Ozark Council of Governments for public review and comment, and announce its availability in the Standard Journal prior to the plan’s submittal to the State Emergency Management Agency

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

**44 CFR Requirement 201.6(b): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process. (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.**

There are many organizations that are ‘regional’ in nature whose interests interface with hazard mitigation planning in Oregon County. These groups were engaged via telephone calls and direct mail letters to invite interested parties to the March 2021 planning meeting. The agencies and interest groups who were invited to take part in the hazard mitigation plan update are listed below:

- Red Cross
- Community Foundation of the Ozarks
- Shannon County Presiding Commissioner Jeff Cowen
- Howell County Presiding Commissioner
- Texas County EMD Jack Watson
- Howell County EMD Mike Coldiron
- Alton Volunteer Fire Department
- Many Springs Volunteer Fire Department
- Couch Volunteer Fire Department
- Missouri Department of Conservation
- Missouri Department of Transportation (Southeast District)

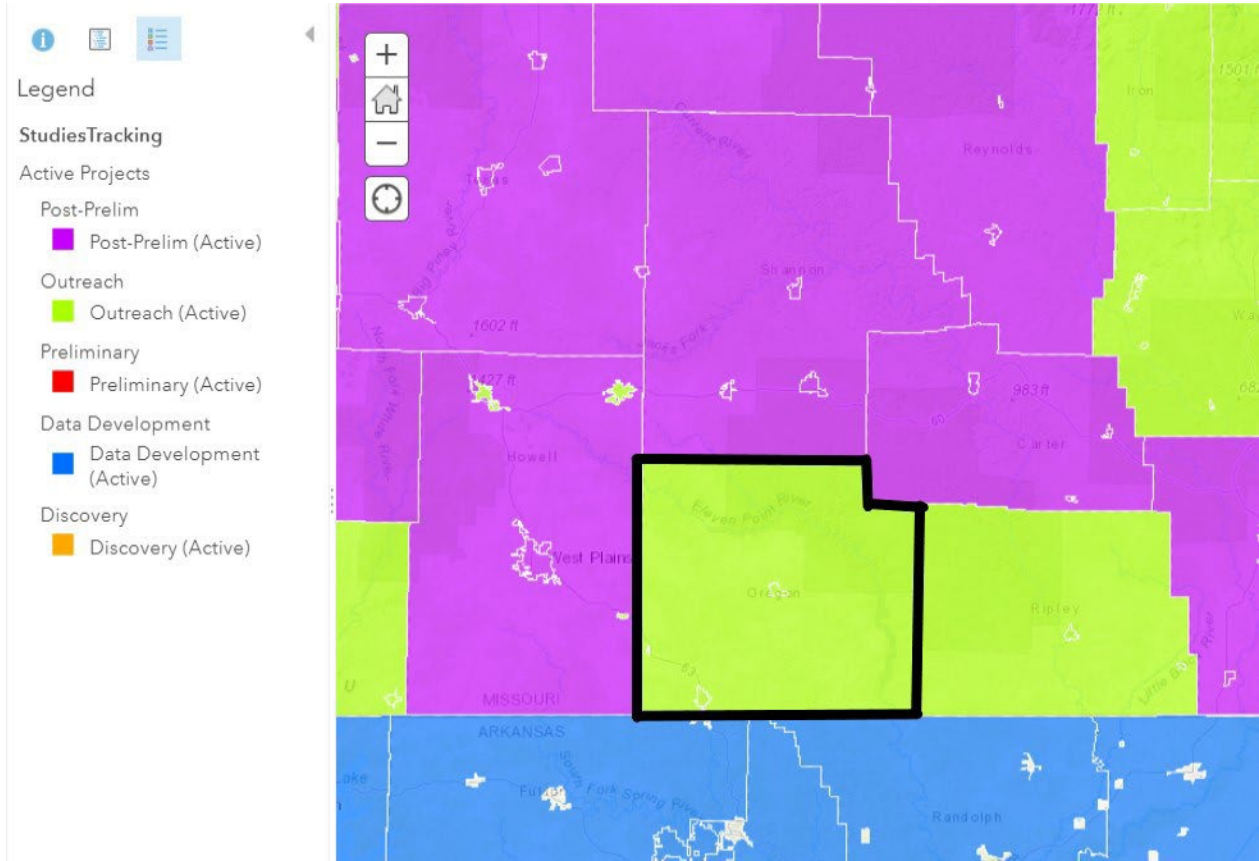
### **Integration of Other Data, Reports, Studies, and Plans**

A review of the most current data, reports, studies and Plans relating to hazard mitigation planning in Oregon County were reviewed in order to provide the latest “snapshot” of existing conditions to inform the development of the 2016 Plan. Local planning documents that were reviewed were the Region G Threat Hazard Risk Assessment (THIRA), the Comprehensive Economic Development Strategy, the South Central Regional Transportation Plan, The State Transportation Plan, and the Oregon County Local Emergency Operations Plan. Where available, information from these Plans was integrated into the planning meeting discussions and into the Hazard Mitigation Plan narrative itself.

#### Coordination with FEMA Risk MAP Project

Risk Mapping, Assessment, and Planning (Risk MAP) is the Federal Emergency Management Agency (FEMA) Program that provides communities with flood information and tools they can use to enhance their mitigation plans and take action to better protect their citizens. Through collaboration with State, Tribal, and local entities, Risk MAP delivers quality data that increases public awareness and leads to action that reduces risk to life and property. As depicted in the following Figure 1.1, Oregon County is currently within the active Outreach phase of Risk MAP activities:

**Figure 1.1. Map of RiskMAP projects**



Oregon County Emergency Operations Plan (EOP)

Oregon County emergency management is set up along the following functional segments: direction and control; communications and warning; emergency public information; damage assessment; law enforcement; fire and rescue; civil disorder; hazardous materials response; public works; evacuation; in-place sheltering; reception and care; health and medial terrorism response; and resources and supply. This plan also defines lines of succession for the continuity of government operations during a disaster as well as the preservation of records and the logistics of administrative functions such as procedures for obtaining temporary use of facilities. The Oregon County Emergency Operations Plan was last updated in 2019.

South Central Ozark Regional Transportation Plan (RTP)

SCOCOG maintains and updates annually the Regional Transportation Plan (RTP) as part of a work agreement with the Missouri Department of Transportation. The RTP begins with the statewide Long Range Transportation Plan’s goals then refines them to fit the unique nature of the South Central region. The local planning process involves prioritization of transportation projects and defining broad transportation improvement strategies, including economic development, safety, and expansion of multimodal opportunities.

### Comprehensive Economic Development Strategy (CEDS)

The regional Comprehensive Economic Development Strategy was updated in 2019 following an extensive regional planning process. A dozen planning meetings were held throughout the seven county region to identify economic development goals and strategies, gain input on the function and effectiveness of the regional planning commission's services, and identify vital economic development projects & programs for every jurisdiction in the region. The CEDS provides detailed information on social and economic data, and an overview of funding programs available to local governments and not-for-profit agencies.

Community, economic, and human resources development projects continue to be implemented across Oregon County. All three incorporated communities, and the county itself are very active in these areas. Oregon County acknowledged some of their emergency management and response needs in the Community Improvement Project List contained in the 2019 Comprehensive Economic Development Strategy. Projects listed by municipalities in Oregon County in the CEDS relating to emergency management are listed on the next page:

- Community tornado safe room in Koshkonong
- Community tornado safe room in Thayer
- Backup generator at the Alton City Hall
- Water and Wastewater Improvement Projects in Alton & Thayer

A wide variety of technical data gathered from a number of state and federal agencies was integrated to the 2016 Plan to develop the Risk Assessment portion of the plan. Federal Emergency Management Agency DFIRM maps were utilized to delineate flood hazard areas and at risk structures in the county. NOAA data was used to compile event history for hazard profiles. Data from Missouri Department of Transportation, Missouri Department of Natural Resources, and Missouri Economic Resource Information Center (MERIC) were utilized to define the county's vulnerability to natural hazard events.

National datasets such as the National Agriculture Imagery Program, the National Inventory of Dams, the SILVIS Lab housed at the University of Wisconsin-Madison, and the 2020 U.S. Census were referenced in the updated Risk Assessment.

### ***Step 4: Assess the Hazard: Identify and Profile Hazards (Handbook Task 5)***

The hazard profiles contained within the 2016 Oregon County Hazard Mitigation Plan were reassessed during the kickoff planning meeting in March.

During the remainder of the planning meetings in the county, attendees were provided the latest hazard data via the research conducted by the South Central Ozark Council of Governments. The attendees provided to SCOCOG their input on hazard events from the DCQs completed by each participating jurisdiction. By consensus the participants identified the natural hazards that are not considered a threat to their own jurisdiction and eliminated those disasters from consideration in the Risk Assessment process. A Hazard Vulnerability Sheet was completed by each participating jurisdiction to help determine the perceived threat faced by their respective jurisdictions for inclusion in the Hazard Mitigation Plan.

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

Identified assets in the planning area include population, structures, critical facilities and infrastructure, and other important assets that may be at risk to hazards. The inventory of assets for each jurisdiction were derived from GIS layers identified structures by use in the county and the local jurisdiction and school district data collection questionnaires, and FEMA DFIRM data. Potential losses to existing development were estimated on hazard event scenarios and annualized losses. In most cases the county assessor's valuations were used to estimate structure losses in impacted areas by structure occupancy type. The methodology for estimating losses varies by hazard. Loss estimates are included in each hazard profile contained in the Risk Assessment chapter.

## ***Step 6: Set Goals (Handbook Task 6)***

The Mitigation Planning Committee reviewed the goals from the 2016 Oregon County Plan during the kickoff planning meeting in March 2021. The MPC opted to carry over the Mitigation Goals from the previous iteration of the plan, as they were determined to still be applicable:

### **Goal 1: Protect the Lives and Property of all Citizens of Oregon County**

- Identify and provide sufficient emergency shelters
- Review and maintain current warning systems for sufficient coverage

### **Goal 2: Preserve the Functioning of Civil Government During Natural Disasters**

- Implement proper maintenance and necessary upgrades of critical buildings and infrastructures in the county
- Improve the efficiency, timing, and effectiveness of response and recovery efforts for natural hazard disasters

### **Goal 3: Maintain Economic Activities Essential to the Survival and Recovery from Natural Disasters**

- Periodically review chain of command of government organizations for emergency situations and keep up-to-date
- Continuously review communications systems and keep in good working order

## ***Step 7: Review Possible Mitigation Actions and Activities***

The Mitigation Planning Committee and representatives from participating jurisdictions reviewed the mitigation actions from the 2016 Plan during the March kickoff meetings, as well as subsequent planning meetings with participating jurisdictions. It was decided that a couple of the actions from the previous plan were vague or unclear in their intent and the consensus of the group was that the mitigation actions needed to be more individualized in nature. New actions were identified, potential costs were discussed, lead agencies and staff were identified. Actions were prioritized using the STAPLEE methodology during the October 26<sup>th</sup> MPC work session. The FEMA publication *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (January 2013)* was used as a primary source to guide the action formulation process. Participants were encouraged to focus on mitigation efforts that could be reasonably be attained in the next five-to-ten years

### ***Step 8: Draft an Action Plan***

The MPC reviewed the results of the jurisdiction-specific action identification and developed action prioritization during a conference call work session on October 26<sup>th</sup>. Progress in implementing the mitigation actions will be reviewed annually by the regional planner housed at the South Central Ozark Council of Governments. Additionally, as potential grant funding becomes available, SCOCOG planners will work with the jurisdictions of Oregon County to develop applications when a viable project arises.

### ***Step 9: Adopt the Plan (Handbook Task 8)***

The jurisdictions will be asked to adopt the plan after SEMA's initial plan review to ensure that no wholesale changes are being required within the planning document. Upon approval of the draft Plan by SEMA staff, the SCOCOG planners will work with participating jurisdictions to facilitate the Plan Adoption process.

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

During the conference call of the MPC on October 26<sup>th</sup> it was prescribed that the implementation the mitigation actions will be reviewed annually and revised (as needed) by the regional planner housed at the South Central Ozark Council of Governments. Additionally, as potential grant funding becomes available, SCOCOG planners will work with the jurisdictions of Oregon County to develop applications when a viable project arises. The process for Plan Maintenance is detailed in Chapter 5 of this document.

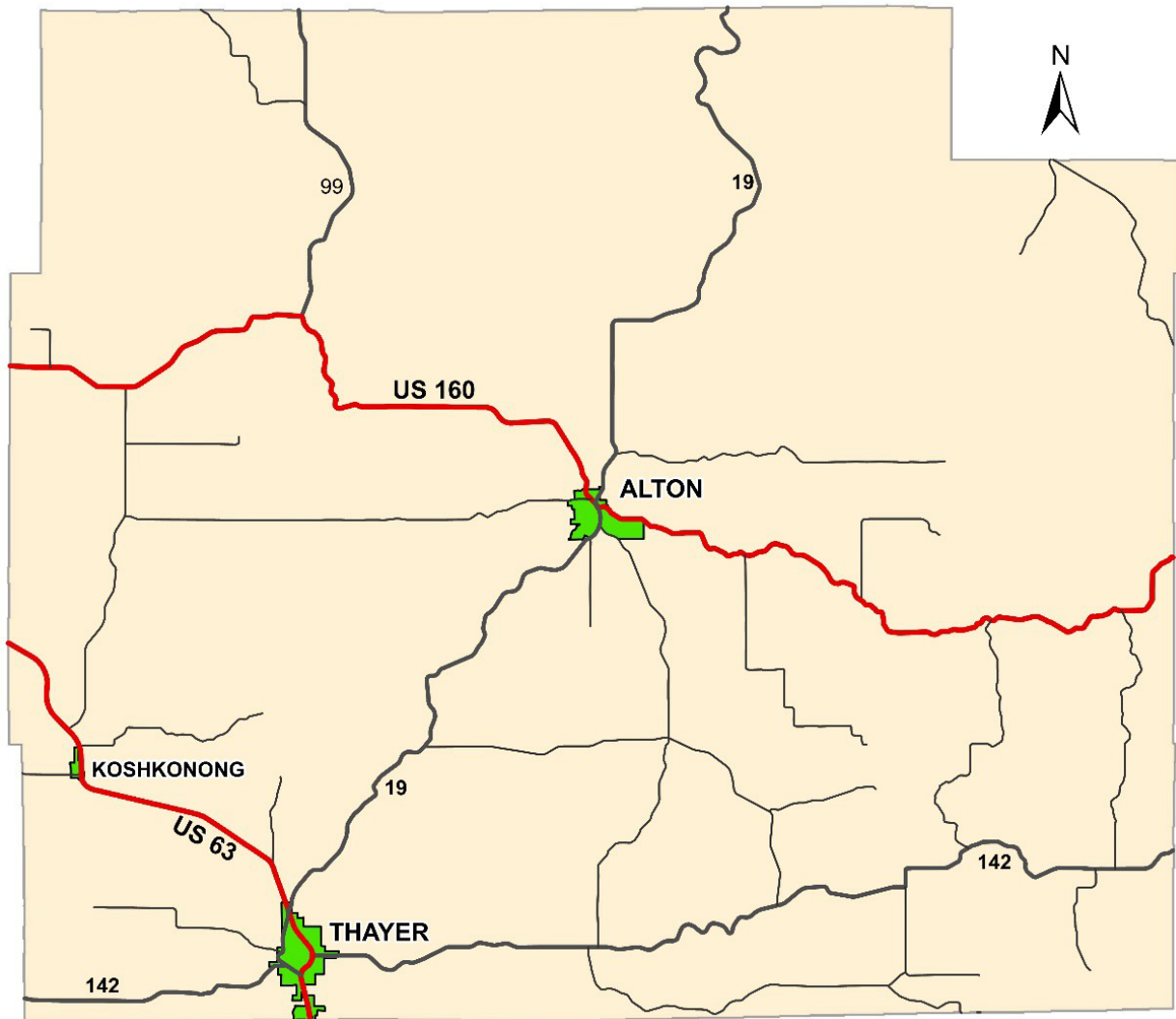
## 2 PLANNING AREA PROFILE AND CAPABILITIES

---

<b>2</b>	<b>PLANNING AREA PROFILE AND CAPABILITIES</b>	<b>2.1</b>
<b>2.1</b>	<b>Oregon County Planning Area Profile</b>	<b>2.2</b>
2.1.1	Geography, Geology and Topography	2.3
2.1.2	Climate	2.3
2.1.3	Demographics	2.4
2.1.4	History	2.5
2.1.5	Occupations	2.6
2.1.6	Agriculture	2.6
2.1.7	FEMA Hazard Mitigation Assistance Grants in Planning Area	2.7
2.1.8	FEMA Public Assistance (PA) Grants in Planning Area	2.7
<b>2.2</b>	<b>Jurisdictional Profiles and Mitigation Capabilities</b>	<b>2.10</b>
2.2.1	Unincorporated Oregon County, Missouri	2.11
2.2.2	City of Alton	2.15
2.2.3	City of Koshkonong	2.17
2.2.4	City of Thayer	2.19
2.2.5	Public School District Profiles and Mitigation Capabilities	2.23
2.2.6	Alton R-IV School District	2.24
2.2.7	Couch R-I School District	2.25
2.2.8	Oregon-Howell R-III School District	2.26
2.2.9	Thayer R-II School District	2.27

## 2.1 OREGON COUNTY PLANNING AREA PROFILE

Figure 2.1. Map of Oregon County



According to the 2019 American Community Survey Census Estimates, the 2019 population of Oregon County was 10,647, which represented a decrease from the County's 2010 population 10,881. This represents an increase of 537 residents or 5.2% growth since the 2000 census. The State of Missouri's population increased 7% during the same time period.

The median household income for Oregon County rose rather substantially from \$27,646 in 2010 to \$33,601 in 2019, yet family income still lags far behind the state and national figures of \$49,600 and \$53,292, respectively.

The median assessed home value in Oregon County in 2015 was \$47,368, an increase of 3% since the 2016 Plan update.



## 2.1.1 Geography, Geology and Topography

Oregon County is located in the south-central region of Missouri, in an area referred to as the Ozark Plateau. This part of Missouri is characterized by one of the most karstic regions in the continental United States. A region with outstanding water resources, numerous springs, sinkholes, losing streams, caves and hollows.

The underground and surface water resources found in Oregon County are very much connected as a result of the karst topography of the county and region. There are seven unique watershed in the county, each having their own unique drainage feature—creek or river—that flows south- southwest toward larger rivers and final destinations in Arkansas to the south.

<b>Watershed</b>	<b>General Location in Oregon County</b>	<b>Tributary to:</b>
Warm Fork of the Spring River	Southwest	Spring River (AR)
Myatt Creek	Southwest	Spring River (AR)
Middle Fork Creek	Northwest	Eleven Point River
Spring Creek	North-Central	Eleven Point River
Eleven Point River	Eastern	White River (AR)
James Creek	South-Central	Spring River (AR)
Piney Creek	Central	Frederick Creek

The vast majority of the county is rural. In fact, a large portion of the county is designated as wilderness or national forest land. The county is comprised of 506,880 acres. Farmland in Oregon County totals 239,390 acres, or approximately 47%. Another 105,000 acres, or 21%, is held by state or federal agencies. The overall population density in the county is 13.2/sq. mi.

Elevations in county range from 1,071 feet near Alton, to the lowest point of 341 feet above sea level in the southeastern corner of the county. Oregon County’s major land typologies include four major characteristics which are: strongly sloping cherty land with red clay subsoils, gently sloping uplands with red clay subsoils, level and gently sloping uplands, and cherty gently sloping to steep timbered uplands. Less than 5% of the remaining land area is bottom and terrace land containing the richest soils.

## 2.1.2 Climate

Oregon County’s average annual precipitation through the reporting years of 1971-2020 was 45.91 inches. The average annual temperature for the county is 56 degrees Fahrenheit. On average, the hottest month of the year in Oregon County is July, with a mean temperature of 78.5 degrees. The coldest month is January, with a mean temperature of 32.3 degrees.

## 2.1.3 Demographics

**Table 2.1. Oregon County Population 2000-2010 by Community**

Jurisdiction	Total Population 2010	Total Population 2019	2010-2019 # Change	2000-2019 % Change
Oregon County	10,881	10,647	234	-22%
City of Alton	871	628	243	-28%
City of Koshkonong	212	195	17	-8%
City of Thayer	2243	2,335	92	+4%

Source: U.S. Bureau of the Census, 2019 ACS estimates

In Oregon County, there are approximately 4,251 households, out of which 28.6% have children under the age of 18 living with them.

58.1% of households are married couples living together, 8.5% of households have a female householder with no husband present, and 29.5% of households were non-families. 26.6% of all Oregon County households are made up of individuals--and 14.5% has someone living alone who was 65 years of age or older. The average household size in the County is 2.4 persons and the average family size is 2.86.

In Oregon County, the population demographic is “spread-out” with 24.3% under the age of 18. 2% from 18 to 24, 24.3% from 25 to 44, 26.9% from 45 to 64, and 18.8% who were 65 years of age or older. The median age in Oregon County is 42 years.

For every 100 females there were 96.50 males. For every 100 females age 18 and over, there were 92.7 males.

**Table 2.2. Unemployment, Poverty, Education, and Language Percentage Demographics**

Jurisdiction	Total in Labor Force	Percent of Population Unemployed	Percent of Families Below the Poverty Level	Percentage of Population (High School graduate)	Percentage of Population (Bachelor's degree or higher)	Percentage of population (spoken language other than English)
Oregon County	4279	9.1	19.8	80.9	9.3	1.1
City of Alton	410	12.4	38.1	75.5	8.6	2.0
City of Koshkonong	118	2.5	16.0	81.1	11.2	0.9
City of Thayer	866	10.9	17.9	80.7	10.0	1.4
State	3,005,604	8.4	11.1	88.0	26.7	6.1

Source: U.S. Census, 2019 American Community Survey, 5-year Estimates.

## 2.1.4 History

Oregon County was formed on February 14, 1845 and was named for the Oregon Territory. The county seat is Alton. The first known white settler was Charles Hatcher in 1809, a Revolutionary War veteran. Oregon County, with its county seat at Alton, is located in the south-central part of Missouri. Various Indian tribes roamed this area until 1809 when pioneers, mostly from Tennessee and Kentucky, began to settle this area. Oregon County was formally organized in 1845 and got its name from the western territory of Oregon. Oregon County was originally much larger than its present size. However, in 1859, Oregon County was split to form Howell County, which now lies directly to the west. Consequently, Thomasville, which was the first county seat of Oregon County and located on the Eleven Point River, was no longer near the geographic center of the county, and a new county seat had to be established. At this time the county seat was moved to the more centralized location of Alton, Missouri, where a new courthouse was constructed. Probably the first two businesses established in Alton were the general merchandise store and a grist mill by John Crawley and Judge John L. Keel, respectively. The Oregon County Courthouse was completed in 1860.

Oregon County was pro-Confederate during the Civil War though Union troops occupied the County Courthouse during part of the war. When Union troops vacated the building on October 21, 1863, they burned both it and the grist mill. The county records were saved as Matthew G. Norman and other

officials hid them in a Piney Creek cave on the Norman Farm. The grist mill was reopened and continued operation until the mid-1920's. The schoolhouse in Alton was destroyed by fire in the 1890's and was replaced by a longer and more modern building. The school district is now the pride of Alton with an enrollment of 732, which is greater than the population of the town itself (692). Along with their public buildup, there was an increase in residential development, some of which still stand today. A new courthouse was built on the old foundation in 1871 at the cost of \$5,795. This courthouse was remodeled, had a third floor added in 1903-1904, and served until 1939 when it was vacated and demolished in order to make room for a more modern structure. Construction of the present courthouse began in 1939 by the W.P.A. and was completed and became official on February 1, 1942. The courthouse has stood since that time and has only recently had an addition of an elevator added to its three floors.

Alton is located near the Eleven Point River, and although not a national park, a 44-mile portion of the Eleven Point between Thomasville and the MO 142 Bridge was designated in 1968 as a National Scenic River under the jurisdiction of the Department of Agriculture. The river is fed by some of Missouri's most beautiful springs; its lower section, doubled by Greer Spring is floatable all year. Stocked with trout for the first eleven miles below the spring, this cool, fast stream flows near scenic areas like the Irish Wilderness. The discovery of the Eleven Point River by an English-speaking traveler is credited to Edmund Jennings, a North Carolina man who hunted, trapped, and fished with the Indians in the region around 1800 and referred to the area as the County of the Six Boils, or the Six Great Springs. Among which were probably Big, Mammoth, Greer, Boze, and Blue Springs. Credit is given to Charles Hatcher as the first pioneer of the Eleven Point River who settled near the present town of Thomasville about 1809, naming his home Rich Hill when the territory was part of New Madrid County. The 1800's saw a large influx of people into the Oregon County region. The population in 1845 was 700 and within the next 5 years the population grew to 1,432. In 1860 the population had more than doubled to 3,009. In 1870 there were 278 more individuals and in 1880 there was another increase up to 5, 721. However, in 1890 the population had almost doubled again to 10, 467. In the last three decades of the 1900s its population grew by 12.7%.

Source: [www.historicmarkers.com/mo/](http://www.historicmarkers.com/mo/)

## 2.1.5 Occupations

**Table 2.3. Occupation Statistics, Oregon County, Missouri**

Place	Management, Business, Science, and Arts Occupations	Service Occupations	Sales and Office Occupations	Natural Resources, Construction, and Maintenance Occupations	Production, Transportation, and Material Moving Occupations
Oregon County	22.2%	19.5%	21.1%	14.9%	22.4%
Alton	13.1%	37.6%	13.9%	19.5%	15.9%
Koshkonong	21.7%	35.7%	18.3%	11.3%	13%
Thayer	23.1%	21.9%	23.9%	7.3%	23.9%

Source: U.S. Census, 2019 American Community Survey, 5-year Estimates.

## 2.1.6 Agriculture

According to the 2017 Census of Agriculture, Oregon County is home to 564 farms consisting of 253,838 acres. This represents a dramatic decrease from the 2012 census, which listed the county having 731 farms. The average market value of products sold per farm is \$45,934, a 33% increase in value from 2012. The top crop in the county is Forage-land, the top livestock item is cattle and calves. The farming sector is a significant part of the county's economy with an estimated 22.8% of workers employed as a farm owner or farm worker. This figure is slightly higher than the overall 19.8% for the seven county South Central Missouri region.

[http://www.agcensus.usda.gov/Publications/2012/Full\\_Report/Census\\_by\\_State/Missouri/index.asp](http://www.agcensus.usda.gov/Publications/2012/Full_Report/Census_by_State/Missouri/index.asp)

<http://mcdc.missouri.edu/othersites.shtml>

<http://extension.missouri.edu/main/DisplayCategory.aspx?C=43>

National Agricultural Statistics Service Census of Agriculture, <http://www.agcensus.usda.gov/index.php>

## 2.1.7 FEMA Hazard Mitigation Assistance Grants in Planning Area

**Table 2.4. FEMA HMA Grants in County from 1993-2020**

Project Type	Sub applicant	Award Date	Project Total
Tornado Safe Room	Alton R-IV School District	2007	\$1,356,728
Outdoor Warning Sirens	Koshkonong	2019	\$58,667
<b>Total</b>	-	-	<b>\$1,415,395</b>

Source: SCOCOG

## 2.1.8 FEMA Public Assistance (PA) Grants in Planning Area

Since 2002, jurisdictions in Oregon County have received \$3,361,275 in public assistance due to natural hazard damages. Table 2.5 shows all the public assistance payouts received by jurisdictions, as well as the project type and disaster declaration.

**Table 2.5. PA Grants in Oregon County, Missouri 2002 - 2020**

Disaster Declaration	Project Type	Project Size	Applicant	Project Total
1412	C - Roads and Bridges	Small	Oregon County	1054.6
1412	C - Roads and Bridges	Small	Oregon County	2718.05
1412	C - Roads and Bridges	Small	Oregon County	38687.95
1412	C - Roads and Bridges	Small	Oregon County	49389.09
1412	C - Roads and Bridges	Large	Oregon County	113157.72
1412	C - Roads and Bridges	Small	Oregon County	26353.17
1412	C - Roads and Bridges	Small	Oregon County	2262
1412	C - Roads and Bridges	Small	Oregon County	3946.96
1412	C - Roads and Bridges	Small	Oregon County	4208.53
1412	C - Roads and Bridges	Small	Oregon County	34279.13
1412	C - Roads and Bridges	Small	Oregon County	34907.31
1463	A - Debris Removal	Small	Oregon County	4909.24

1463	B - Protective Measures	Small	Oregon County	460
1463	F - Public Utilities	Small	Oregon County	6662.65
1463	E - Public Buildings	Small	Oregon County	2500
1749	C - Roads and Bridges	Large	Oregon County	38489.44
1749	C - Roads and Bridges	Small	Oregon County	6877.2
1749	G - Recreational or Other	Small	Oregon County	2169.35
1749	C - Roads and Bridges	Small	Oregon County	5235.42
1749	C - Roads and Bridges	Small	Oregon County	9499.41
1749	C - Roads and Bridges	Small	Oregon County	7468.3
1749	F - Public Utilities	Small	Oregon County	2765.34
1749	C - Roads and Bridges	Small	Oregon County	2659.4
1749	C - Roads and Bridges	Small	Oregon County	9706.69
1749	C - Roads and Bridges	Small	Oregon County	4132.6
1749	C - Roads and Bridges	Small	Oregon County	7491.8
1749	E - Public Buildings	Small	Oregon County	58190.72
1749	C - Roads and Bridges	Small	Oregon County	5197.79
1749	C - Roads and Bridges	Small	Oregon County	3020.2
1749	G - Recreational or Other	Small	Oregon County	4047.47
1749	C - Roads and Bridges	Large	Oregon County	81694.61
1749	C - Roads and Bridges	Small	Oregon County	8521.13
1749	C - Roads and Bridges	Small	Oregon County	7751.6
1749	C - Roads and Bridges	Small	Oregon County	3144.29
1749	A - Debris Removal	Small	Oregon County	5265.03
1749	C - Roads and Bridges	Small	Oregon County	17504.51
1749	F - Public Utilities	Small	Oregon County	9276.99
1749	C - Roads and Bridges	Small	Oregon County	1263.87
1749	C - Roads and Bridges	Small	Oregon County	19132.61
1749	C - Roads and Bridges	Small	Oregon County	1692.3
1749	C - Roads and Bridges	Small	Oregon County	18562
1749	C - Roads and Bridges	Small	Oregon County	4188.61
1749	C - Roads and Bridges	Small	Oregon County	7129.81
1749	C - Roads and Bridges	Small	Oregon County	11021.39
1749	C - Roads and Bridges	Small	Oregon County	6106.28
1749	C - Roads and Bridges	Small	Oregon County	8237.76
1749	C - Roads and Bridges	Small	Oregon County	20698.25
1749	C - Roads and Bridges	Small	Oregon County	31595.18
1749	C - Roads and Bridges	Small	Oregon County	10750.53
1749	C - Roads and Bridges	Small	Oregon County	17457.84
1749	C - Roads and Bridges	Small	Oregon County	11139.23
1749	C - Roads and Bridges	Small	Oregon County	2999.61
1749	C - Roads and Bridges	Small	Oregon County	4228.88
1749	C - Roads and Bridges	Small	Oregon County	20319.92
1749	C - Roads and Bridges	Small	Oregon County	8260.75

1749	C - Roads and Bridges	Small	Oregon County	9951.65
1749	C - Roads and Bridges	Small	Oregon County	17397.99
1749	C - Roads and Bridges	Small	Oregon County	4010.26
1749	C - Roads and Bridges	Small	Oregon County	18781.93
1749	C - Roads and Bridges	Small	Oregon County	32242.61
1749	C - Roads and Bridges	Small	Oregon County	20670.22
1749	C - Roads and Bridges	Small	Oregon County	3134.42
1749	C - Roads and Bridges	Small	Oregon County	2971.96
1749	G - Recreational or Other	Small	Oregon County	21523.94
1822	F - Public Utilities	Small	Oregon County	2179.74
1822	B - Protective Measures	Small	Oregon County	3523.68
1822	A - Debris Removal	Small	Oregon County	6947.4
1822	E - Public Buildings	Small	Oregon County	1000
1822	A - Debris Removal	Small	Oregon County	9174
1822	A - Debris Removal	Large	Oregon County	188674.62
1822	A - Debris Removal	Large	Oregon County	279498.27
1822	A - Debris Removal	Large	Oregon County	55392.95
1822	F - Public Utilities	Small	Oregon County	1219.06
1822	B - Protective Measures	Small	Oregon County	4836.35
1822	E - Public Buildings	Small	Oregon County	1000
1822	C - Roads and Bridges	Small	Oregon County	2803.88
1822	A - Debris Removal	Small	Oregon County	15630.21
1822	A - Debris Removal	Large	Oregon County	302635.76
1822	B - Protective Measures	Small	Oregon County	6989.14
1822	B - Protective Measures	Small	Oregon County	5560
1822	B - Protective Measures	Small	Oregon County	44636.05
1822	B - Protective Measures	Small	Oregon County	23554.1
1822	B - Protective Measures	Small	Oregon County	45441.41
1822	B - Protective Measures	Small	Oregon County	5470
1822	B - Protective Measures	Small	Oregon County	8862.45
1822	F - Public Utilities	Large	Oregon County	367005.55
1822	B - Protective Measures	Large	Oregon County	97094.37
1980	C - Roads and Bridges	Small	Oregon County	26145.87
1980	C - Roads and Bridges	Small	Oregon County	12234.61
1980	C - Roads and Bridges	Small	Oregon County	17126.94
1980	C - Roads and Bridges	Small	Oregon County	3537.94
1980	C - Roads and Bridges	Small	Oregon County	11006.17
1980	C - Roads and Bridges	Small	Oregon County	6663.15
1980	C - Roads and Bridges	Small	Oregon County	4546.23
1980	C - Roads and Bridges	Small	Oregon County	11791.66
1980	C - Roads and Bridges	Small	Oregon County	5380.16
1980	C - Roads and Bridges	Small	Oregon County	20933.12
1980	C - Roads and Bridges	Small	Oregon County	1378.58

1980	C - Roads and Bridges	Small	Oregon County	8673
1980	C - Roads and Bridges	Small	Oregon County	12357.45
1980	C - Roads and Bridges	Small	Oregon County	7325.33
1980	C - Roads and Bridges	Small	Oregon County	4577.96
1980	C - Roads and Bridges	Small	Oregon County	8071.24
1980	C - Roads and Bridges	Small	Oregon County	1562.11
1980	C - Roads and Bridges	Small	Oregon County	3989.18
1980	C - Roads and Bridges	Small	Oregon County	13423.98
1980	C - Roads and Bridges	Small	Oregon County	11750.44
1980	C - Roads and Bridges	Small	Oregon County	8753.98
3267	A - Debris Removal	Small	Oregon County	38357.26
3267	B - Protective Measures	Small	Oregon County	16171.96
3267	B - Protective Measures	Small	Oregon County	3816.6
4238	G - Recreational or Other	Small	Oregon County	3468.19
4317	E - Public Buildings	Small	Oregon County	9926
4317	A - Debris Removal	Small	Oregon County	2894.98
4317	A - Debris Removal	Small	Oregon County	7496.39
4317	B - Protective Measures	Large	Oregon County	2376.01
4317	C - Roads and Bridges	Small	Oregon County	16751.64
4317	C - Roads and Bridges	Large	Oregon County	597921.74
4317	G - Recreational or Other	Small	Oregon County	5297.88
4317	A - Debris Removal	Small	Oregon County	8074.32
4317	C - Roads and Bridges	Small	Oregon County	7289.3
				<b>3,361,275.85</b>

## 2.2 JURISDICTIONAL PROFILES AND MITIGATION CAPABILITIES

The following section will include individual profiles for each participating jurisdiction. It will also include a discussion of previous mitigation initiatives in the planning area. There will be a summary table indicating specific capabilities of each jurisdiction that relate to their ability to implement mitigation opportunities. The unincorporated county is profiled first, followed by the incorporated communities, and the public school districts.



## 2.2.1 Unincorporated Oregon County, Missouri

Oregon County's jurisdiction includes all unincorporated areas within the county boundaries. Oregon is identified as a third-class county in the State of Missouri. The governing body of the County is the County Commission. The Commission consists of a Presiding Commissioner, a northern Commissioner and a southern Commissioner.

The County's elected governing body; the Board of County Commissioners directs the general administration of County Government. The Commission sets broad operating policies, enacts ordinances and establishes budgets as mandated by State law. The County enters into contracts with other public and private agencies to ensure the smooth flow of services including law enforcement, construction and maintenance of public roads, bridges and the operations of county offices, equipment and services. The departments of the County government include:

- Board of Commissioners
- County Assessor
- County Attorney
- County Auditor
- County Recorder
- County Sheriff
- County Treasurer
- County Coroner
- County Clerk
- Emergency Management

### Mitigation Initiatives and Capabilities

Staff capabilities to mitigate the impact of natural hazards include the local emergency management officials and local law enforcement members who are involved in mitigation planning, response and recovery processes. Efforts in coordinating with local government officials and cooperating with private organizations to: 1) prevent avoidable disasters and reduce the vulnerability of the residents to any disaster that may strike; 2) establish capabilities for protecting citizens from the effects of disasters; 3) respond effectively to the actual occurrences of disasters; and 4) provide for recovery in the aftermath of any emergency involving extensive damage within the county. The Emergency Management Director (EMD) is responsible for the development and maintenance of the Local Emergency Operations Plan.

Table 2.6 provides information about the mitigation capabilities and policies for the unincorporated county based on responses from the Mitigation Planning Data Collection Questionnaire.

**Table 2.6. Unincorporated Oregon County Mitigation Capabilities**

<b>Capabilities</b>	<b>Status Including Date of Document or Policy</b>
Planning Capabilities	
Comprehensive Plan	None
Capital Improvement Plan	None
Local Emergency Operations Plan	Yes 12/2015
Local Recovery Plan	None
Local Mitigation Plan	Yes, 2016
Economic Development Plan	Yes, 2019
Transportation Plan	Yes, 2019
Land-use Plan	None
Watershed Plan	None
Firewise or other fire mitigation plan	No
Open Space/Recreation Plan	Yes, 12/2015

Policies/Ordinance	
Zoning Ordinance	None
Building Code	None
Floodplain Ordinance	None
Subdivision Ordinance	None
Tree Trimming Ordinance	None
Nuisance Ordinance	None
Storm Water Ordinance	None
Drainage Ordinance	None
Site Plan Review Requirements	None
Historic Preservation Ordinance	None
Landscape Ordinance	None
Program	
Zoning/Land Use Restrictions	No
Codes Building Site/Design	No
NFIP Participant	No
CRS Participating Community	No
Hazard Awareness Program	Yes, 12/2015
National Weather Service (NWS) Storm Ready	No
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	No
Economic Development Program	No
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	No
Mutual Aid Agreements	No
Studies/Reports/Maps	
Flood Insurance Maps	Yes, 2008
FEMA Flood Insurance Study (Detailed)	No
Evacuation Route Map	No
Critical Facilities Inventory	Yes, 2011
Vulnerable Population Inventory	No
Land Use Map	No
Staff/Department	
Building Code Official	No
Building Inspector	No
Mapping Specialist (GIS)	No

Engineer	No
Development Planner	No
Public Works Official	Yes
Emergency Management Director	Yes
NFIP Floodplain Administrator	No
Emergency Response Team	Yes – HSRT
Hazardous Materials Expert	Yes – HSRT
Local Emergency Planning Committee	No
Transportation Department	No
Housing Authority	No
Local Funding Availability	
Ability to apply for Community Development Block Grants	Yes
Ability to fund projects through Capital Improvements funding	Yes
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	No
Impact fees for new development	No
Ability to incur debt through GO bonds	Yes
Ability to incur debt through special tax bonds	Yes

Source: Data Collection Questionnaire, 2021

## 2.2.2 City of Alton

The City of Alton is located in the central portion of Oregon County at the intersection of State Highway 19 and U.S. Highway 160. Alton serves as the Oregon County seat. The governing body of Alton includes the Mayor and four (4) Aldermen. Alton is the fastest growing community (by percentage) in Oregon County. At the time of the 2000 census the population in Alton was 668. The 2019 census estimates reported the City’s population as 628, which equals a 28% decrease in population since 2010. The City of Alton participated in the last update of the County- wide plan; however, specific mitigation activities undertaken by the City have been limited since 2011. City departments include:

- Mayor/Board of Aldermen
- City Clerk
- Water and Sewer
- City Maintenance
- Police Department

According to 2019 Estimates, the median year built for structures in Alton is 1966. Additionally, 21.4% of the population were over the age of 65, median household income was \$26,251, and 38.5% of the families in Alton were living below the poverty level. Mitigation capabilities in Alton include:

- One (1) outdoor warning siren
- Mutual aid agreements with local governments/law enforcement
- One (1) part-time building inspector/code official

**Table 2.7. City of Alton Mitigation Capabilities**

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	None
Capital Improvement Plan	None
Local Emergency Operations Plan	Yes 12/2015
Local Recovery Plan	None
Local Mitigation Plan	Yes, 2016
Economic Development Plan	Yes, 2019
Transportation Plan	Yes, 2019
Land-use Plan	None
Watershed Plan	None
Firewise or other fire mitigation plan	None
Open Space/Recreation Plan	None
Policies/Ordinance	
Zoning Ordinance	None
Building Code	None
Floodplain Ordinance	Yes
Subdivision Ordinance	None
Tree Trimming Ordinance	None
Nuisance Ordinance	Yes – 4/2010
Storm Water Ordinance	None
Drainage Ordinance	None
Site Plan Review Requirements	None
Historic Preservation Ordinance	None
Landscape Ordinance	None

<b>Program</b>	
Zoning/Land Use Restrictions	No
Codes Building Site/Design	No
NFIP Participant	Yes
CRS Participating Community	No
Hazard Awareness Program	Yes, 12/2015
National Weather Service (NWS) Storm Ready	No
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	Yes - 8
Economic Development Program	No
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	No
Mutual Aid Agreements	No
<b>Studies/Reports/Maps</b>	
Flood Insurance Maps	Yes, 2008
FEMA Flood Insurance Study (Detailed)	No
Evacuation Route Map	No
Critical Facilities Inventory	Yes, 2016
Vulnerable Population Inventory	No
Land Use Map	No
<b>Staff/Department</b>	
Building Code Official	Yes – Part Time
Building Inspector	Yes – Part Time
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	Yes – Full Time
Emergency Management Director	No
NFIP Floodplain Administrator	Yes – Part Time
Emergency Response Team	No
Hazardous Materials Expert	No
Local Emergency Planning Committee	No
Transportation Department	No
Housing Authority	No
<b>Local Funding Availability</b>	
Ability to apply for CDBG Grants	Yes
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	Yes – Water & Sewer
Impact fees for new development	No
Ability to incur debt through GO bonds	Yes
Ability to incur debt through special tax bonds	Yes

Source: Data Collection Questionnaire 2021

## 2.2.3 City of Koshkonong

The City of Koshkonong is located in west-central Oregon County along US Highway 63 near the Howell County border. The governing body of Koshkonong includes the Mayor and two Aldermen. Koshkonong’s population is declining according to figures between the years 2010 and 2019. At the time of the 2019 census estimate, the population in Koshkonong was 205. The 2010 census reported the City’s population as 195, which equals an 8% decline. The City of Koshkonong participated in the last update of the county-wide plan and was recently awarded FEMA funding for outdoor warning sirens. City departments include:

- Mayor/Board of Aldermen
- City Clerk
- Water and Sewer
- City Maintenance
- Police Department

According to 2019 Estimates, the median year built for structures in in Koshkonong is 1962. Additionally, 23.4% of the population were over the age of 65, median household income was \$23,429 and 17.4% of the families in Koshkonong were living below the poverty level. Mitigation capabilities in Koshkonong include:

- One (3) outdoor warning siren
- Mutual aid agreements with local governments/law enforcement

**Table 2.8. City of Koshkonong Mitigation Capabilities**

<b>Capabilities</b>	<b>Status Including Date of Document or Policy</b>
<b>Planning Capabilities</b>	
Comprehensive Plan	None
Capital Improvement Plan	None
Local Emergency Operations Plan	Yes 12/2015
Local Recovery Plan	None
Local Mitigation Plan	Yes, 2016
Economic Development Plan	Yes, 2019
Transportation Plan	Yes, 2019
Land-use Plan	None
Watershed Plan	None
Firewise or other fire mitigation plan	None
Open Space/Recreation Plan	None
<b>Policies/Ordinance</b>	
Zoning Ordinance	None
Building Code	None
Floodplain Ordinance	Yes
Subdivision Ordinance	None
Tree Trimming Ordinance	None
Nuisance Ordinance	None
Storm Water Ordinance	None
Drainage Ordinance	None
Site Plan Review Requirements	None
Historic Preservation Ordinance	None
Landscape Ordinance	None
<b>Program</b>	

Zoning/Land Use Restrictions	No
Codes Building Site/Design	No
NFIP Participant	Yes
CRS Participating Community	No
Hazard Awareness Program	No
National Weather Service (NWS) Storm Ready	No
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	No
Economic Development Program	No
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	No
Mutual Aid Agreements	No
Studies/Reports/Maps	
Flood Insurance Maps	Yes, 2008
FEMA Flood Insurance Study (Detailed)	No
Evacuation Route Map	No
Critical Facilities Inventory	Yes, 2019
Vulnerable Population Inventory	No
Land Use Map	No
Staff/Department	
Building Code Official	No
Building Inspector	No
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	Yes – Part Time
Emergency Management Director	No
NFIP Floodplain Administrator	Yes
Emergency Response Team	No
Hazardous Materials Expert	No
Local Emergency Planning Committee	No
Transportation Department	No
Housing Authority	No
Local Funding Availability	
Ability to apply for CDBG Grants	Yes
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	Yes – Water & Sewer
Impact fees for new development	No
Ability to incur debt through GO bonds	Yes
Ability to incur debt through special tax bonds	Yes



## 2.2.4 City of Thayer

The City of Thayer is located in the southwest portion of Oregon County along US Highway 63 situated just north of the Arkansas State Line. The governing body of Thayer includes the Mayor and four (4) Aldermen. Thayer is the only incorporated community in the county which experienced population growth between the years 2010 and 2019. The 2019 American Community Survey estimates the city’s population at 2,335 residents, up from 2,243 in 2010. The City of Thayer participated in the last update of the county-wide plan; however, specific mitigation activities undertaken by the City have been limited since that time. City departments include:

- Mayor/Board of Aldermen
- City Clerk
- Water and Sewer
- City Maintenance
- Emergency Management
- Fire Department
- Police Department

According to 2019 Estimates, the median year built for structures in Thayer is 1960. Additionally, 19.2% of the population were over the age of 65, median household income was \$26,794, and 17.7% of the families in Thayer were living below the poverty level. Mitigation capabilities in Thayer include:

- Three (3) outdoor warning siren
- Mutual aid agreements with local governments/law enforcement
- One (1) part-time inspection & building code official

**Table 2.9. City of Thayer Mitigation Capabilities**

Capabilities	Status Including Date of Document or Policy
<b>Planning Capabilities</b>	
Comprehensive Plan	None
Capital Improvement Plan	None
Local Emergency Operations Plan	Yes 12/2015
Local Recovery Plan	None
Local Mitigation Plan	Yes, 2016
Economic Development Plan	Yes, 2019
Transportation Plan	Yes, 2019
Land-use Plan	Yes – Chapter 400 Ordinances
Watershed Plan	None
Firewise or other fire mitigation plan	None
Open Space/Recreation Plan	None
<b>Policies/Ordinance</b>	
Zoning Ordinance	Yes
Building Code	Yes – BOCA 1990
Floodplain Ordinance	Yes - 2008
Subdivision Ordinance	None
Tree Trimming Ordinance	None
Nuisance Ordinance	Yes – Section 215
Storm Water Ordinance	Yes – Section 710
Drainage Ordinance	Yes – Section 515
Site Plan Review Requirements	Yes – Section 230.280
Historic Preservation Ordinance	None
Landscape Ordinance	None

Program	
Zoning/Land Use Restrictions	Yes
Codes Building Site/Design	Yes
NFIP Participant	Yes
CRS Participating Community	No
Hazard Awareness Program	Yes
National Weather Service (NWS) Storm Ready	Yes
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	Yes – 7
Economic Development Program	No
Public Education/Awareness	Yes
Property Acquisition	No
Planning/Zoning Boards	Yes
Mutual Aid Agreements	Yes – Fire Dept.
Studies/Reports/Maps	
Flood Insurance Maps	Yes, 2008
FEMA Flood Insurance Study (Detailed)	No
Evacuation Route Map	No
Critical Facilities Inventory	Yes, 2019
Vulnerable Population Inventory	No
Land Use Map	Yes
Staff/Department	
Building Code Official	No
Building Inspector	No
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	Yes - Full
Emergency Management Director	Yes - Part
NFIP Floodplain Administrator	Yes - Part
Emergency Response Team	Yes – Part
Hazardous Materials Expert	No
Local Emergency Planning Committee	No
Transportation Department	Yes - Full
Housing Authority	No
Local Funding Availability	
Ability to apply for CDBG Grants	Yes
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	No
Ability to incur debt through GO bonds	Yes
Ability to incur debt through special tax bonds	Yes

**Table 2.10. Municipal Mitigation Capabilities Summary Table**

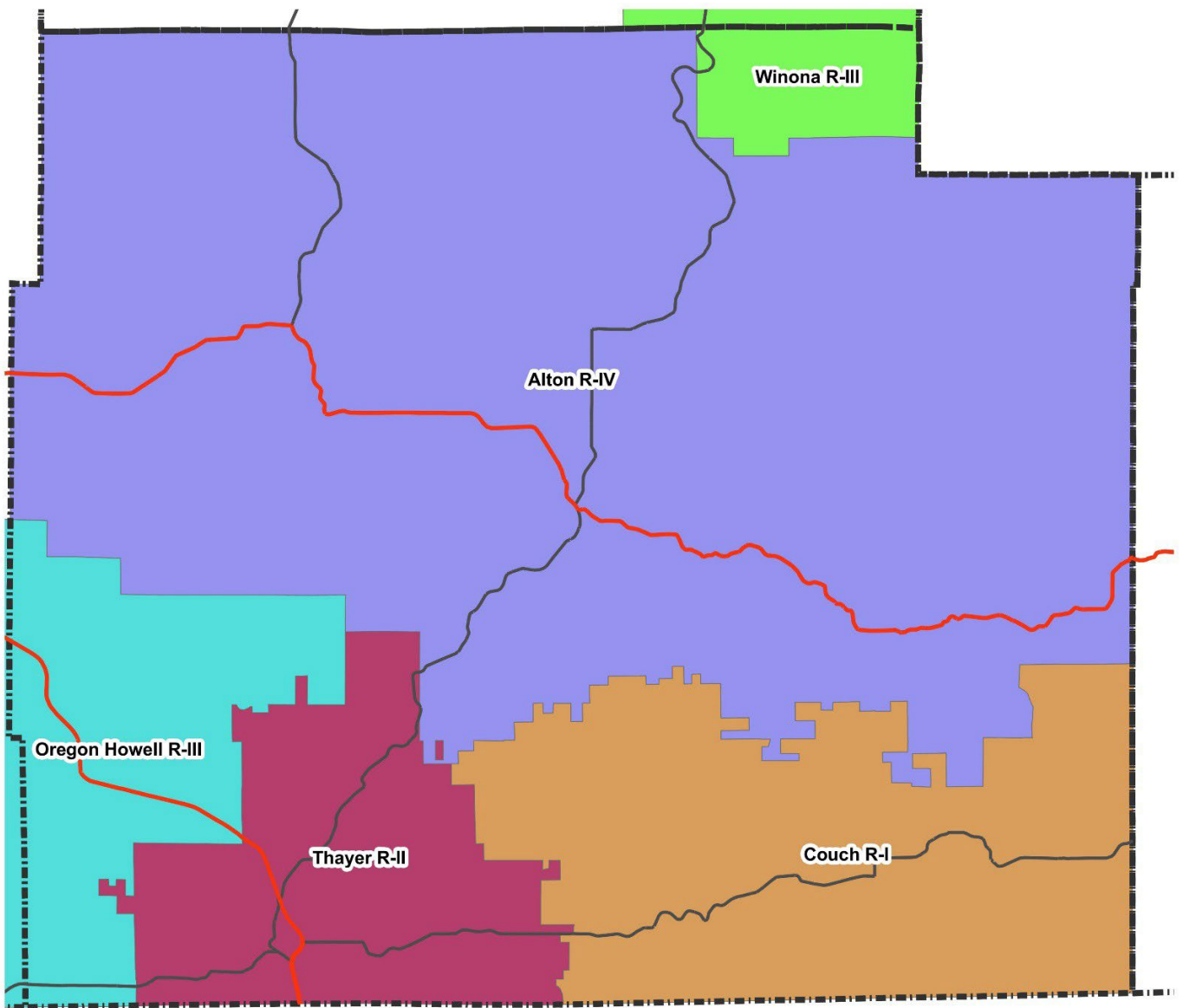
<b>CAPABILITIES</b>	<b>Oregon County</b>	<b>Alton</b>	<b>Koshkonong</b>	<b>Thayer</b>
Planning Capabilities				
Comprehensive Plan	None	None	None	None
Capital Improvement Plan	None	None	None	None
Local Emergency Operations Plan	Yes 12/2015	Yes 12/2015	Yes 12/2015	Yes 12/2015
Local Recovery Plan	None	None	None	None
Local Mitigation Plan	Yes, 2016	Yes, 2016	Yes, 2016	Yes, 2016
Economic Development Plan	Yes, 2019	Yes, 2019	Yes, 2019	Yes, 2019
Transportation Plan	Yes, 2019	Yes, 2019	Yes, 2019	Yes, 2019
Land-use Plan	None	None	None	Yes – Chapter 400 Ordinances
Watershed Plan	None	None	None	None
Firewise or other fire mitigation plan	No	None	None	None
Open Space/Recreation Plan	Yes, 12/2015	None	None	None
Policies/Ordinance				
Zoning Ordinance	None	None	None	Yes
Building Code	None	None	None	Yes – BOCA 1990
Floodplain Ordinance	None	Yes	Yes	Yes - 2008
Subdivision Ordinance	None	None	None	None
Tree Trimming Ordinance	None	None	None	None
Nuisance Ordinance	None	Yes – 4/2010	None	Yes – Section 215
Storm Water Ordinance	None	None	None	Yes – Section 710
Drainage Ordinance	None	None	None	Yes – Section 515
Site Plan Review Requirements	None	None	None	Yes – Section 230.280
Historic Preservation Ordinance	None	None	None	None
Landscape Ordinance	None	None	None	None
Program				
Zoning/Land Use Restrictions	No	No	No	Yes
Codes Building Site/Design	No	No	No	Yes
NFIP Participant	No	Yes	Yes	Yes
CRS Participating Community	No	No	No	No
Hazard Awareness Program	Yes, 12/2015	Yes, 12/2015	No	Yes
National Weather Service (NWS) Storm Ready	No	No	No	Yes
Building Code Effectiveness Grading (BCEGs)	No	No	No	No

<b>CAPABILITIES</b>	<b>Oregon County</b>	<b>Alton</b>	<b>Koshkonong</b>	<b>Thayer</b>
ISO Fire Rating	No	Yes - 8	No	Yes – 7
Economic Development Program	No	No	No	No
Public Education/Awareness	No	No	No	Yes
Property Acquisition	No	No	No	No
Planning/Zoning Boards	No	No	No	Yes
Mutual Aid Agreements	No	No	No	Yes – Fire Dept.
<b>Studies/Reports/Maps</b>				
Flood Insurance Maps	Yes, 2008	Yes, 2008	Yes, 2008	Yes, 2008
FEMA Flood Insurance Study (Detailed)	No	No	No	No
Evacuation Route Map	No	No	No	No
Critical Facilities Inventory	Yes, 2016	Yes, 2016	Yes, 2016	Yes, 2016
Vulnerable Population Inventory	No	No	No	No
Land Use Map	No	No	No	Yes
<b>Staff/Department</b>				
Building Code Official	No	No	No	No
Building Inspector	No	No	No	No
Mapping Specialist (GIS)	No	No	No	No
Engineer	No	No	No	No
Development Planner	No	No	No	No
Public Works Official	Yes	Yes – Full Time	Yes – Part Time	Yes - Full
Emergency Management Director	Yes	No	No	Yes - Part
NFIP Floodplain Administrator	No	Yes – Part Time	Yes – Part Time	Yes - Part
Emergency Response Team	Yes – HSRT	No	No	Yes – Part
Hazardous Materials Expert	Yes – HSRT	No	No	No
Local Emergency Planning Committee	No	No	No	No
Transportation Department	No	No	No	Yes - Full
Housing Authority	No	No	No	No
<b>Local Funding Availability</b>				
Ability to apply for CDBG Grants	Yes	Yes	Yes	Yes
Authority to levy taxes for a specific purpose	Yes	Yes	Yes	Yes
Fees for water, sewer, gas, or electric services	Yes	Yes – Water & Sewer	Yes – Water & Sewer	Yes
Impact fees for new development	No	No	No	No
Ability to incur debt through GO bonds	No	Yes	Yes	Yes
Ability to incur debt through special tax bonds	Yes	Yes	Yes	Yes

## 2.2.5 Public School District Profiles and Mitigation Capabilities

This section provides general information about participating school districts in the Plan. There are four school districts based in Oregon County: Alton R-IV, Couch R-I, Oregon-Howell R-III, and Thayer R-II. Other school district boundaries include areas of Oregon County (*Winona R-III* is included in the Shannon County HMP) but is not headquartered and do not have facilities within the county. Figure 2.2 is a map of school district boundaries in Oregon County.

**Figure 2.2. Oregon County School Districts**



## 2.2.6 Alton R-IV School District

All of Alton R-IV School District facilities are within the city limits of the county seat Alton, MO. Table 2.11 provides building and enrollment information.

**Table 2.11. Alton R-IV Building and Enrollment Information**

Building Name	Address	Building Occupants
Alton High School	100 School Street	322
Alton Elementary	100 School Street	263

Alton R-IV Schools are governed by a Board of Education consisting of the Board President and six board members. The District serves over 500 students and employees approximately 50 teachers and staff. District departments include:

- Transportation
- Cafeteria Services
- Custodial Services
- Health Services
- Central Office

The District was awarded a Pre Disaster Mitigation Grant to construct a FEMA standard tornado saferoom in 2008. Table 2.12 provides responses from the Mitigation Planning Data Collection Questionnaire for School Districts.

**Table 2.12. Alton R-IV School District Mitigation Capabilities**

Capability		
<b>Planning Elements</b>	<b>Y/N</b>	<b>Date of Latest Version</b>
Master Plan	N	
Capital Improvement Plan	N	
School Emergency Plan	Y	2007
Weapons Policy	Y	2020
<b>Personnel Resources</b>	<b>Y/N</b>	<b>Department/Position</b>
Full Time Building Official	Y	Supt., Bldg Principals
Emergency Manager	Y	Bldg Principal
Grant Writer	Y	Cost Director
Public Information Officer	N	
Information Technology	Y	Staff
<b>Financial Resources</b>	<b>Accessible/Eligible to Use?</b>	
Capital Improvement Project Funding	Y	
Local Funds	Y	
General Obligation Bonds	N	
Special Tax Bonds	N	
Private Activities Donations	N	
State and Federal Grant Funds	Y	
<b>Other</b>		<b>Status Including Date of Document or Policy</b>
Fire Evacuation Training	Y	
Tornado Sheltering Exercises	Y	
Public Address/EAS	Y	
NOAA Weather Radios	Y	
Tornado Shelter/Saferoom	Y	
Campus Police	N	

Source: Data Collection Questionnaire, 2021

## 2.2.7 Couch R-I School District

All of Couch R-I School District Facilities are located in unincorporated Oregon County in the south- central section of the County along State Route 142. Table 2.13 provides building and enrollment information.

**Table 2.13. Couch R-I Building and Enrollment Information**

Building Name	Address	Building Occupants
Couch High School	Route 1 PO Box 1187-14	121
Couch Elementary	Route 1 PO Box 1187-10	96

Couch R-I Schools are governed by a Board of Education consisting of the Board President and six board members. The District serves over 200 students and employees approximately 30 teachers and staff. District departments include:

- Transportation
- Cafeteria Services
- Custodial Services
- Health Services
- Central Office

The District is currently in the process of applying for a hazard mitigation grant to construct a FEMA saferoom. Table 2.14 provides responses from the Mitigation Planning Data Collection Questionnaire for School Districts.

**Table 2.14. Couch R-I School District Mitigation Capabilities**

Capability		
<b>Planning Elements</b>	<b>Y/N</b>	<b>Date of Latest Version</b>
Master Plan	N	
Capital Improvement Plan	N	
School Emergency Plan	Y	2014
Weapons Policy	Y	2014
<b>Personnel Resources</b>	<b>Y/N</b>	<b>Department/Position</b>
Full Time Building Official	Y	HS Principal
Emergency Manager	Y	Superintendent
Grant Writer	Y	Superintendent
Public Information Officer	Y	Superintendent
Information Technology	N	
<b>Financial Resources</b>	<b>Accessible/Eligible to Use?</b>	
Capital Improvement Project Funding	Y	
Local Funds	Y	
General Obligation Bonds	Y	
Special Tax Bonds	N	
Private Activities Donations	N	
State and Federal Grant Funds	Y	
<b>Other</b>		<b>Status Including Date of Document or Policy</b>
Fire Evacuation Training	Y	
Tornado Sheltering Exercises	Y	
Public Address/EAS	Y	
NOAA Weather Radios	N	
Tornado Shelter/Saferoom	N	
Campus Police	N	

Source: Data Collection Questionnaire, 2021

## 2.2.8 Oregon-Howell R-III School District

All of Oregon-Howell R-III School District Facilities are located in the City of Koshkonong in southeastern Oregon County. Table 2.15 provides building and enrollment information.

**Table 2.15. Oregon-Howell R-III Building and Enrollment Information**

Building Name	Address	Building Occupants
Koshkonong High School	100 School St. Koshkonong	83
Koshkonong Elementary	100 School St. Koshkonong	150

Oregon-Howell R-III Schools are governed by a Board of Education consisting of the Board President and six board members. The District serves approximately 230 students and employees approximately 25 teachers and staff. District departments include:

- Transportation
- Cafeteria Services
- Custodial Services
- Health Services
- Central Office

Table 2.16 provides responses from the Mitigation Planning Data Collection Questionnaire for School Districts.

**Table 2.16. Couch R-I School District Mitigation Capabilities**

Capability		
<b>Planning Elements</b>	<b>Y/N</b>	<b>Date of Latest Version</b>
Master Plan	N	
Capital Improvement Plan	N	
School Emergency Plan	Y	2020
Weapons Policy	Y	2020
<b>Personnel Resources</b>	<b>Y/N</b>	<b>Department/Position</b>
Full Time Building Official	Y	HS Principal
Emergency Manager	Y	Superintendent
Grant Writer	N	
Public Information Officer	N	
Information Technology	N	
<b>Financial Resources</b>	<b>Accessible/Eligible to Use?</b>	
Capital Improvement Project Funding	Y	
Local Funds	Y	
General Obligation Bonds	N	
Special Tax Bonds	N	
Private Activities Donations	Y	
State and Federal Grant Funds	Y	
<b>Other</b>		<b>Status Including Date of Document or Policy</b>
Fire Evacuation Training	Y	
Tornado Sheltering Exercises	Y	
Public Address/EAS	Y	
NOAA Weather Radios	Y	
Tornado Shelter/Saferoom	Y*	**not 361 design standards
Campus Police	N	

Source: Data Collection Questionnaire, 2021



## 2.2.9 Thayer R-II School District

All of Thayer R-II School District Facilities are located in the City of Thayer, in the southwestern portion of Oregon County near the intersection of US Hwy 63 and State Route 142. Table 2.17 provides building and enrollment information.

**Table 2.17. Thayer R-II Building and Enrollment Information**

Building Name	Address	Building Occupants
Thayer Elementary	365 East Walnut Street	321
Thayer High School	401 East Walnut Street	353

Thayer R-I Schools are governed by a Board of Education consisting of the Board President and six board members. The District serves over 670 students and employees approximately 50 teachers and staff. District departments include:

- Transportation
- Cafeteria Services
- Custodial Services
- Health Services
- Central Office

The District is currently in the process of applying for a hazard mitigation grant to construct a FEMA saferoom. Table 2.18 provides responses from the Mitigation Planning Data Collection Questionnaire for School Districts.

**Table 2.18. Thayer R-II School District Mitigation Capabilities**

Capability		
<b>Planning Elements</b>	<b>Y/N</b>	<b>Date of Latest Version</b>
Master Plan	Y	8/17/2016
Capital Improvement Plan	Y	8/17/2016
School Emergency Plan	Y	9/1/2020
Weapons Policy	Y	4/09/2009
<b>Personnel Resources</b>	<b>Y/N</b>	<b>Department/Position</b>
Full Time Building Official	Y	Elem. & HS principals
Emergency Manager	Y	Elem. Principal
Grant Writer	N	NA
Public Information Officer	Y	Superintendent
Information Technology	N	
<b>Financial Resources</b>	<b>Accessible/Eligible to Use?</b>	
Capital Improvement Project Funding	Y	
Local Funds	Y	
General Obligation Bonds	Y	
Special Tax Bonds	N	
Private Activities Donations	N	
State and Federal Grant Funds	Y	
<b>Other</b>		<b>Status Including Date of Document or Policy</b>
Fire Evacuation Training	Y	
Tornado Sheltering Exercises	Y	
Public Address/EAS	Y	
NOAA Weather Radios	Y	
Tornado Shelter/Saferoom	N	
Campus Police	Y	

Source: Data Collection Questionnaire, 2021

**Table 2.19. School Districts – Summary of Mitigation Capabilities**

<b>Capability</b>	<b>ALTON R-IV</b>	<b>COUCH R-I</b>	<b>OREGON-HOWELL R-III</b>	<b>THAYER R-II</b>
Planning Elements				
Master Plan/ Date	N	N	Y	Y
Capital Improvement Plan/Date	N	N	Y	Y
School Emergency Plan / Date	Y	Y	Y	Y
Weapons Policy/Date	Y	Y	Y	Y
Personnel Resources	<b>Y/N</b>	<b>Y/N</b>	<b>Y/N</b>	<b>Y/N</b>
Full-Time Building Official (Principal)	Y	Y	Y	Y
Emergency Manager	Y	Y	Y	Y
Grant Writer	Y	Y	N	N
Public Information Officer	N	Y	Y	Y
Information Technology	Y	N	N	N
Financial Resources	<b>Accessible/Eligible to Use?</b>	<b>Accessible/Eligible to Use?</b>	<b>Accessible/Eligible to Use?</b>	<b>Accessible/Eligible to Use?</b>
Capital Improvements Project Funding	Y	Y	Y	Y
Local Funds	Y	Y	Y	Y
General Obligation Bonds	N	Y	Y	Y
Special Tax Bonds	N	N	N	N
Private Activities/Donations	N	N	N	N
State And Federal Funds/Grants	Y	Y	Y	Y

Capabilities	ALTON R-IV	COUCH R-I	OREGON-HOWELL R-III	THAYER R-
Other				
Fire Evacuation Training	Y	Y	Y	Y
Tornado Sheltering Exercises	Y	Y	Y	Y
Public Address/Emergency Alert System	Y	Y	Y	Y
NOAA Weather Radios	Y	N	Y	Y
Tornado Shelter/Saferoom	Y	N	N	N
Campus Police	N	N	Y	Y

Data Collection Questionnaires, 2021

# 3 RISK ASSESSMENT

<b>3</b>	<b>RISK ASSESSMENT</b>	<b>3.1</b>
3.1	<i>HAZARD IDENTIFICATION</i>	3.3
3.1.1	Review of Existing Mitigation Plans	3.3
3.1.2	Review Disaster Declaration History	3.4
3.1.3	Research Additional Sources	3.7
3.1.4	Hazards Identified	3.9
3.1.5	Multi-Jurisdictional Risk Assessment	3.10
3.2	<i>ASSETS AT RISK</i>	3.10
3.2.1	Total Exposure of Population and Structures	3.11
3.2.2	Critical and Essential Facilities and Infrastructure	3.13
3.2.3	Other Assets	3.14
3.3	<i>LAND USE AND DEVELOPMENT</i>	3.16
3.3.1	Development Since Previous Plan Update	3.16
3.3.2	Future Land Use and Development	3.18
3.4	<i>HAZARD PROFILES, VULNERABILITY, AND PROBLEM STATEMENTS</i>	3.19
3.4.1	Flooding	3.21
3.4.2	Dam Failure	3.31
3.4.3	Earthquakes	3.40
3.4.4	Land Subsidence/Sinkholes	3.46
3.4.5	Drought	3.49
3.4.6	Extreme Temperatures	3.54
3.4.7	Severe Thunderstorms <i>Including High Winds, Hail, and Lightning</i>	3.60
3.4.8	Severe Winter Weather	3.67
3.4.9	Tornado	3.73
3.4.10	Wildfire	3.79

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

The goal of the risk assessment is to estimate the potential loss in the planning area, including loss of life, personal injury, property damage, and economic loss, from a hazard event. The risk assessment process allows communities and the school districts of Oregon County to better understand their potential risk to the identified hazards. It will provide a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

This chapter is divided into four main parts:

- **Section 3.1 Hazard Identification** identifies the hazards that threaten Oregon County and provides a factual basis for elimination of hazards from further consideration;
- **Section 3.2 Assets at Risk** provides Oregon County’s total exposure to natural hazards, considering critical facilities and other community assets at risk;
- **Section 3.3 Future Land Use and Development** discusses development that has occurred since the last plan update and any increased or decreased risk that resulted. This section also discusses areas of planned future development and any implications on risk/vulnerability
- **Section 3.4 Hazard Profiles and Vulnerability Analysis** provides more detailed information about the hazards impacting the planning area. For each hazard, there are three sections:
  - 1) Hazard Profile provides a general description and discusses the threat to the planning area, the geographic location at risk, potential severity/magnitude/extent, previous occurrences of hazard events, probability of future occurrence, risk summary by jurisdiction, impact of future development on the risk;
  - 2) Vulnerability Assessment further defines and quantifies populations, buildings, critical facilities, and other jurisdictional assets at risk to natural hazards; and
  - 3) Problem Statement briefly summarizes the problem and develops possible solutions.

Oregon Co. Courthouse – Alton, MO



## 3.1 HAZARD IDENTIFICATION

---

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

The Plan profiles all natural hazards that can affect Oregon County. The natural hazards that can affect the county have been identified in the 2016 Oregon County Plan and the 2018 Missouri State Plan. Natural hazards are naturally occurring climatological, hydrological, or geologic events that have a negative effect of people and the built environment. Natural hazards identified include:

- Riverine and Flash Flood
- Dam Failure
- Earthquake
- Land Subsidence/ Sinkholes
- Drought
- Extreme Temperatures
- Severe Thunderstorm/ High Winds/ Lightning/ Hail
- Severe Winter Weather
- Tornado
- Wildfire

### 3.1.1 Review of Existing Mitigation Plans

The Plan profiles all natural hazards that affect Oregon County. The hazards identified in the 2016 Oregon County Plan are identified in the 2018 Missouri State Plan. The State Plan also includes levee failure. Levee failure was excluded from the mitigation planning process as there are no mapped levees nor associated levee protected areas within or immediately upstream of Oregon County.

Human-caused and technological hazards identified in the State Plan include:

- CBRNE Attack
- Civil Disorder
- Cyber Disruption
- Structural and Urban Fires
- Hazardous Materials
- Mass Transportation Accidents
- Nuclear Power Plants
- Public Health Emergencies/Environmental Issues
- Special Events
- Terrorism
- Utility Interruptions and System Failures

In Missouri, local plans customarily include only natural hazards, as only natural hazards are required by federal regulations to be included. It was determined to include only natural hazards. The MPC agreed that human-caused and technological hazards are addressed in a Regional Homeland Security Oversight Committee (RHSOC) Threat and Hazard Identification Risk Assessment (THIRA) and that including only natural hazards would meet the needs of local entities participating in the plan update. The THIRA was referenced during the update in order to assist SCOCOG staff in understanding the risk structure within Oregon County.

### 3.1.2 Review Disaster Declaration History

Since 1953, FEMA has announced 21 disaster declarations that include Oregon County. Examples of these disasters include the following: severe storms, tornadoes, flooding, severe winter storms, a pandemic, and a hurricane evacuation. Federal and/or state declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. If the disaster is so severe that both the local and state governments' capacities are exceeded; a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

The Robert T. Stafford Disaster Relief and Emergency Assistance Act, (PL 100-707) requires that all requests for a declaration by the President must be made by the governor of the affected state. State and federal officials conduct a Preliminary Damage Assessment (PDA) to show that the disaster is of such severity and magnitude that effective response is beyond state and local capabilities. Based on the governor's request, the president may declare that a major disaster or emergency exists, thus activating federal programs to assist in the response and recovery effort. Not all programs are activated for every disaster. Some declarations will provide only individual assistance or public assistance, while others provide both.

FEMA also issues emergency declarations, which are more limited in scope and do not include the long-term federal recovery programs of major disaster declarations. Determinations for declaration type are based on scale and type of damages and institutions or industrial sectors affected. (<https://www.fema.gov/declaration-process>)

The most recent disaster declaration occurred on March 26, 2020. Table 3.1 lists the federal FEMA disaster declarations that included Oregon County. Examples of these disasters include the following: severe storms, tornadoes, flooding, severe winter storms, a pandemic, and a hurricane evacuation. Federal and/or state declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. If the disaster is so severe that both the local and state governments'

capacities are exceeded; a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

The Robert T. Stafford Disaster Relief and Emergency Assistance Act, (PL 100-707) requires that all requests for a declaration by the President must be made by the governor of the affected state. State and federal officials conduct a Preliminary Damage Assessment (PDA) to show that the disaster is of such severity and magnitude that effective response is beyond state and local capabilities. Based on the governor's request, the president may declare that a major disaster or emergency exists, thus activating federal programs to assist in the response and recovery effort. Not all programs are activated for every disaster. Some declarations will provide only individual assistance or public assistance, while others provide both.

FEMA also issues emergency declarations, which are more limited in scope and do not include the long-term federal recovery programs of major disaster declarations. Determinations for declaration type are based on scale and type of damages and institutions or industrial sectors affected. (<https://www.fema.gov/declaration-process>)



**Table 3.1. FEMA Disaster Declarations that included Oregon County, Missouri, 1965-Present**

Disaster Number	Description	Year of Declaration	Individual Assistance (IA) Public Assistance (PA)
4552	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING	2020	PA
4490	COVID-19 PANDEMIC	2020	IA, PA
3482	COVID-19	2020	IA, PA
4317	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS AND FLOODING	2017	IA, PA
3374	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING	2015-16	PA
4238	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING	2015	PA
1980	SEVERE STORMS, TORNADOES, AND FLOODING	2011	PA
3317	SEVERE WINTER STORM	2011	PA
1847	SEVERE STORMS, TORNADOES, AND FLOODING	2009	PA
1822	SEVERE WINTER STORM	2009	PA
3303	SEVERE WINTER STORM	2009	PA
1809	SEVERE STORMS, FLOODING, AND A TORNADO	2008	PA
1749	SEVERE STORMS AND FLOODING	2008	IA, PA
3281	SEVERE WINTER STORMS	2007	PA
3267	SEVERE STORMS	2006	PA
3232	HURRICANE KATRINA EVACUATION	2005	PA
1463	SEVERE STORMS, TORNADOES, AND FLOODING	2003	IA, PA
1412	SEVERE STORMS, TORNADOES, AND FLOODING	2002	PA
1006	SEVERE STORMS, TORNADOES, AND FLOODING	1993	IA, PA
3017	DROUGHT	1979	IA, PA
1973	HEAVY RAINS, TORNADOES AND FLOODING	1973	IA, PA

Source: Federal Emergency Management Agency,  
<https://www.fema.gov/data-visualization-summary-disaster-declarations-and-grants>

### 3.1.3 Research Additional Sources

A variety of sources were researched for data on natural hazards. Primary sources included FEMA, State Emergency Management Agency (SEMA), National Centers for Environmental Information (NCEI) and National Oceanic and Atmospheric Administration (NOAA). The U.S. Geological Survey (USGS) and the Center for Earthquake Research and Information (CERI) were major sources for earthquake information. The Missouri Department of Natural Resources (MDNR) Dam Safety Division provided information concerning dams and the Missouri Department of Conservation (MDC). Other information sources included county officials; existing city, county, regional and state plans; and information from local officials. The additional sources of data on locations and past impacts of hazards in Oregon County include:

- Missouri Hazard Mitigation Plans (2013 and 2018)
- Previously approved planning area Hazard Mitigation Plan (2016)
- Federal Emergency Management Agency (FEMA)
- Missouri Department of Natural Resources
- National Drought Mitigation Center Drought Reporter
- US Department of Agriculture's (USDA) Risk Management Agency Crop Insurance Statistics
- National Agricultural Statistics Service (Agriculture production/losses)
- Data Collection Questionnaires completed by each jurisdiction
- State of Missouri GIS data
- Environmental Protection Agency
- Flood Insurance Administration
- Hazards US (Hazardus)
- Missouri Department of Transportation
- Missouri Public Service Commission
- National Fire Incident Reporting System (NFIRS)
- National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI);
- County and local Comprehensive Plans to the extent available
- County Emergency Management
- County Flood Insurance Rate Map, FEMA
- Flood Insurance Study, FEMA
- SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin
- U.S. Army Corps of Engineers
- U.S. Department of Transportation
- United States Geological Survey (USGS)

The only centralized source of data for many of the weather-related hazards is the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI). Although it is usually the best and most current source, there are limitations to the data which should be noted. The NCEI documents the occurrence of storms and other significant weather phenomena having sufficient intensity to

cause loss of life, injuries, significant property damage, and/or disruption to commerce. In addition, it is a partial record of other significant meteorological events, such as record maximum or minimum temperatures or precipitation that occurs in connection with another event. Some information appearing in the NCEI may be provided by or gathered from sources outside the National Weather Service (NWS), such as the media, law enforcement and/or other government agencies, private companies, individuals, etc. An effort is made to use the best available information but because of time and resource constraints, information from these sources may be unverified by the NWS. Those using information from NCEI should be cautious as the NWS does not guarantee the accuracy or validity of the information.

The NCEI damage amounts are estimates received from a variety of sources, including those listed above in the Data Sources section. For damage amounts, the NWS makes a best guess using all available data at the time of the publication. Property and crop damage figures should be considered as a broad estimate. Damages reported are in dollar values as they existed at the time of the storm event. They do not represent current dollar values.

The database currently contains data from January 1950 to September 2021, as entered by the NWS. Due to changes in the data collection and processing procedures over time, there are unique periods of record available depending on the event type. The following timelines show the different time spans for each period of unique data collection and processing procedures.

- 1) Tornado: From 1950 through 1954, only tornado events were recorded.
- 2) Tornado, Thunderstorm Wind and Hail: From 1955 through 1992, only tornado, thunderstorm wind and hail events were keyed from the paper publications into digital data. From 1993 to 1995, only tornado, thunderstorm wind and hail events have been extracted from the Unformatted Text Files.
- 3) All Event Types (48 from Directive 10-1605): From 1996 to present, 48 event types are recorded as defined in NWS Directive 10-1605.

Injuries and deaths caused by a storm event are reported on an area-wide basis. A table resulting from an NCEI search by county, with a death or injury listed in connection with that search did not necessarily occur in that county.

### 3.1.4 Hazards Identified

**Table 3.2. Hazards Identified for Each Jurisdiction**

The natural hazards that may impact or have affected Oregon County are profiled below. All hazards do not necessarily affect every jurisdiction participating in the same way. Table 3.2 provides a summary of the jurisdictions that may be affected by each hazard. An “x” in the table indicates that jurisdiction is affected by the hazard, and a “-”, indicates the hazard is not applicable to that jurisdiction

Jurisdiction	Dam Failure	Drought	Earthquake	Extreme Temperature	Wildfire	Flooding (River and Flash)	Land Subsidence/Sinkholes	Severe Winter Weather	Thunderstorm/Lightning/Hail/High Wind	Tornado
Oregon County	x	x	x	x	x	x	x	x	x	x
City of Alton	-	x	x	x	x	x	x	x	x	x
City of Koshkonong	-	x	x	x	x	-	x	x	x	x
City of Thayer	-	x	x	x	x	x	x	x	x	x
<b>School Districts</b>										
Alton R-IV	-	X	x	X	x	X	x	X	x	X
Couch R-I	-	X	X	X	X	X	X	X	X	X
Oregon-Howell R-III	-	X	X	X	X	X	X	X	X	X
Thayer R-II	-	x	X	x	X	x	X	x	X	X

### **3.1.5 Multi-Jurisdictional Risk Assessment**

The risk assessment assesses each participating jurisdiction's vulnerability to each hazard that can affect the planning area. Many of the hazards identified in the risk assessment have the same probability of occurrence throughout the planning area. The hazards that vary across the planning area in terms of risk include dam failure, flash flood, grass or wildland fire, river flood, and sinkholes/land subsidence. These differences are detailed in each hazard profile under geographic location and vulnerability.

Oregon County is uniform in terms of climate, however, topography and building construction characteristics vary within the county. Oregon County has experienced little growth in population and development from 2000 to the present. Mitigation capabilities of each jurisdiction are profiled in section 2.2.

The urbanized areas within the planning area, which have more assets at a greater density, have greater vulnerability to weather-related hazards, however, the vulnerability to future development can be mitigated through updated building codes and code enforcement as well as land use planning. These capabilities and resources to mitigate the impact of natural hazards vary across jurisdictions in the planning area. These differences will be discussed in greater detail in the vulnerability sections of each hazard

## **3.2 ASSETS AT RISK**

This section assesses Oregon County population, structures, critical facilities and infrastructure, and other important assets that may be at risk of natural hazards. The inventory of assets for each jurisdiction were derived from parcel data from the Oregon County Assessor, the Oregon County Structures dataset downloaded from the Missouri Spatial Data Information Service (MSDIS), and local jurisdiction data collection questionnaires. The Missouri Mitigation Viewer was also referenced to ensure that total counts are accurate

### 3.2.1 Total Exposure of Population and Structures

Missouri Spatial Data Information Service (MSDIS) data was used for structure points and paired with Oregon County Assessors data for values.

#### Unincorporated County and Incorporated Cities

In the following three tables, population data is based on 2010 Census Bureau data. Building counts and building exposure values are based on parcel data developed by the State of Missouri Geographic Information Systems (GIS) database and the Oregon County Assessor.

Contents exposure values were calculated by factoring a multiplier to the building exposure values based on usage type. The multipliers were derived from HAZUS definitions and are defined below in **Table 3.3**

Land values have been purposely excluded from consideration because land remains following disasters, and subsequent market devaluations are frequently short term and difficult to quantify. Another reason for excluding land values is that state and federal disaster assistance programs generally do not address loss of land (other than crop insurance). It should be noted that the total valuation of buildings is based on county assessors' data which may not be current. In addition, government-owned properties are usually taxed differently or not at all, and so may not be an accurate

representation of true value. Note that public school district assets and special districts assets are included in the total exposure tables assets by community and county.

Table 3.3 shows the total population, building count, estimated value of buildings, estimated value of contents, and estimated total exposure to parcels for the unincorporated county and each incorporated city. For multi-county communities, the population and building data may include data on assets located outside the planning area. Table 3.4 provides the building value exposures for the county and each city in the planning area broken down by usage type. Finally, Table 3.5 provides the building count total for the county and each city in the planning area broken out by building usage types (residential, commercial, industrial, and agricultural).

**Table 3.3. Maximum Population and Building Exposure by Jurisdiction**

Jurisdiction	2010 Population	Building Count	Building Exposure (\$)	Contents Exposure (\$)	Total Exposure (\$)
City of Alton	871	488	40,011.50	25,904.50	65,916.00
City of Koshkonong	212	141	22,360.60	15,030.80	37,391.40
City Thayer	2,243	1263	42,071.35	28,380.18	70,451.53
Oregon County	7,555	10,039	28,342.07	19,100.35	47,442.42
<b>Totals</b>	<b>10,881</b>	<b>9483</b>	<b>\$132,785.52</b>	<b>\$88,415.83</b>	<b>\$221,201.35</b>

Source: U.S. Bureau of the Census, Building Count and Building Exposure, Missouri GIS Database from SEMA Mitigation Management; Contents Exposure derived by applying multiplier to Building Exposure based on Hazus MH 2.1 standard contents multipliers per usage type as follows: Residential (50%), Commercial (100%), Industrial (150%), Agricultural (100%). For purposes of these calculations, government, school, and utility were calculated at the commercial contents rate.

**Table 3.4. Building Values/Exposure by Usage Type**

Jurisdiction	Residential (\$)	Commercial (\$)	Agricultural (\$)	Total (\$)
City of Alton	52,893.54	127,580.56	10,763.08	191,237.18
City of Koshkonong	25,189.62	62,471.76	4,425.00	92,086.38
City Thayer	54,971.78	170,288.83	4,100.42	229,361.03
Oregon County	75,721.55	210,996.81	21,688.99	308,407.35
<b>Totals</b>	<b>208,776.49</b>	<b>571,337.96</b>	<b>40,977.49</b>	<b>821,091.94</b>

Source: Missouri GIS Database, Oregon Co. Assessor, SEMA Mitigation Management Section

**Table 3.5. Building and Parcel Counts by Usage Type**

Jurisdiction	Residential Counts	Commercial Counts	Agricultural Counts	Total
City of Alton	387	75	26	488
City of Koshkonong	118	19	4	141
City Thayer	1,050	165	48	1,263
Oregon County	3,851	187	739	4,777
<b>Totals</b>	<b>5,406</b>	<b>446</b>	<b>817</b>	<b>6,669</b>

Source: Missouri GIS Database, Oregon Co. Assessor, SEMA Mitigation Management Section; Public School Districts and Special Districts

Even though school district total assets are included in the tables above, additional discussion is needed, based on the data that is available from the districts' completion of the Data Collection Questionnaire and district-maintained websites. The number of enrolled students at the participating public school districts is provided in Table 3.6 below. Additional information includes the number of buildings, building values (building exposure) and contents value (contents exposure).

**Table 3.6. Population and Building Exposure by Jurisdiction-Public School Districts**

Public School District	Staff and Enrolment	Building Count	Building Exposure (\$)	Contents Exposure (\$)	Total Exposure (\$)
Alton R-IV	585	4	38,791,624.67	5,296,882.33	44,088,507
Couch R-I	217	12	10,196,709.13	2,587,957.87	12,784,667
Oregon-Howell R-III	233	15	13,813,796.48	2,357,129.52	16,170,926
Thayer R-II	674	7	32,325,045.97	2,398,165.03	34,723,211

Source: <http://mcds.dese.mo.gov/quickfacts/Pages/District-and-School-Information.aspx>, select the file for the most recent year called "20xx Building Enrollment PK-12", filter the spreadsheet by selecting only the public school districts in the planning area. The Building Exposure, Contents Exposure, and Total Exposure amounts come from the completed Data Collection Questionnaires from Public School Districts. In general, the school districts obtain this information from their insurance coverage amounts.

### 3.2.2 Critical and Essential Facilities and Infrastructure

This section will include information from the Data Collection Questionnaire and other sources concerning the vulnerability of participating jurisdictions' critical, essential, high potential loss, and transportation/lifeline facilities to identified hazards. Definitions of each of these types of facilities are provided below.

- Critical Facility: Those facilities essential in providing utility or direction either during the response to an emergency or during the recovery operation.
- Essential Facility: Those facilities that if damaged, would have devastating impacts on disaster response and/or recovery.
- High Potential Loss Facilities: Those facilities that would have a high loss or impact on the community.
- Transportation and lifeline facilities: Those facilities and infrastructure critical to transportation, communications, and necessary utilities.

Table 3.6 on page 3.12 includes a summary of the inventory of critical and essential facilities and infrastructure in the planning area. The list was compiled from the Data Collection Questionnaire.



**Table 3.7. Inventory of Critical/Essential Facilities and Infrastructure by Jurisdiction**

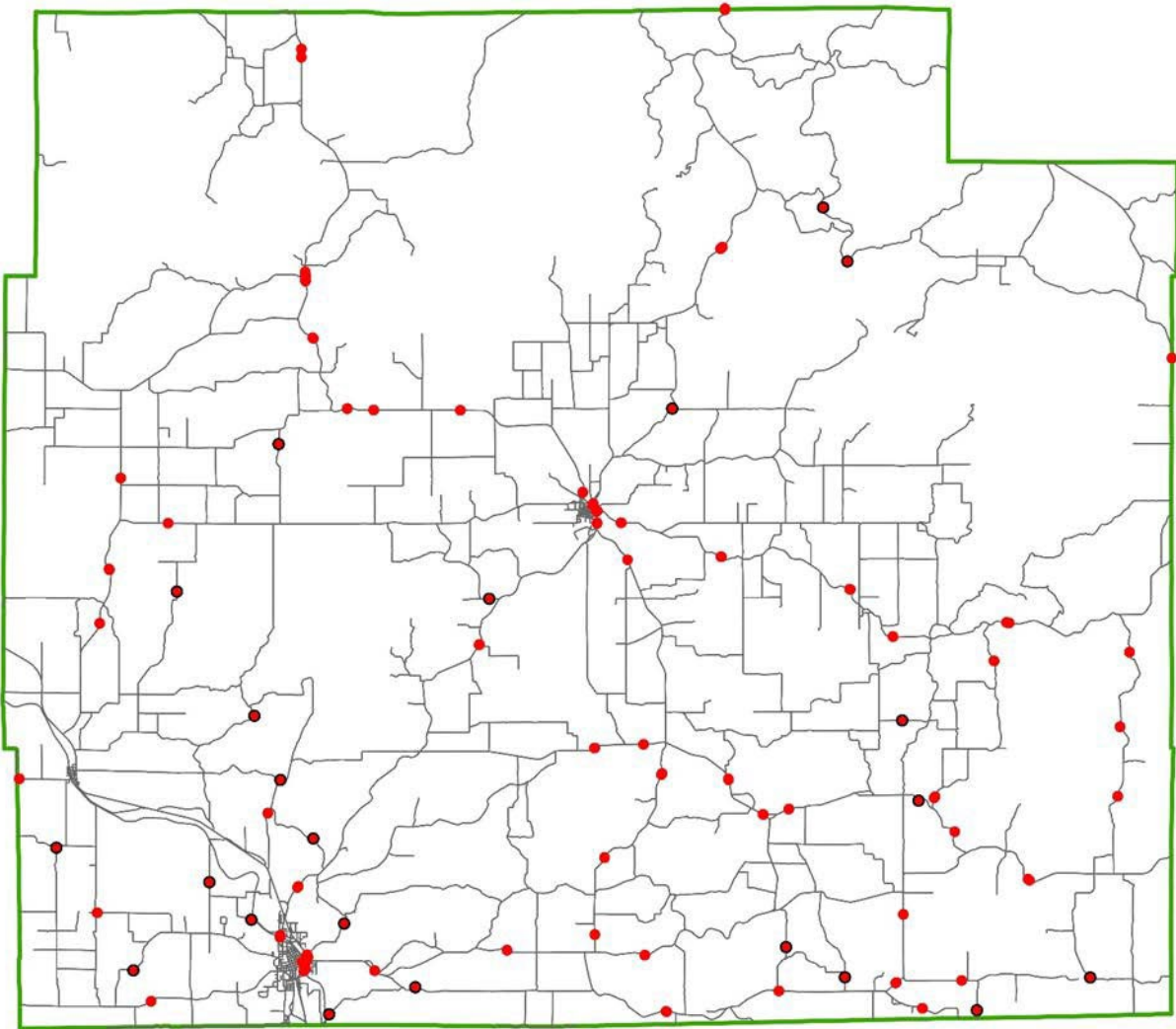
Jurisdiction	Airport Facility	Bus Facility	Childcare Facility	Communications Tower	Electric Power Facility	Emergency Operations	Fire Service	Government	Housing	Shelters	Highway Bridge	Hospital/Health Care	Military	Natural Gas Facility	Nursing Homes	Police Station	Potable Water Facility	Rail	Sanitary Pump Stations	School Facilities	Stormwater Pump Stations	Tier II Chemical Facility	Wastewater Facility	Total
City of Alton	-	-	1	2	-	-	1	2	1	1	3	-	-	-	-	2	1	-	-	1	-	-	1	16
City of Koshkonong	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1	4
City Thayer	1	-	1	2	-	1	1	1	1	-	4	2	-	-	1	1	1	1	-	2	-	-	1	21
Oregon County	-	-	-	1	-	-	3	-	-	-	74	-	-	-	-	-	-	1	1	1	-	-	-	82
<b>Totals</b>	<b>1</b>	<b>-</b>	<b>2</b>	<b>5</b>	<b>-</b>	<b>1</b>	<b>5</b>	<b>4</b>	<b>2</b>	<b>1</b>	<b>81</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>5</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>123</b>

Source: Missouri 2018 State Hazard Mitigation Plan and Hazard Mitigation Viewer; Data Collection Questionnaires; Hazus, etc.

Figure 3.1 is a map that shows the locations of bridges in Oregon County included in the National Bridge Inventory (NBI) data set. The NBI data contains a “scour index”, which is a number indicating the vulnerability of a bridge to scour during a flood. Bridges with a scour index between 1 and 3 are considered “scour critical”, or a bridge with a foundation determined to be unstable for the observed or evaluated scour condition. One scour critical bridge is located within Oregon County. US Highway 160 bridge over Piney Creek, just east of the City of Thayer.

Upon completion of the Thayer MO 19 Railroad Overpass Replacement Project in 2020, there are no **structurally deficient bridges** in Oregon County.

**Figure 3.1. Oregon County Bridges**



### 3.2.3 Other Assets

Assessing the vulnerability of the planning area to disaster also requires data on the natural, historic, cultural, and economic assets of the area. This information is important for many reasons.

- These types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- Knowing about these resources in advance allows for consideration immediately following a hazard event, which is when the potential for damages is higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- The presence of natural resources can reduce the impacts of future natural hazards, such as wetlands and riparian habitats which help absorb floodwaters.
- Losses to economic assets like these (e.g., major employers or primary economic sectors) could have severe impacts on a community and its ability to recover from disaster.

**Table 3.8. Threatened and Endangered Species in Oregon County, Missouri**

Common Name	Scientific Name	Status
Gray Bat	Myotis grisescens	Endangered
Indiana Bat	Myotis sodalist	Endangered
Northern Long-Eared Bat	Myotis septentrionalis	Threatened
Ozark Hellbender	Cryptobranchus alleganiensis bishopi	Endangered
Virginia Sneezeweed	Helenium virginicum	Threatened

Source: U.S. Fish and Wildlife Service, <http://www.fws.gov/midwest/Endangered/lists/missouri-cty.html>;

#### Natural Resources:

**Table 3.9. Parks in Oregon County**

Area Name	Address	City
Cover Memorial Wildlife Area	From Alton, take Route P west 5 miles, then County Road P-314 south 1 mile.	Unincorporated
Martin Access	From Thayer, take County Road 19-213 east 1.50 miles.	Thayer
Warm Fork Conservation Area	From Koshkonong, take Route Z east 5 miles, then County Road P-323 north 0.10 mile.	Unincorporated

<http://mdc4.mdc.mo.gov/applications/moatlas/AreaList.aspx?txtUserID=quest&txtAreaNm=s>

Park Name	Address	City
Warm Fork Park	Warm Fork Park is in Thayer just north of the bypass at Highways 63 and 142, with an exit off of Highway 63.	Thayer
Grand Gulf State Park	From Thayer, take Highway W six miles west to the area entrance	Unincorporated
Tucker Creek Park	Tucker Creek Road	Alton
City Park	8 <sup>th</sup> Street	Thayer

Source: MDC, DataCollectionQuestionnaires

Historic Resources: The National Register of Historic Places is the official list of registered cultural resources worthy of preservation. It was authorized under the National Historic Preservation Act of 1966 as part of a national program. The purpose of the program is to coordinate and support public and private efforts to identify, evaluate, and protect our historic and archeological resources. The National Register is administered by the National Park Service under the Secretary of the Interior. Properties listed in the National Register include districts, sites, buildings, structures and objects that are significant in American history, architecture, archeology, engineering, and culture.

**Table 3.10. Oregon County Properties on the National Register of Historic Places**

Property	Address	City	Date Listed
Greer Mill	W. Side of MO 19; 10 mi. N. of Alton	Unincorporated	1/26/06
Pigman Mound Archaeological Site	Address restricted	N/A	3/4/71

Source: Missouri Department of Natural Resources – Missouri National Register Listings by County <http://dnr.mo.gov/shpo/mnrlist.htm>

Economic Resources:

**Table 3.11. Major Non-Government Employers in Oregon County**

Employer Name	Main Locations	Product or Service	Employees
Walmart	Thayer	Retail	102
McClain	Koshkonong	Hardwood Flooring	55
Central Ozark Machining	Alton	Airplane Parts Mfg.	30

Source: Data Collection Questionnaires; local Economic Development Commissions

Agriculture

**Table 3.12. Agriculture-Related Sales in Oregon County**

Commodity Group	State Rank (out of 114)
Milk from cows	13
Cattle and calves	15
Sheep, goats, wool, mohair, and milk	26
Fruits, tree nuts, and berries	77

Source: 2016 Missouri Agricultural Census

**Table 3.13. Top Livestock Inventory Items**

Livestock Inventory	State Rank (out of 114)
Goats, all	5
Pheasants	7
Cattle and calves	21
Horses and ponies	44

Source: 2016 Missouri Agricultural Census

## 3.3 LAND USE AND DEVELOPMENT

### 3.3.1 Development Since Previous Plan Update

**Table 3.14. County Population Growth, 2010-2019**

Jurisdiction	Total Population 2010	Total Population 2019	2010-2019 # Change	2000-2019 % Change
Oregon County	10,881	10,647	234	-22%
City of Alton	871	628	243	-28%
City of Koshkonong	212	195	17	-8%
City of Thayer	2243	2,335	92	+4%

Source: U.S. Bureau of the Census, Decennial Census, 2019 Population Estimates, American Community Survey 5-year Estimates; Population Statistics are for entire incorporated areas as reported by the Census bureau

**Table 3.15. Change in Housing Units, 2010-2019**

Jurisdiction	Housing Units 2010	Housing Units 2019	2010-2019 # Change	2000-2019 % Change
Oregon County	5114	4249	865	-17%
City of Alton	406	304	102	-25%
City of Koshkonong	102	66	36	-35%
City of Thayer	1140	993	147	-13%

Source: U.S. Bureau of the Census, Decennial Census, American Community Survey 5-year Estimates; Population Statistics are for entire incorporated areas as reported by the U.S. Census Bureau

**Unincorporated Oregon County** has seen significant estimated population decline since 2010. Most of the new development in the county is taking place in locations just outside the county’s two largest cities: Alton and Thayer. Much of the eastern half the county is owned by federal and state governments and will remain nature and wildlife reserves for the foreseeable future. Figure 3.2 below depicts the amount of government-controlled land in Oregon County.

#### ***The City of Alton***

The City of Alton currently has no comprehensive plan. Alton experienced significant estimated population decline since 2010. This growth is primarily occurring in the western half of the city where two new multi-family residential developments were constructed during that period. This provided much-needed affordable housing in one of the poorest counties in the State of Missouri. These new developments are in short walking distance to the Alton School District’s tornado safe room, which was constructed to accommodate all students in the district as well as the entire population of the City of Alton. It is expected that additional growth inside the city limits of Alton will continue to occur on the western side of the city, west of State Highway 19.

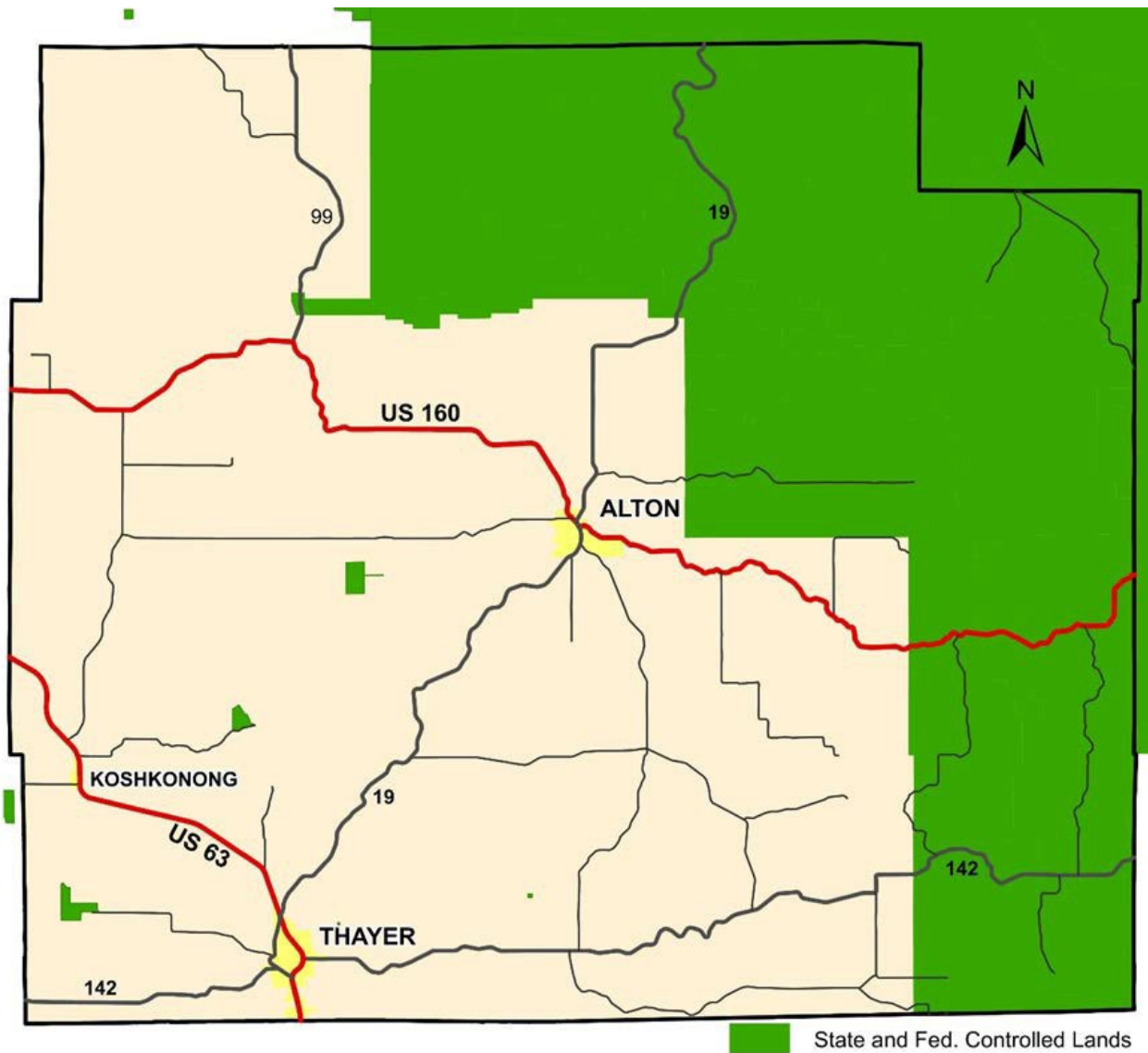
#### ***The City of Koshkonong***

The City of Koshkonong currently has no comprehensive plan. The city is estimated to have lost approximately 8% of its population between 2010 and 2019. Koshkonong is a very small bedroom community located on US Highway 63 between the City of West Plains (Howell County) and Thayer, MO. Once known as the “Peach Capital of the World”, the community has lost most of its industry through the years and growth has stagnated. The City was awarded a Community Development Block Grant in 2018 to resurface its entire city-street network, in response to severely deteriorating conditions. The growth in Koshkonong is expected to stagnate over the coming years and will likely be limited to one new residential structure every two or three years.

**The City of Thayer**

The City of Thayer does have a Comprehensive Plan on file; however, it was last updated in 1990. The city's Floodplain Ordinance was updated in 2008. City officials provide several public information programs including household preparedness training and smoke alarm programs. Thayer experienced modest population growth between 2000 and 2019 with a 4% percent increase in its citizenry. The focus of new development in the city is expected to be in the eastern half of the community, east of US Highway 63.

**Figure 3.2. State and Federal Controlled Lands in Oregon County**



### **3.3.2 Future Land Use and Development**

The following discussion in this section provides future growth and development information, where available, relative to each participating jurisdiction. Much of the information included is from the community data collection questionnaires:

#### ***Unincorporated Oregon County***

No major future development at the county level was reported by Oregon County.

#### ***City of Alton***

The city is currently in talks to purchase a new building on the city square in an effort to relocate its city offices and police department from a residential area to a more centralized location.

#### ***City of Koshkonong***

“Kosh” city officials are working on the installation of new outdoor warning sirens, funded by a FEMA grant. Additionally, they are marketing city-owned parcels of land along US Highway 63 in an effort to spur economic growth.

#### ***City of Thayer***

City officials are working with a developer to facilitate the development of the 60-acre Thayer Industrial Park into a mixed-used development. The project would consist of approximately 60 new homes, a commercial strip development along US Highway 63, and a new City Park and Community Center. The City of Thayer is looking for funding opportunities to mitigate flash flooding damage through stormwater drainage infrastructure improvements. NOIs have been submitted for a number of years, with no success.

#### ***Alton R-IV School District***

No major future development was noted by then Alton R-IV School District.

#### ***Couch R-I School District***

Couch School has plans to construct a multi-purpose tornado safe room if grant funding assistance can be acquired.

#### ***Oregon R-III School District***

Oregon-Howell School (Koshkonong) has plans to construct a multi-purpose tornado safe room if grant funding assistance can be acquired.

#### ***Thayer R-II School District***

Thayer has plans to construct a multi-purpose tornado safe room if grant funding assistance can be acquired.

## 3.4 HAZARD PROFILES, VULNERABILITY, AND PROBLEM STATEMENTS

---

Each hazard will be analyzed individually in a hazard profile. The profile will consist of a general hazard description, location, strength/magnitude/extent, previous events, future probability, a discussion of risk variations between jurisdictions, and how anticipated development could impact risk. At the end of each hazard profile will be a vulnerability assessment, followed by a summary problem statement.

### Hazard Profiles

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

The level of information presented in the profiles will vary by hazard based on the information available. With each update of this plan, new information will be incorporated to provide better evaluation and prioritization of the hazards that affect the planning area. Detailed profiles for each of the identified hazards include the information categorized as follows:

**Hazard Description:** This section consists of a general description of the hazard and the types of impacts it may have on a community or school/special district.

**Geographic Location:** This section describes the geographic location of the hazard in the planning area. Where available, use maps to indicate the specific locations of the planning area that are vulnerable to the subject hazard. For some hazards, the entire planning area is at risk.

**Severity/Magnitude/Extent:** This includes information about the severity, magnitude, and extent of a hazard. For some hazards, this is accomplished with description of a value on an established scientific scale or measurement system, such as an EF2 tornado on the Enhanced Fujita Scale. Severity, magnitude, and extent can also include the speed of onset and the duration of hazard events. Describing the severity/magnitude/extent of a hazard is not the same as describing its potential impacts on a community. Severity/magnitude/extent defines the characteristics of the hazard regardless of the people and property it affects.

**Previous Occurrences:** This section includes available information on historic incidents and their impacts. Historic event records form a solid basis for probability calculations.

**Probability of Future Occurrence:** The frequency of recorded past events is used to estimate the likelihood of future occurrences. Probability was determined by dividing the number of recorded events by the number of years and multiplying by 100. This gives the percent chance of the event happening in any given year. For events occurring more than once annually, the probability will be reported 100% in any given year, with a statement of the average number of events annually.

**Changing Future Conditions Considerations:** In addition to the probability of future occurrence, changing future conditions are considered, including the effects of long-term changes in weather patterns and climate on the identified hazards. This analysis is provided by the National Oceanic and Atmospheric Administration (NOAA)



## **Vulnerability Assessments**

**Requirement §201.6(c)(2)(ii) :**[The risk assessment shall include a] description of the jurisdiction’s vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

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

**Requirement §201.6(c)(2)(ii)(B) :**[The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

**Requirement §201.6(c)(2)(ii)(C) :** [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

**Requirement §201.6(c)(2)(ii) :** (As of October 1, 2008) [The risk assessment] must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged in floods.

Following the hazard profile for each hazard will be the vulnerability assessment. The vulnerability assessment further defines and quantifies populations, buildings, critical facilities, and other community assets at risk to damages from natural hazards. The vulnerability assessments should be based on the best available data, including data collected from the 2018 State Hazard Mitigation Plan.

The vulnerability assessments in this plan will also be based on:

- Written descriptions of assets and risks provided by participating jurisdictions;
- Existing plans and reports;
- Personal interviews with planning committee members and other stakeholders; and,
- Other sources as cited.

In the Vulnerability Assessment, the following sub-headings will be addressed:

- **Vulnerability Overview:** An overall summary of each jurisdiction’s vulnerability to the identified hazards. The overall summary of vulnerability identifies structures, systems, populations, or other community assets as defined by the community that are susceptible to damage and loss for hazard events.
- **Potential Losses to Existing Development:** Includes the types and numbers of building and critical facilities
- **Previous and Future Development:** This section will include information on how changes in development have impacted the community’s vulnerability to this hazard. It also includes a description of how changes in development that occurred in known hazard prone areas since the previous plan have increased or decreased the community’s vulnerability, and any anticipated future development in the county, and how that would impact hazard risk in Oregon County.

- **Hazard Summary by Jurisdiction:** For hazard risks that vary by jurisdiction, this section will provide an overview of the variation and the factual basis for that variation. For example, a community that has adopted more recent building codes and constructed safe rooms would be less vulnerable to the impact of tornados.

### **Problem Statements**

Each hazard analysis will conclude with a brief summary of the problems created by the hazard in Oregon County, and possible ways to resolve those problems. Jurisdiction-specific information in those cases where the risk varies across Oregon County is included.

## **3.4.1 Flooding (Riverine and Flash)**

### **Hazard Profile**

#### ***Hazard Description***

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

A flash flood occurs when water levels rise at an extremely fast rate as a result of intense rainfall over a brief period, sometimes combined with rapid snowmelt, ice jam release, frozen ground, saturated soil, or impermeable surfaces. Flash flooding can happen in Special Flood Hazard Areas (SFHAs) as delineated by the National Flood Insurance Program (NFIP), and can also happen in areas not associated with floodplains.

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

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

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

of flash flooding in the planning area.

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

### **Geographic Location**

Riverine and Flash flooding is most likely to occur in Special Flood Hazard Areas (SFHAs) where the 1% chance floodplain has been mapped. Areas along the Warm Fork of the Spring River and the Eleven Point River, specifically, the City of Alton and Thayer, and developed parts of the unincorporated county experience the greatest impact of flooding. According to NCEI storm event data from 2000 through 2020 there were 25 riverine flood events and 35 flash flood events recorded in the county during this period. These events are typically regional in nature and affect rivers, streams, and tributaries across a wide area. Figure 3.3, Figure 3.4, and Figure 3.5 are mapped Special Flood Hazard Areas for at risk communities in Oregon County.

**Table 3.16. Oregon County NCEI Flood Events by Location, 2000-2020**

Location	# of Events
Oregon County	21
City of Alton	0
City of Koshkonong	0
City of Thayer	14
<b>Total Unique Events</b>	<b>25</b>

Source: National Centers for Environmental Information, 2021

The NCEI storm event data lists flash flood events according to the nearest community or place. Most of these events cover larger areas than the smaller geographic areas reported in the data. Although some events may not be inside the corporate limits of the community identified in the narrative, they are in such proximity that the community named would be the most affected by impassible roads. It is safe to assume that numerous low water crossings would be impacted by heavy rains that exacerbate flash flooding across the county. In addition, multiple records are related to the same event and vice versa.

**Table 3.17. Oregon County Flash Flooding Events by Location, 2000-2020**

Location	# of Events
Oregon County	35
City of Alton	21
City of Koshkonong	0
City of Thayer	27
<b>Total Unique Events</b>	<b>35</b>

Source: National Centers for Environmental Information, 2021

Figure 3.3. Oregon County SFHAs with Critical Facilities



Figure 3.4. City of Alton Special Flood Hazard Areas with Critical Facilities

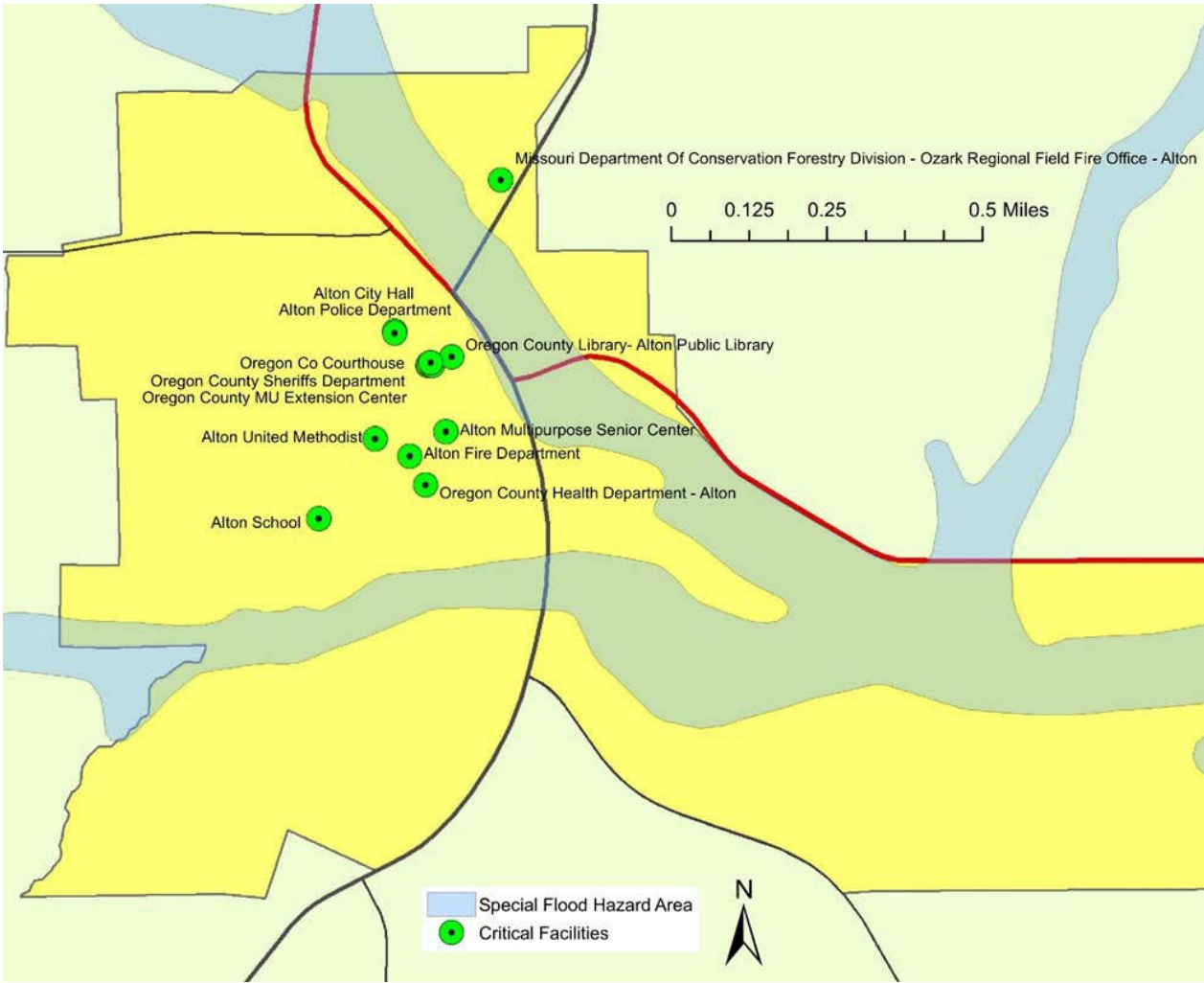
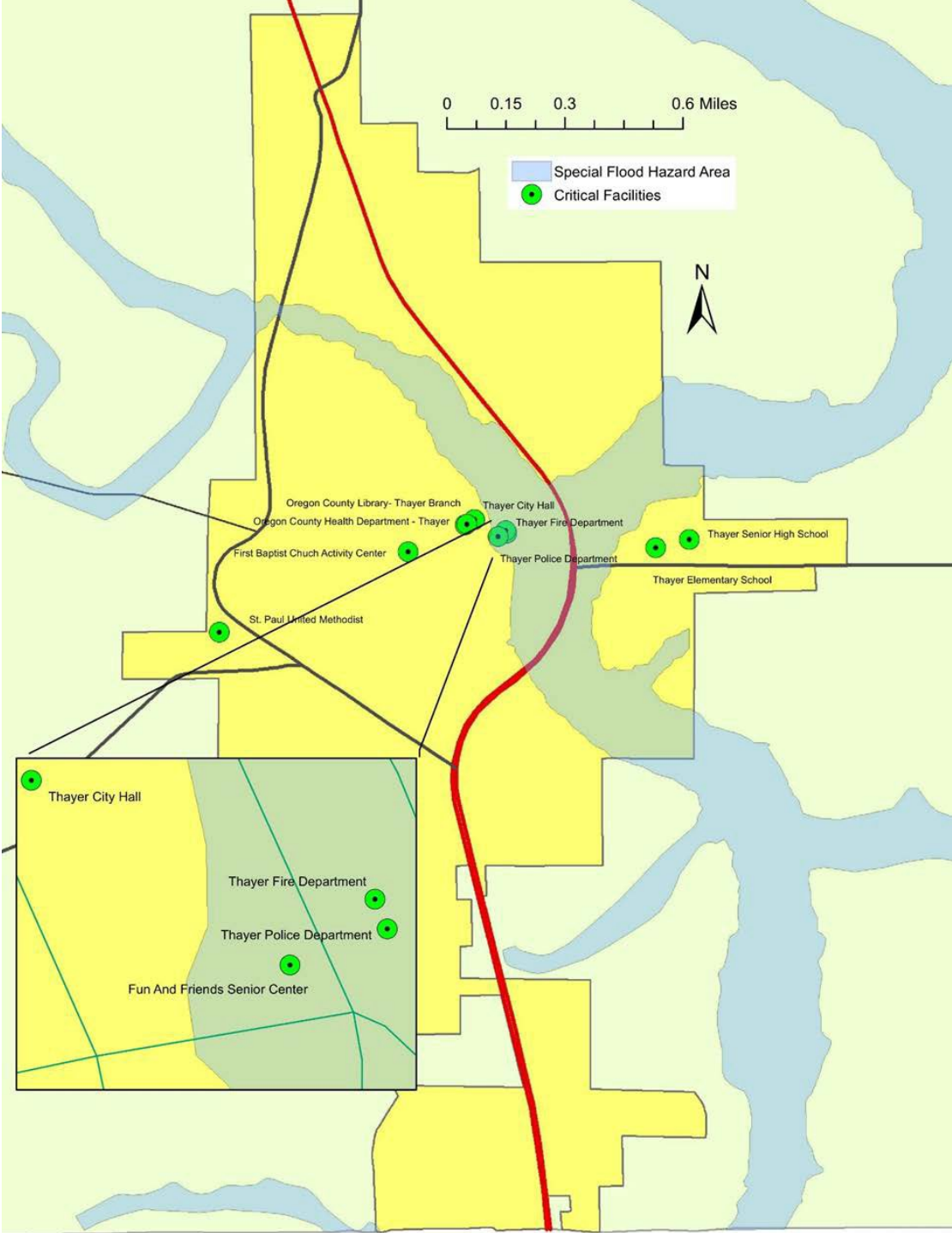


Figure 3.5. City of Thayer SFHA with Critical Facilities





## Strength/Magnitude/Extent

Missouri has a long and active history of flooding over the past century, according to the 2018 State Hazard Mitigation Plan. Flooding along Missouri’s major rivers generally results in slow-moving disasters. River crest levels are forecast several days in advance, allowing communities downstream sufficient time to take protective measures, such as sandbagging and evacuations. Nevertheless, floods exact a heavy toll in terms of human suffering and losses to public and private property. By contrast, flash flood events in recent years have caused a higher number of deaths and major property damage in many areas of Missouri.

Flooding presents a danger to life and property, often resulting in injuries, and in some cases, fatalities. Floodwaters themselves can interact with hazardous materials. Hazardous materials stored in large containers could break loose or puncture as a result of flood activity. Examples are bulk propane tanks. When this happens, evacuation of citizens is necessary.

Public health concerns may result from flooding, requiring disease and injury surveillance. Community sanitation to evaluate flood-affected food supplies may also be necessary. Private water and sewage sanitation could be impacted, and vector control (for mosquitoes and other entomology concerns) may be necessary.

When roads and bridges are inundated by water, damage can occur as the water scours materials around bridge abutments and gravel roads. Floodwaters can also cause erosion undermining roadbeds. In some instances, steep slopes that are saturated with water may cause mud or rockslides onto roadways. These damages can cause costly repairs for state, county, and city road and bridge maintenance departments. Flooding at low water crossings is extremely hazardous to public safety. Motorists can easily be swept from the roadway when they attempt to cross flooded roads resulting in water rescues, loss of property, and fatalities.

According to the U.S. Geological Survey, two critical factors affect flooding due to rainfall: rainfall duration and rainfall intensity – the rate at which it rains. These factors contribute to a flood’s height, water velocity and other properties that reveal its magnitude.

## National Flood Insurance Program (NFIP) Participation

Table 3.18 provides details on NFIP participation for the communities in the planning area. Table 3.26 contains the number of policies in force, amount of insurance in forces, number of closed losses, and total payments for each effected jurisdiction. The time represented by the 41 closed losses is from 1978 through August 2021. Oregon County’s Participation in the NFIP is currently sanctioned due to non- compliance with the local floodplain ordinance.

**Table 3.18. NFIP Participation in Oregon County**

Community ID #	Community Name	NFIP Participant (Y/N/Sanctioned)	Current Effective Map Date	Regular-Emergency Program Entry Date
290822	Oregon County (Sanctioned)	S	12/16/08	--
290490	Alton, City of	Y	10/19/05	08/04/87
--	Koshkonong, City of	Y	NSFHA	01/11/18
290267	Thayer, City of	Y	12/16/08	01/01/87

Source: NFIP Community Status Book, 2021; BureauNet, <http://www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-status-book>; M= No elevation determined – all Zone A, C, and X; NSFHA = No Special Flood Hazard Area; E=Emergency Program

**Table 3.19. NFIP Policy and Claim Statistics as of Date**

Community Name	Policies in Force	Insurance in Force	Closed Losses	Total Payments
City of Alton	2	\$479,000	40	\$412,354
City of Thayer	9	\$1,103,000	1	\$16,843

Source: NFIP Community Status Book, [insert date]; BureauNet, <http://bsa.nfipstat.fema.gov/reports/reports.html>; \*Closed Losses are those flood insurance claims that resulted in payment.

*The City of Alton shows the most insurance payments with 40 closed losses at a value of \$412,354.*

### **Repetitive Loss/Severe Repetitive Loss Properties**

*Repetitive Loss Properties* are those properties with at least two flood insurance payments of \$1,000 or more in a 10-year period. According to the Flood Insurance Administration, jurisdictions included in the planning area have a combined total of 0 repetitive loss properties.

*Severe Repetitive Loss (SRL):* A SRL property is defined it as a single family property (consisting of one- to-four residences) that is covered under flood insurance by the NFIP; and has (1) incurred flood-related damage for which four or more separate claims payments have been paid under flood insurance coverage with the amount of each claim payment exceeding \$1,000 and with cumulative amounts of such claims payments exceeding \$20,000; or (2) for which at least two separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

FEMA records indicate that there are no repetitive loss or severe repetitive loss property in Oregon County.

### **Previous Occurrences**

According to the NCEI storm event data, there have been 35 flash flood events recorded in Oregon County from 2000 to 2020. Six of these events resulted in reported property damage. The most recent damaging event occurred in April 2017 when a slow moving and strong weather system caused several rounds of very heavy and record-breaking rainfall to occur across the Missouri Ozarks leading to historic and deadly flooding. In Oregon County specifically, Highway 142 was closed at the Eleven Point River for several days. Numerous low water crossings were flooded. Several county roads were damaged. The NCEI data reports \$4,000,000 in property damage as a result of the historic 2017 event. Table 3.20 summarizes flash flood events by year from 2000 to 2020 in Oregon County.

**Table 3.20. NCEI Oregon County Flash Flood Events Summary, 2000 to 2020**

Year	# of Events	# of Deaths	# of Injuries	Property Damages	Crop Damages
2002	1	0	0	0	0
2003	1	0	0	\$10,000	0
2005	1	0	0	0	0
2006	8	0	0	0	0
2007	1	0	0	0	0
2008	3	0	0	\$1,050,000	0
2009	5	0	0	0	0
2011	6	0	0	\$1,000,000	0
2014	2	0	0	0	0
2015	2	0	0	\$500,000	0
2016	2	0	0	0	0
2017	1	0	0	\$4,000,000	0
2018	2	0	0	\$1,000	0
<b>TOTAL</b>	<b>35</b>	<b>0</b>	<b>0</b>	<b>\$6,561,000.00</b>	<b>0</b>

Source: NCEI, data accessed 2021



**Table 3.21. NCEI Oregon County Riverine Flood Events Summary, 2000 to 2020**

Year	# of Events	# of Deaths	# of Injuries	Property Damages	Crop Damages
2001	1	0	0	0	0
2002	7	0	0	\$45,000	0
2005	1	0	0	0	0
2008	1	0	0	0	0
2013	4	0	0	0	0
2015	5	0	0	0	0
2016	5	0	0	0	0
2019	1	0	0	0	0
<b>TOTAL</b>	<b>25</b>	<b>0</b>	<b>0</b>	<b>\$45,000.00</b>	<b>0</b>

Source: NCEI, 2021

Table 3.21 above summarizes riverine flood events listed in the NCEI in Oregon County by year. The data contains record of 25 events from 2000 to 2020. The greatest amount of losses occurred in 2002.

### ***Probability of Future Occurrence***

There have been a total of 60 unique flood events in Oregon County from 2000 to 2020 in the NCEI storm event database. Of those, 35 have been flash floods and the remaining 25 have been considered riverine flooding. Using a 21 year period of record, this equates to 1.66 flash flood events per year and a 100% probability of occurrence in the county in any given year. Using the same period of record, the probably of occurrence of riverine flooding inside Oregon County is 100%.

### ***Changing Future Conditions Considerations***

With changing climate conditions comes more uncertainty and less predictability for hazard events. An overall increasing global temperature is likely to lead to increased precipitation and intense rainstorms. Over the last fifty-years, the average annual precipitation in most of the Midwest has increased by 5- 10%; however, rainfall during the four wettest days of the year has increased nearly 35%. The amount of water flowing in most streams during the worst flood of the year has increased by more than 20%.

The National Climate Assessment states that extreme rainfall events and flooding have increased in the last century and that those trends are expected to continue. Heavy rain events are likely to cause erosion, diminished water quality, and negative impacts on transportation, agriculture, human health, and infrastructure.

### **Vulnerability**

#### ***Vulnerability Overview***

Flooding has been included in 10 of the 16 presidential natural disaster declarations that have included Oregon County. Periods of heavy rain falling at the rate of one inch per hour floods low water crossings throughout the county making many roads impassable. This creates a severe threat to motorists that attempt to drive through flood waters over the roadway. Riverine flooding occurs less frequently than flash flooding. Spaces in low lying areas outside the identified floodplain are frequently flooding. Street flooding over roadways has been reported in the Cities of Alton and Thayer and in unincorporated Oregon County. There are no school district facilities in SFHAs in Oregon County. Increases in development add to surface runoff and can potentially exacerbate flash flooding in areas that previously have not experienced flooding.

### ***Potential Losses to Existing Development***

Flood loss estimates were developed using a GIS methodology. A county-wide structures layer development by the University of Missouri in partnership with regional planning commissions across the state was overlaid on FEMA DFIRM maps to show number of structures and structure types situated inside Special Flood Hazard Areas. An average valuation from the Oregon County Assessor for each structure type: Residential, Commercial, or Agriculture was applied to the structures in identified SFHAs. A review of GIS data indicate that no school district facilities in Oregon County are located in the FEMA SFHA.

**Table 3.22. Potential Flood Losses for Building Types by Jurisdiction**

<b>Jurisdiction</b>	<b>Residential</b>	<b>Commercial</b>	<b>Agricultural</b>	<b>Total Building County</b>
Oregon County	251	4	204	459
City of Alton	3	19	4	26
City of Koshkonong	0	0	0	0
City of Thayer	15	14	13	42

Table 3.23 provides the total exposure for structures and contents by building type and jurisdiction. Losses were estimated by applying a 5% damage factor to total exposure. A 5% damage factor was used under the assumption that not all at-risk structures in the county would be affected simultaneously during a flooding event, nor would the individual structures sustain catastrophic damage.

**Table 3.23. Total Flood Exposure and Estimated Losses by Jurisdiction (in dollars)**

<b>Jurisdiction</b>	<b>Residential</b>	<b>Commercial</b>	<b>Agricultural</b>	<b>Estimated Exposure</b>	<b>Estimated Loss</b>
Oregon County	12,670,731	421,992	2,212,176	15,304,899	765,244.95
City of Alton	105,786	1,085,800	21,528	1,213,114	60,655.70
City of Koshkonong	-	-	-	-	-
City of Thayer	549,705	1,658,188	26,650	2,234,543	111,727.15

### ***Impact of Previous and Future Development***

Future development could impact flash flooding and riverine flooding in the planning area. Development in low-lying areas near rivers and streams or where interior drainage systems are not adequate to provide drainage during heavy rainfall events will be at risk to flash flooding. Future development would also increase impervious surfaces causing additional water run-off and drainage problems during heavy rainfall events. Not all jurisdictions in the county participate in the NFIP. Not all jurisdictions in the county have identified SFHAs, in Oregon County the City of Koshkonong does not have SFHA within its corporate boundaries. Zoning regulations that prohibit development in SFHAs and violations of floodplain management regulations are effective mitigation strategies in participating municipalities.

### ***Hazard Summary by Jurisdiction***

All local governments in the county are not equally at risk to flood hazards. The City of Koshkonong does not contain any Special Flood Hazard Areas and has no documented flood damages. Table 3.17 above details the exposure of assets near SFHAs and how it varies by jurisdiction. Many parts of the county are vulnerable to street and road flooding during periods of heavy rainfall. In particular, Highway 142 in southeastern Oregon County at the Eleven Point River Bridge becomes inundated for several days at a time during flooding events. The greatest impact of flooding is felt in the unincorporated part of the county. Due to the topography and many streams in the county, numerous low water crossings are damaged and create a significant hazard to public safety during flood events. This heightens the risk and exposure to infrastructure maintained by the Oregon County Commission. There is no heightened risk to school district facilities due to flood as no facilities are located inside FEMA SFHAs. No previous damage to school facilities by flooding was reported on the Data Collection Questionnaires used in the planning process.

### **Problem Statement**

Floods are frequent events and have been listed in 10 out of 16 presidential disaster declarations that have included Oregon County. Historic flooding in 2017 resulted in \$4,000,000 of reported damages throughout the county – a figure that many believe to be largely under-reported. Numerous water rescues have occurred in the county since 2002. Significant debris accumulation and damages at low water crossings have become regular occurrences due to flash flooding events.

The County Commission is in the process of developing a low water crossing inventory and improvement priority list for inclusion in their ongoing maintenance and management efforts. It is desired that warning signs, gauges, and perhaps warning lights be installed at frequently flooded low water crossings. The county is focusing on the replacements of frequently damaged crossings. Hazard awareness programs and education, such as “turn around, don’t drowned” messages during and prior to flood events in the county broadcast by local media can mitigate future risks to motorists at low water crossings.

## 3.4.2 Dam Failure

### Hazard Profile

#### *Hazard Description*

A dam is defined as a barrier constructed across a watercourse for the purpose of storage, control, or diversion of water. Dams are typically constructed of earth, rock, concrete, or mine tailings. Dam failure is the uncontrolled release of impounded water resulting in downstream flooding, affecting both life and property. Dam failure can be caused by any of the following:

- Overtopping - inadequate spillway design, debris blockage of spillways or settlement of the dam crest.
- Piping: internal erosion caused by embankment leakage, foundation leakage and deterioration of pertinent structures appended to the dam.
- Erosion: inadequate spillway capacity causing overtopping of the dam, flow erosion, and inadequate slope protection.
- Structural Failure: caused by an earthquake, slope instability or faulty construction.

According to the State Plan, Missouri had some 5,423 recorded dams in 2018, the largest number of man-made dams of any state in the country. Missouri topography allows lakes to be built easily and inexpensively, which accounts for the high number of dams. Despite the large number of dams, there are only 682 (about 13 percent) state regulated dams, with an additional 66 federally regulated dams. Federal dams in Missouri are primarily regulated by two federal agencies; the US Army Corps of Engineers (USACE) and the US Department of Agriculture Forest Service. The remaining 4,495 dams are unregulated.

Dams that fall under state regulation are non-federally regulated dams that are more than 35 feet in height. Most nonfederal dams are privately owned structures built either for agricultural, water supply or recreational use. The Department of Natural Resources (MDNR) Water Resources Center maintains the Dam and Reservoir Safety Program in Missouri. The program ensures that dams over 35 feet in height are safely constructed, operated, and maintained pursuant to Chapter 236 of the Revised Statutes of Missouri.

The Department of Natural Resources provided information about regulated and unregulated dams in Missouri. The information includes details of the dam dimensions, date of construction, approximate reservoir volume, contributing drainage basin area and hazard classification. In addition, USACE maintains the National Inventory of Dams (NID). The information in the NID database matches the list from the MDNR website with some additional details for dams in Oregon County. Although both agencies proved a hazard classification for dams, the dam classification systems differ.

The Missouri Dam and Reservoir Safety Council Rules and Regulations uses three classes of downstream environmental zones used when considering permits. The downstream environment zone is the area below the dam that would become inundated should the dam fail. Inundation is defined as water two feet or more over the submerged ground outside of the stream channel. These classes are based on the number of structures and types of development contained within the inundation area as presented in Table 3.24. The downstream environment zone classification is also used to prescribe the frequency of inspection.

**Table 3.24. MDNR Dam Hazard Classification Definitions**

Hazard Class	Definition
Class I	The area downstream from the dam that would be affected by inundation contains ten (10) or more permanent dwellings or any public building. Inspections of these dams must occur every two years.
Class II	The area downstream from the dam that would be affected by inundation contains one to nine permanent dwellings, or one (1) or more campgrounds with permanent water, sewer and electrical services or one (1) or more industrial buildings. Inspections of these dams must occur once every three years.
Class III	The area downstream from the dam that would be affected by inundation does not contain any of the structures identified for Class I or Class II dams. Inspections of these dams must occur once every five years.

Source: Missouri Department of Natural Resources, [http://dnr.mo.gov/env/wrc/docs/rules\\_reg\\_94.pdf](http://dnr.mo.gov/env/wrc/docs/rules_reg_94.pdf)

Dams in the NID are classified according to hazard potential, an indicator of the consequences of dam failure. A dam’s hazard potential classification, presented in Table 3.25 does not indicate its condition. Dams assigned the high hazards potential classification are those where failure will potentially result in loss of human life. Significant hazard potential are those dams where failure results in no probable loss of human life but can cause economic loss. Dams assigned the low hazard potential classification are those where failure will result in no probable loss of human life and low economic or environmental losses. Losses are principally limited to the owner’s property.

**Table 3.25. NID Dam Hazard Classification Definitions**

Hazard Class	Definition
Low Hazard	Failure results in only minimal property damage
Significant Hazard	Failure could possibly result in the loss of life and appreciable property damage
High Hazard	If the dam were to fail, lives would likely be lost and extensive property damage would result

Source: National Inventory of Dams

There is not a direct correlation between the State Hazard classification and the NID classifications. However, most dams that are in the States Classes I and II are considered NID High Hazard Dams.

**Geographic Location**

According to the MDNR there are nine (9) total dams in Oregon County and zero regulated dams. MDNR lists two dams as hazard class 1: Nuwer Lake Dam and S. Jones Lake Dam, and one dam as hazard class 2: McCormack Lake Dam.

NID data also indicated that there are nine total dams in the county, six listed as low hazard potential and three listed as high hazard potential (Nuwer, S.Jones, and McCormack).

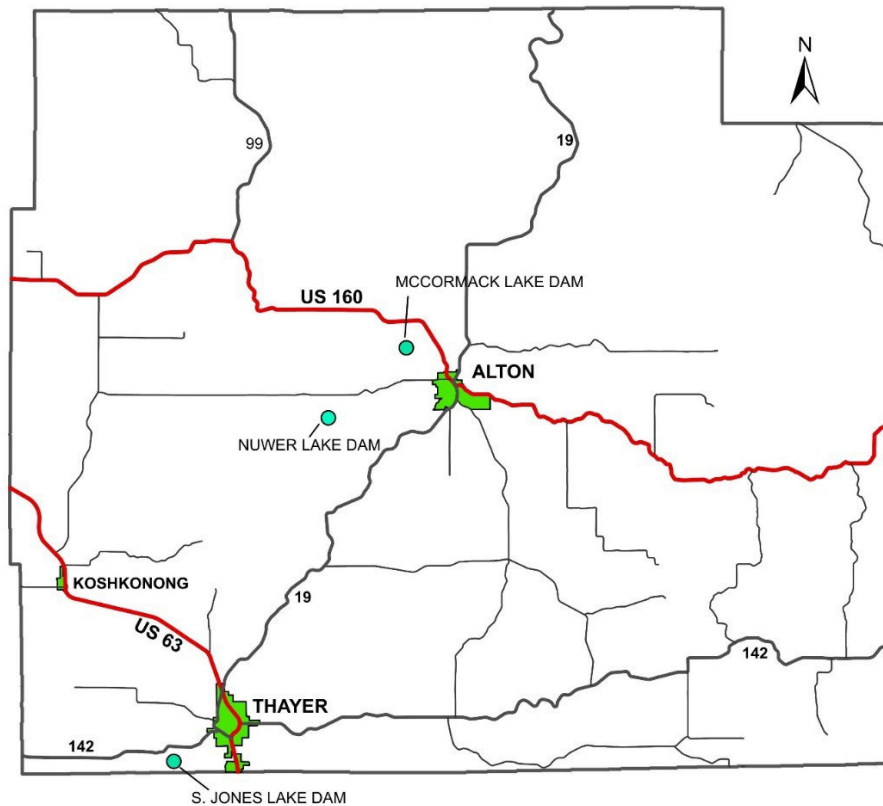
Dams in Planning Area

**Table 3.26. High Hazard Dams in the Oregon County Planning Area**

Dam Name	Emergency Action Plan (EAP/AP)	Dam Height (Ft)	Normal Storage (Acre-Ft)	Last Inspection Date	River	Nearest Downstream City	Distance To Nearest City (Miles)	Dam Owner
Nuwer Lake Dam	N/A	23	86	6/8/1980	TRIB-FREDERICK CREEK	COUCH	12	Allen Nuwer
S. Jones Lake Dam	N/A	21	67	6/18/1980	TRIB-DILES CREEK	DALTON, ARK	22	Sydney W. Jones
McCormack Lake Dam	N/A	27	159	9/12/1989	MCCORMACK HOLLOW	ALTON	3	USDA Fish & Wildlife Service

Sources: Missouri Department of Natural Resources, <http://dnr.mo.gov/env/wrc/dam-safety/statemap.htm> and National Inventory of Dams, [http://nid.usace.army.mil/cm\\_apex/f?p=838:12](http://nid.usace.army.mil/cm_apex/f?p=838:12) By the end of 2015, the Missouri DNR anticipates having Emergency Action Plans, including inundation maps for all state-regulated Class 1 and Class 2 dams. Contact the DNR Dam and Reservoir Safety Program at 800-361-4827 to request the inundation maps for your county to show geographic locations at risk, extent of failure and to perform GIS analysis of those assets at risk to dam failure.

**Table 3.27. High Hazard Dam Locations in Oregon County**

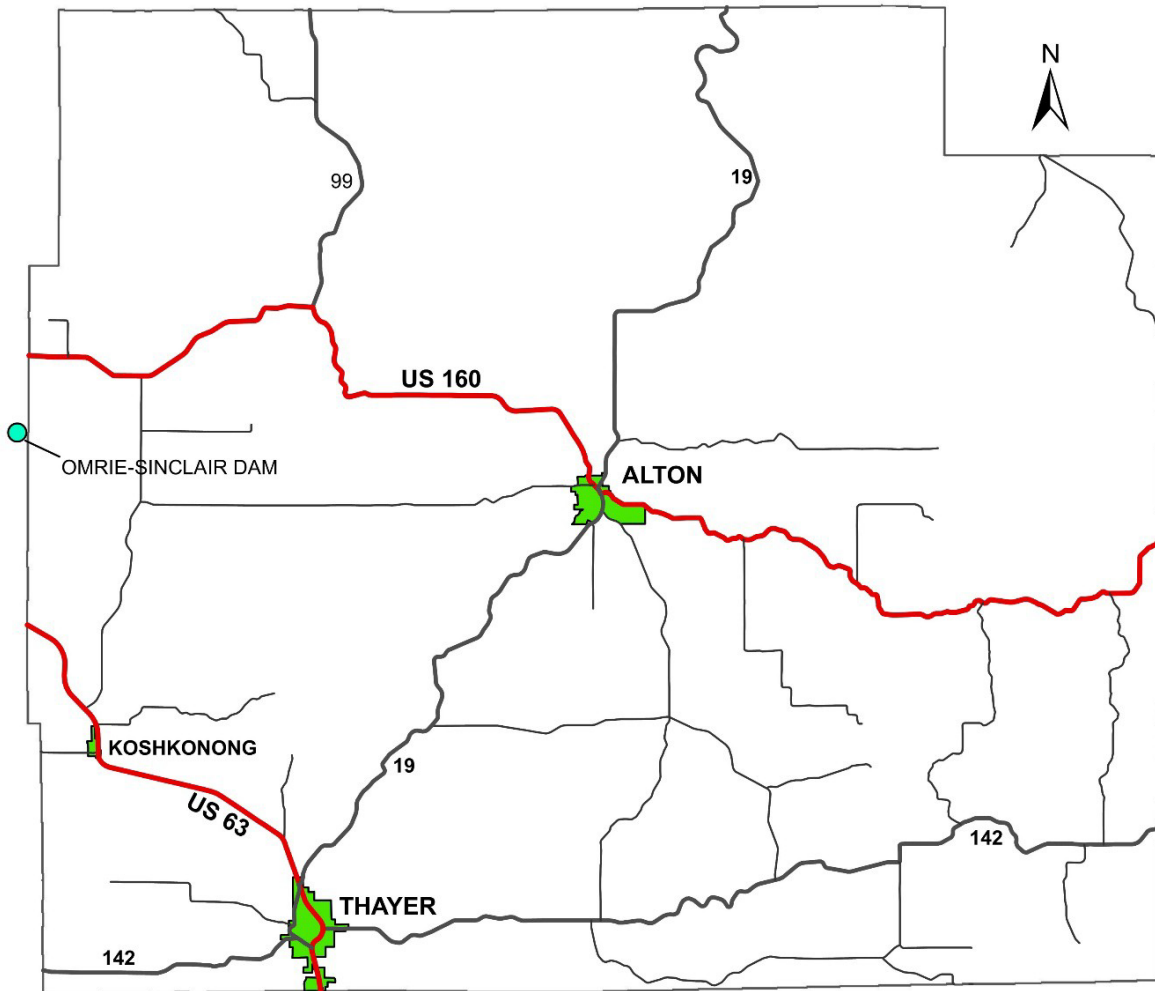


Source: U.S. Army Corps of Engineers, Missouri Department of Natural Resources

### Upstream Dams Outside the Planning Area

The Omrie-Sinclair Dam in east-central Howell County is located less than one mile from the western Oregon County Border. This dam is not reported on the NID, however, the MDNR database shows that the Omrie-Sinclair Dam is a Hazard Class 3 Dam constructed in 1965. The dam is 18 feet in height and has a 40 acre drainage area.

**Table 3.28. Upstream Dams Outside Oregon County, Missouri**



Source: U.S. Army Corps of Engineers, Missouri Department of Natural Resources

### ***Severity/Magnitude/Extent***

The severity/magnitude of dam failure would be similar in some cases to the impacts associated with flood events (see the flood hazard vulnerability analysis and discussion). Based on the hazard class definitions, failure of any of the High Hazard/Class I dams could result in a serious threat of loss of human life, serious damage to residential, industrial or commercial areas, public utilities, public buildings, or major transportation facilities. Catastrophic failure of any high hazard dams has the potential to result in greater destruction due to the potential speed of onset and greater depth, extent,

and velocity of flooding. Note that for this reason, dam failures could flood areas outside of mapped flood hazards.

Actual dam failure can result not only in loss of life, but also considerable loss of capital investment, loss of income, and property damage. Loss of the reservoir itself can cause hardship for those dependent on it for their livelihood or water supply.

### ***Previous Occurrences***

There are no records of dam failure in Oregon County. Since there are zero recorded events in the planning area, a calculation of a probability percent is not possible. According to information from the 2018 State Plan, Missouri's percentage of high hazard dams in the MDNR inventory puts the State at about the national average for that category. However, if development occurs downstream of dams the percentage of high hazard dams will increase. Additionally, the probability of dam failure increases as many of the smaller and privately owned dams continue to deteriorate without the benefit of further regulation or improvements. Regular inspection and maintenance schedules for dams greatly reduces the probability of dam failure. The last inspection of a high hazard dam in Oregon County was 32 years ago. The next two previous were 41 years ago.

### ***Probability of Future Occurrence***

There are no records of dam failure in Oregon County. Since there are zero recorded events in the planning area, a calculation of a probability percent is not possible. According to information from the 2018 State Plan, Missouri's percentage of high hazard dams in the DNR inventory puts the State at about the national average for that category. However, if development occurs downstream of dams the percentage of high hazard dams will increase. Additionally, the probability of dam failure increases as many of the smaller and privately owned dams continue to deteriorate without the benefit of further regulation or improvements. Regular inspection and maintenanceschedules for dams greatly reduces the probability of dam failure.

### **Vulnerability**

Vulnerability to dam failure in Oregon County is limited to structures and critical infrastructure located in dam inundation zones. All dams are located in unincorporated parts of the county. According to the State Plan page 3.54, there are no dams in Oregon County with mapped inundation areas.

S. Jones Lake Dam: the expected inundation areas in the event of a failure at S. Jones Lake Dam would be to the east. There are no structures in the area immediately east of the dam. The structure east/southeast of the dam in the first aerial photo below is approximately 0.27 miles away.



**Figure 3.6. S. Jones Lake Dam**



**Figure 3.7. S. Jones Lake Dam**



Nuwer Lake Dam: The Nuwer Lake Dam's likely inundation area is to the east of the dam structure. As of 3/21/2016 there is one barn and one farm pond located east of the dam. Figure 3.8 and Figure 3.9 show an approximate area that could be expected to be inundated in the event of dam failure.

**Figure 3.8. Nuwer Lake Dam**



**Figure 3.9. Nuwer Lake Dam**





McCormack Lake Dam: This dam, owned by the National Forest Service, is located approximately 0.50 miles due north of the Eleven Point River. This dam is located in an extremely rural area with no structures, however, due to its use as a recreation area, the site is accessed by thousands of visitors per year. The two aerial photographs below depict the exist conditions at McCormack Lake as of March 2016.

**Figure 3.10. McCormack Lake Dam**



**Figure 3.11. McCormack Lake Dam**



***Potential Losses to Existing Development: (including types and numbers, of buildings, critical facilities, etc.)***

Fortunately, the three high hazard dams located in Oregon County are located in areas where there is no significant development in downstream areas. In the absence of MDNR inundation zone maps and Emergency Action Plans, it is difficult to determine the exact areas where inundation would occur, but in reviewing recent aerial photography, it can be stated that the risk to human life, and the risk for property damage in the event of a failure of one of the three high hazard dams in Oregon County would be minimal.

***Impact of Future Development***

The planning area, specifically, the areas downstream of Oregon County's high hazard dams are very rural in nature. Currently, only one dam (Nuwer) has any development near the potential inundation zone. Growth in the county, as a whole has been very slow with an average of ten new housing units per year in the unincorporated parts of the county. Due to the amount and affordability of developable land, it is unlikely that residential structures will be developed in a location that is inside an inundation zone.

***Hazard Summary by Jurisdiction***

Unincorporated Oregon County is the only jurisdiction in the Plan that is vulnerable to dam failure. There are no mapped inundation areas or potential inundation areas within cities. No school district facilities are located within inundation areas or downstream environments from existing dams.

**Problem Statement**

There are three dams in the county with high hazard potential. However, none of the dams have mapped inundation zones or EAPs. The development of inundation zone maps by MDNR would help the citizenry of Oregon County become more familiar with the risk they face due to the potential for dam failure. Additionally, the inspection rate of the high hazard dams in Oregon County seems to be lacking. Of the three high hazard dams, Nuwer was last inspected in 1980, S. Jones was last inspected in 1980 and McCormack was last inspected in 1989. The MPC feels it would be beneficial if these dams were inspected more regularly.

### 3.4.3 Earthquakes

#### **Hazard Profile**

##### ***Hazard Description***

An earthquake is a sudden motion or trembling that is caused by a release of energy accumulated within or along the edge of the earth's tectonic plates. Earthquakes occur primarily along fault zones and tears in the earth's crust. Along these faults and tears in the crust, stresses can build until one side of the fault slips, generating compressive and shear energy that produces the shaking and damage to the built environment. Heaviest damage generally occurs nearest the earthquake epicenter, which is that point on the earth's surface directly above the point of fault movement. The composition of geologic materials between these points is a major factor in transmitting the energy to buildings and other structures on the earth's surface.

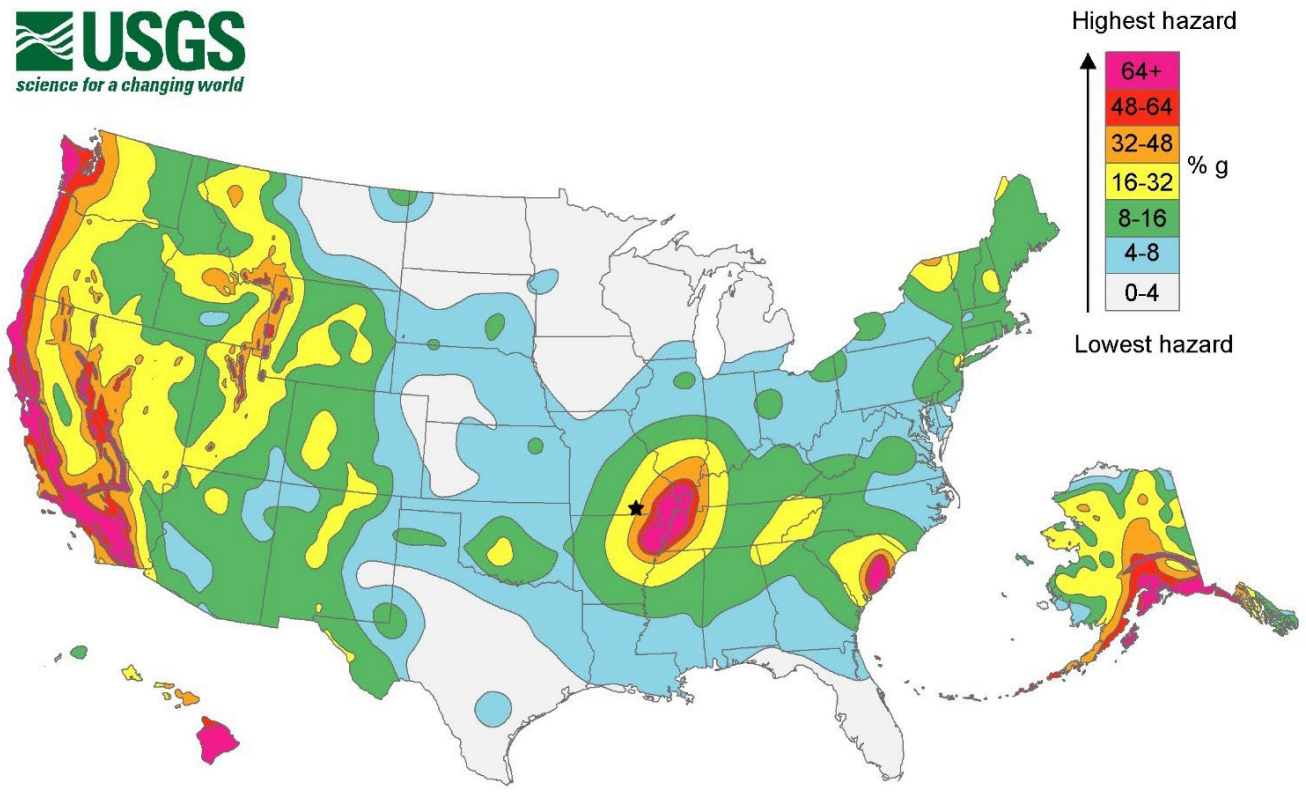
The subterranean faults were formed many millions of years ago on or near the surface of the earth. Subsequent to that time, these ancient faults subsided, while the areas adjacent were pushed up. As this fault zone (also known as a rift) lowered, sediments filled in the lower areas. Under pressure, the sediments hardened into limestones, sandstones, and shales – thus burying the rifts. The pressures on the North American plan and the movements along the San Andreas Fault by the Pacific plate have reactivated the buried rift(s) in the Mississippi embayment. This rift system is called the Reelfoot Rift and underlies the New Madrid Seismic Zone. (Braile et al., 1986)

##### ***Geographic Location***

The greatest hazard from earthquakes in Oregon County comes from the New Madrid Seismic Zone situated in the boot heel area of southeast Missouri. The potential of high magnitude earthquakes occurring along the New Madrid fault presents risk that does not vary across the planning area. The Nemaha uplift in central Kansas is also prone to seismic activity, however the center of the Humbolt fault zone near the Nemaha Uplift is approximately 300-350 miles west/northwest of Oregon County and lower magnitude seismic events that will not impact jurisdictions in Oregon County.

The 2014 USGS National Seismic Hazard Maps display earthquake ground motions for various probability levels across the United States and are applied in seismic provisions of building codes, insurance rate structures, risk assessments and other public policy. The updated maps represent an assessment of the best available science in earthquake hazards and incorporate new findings on earthquake ground shaking, faults, seismicity, and geodesy. The USGS National Seismic Hazard Mapping Project developed these maps by incorporating information on potential earthquakes and associated ground shaking obtained from interaction in science and engineering workshops involving hundreds of participants, review by several science organizations and State surveys, and advice from expert panels and a Steering Committee. Figure 3.12 is a USGS map illustrating seismicity in the United States. A star showing the general location of Oregon County has been inserted on the map.

**Figure 3.12. Seismicity in the United States**



Source: United States Geological Survey at [http://earthquake.usgs.gov/hazards/products/conterminous/2014/HazardMap2014\\_lg.jpg](http://earthquake.usgs.gov/hazards/products/conterminous/2014/HazardMap2014_lg.jpg)

**Severity/Magnitude/Extent**

The extent or severity of earthquakes is generally measured in two ways: 1) the Richter Magnitude Scale is a measure of earthquake magnitude; and 2) the Modified Mercalli Intensity Scale is a measure of earthquake severity. The two scales are defined as follows.

*Richter Magnitude Scale*

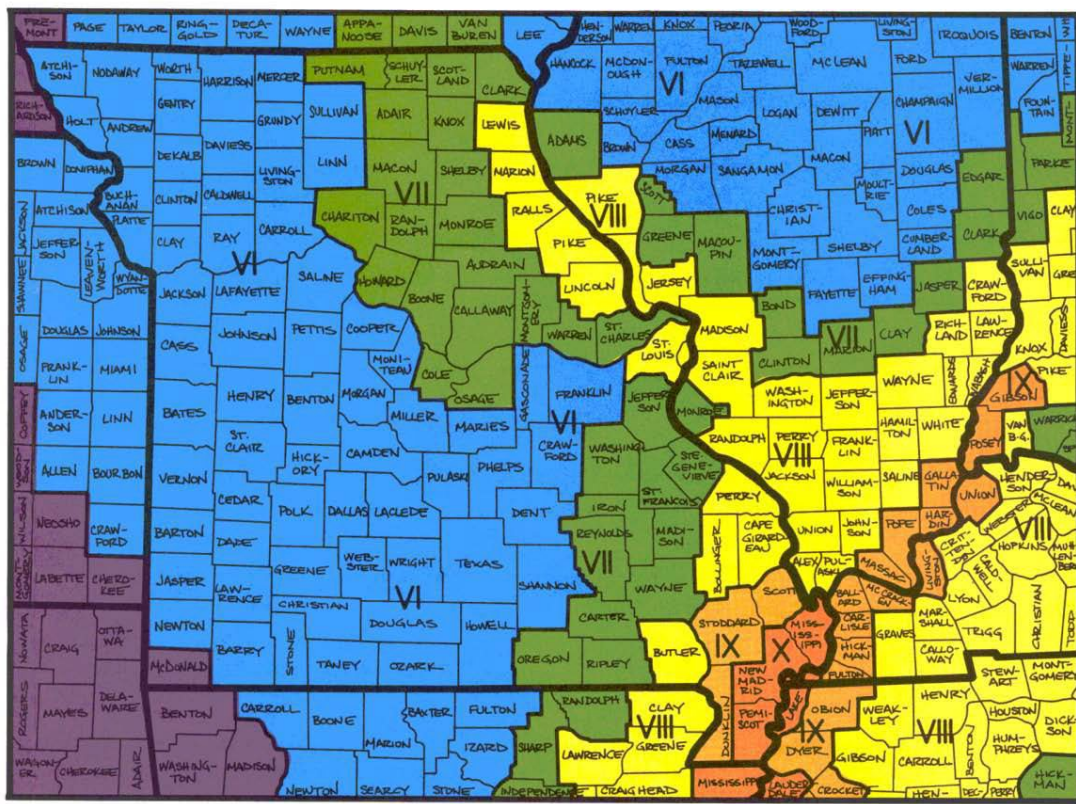
The Richter Magnitude Scale was developed in 1935 as a device to compare the size of earthquakes. The magnitude of an earthquake is measured using a logarithm of the maximum extent of waves recorded by seismographs. Adjustments are made to reflect the variation in the distance between the various seismographs and the epicenter of the earthquakes. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, comparing a 5.3 and a 6.3 earthquake shows that the 6.3 quake is ten times bigger in magnitude. Each whole number increase in magnitude represents a tenfold increase in measured amplitude because of the logarithm. Each whole number step in the magnitude scale represents a release of approximately 31 times more energy.



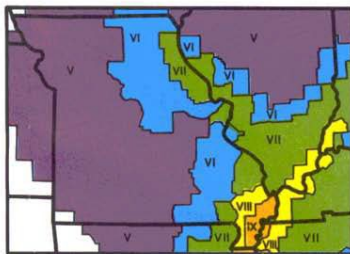
### Modified Mercalli Intensity Scale

The intensity of an earthquake is measured by the effect of the earthquake on the earth's surface. The intensity scale is based on the responses to the quake, such as people awakening, movement of furniture, damage to chimneys, etc. The intensity scale currently used in the United States is the Modified Mercalli (MM) Intensity Scale. It was developed in 1931 and is composed of 12 increasing levels of intensity. They range from imperceptible shaking to catastrophic destruction, and each of the twelve levels is denoted by a Roman numeral. The scale does not have a mathematical basis, but is based on observed effects. Its use gives the laymen a more meaningful idea of the severity.

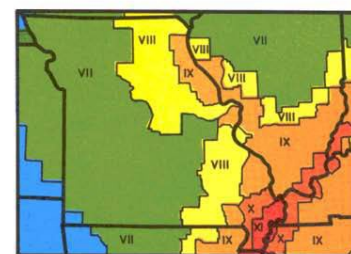
**Figure 3.13. Impact Zones for Earthquake Along the New Madrid Fault**



This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.



This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 6.7 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.



This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 8.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.

Source: [http://sema.dps.mo.gov/docs/programs/Planning,%20Disaster%20&%20Recovery/State%20of%20Missouri%20Hazard%20Analysis/2012-State-Hazard-Analysis/Annex\\_F\\_Earthquakes.pdf](http://sema.dps.mo.gov/docs/programs/Planning,%20Disaster%20&%20Recovery/State%20of%20Missouri%20Hazard%20Analysis/2012-State-Hazard-Analysis/Annex_F_Earthquakes.pdf)

Figure 3.13 (above) shows the highest projected Modified Mercalli Intensities by county from a potential magnitude 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid Seismic Zone. The secondary maps in the figure above show the same regional intensities for 6.7 and 8.6 earthquake, respectively. Oregon County is located in zone VII from a potential magnitude 7.6 earthquake along the New Madrid fault.

**Table 3.29. Modified Mercalli Intensity Scale**

<b>Intensity Level</b>	<b>Description</b>
<b>I</b>	People do not feel any movement.
<b>II</b>	A few people might notice movement.
<b>III</b>	Many people indoors feel movement; Hanging objects swing.
<b>IV</b>	Most people indoors feel movement; Dishes, windows, and doors rattle; Walls, frames and structures creak; Liquids in open vessels are slightly disturbed; Parked cars rocked.
<b>V</b>	Almost everyone feels movement. Most people are awakened; Doors swing open or closed; Dishes are broken; Pictures on the wall move; Windows crack in some cases; Small objects move or are turned over; Liquids might spill out of open containers.
<b>VI</b>	Almost everyone feels movement. Most people are awakened; Considerable quantities of dishes, glassware, and windows are broken; People have trouble walking; Pictures fall off walls; Objects fall from shelves; Plaster in walls might crack; Some furniture is overturned; Small bells in churches, chapels, and schools ring.
<b>VII</b>	People have difficulty standing; Considerable damage in poorly built or badly designed buildings, adobe houses, old walls, and spires; Damage is slight to moderate in well-built buildings; Numerous windows are broken; Weak chimneys break at rooflines; Cornices from towers and high buildings fall; Loose bricks fall from buildings; Heavy furniture is overturned and damaged; Some sand and gravel stream banks cave in.
<b>VIII</b>	Drivers have trouble steering; Poorly built structures suffer severe damage; Ordinary substantial buildings partially collapse; Damage slight in structures especially built to withstand earthquakes; Tree branches break; Houses not bolted down may shift on foundations; Tall structures such as towers and might chimneys twist and fall; Temporary or permanent changes in springs and wells; Sand and mud is ejected.
<b>IX</b>	Most buildings suffer damage; Houses not bolted down move off their foundations; Some underground pipes are broken; The ground cracks conspicuously; Reservoirs suffer damage.
<b>X</b>	Well-built wooden structures destroyed; most masonry and frame structures destroyed, including foundations; Rails bent; Dams seriously damaged; Cracks open in pavement.
<b>XI</b>	Few, if any masonry structures remain standing; Large well-built bridges destroyed; Rails

**Previous Occurrences**

There is no record of recent earthquake occurrence within Oregon County (2000-2020). The southeastern portion of Missouri is most susceptible to earthquakes because it overlies the New Madrid Seismic Zone. No area of Missouri is immune from the danger of earthquakes. Minor, but potentially damaging earthquakes can occur anywhere in the state. (SEMA, 2013)



### ***Probability of Future Occurrence***

Without a historical record for earthquakes in Oregon County it is not possible to calculate a precise probability of earthquake occurrence. The Center for Earthquake Research and Information (CERI) at the University of Memphis has computed conditional probabilities of a magnitude 6.0 earthquake in the New Madrid seismic zone. According to a fact sheet prepared by SEMA in 2003, the probability for a magnitude 6.0 to 7.5 or greater earthquake along the New Madrid Fault is 25 to 40 percent over the next 50 years. At the 25% level, the likelihood of an earthquake happening in a given year is 1.0%. At the 40% level, the likelihood of an earthquake happening in a given year is 1.6%.

### ***Changing Future Conditions Considerations***

Scientists are beginning to believe there may be a connection between changing climate conditions and earthquakes. Changing ice caps and sea-level redistribute weight over fault lines, which could potentially have an influence on earthquake occurrences. However, currently no studies quantify the relationship to a high level of detail, so recent earthquakes should not be linked with climate change. While not conclusive, early research suggests that more intense earthquakes and tsunamis may eventually be added to the adverse consequences that are caused by changing future conditions.

## **Vulnerability**

### ***Vulnerability Overview***

Ground shaking is the most damaging effect from earthquakes. Ground shaking will impact all structures and critical infrastructure such as roads and electrical transmission systems. The greatest earthquake risk to Oregon County is the New Madrid fault in the boot-heel region of Missouri. A 7.6 magnitude earthquake would result in poorly built buildings damaged slightly; considerable quantities of dishes, glassware and windows are broken; people having trouble walking; pictures falling off walls; objects falling from shelves; plaster in walls cracking; and furniture overturned. Damage to structures will occur but will vary on the quality of construction. In addition, some underground utilities may be damaged. Some injuries may occur, but fatalities are unlikely.

### ***Potential Losses to Existing Development***

Potential losses to existing development include the total exposure for all communities in the planning area. The total exposure for each jurisdiction was used to estimate losses due to a 7.6 earthquake along the New Madrid Fault. A damage factor of 0.5% was applied to each jurisdiction's total building and contents based on the expected impact for Zone VI on the Modified Mercalli Scale. Table 3.30 below summarizes the estimated losses for each jurisdiction.

### ***Impact of Previous and Future Development***

It is possible that future development will occur in the downstream environment of dams within the planning area; however, no major development is expected due to the slow growth of Oregon County.

### ***Hazard Summary by Jurisdiction***

Earthquake intensity is not likely to vary greatly throughout the planning area, the risk of occurrence is the same throughout. However, damages will differ where there are variations in the planning area based on percentage of structures build prior to 1939. For example, if one community has a high percentage of residences built prior to 1939 than the other participants, that community is likely to experience higher damages. Table 3.30 lists the number and percentage of housing units built in 1939 or earlier.

---

**Table 3.30. Percent of Housing Units Built in 1939 or Earlier**

<b>Jurisdiction</b>	<b>Built in 1939 or earlier #</b>	<b>Built 1939 or earlier %</b>
Oregon County	348	6.8%
City of Alton	80	19.6%
City of Koshkonong	21	20.3%
City of Thayer	261	22.9%

Source: Missouri Census Data Center (2015) ACS Profiles

School districts with facilities constructed prior to 1939 could suffer more damages than newer facilities, however, the majority of the currently utilized school facilities in the district have been constructed after 1939 and are considered well-built structures and therefore, less vulnerable to potential ground shaking. Couch School in South Central Oregon County has facilities that were constructed prior to 1939 and is at a higher vulnerability to earthquake damages.

### **Problem Statement**

Based on likely damage from a 7.6 magnitude earthquake along the New Madrid fault, it is clear that the downtowns and historic districts of communities in Oregon County are at risk to significant damage. These older structures could perhaps be retrofitted with earthquake resistance measures to ensure their stability in the event of an earthquake of severe magnitude. Potential damages to future development can be mitigated by adopting and enforcing IBC 2012 building codes. Currently, only the City of Thayer enforces such codes. Updating and enforcing building codes in other jurisdictions would mitigate the impact on future development from an earthquake event.

### 3.4.4 Land Subsidence/Sinkholes

#### **Hazard Profile**

##### ***Hazard Description***

Sinkholes are depressed or collapsed areas formed by dissolution of carbonate bedrock or collapse of underlying caves. They range in size from several square yards to hundreds of acres and may be very shallow or hundreds of feet deep. Sinkholes are part of what is called karst topography, which also includes caves, springs and losing streams. Sinkholes are common where the rock below the land surface is limestone, carbonate rock, salt beds, or rocks that naturally can be dissolved by ground water circulating through them. As the rock dissolves, spaces and caverns develop underground. The sudden collapse of the land surface above them can be dramatic and range in size from broad, regional lowering of the land surface to localized collapse. Land subsidence may also result from human activities such as, underground mining, groundwater or petroleum withdrawal, and drainage of organic soils.

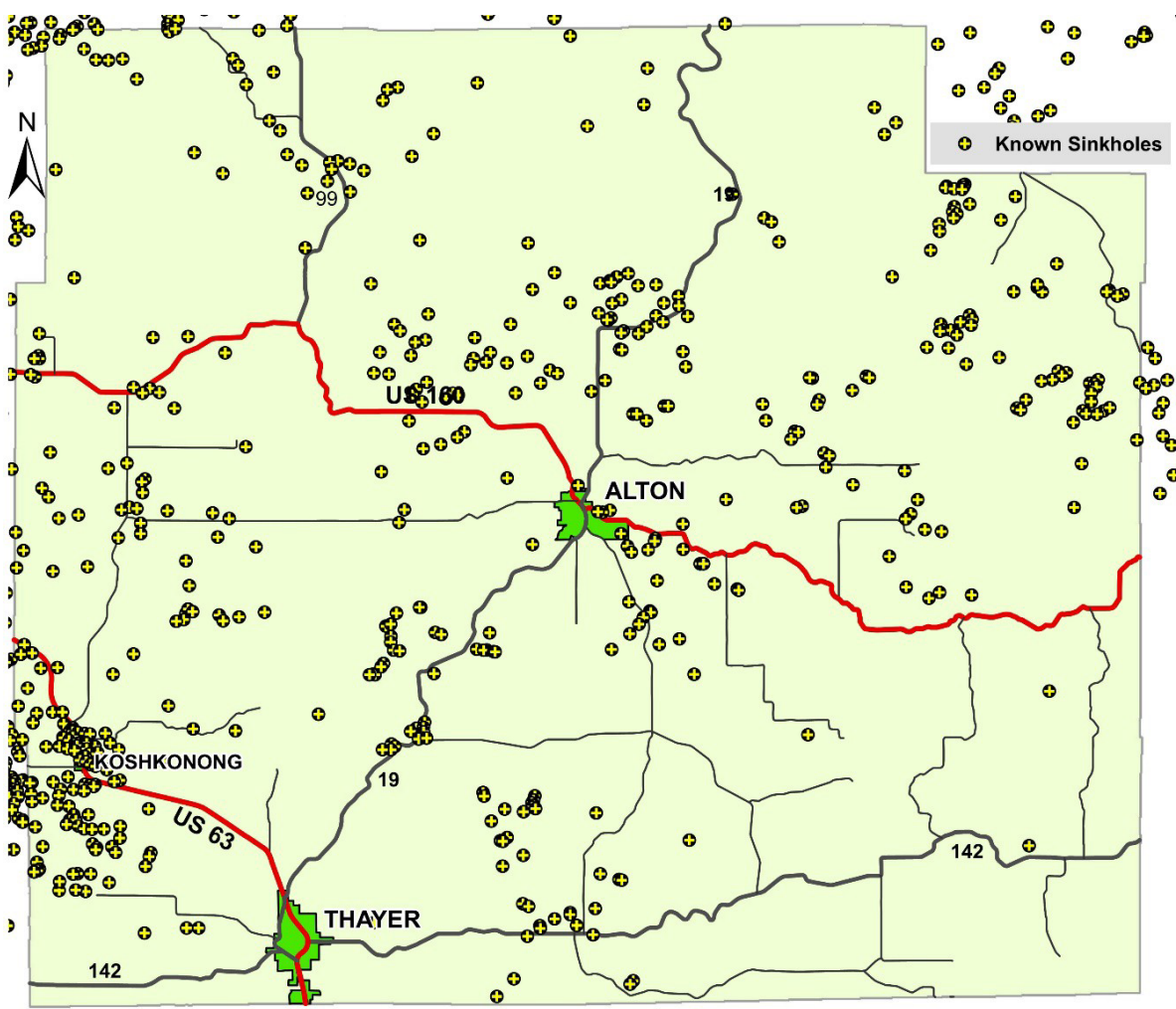
In the case of sinkholes, the rock below the surface is rock that has been dissolving by circulating groundwater. As the rock dissolves, spaces and caverns form, and ultimately the land above the spaces collapse. In Missouri, sinkhole problems are usually a result of surface materials above openings into bedrock caves eroding and collapsing into the cave opening. These collapses are called “cover collapses” and geologic information can be applied to predict the general regions where collapse will occur. Land subsidence occurs slowly and continuously over time, as a general rule. On occasion, it can occur abruptly, as in the sudden formation of sinkholes. Sinkhole formation can be aggravated by a change in stormwater runoff patterns resulting from an increase in impervious surfaces from land development.

According to the U.S. Geological Survey (USGS), the most damage from sinkholes tends to occur in Florida, Texas, Alabama, Missouri, Kentucky, Tennessee, and Pennsylvania. Fifty-nine percent of Missouri is underlain by thick, carbonate rock that makes Missouri vulnerable to sinkholes. Sinkholes occur in Missouri on a fairly frequent basis. Most of Missouri’s sinkholes occur naturally in the State’s karst regions (areas with soluble bedrock). They are a common geologic hazard in southern Missouri, but also occur in the central and northeastern parts of the State. Missouri sinkholes have varied from a few feet to hundreds of acres and from less than one to more than 100 feet deep. Sinkholes can also vary in shape like shallow bowls or saucers whereas other have vertical walls. Some hold water and form natural ponds.

##### ***Geographic Location***

According to spatial data from Missouri Geological Survey, there are 499 known sinkhole formations that have been identified in Oregon County. Due to the remote nature of parts of Oregon County, it is certain that there are many sinkholes that exist that have not yet been identified. Figure 3.14, below, provides the location of known sinkholes in the county. Although the risk of sinkhole formation exists countywide, the map shows that the unincorporated areas of the county and in particular the City of Koshkonong have an elevated risk to sinkhole formation than other communities in the county.

**Figure 3.14. Sinkholes in Oregon County**



**Severity/Magnitude/Extent**

Sinkholes vary in size and location, and these variances will determine the impact of the hazard. A sinkhole could result in the loss of a personal vehicle, a building collapse, or damage to infrastructure such as roads, water, or sewer lines. Groundwater contamination is also possible from a sinkhole. Because of the relationship of sinkholes to groundwater, pollutants captured or dumped in sinkholes could affect a community’s groundwater system. Sinkhole collapse could be triggered by large earthquakes. Sinkholes located in floodplains can absorb floodwaters but make detailed flood hazard studies difficult to model.

**Previous Occurrences**

The 2018 State Plan includes only seven documented sinkhole notable events statewide where property damage has occurred. The plan stated that sinkholes are common to Missouri and the probability is high that they will occur in the future. To date, Missouri sinkholes have historically not had major impacts on development nor have they caused serious damage. Thus, the severity of future events is likely to be low.

### ***Probability of Future Occurrence***

Based on local information and the 2011 Missouri State Hazard Mitigation Plan, there have been zero documented sinkhole formations or expansions in the county during an eleven year period from 2006-2015. This equates to a 0% probability of a sinkhole formation in any given year in the county. However, in considering the large number of known sinkholes in Oregon County, it is likely that unreported sinkhole formation occurs every year.

### **Vulnerability**

#### ***Vulnerability Overview***

Sinkholes in Missouri are a common feature where limestone and dolomite outcrop. Dolomite is a rock similar to limestone with magnesium as an additional element with the calcium normally present in the minerals that form the rocks. While some sinkholes may be considered a slow changing nuisance; other more sudden catastrophic collapses can destroy property, delay construction projects, contaminated groundwater resources, and damage underground utilities. The entire county is underlain with limestone and dolomite bedrock.

#### ***Potential Losses to Existing Development***

A 150-foot buffer was created around the known sinkhole locations in Oregon County then overlaid on the Oregon County structures GIS layer to provide the number of structures that are located within 150 feet of a known sinkhole. Then the average valuations for each structure type was applied to provide a dollar figure in terms of potential loss vulnerability. In total there are 20 structures located within 150 feet of known sinkholes: 18 agricultural use buildings and two single family residences. Using average appraised valuations for Oregon County, the total exposure for these structure-types are \$195,912 and \$100,962, respectively.

#### ***Impact of Future Development***

Future development in areas of known risk to sinkhole formation in the planning area will increase vulnerability to this hazard. Population and development in these areas, specifically in the Koshkonong area and central Oregon County will increase exposure to sinkhole occurrence. While no building codes currently restrict construction within a certain distance of known sinkholes, it is encouraged that local officials explore options to implement this regulatory condition.

#### ***Hazard Summary by Jurisdiction***

The risk of sinkhole damage for individual communities and school districts is limited to the amount of exposure of buildings and infrastructure. The entire county is at risk for potential sinkhole development, however, the Cities of Koshkonong and Alton are located in areas with high density of known sinkholes. This indicates that the subsurface conditions are currently favorable for the development of sinkhole features. It is unlikely that school districts will be greatly affected by sinkholes due to the localized nature of their exposure, however, Oregon-Howell School District in Koshkonong is at an elevated risk due to the location of school facilities in hazard prone areas.

### **Problem Statement**

It is likely that more sinkholes will occur as development occurs within the county. Sinkholes can be remediated with fill material. Once a sinkhole has been remediated, building should be prohibited at the site. Existing sinkholes can expand if surface runoff erodes the edges of the sinkhole. Best efforts to divert stormwater runoff from known sinkholes should be made. Oregon County has a high density of sinkholes and the effects of collapse sinkholes on the built environment should be noted as a public service to the county's residents.

## 3.4.5 Drought

### **Hazard Profile**

#### ***Hazard Description***

Drought is generally defined as a condition of moisture levels significantly below normal for an extended period of time over a large area that adversely affects plants, animal life, and humans. A drought period can last for months, years, or even decades. There are four types of drought conditions relevant to Missouri, according to the 2013 State Plan, which are as follows.

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

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

Agricultural drought focus is on soil moisture deficiencies, differences between actual and potential evaporation, reduced ground water or reservoir levels, etc. Plant demand for water depends on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil.

Socioeconomic drought refers to when physical water shortage begins to affect people.

#### ***Geographic Location***

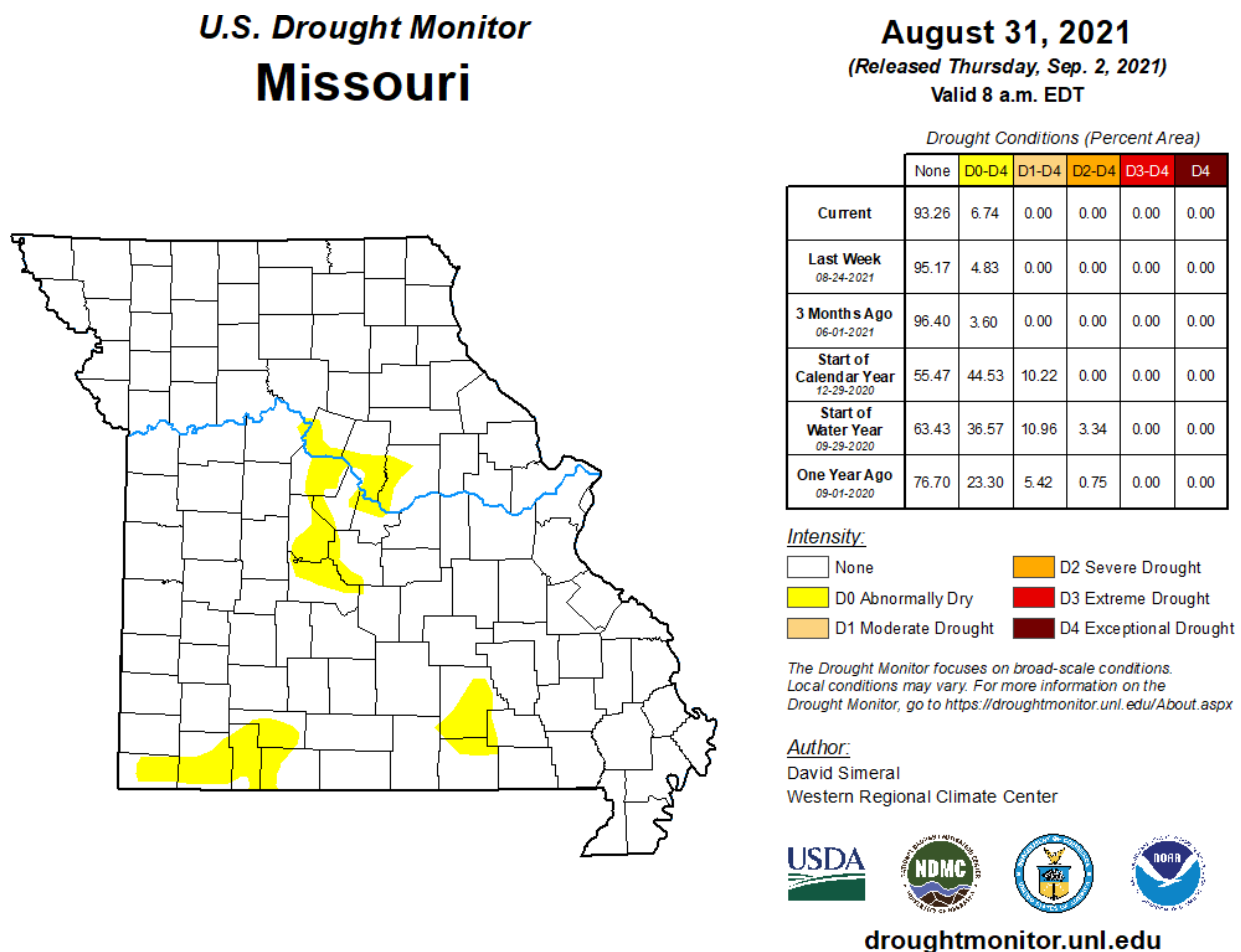
Droughts are regional climatic events that can impact large areas and multiple counties. The entire county is at risk to the impacts of drought. However, drought most directly impacts the agricultural sector, so areas within the county where there is extensive agricultural land use can experience significant impacts. As noted previously in the plan, Oregon County is home to intensive livestock production. All incorporated communities in the county rely on wells for water supply. The impact of drought on deeper public wells would not be significant unless the drought was of such historic severity to reduce groundwater levels.

#### ***Severity/Magnitude/Extent***

Figure 3.15 below is a recent map from the US Drought Monitor and an example of the size of the geographic area that could be in drought conditions at any given moment in time. The map is only a snapshot of conditions at a given time and indicates the severity of drought conditions.

Figure 3.15.

U.S. Drought Monitor Map of Missouri on 8-31-2021



Source: U.S. Drought Monitor, <http://droughtmonitor.unl.edu/Home/StateDroughtMonitor.aspx?MO>

The most commonly used indicator of drought severity is the Palmer Drought Severity Index (PDSI), jointly published by the NOAA and the United States Department of Agriculture. The Palmer Drought Indices measure dryness based on recent precipitation and temperature. The indices are based on a “supply-and-demand model” of soil moisture. Calculation of supply is relatively straightforward, using temperature and the amount of moisture in the soil. However demand is more complicated as it depends on a variety of factors, such as evapotranspiration and recharge rates. These rates are harder to calculate. Palmer tried to overcome these difficulties by developing an algorithm that approximated these rates, and based the algorithm on the most readily available data — precipitation and temperature.

The Palmer Index has proven most effective in identifying long-term drought of more than several months. However, the Palmer Index has been less effective in determining conditions over a matter of weeks. It uses a “0” as normal, and drought is shown in terms of negative numbers; for example, negative 2 is moderate drought, negative 3 is severe drought, and negative 4 is extreme drought. Palmer’s algorithm also is used to describe wet spells, using corresponding positive numbers.

According to the MDNR Missouri Drought Plan revised in 2002, Missouri Drought Response System is divided into four phases based on Palmer Index values:

- **Phase I: Advisory Phase**—Requires a drought monitoring and assessment system to provide enough lead time for state and local planners to take appropriate action;
- **Phase II: Drought Alert**—When the PDSI reads -1.0 to -2.0, and stream flows, reservoir levels, and groundwater levels are below normal over a several month period, or when the Drought Assessment Committee (DAC) determines that Phase II conditions exist based on other drought determination methods;
- **Phase III: Conservation Phase**—When the PDSI reads -2.0 to -4.0, and stream flows, reservoir levels, and groundwater levels continue to decline, along with forecasts indicating an extended period of below-normal precipitation, or when the DAC determines that Phase III conditions exist based on other drought determination models;
- **Phase IV: Drought Emergency**—When the PDSI is lower than -4.0, or when the DAC determines that Phase IV conditions exist based on other drought determination methods.

Palmer also developed a formula for standardizing drought calculations for each individual location based on the variability of precipitation and temperature at that location. The Palmer index can therefore be applied to any site for which sufficient precipitation and temperature data is available.

The USDA’s Risk Management Agency provides insure crop loss payments in the county as a result of drought from 1948 to present. The 2018 State Plan states that Oregon County is categorized as “low” in crop loss ration ratings. Data indicates that from 1998 through 2017 there were zero dollars in insured crop loss payments with annualized losses of \$0.

**Previous Occurrences**

The NCEI storm events database includes 11 drought events occurring in Oregon County from 2000 through 2020. Many of these were multiple reports from persistent drought conditions that lasted several months. The NCEI reports indicate that there were four distinct drought periods during a 21 year timeframe. Table 3.31 provides a summary of these events.

**Table 3.31. Previous Drought Occurrences 2000-2020**

Drought Year	Duration	Property Damage	Crop Damage
1999	July-October	0	\$20,000
2000	August-September	0	\$0
2012	June-December	0	\$2,030,000
2019	June-July	0	\$0

The impact of these events are described in the NCEI storm event narratives:

- **1999** – Stock ponds in many areas dried up forcing farmers to either pump or transport water for livestock, a few shallower wells reportedly ran dry. Many ranchers sold cattle and other livestock due to the lack of an adequate water supply.
- **2000** – These conditions allowed for the continuation of short-term dryness, lower yields of soybeans, and above normal fire danger. Soybean yields were reduced from normally 26-31 bushels per acre to 20 bushels per acre.
- **2012** – The USDA Service Center in Howell County indicated that crop losses were 75 percent of the spring planting. Many farmers and ranchers reported having to feed hay as pastures stopped growing and became dry through the month which added to operation costs, monetary crop loss figures are estimates using information from the National Agricultural Statistics Database.



### ***Probability of Future Occurrence***

Over the 21-year record period, Oregon County was in a drought for 15 months. There are a total of 252 months in the record period. The calculated risk percent from the number of months of drought and the total number of months in the record period equates to the annual average percentage of **5.95%** probability of drought occurrence in the county.

Although drought is not predictable, long-range outlooks and predicted impacts of climate change could indicate an increased chance of drought.

### **Vulnerability**

#### ***Vulnerability Overview***

The agriculture sector is particularly vulnerable to drought. Periods of dry weather can reduce stock ponds and force the early sale of livestock. Crop production can be disrupted and vegetative diseases can spread, reducing yields. Cities that operate water wells can experience water shortages during persistent drought periods like the seven month drought period in 2012. Those that rely on private wells are more likely to be impacted by reductions in the groundwater supply due to the fact that public wells are far deeper than private wells.

#### ***Potential Losses to Existing Development***

The 2018 State Plan states that from 1998 through 2017 there or \$0 in insured crop loss payments in Oregon County. The absence of payment could be due to the absence of crop insurance. There are no anticipated structural losses, loss of life, or injuries associated with this hazard. In addition, according to the NCEI estimates there were \$2,050,000 in crop losses from 2000-2020. According to this data, the total losses divided by the 20 year timeframe equals \$102,500 in estimated annualized crop losses.

#### ***Impact of Future Development***

Increases in acreage planted with crops would add to exposure to drought-related agricultural losses. In addition, increases in population result in increased demand for treated water, adding additional strain on natural water supply systems.

#### ***Changing Future Conditions Considerations***

A new analysis, performed for the Natural Resources Defense Council, examined the effects of climate change on water supply and demand in the contiguous United States. The study found that more than 1,100 counties will face higher risks of water shortages by mid-century as a result of climate change. Two of the principal reasons for the projected water constraints are shifts in precipitation and potential evapotranspiration (PET). Climate models project decreases in precipitation in many regions of the U.S., including areas that may currently be described as experiencing water shortages of some degree.

The Natural Resources Defense Council developed a new water supply sustainability index. The risk to water sustainability is based on the following criteria:

- Projected water demand as a share of available precipitation
- Groundwater use as a share of projected available precipitation
- Susceptibility to drought
- Projected increase in freshwater withdrawals
- Projected increase in summer water deficit

The risk to water sustainability for counties meeting two of the criteria are classified as “moderate”, while those meeting three of the criteria are classified as “high”, and those meeting four or more are classified as “extreme”. Counties meeting less than two criteria are considered to have low risk to water sustainability. According to the Natural Resources Defense Council, without climate change the water sustainability index for Oregon County is “low”. With climate change, the water supply sustainability index is “low”.

### ***Hazard Summary by Jurisdiction***

Although the probability of drought is the same for the entire county, farming and livestock enterprises in the unincorporated parts of the county would feel the greatest impact. These impacts can be mitigated somewhat by the purchase of crop insurance. The existence of private farms and ranches are more concentrated in the western and southern portion of the county where the land is not under government ownership. The communities of Alton, Koshkonong and Thayer each have one well for public water supply and could potentially be impacted during water shortages due to the reliance on these limited source wells.

### **Problem Statement**

Although drought most likely will not cause structure damage, the impact is greatest on the agriculture sector and if persistent enough, could cause reductions in groundwater and water shortages in communities that provide potable water services. Potential solutions to mitigate the impact of drought would be for communities to develop an ordinance to restrict the use of public water resources for non- essential usage, such as landscaping, washing cars, filling swimming pools, etc. during extreme drought periods. School districts can also implement water conservation measures at all district facilities.

## 3.4.6 Extreme Temperatures

### **Hazard Profile**

#### ***Hazard Description***

Extreme temperature events, both hot and cold, can impact human health and mortality, natural ecosystems, agriculture and other economic sectors. According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Ambient air temperature is one component of heat conditions, with relative humidity being the other. The relationship of these factors creates what is known as the apparent temperature. The Heat Index chart shown in Figure 3.18 uses both factors to produce a guide for the apparent temperature or relative intensity of heat conditions.

Extreme cold often accompanies severe winter storms and can lead to hypothermia and frostbite in people without adequate clothing protection. Cold can cause fuel to congeal in storage tanks and supply lines, stopping electric generators. Cold temperatures can also overpower a building's heating system and cause water and sewer pipes to freeze and rupture. Extreme cold also increases the likelihood for ice jams on flat rivers or streams. When combined with high winds from winter storms, extreme cold becomes extreme wind chill, which is hazardous to health and safety.

The National Institute on Aging estimates that more than 2.5 million Americans are elderly and especially vulnerable to hypothermia, with the isolated elders being most at risk. About 10 percent of people over the age of 65 have some kind of bodily temperature-regulating defect, and 3-4 percent of all hospital patients over 65 are hypothermic.

Also at-risk are those without shelter, those who are stranded, or who live in a home that is poorly insulated or without heat. Other impacts of extreme cold include asphyxiation (unconsciousness or death from a lack of oxygen) from toxic fumes from emergency heaters; household fires, which can be caused by fireplaces and emergency heaters; and frozen/burst pipes.

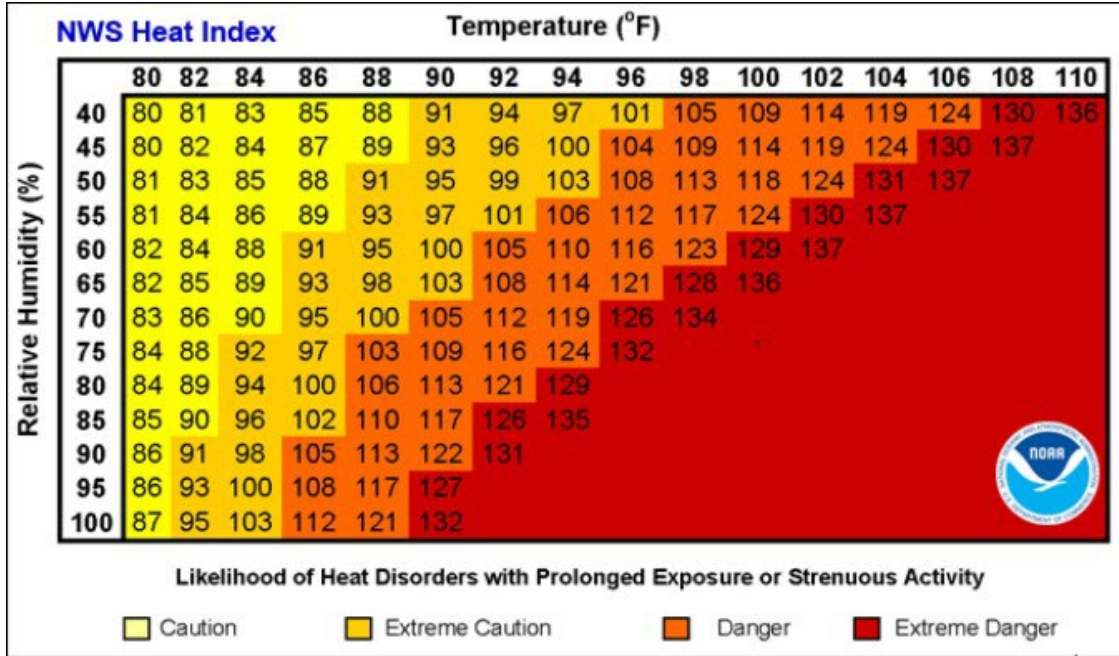
#### ***Geographic Location***

Extreme heat is an area-wide hazard event, the risk of extreme heat does not vary across Oregon County.

#### ***Strength/Magnitude/Extent***

The National Weather Service (NWS) has an alert system in place (advisories or warnings) when the Heat Index is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. A common guideline for issuing excessive heat alerts is when for two or more consecutive days: (1) when the maximum daytime Heat Index is expected to equal or exceed 105 degrees Fahrenheit (°F); and the night time minimum Heat Index is 80°F or above. A heat advisory is issued when temperatures reach 105 degrees and a warning is issued at 115 degrees.

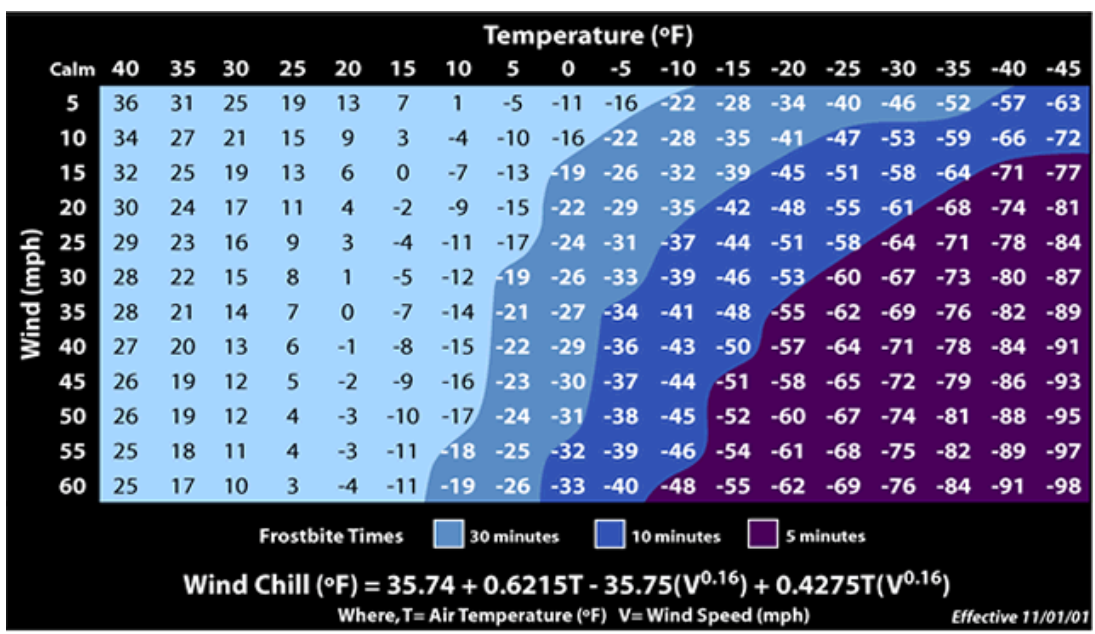
**Figure 3.16. Heat Index (HI) Chart**



Source: National Weather Service (NWS); <https://www.weather.gov/safety/heat-index>  
 Note: Exposure to direct sun can increase Heat Index values by as much as 15°F. The shaded zone above 105°F corresponds to a HI that may cause increasingly severe heat disorders with continued exposure and/or physical activity.

The NWS Wind Chill Temperature (WCT) index uses advances in science, technology, and computer modeling to provide an accurate, understandable, and useful formula for calculating the dangers from winter winds and freezing temperatures. The figure below presents wind chill temperatures which are based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

**Figure 3.17. Wind Chill Chart**



Source: <https://www.weather.gov/safety/cold-wind-chill-chart>

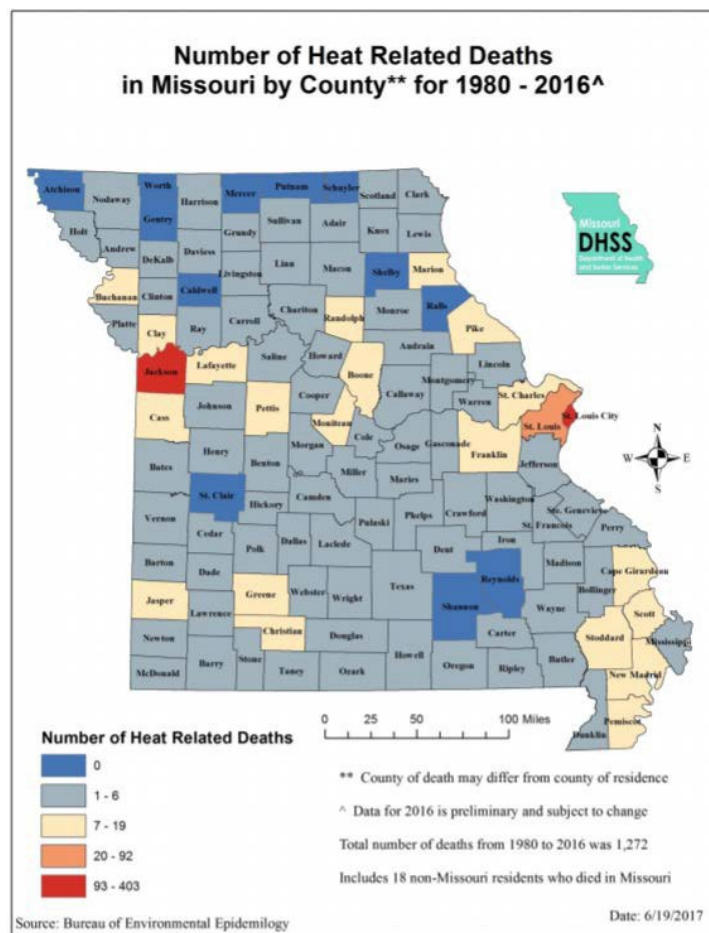
**Previous Occurrences**

There are seven (9) recorded extreme heat events in the National Centers for Environmental Information (NCEI) database from 2000 to 2020 for Oregon County. There were zero deaths and injuries, as well as no property and crop damage associated with these events in the NCEI data for Oregon County. The event narratives describe fatalities that occurred during regional multi-county heat events for other nearby counties as well. Extreme heat events in Oregon County were recorded in consecutive months in three separate years from 2000 to 2020. The months for each year are summarized as follows:

- 1999 – July & August
- 2000 – August & September
- 2001 – July & August
- 2012 – June, July & August

Figure 3.18 is a map created by The Missouri Department of Health and Senior Services (DHSS) for heat related fatalities by county. The map indicates that there have been between one (1) and six (6) heat related fatalities in Oregon County from 1980 to 2016.

**Figure 3.18. Heat Related Deaths in Missouri 2000 - 2016**



### ***Probability of Future Occurrence***

The probability that an extreme heat event will occur in Oregon County in any given year is 20% or once every four years. This equates to dividing four (4) years with an even period by the total number of years in the record period from 2000 to 2020 (21) and multiplying by 100. The events recorded in the NCEI database describe prolonged periods where temperatures rose above at least 90 degrees for at least twelve consecutive days. Heat advisories and warnings are issued for shorter periods of extreme heat nearly every year and may not meet the threshold for consecutive days in the NCEI database. This data limitation indicates that extreme heat events could be underreported in the NCEI.

### ***Changing Future Conditions Considerations***

Under a higher emissions pathway, historically unprecedented warming is projected by the end of the century. Even under a pathway of lower greenhouse gas emissions, average annual temperatures are projected to exceed historical record levels most likely by the middle of the 21st century. For example, in southern Missouri, the annual maximum number of consecutive days with temperatures exceeding 95 degrees F is projected to increase by up to 20 days. Temperature increases will cause future heat waves to be more intense, a concern for this region which already experiences hot and humid conditions. If the warming trend conditions, future heat waves are likely to be more intense, and cold wave intensity is projected to decrease.

The impacts of extreme heat events are experienced most acutely by the elderly and other vulnerable populations. Higher demand for electricity as people try to keep cool amplifies stress on power systems and may lead to an increase in the number of power outages. Atmospheric concentrations of ozone occur at higher air temperatures, resulting in poorer air quality, while harmful algal blooms flourish in warmer water temperatures, resulting in poorer water quality.

Mitigation against the impacts of future temperature increase may include increasing education on heat stress prevention, organizing cooling centers, allocating additional funding to repair and maintain roads damaged by buckling and potholes, and reducing nutrient runoff that contributes to algal blooms. Local governments should also prepare for increased demand on public recreational facilities, utility systems, and healthcare centers. Improving energy efficiency in public buildings will also present an increasingly valuable savings potential.

## **Vulnerability**

### ***Vulnerability Overview***

Those at greatest risk for heat-related illness include infants and children up to five years of age, people 65 years of age and older, people who are overweight, and people who are ill or on certain medications. However, even young and healthy individuals are susceptible if they participate in strenuous physical activities during hot weather. In agricultural areas, the exposure of farm workers, as well as livestock, to extreme temperatures is a major concern.

Table 3.32 lists typical symptoms and health impacts due to exposure to extreme heat.

---

**Table 3.32. Typical Health Impacts of Extreme Heat**

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

Source: National Weather Service Heat Index Program, [www.weather.gov/os/heat/index.shtml](http://www.weather.gov/os/heat/index.shtml)

### ***Potential Losses to Existing Development***

Based on the information in the 2018 State Plan and DHSS, no heat related deaths have occurred in Oregon County in the past 13 years. Therefore the likelihood of heat related death is unlikely, yet the possibility of occurrence should not be completely ruled out.

### ***Impact of Previous and Future Development***

Population growth can result in increases in the age groups that are most vulnerable to extreme heat. Population growth also increases the strain on electricity infrastructure, as more electricity is needed to accommodate the growing population. The City of Thayer is the only community in Oregon County that has experienced population growth between the period between 2010 - 2019. The other jurisdictions in the planning area have experienced population decline. Additionally, Oregon County has a significantly aging population which can be particularly prone to extreme temperatures.

### ***Hazard Summary by Jurisdiction***

Those at greatest risk for heat-related illness and deaths include children up to five years of age, people 65 years of age and older, people who are overweight, and people who are ill or on certain medications. To determine jurisdictions within the planning area with populations more vulnerable to extreme heat, demographic data was obtained from the 2010 census on population percentages in each jurisdiction comprised of those under age 5 and over age 65. Data was not available for overweight individuals and those on medications vulnerable to extreme heat. Table 3.33 below summarizes vulnerable populations in the participating jurisdictions. Note that school and special districts are not included in the table because students and those working for the special districts are not customarily in these age groups.

---

**Table 3.33. County Population Age Dynamics**

Jurisdiction	Population Under Age 5	Population Aged 65 and Over
Oregon County	601 (5.5%)	2,350 (21.4%)
City of Alton	99 (8.4%)	234 (19.9%)
City of Koshkonong	18 (7.3%)	41 (16.5%)
City of Thayer	130 (6%)	402 (18.6%)

Source: U.S. Census Bureau, (\*) includes entire population of each city or county

Schools in the county have proper air-conditioning and heating and follow proper procedures in the event of extreme temperatures. However, daycare and eldercare facilities may be at risk of heat related injuries if facilities are not properly cooled.

### **Problem Statement**

Older and younger segments of the population are more vulnerable to the impact of extreme heat. In addition, people living below the poverty level may be more vulnerable during periods of extreme temperatures due to a lack of air conditioning or heating in their homes. Institutionalized populations, such as those living in nursing homes, become more vulnerable to extreme temperatures due to power outages.

To help reduce the risk of death, heating and cooling centers should be promoted and known to the public, especially to those who have young children or are over the age of 65. Partnering with local community organizations to continue to donate fans and offer weatherization programs would mitigate the impact on vulnerable populations in the county.



### **3.4.7 Severe Thunderstorms**

Including High Winds, Hail, and Lightning

#### **Hazard Profile**

##### ***Hazard Description***

##### ***Thunderstorms***

A thunderstorm is defined as a storm that contains lightning and thunder which is caused by unstable atmospheric conditions. When cold upper air sinks and warm moist air rises, storm clouds or ‘thunderheads’ develop resulting in thunderstorms. This can occur singularly, as well as in clusters or lines. The National Weather Service defines a thunderstorm as “severe” if it includes hail that is one inch or more, or wind gusts that are at 58 miles per hour or higher. At any given moment across the world, there are about 1,800 thunderstorms occurring. Severe thunderstorms most often occur in Missouri in the spring and summer, during the afternoon and evenings, but can occur at any time. Other hazards associated with thunderstorms are heavy rains resulting in flooding (discussed separately in **Section 3.4.1**) and tornadoes (discussed separately in **Section 3.4.9**).

##### ***High Winds***

A severe thunderstorm can produce winds causing as much damage as a weak tornado. The damaging winds of thunderstorms include downbursts, microbursts, and straight-line winds. Downbursts are localized currents of air blasting down from a thunderstorm, which induce an outward burst of damaging wind on or near the ground. Microbursts are minimized downbursts covering an area of less than 2.5 miles across. They include a strong wind shear (a rapid change in the direction of wind over a short distance) near the surface. Microbursts may or may not include precipitation and can produce winds at speeds of more than 150 miles per hour. Damaging straight-line winds are high winds across a wide area that can reach speeds of 140 miles per hour.

##### ***Lightning***

All thunderstorms produce lightning which can strike outside of the area where it is raining and is has been known to fall more than 10 miles away from the rainfall area. Thunder is simply the sound that lightning makes. Lightning is a huge discharge of electricity that shoots through the air causing vibrations and creating the sound of thunder.

##### ***Hail***

According to the National Oceanic and Atmospheric Administration (NOAA), hail is precipitation that is formed when thunderstorm updrafts carry raindrops upward into extremely cold atmosphere causing them to freeze. The raindrops form into small frozen droplets. They continue to grow as they come into contact with super-cooled water which will freeze on contact with the frozen rain droplet. This frozen droplet can continue to grow and form hail. As long as the updraft forces can support or suspend the weight of the hailstone, hail can continue to grow before it hits the earth.

At the time when the updraft can no longer support the hailstone, it will fall down to the earth. For example, a ¼” diameter or pea sized hail requires updrafts of 24 miles per hour, while a 2 ¾” diameter or baseball sized hail requires an updraft of 81 miles per hour. According to the NOAA, the largest hailstone in diameter recorded in the United States was found in Vivian, South Dakota on July 23, 2010. It was eight inches in diameter, almost the size of a soccer ball. Soccer-ball-sized hail is the exception, but even small pea-sized hail can do damage.

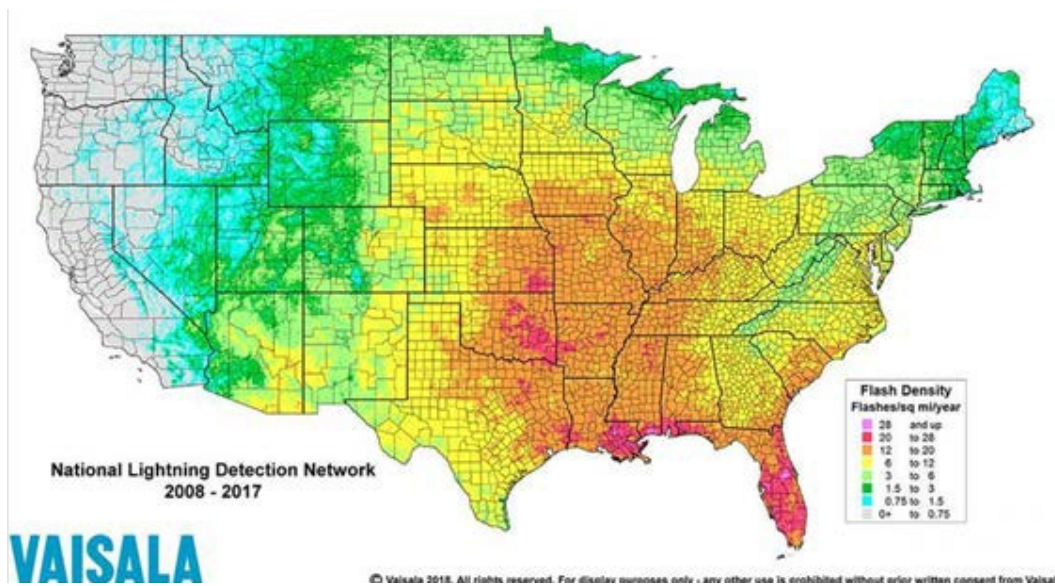
**Table 3.34. Tornado and Storm Research Organization Hailstorm Intensity Scale**

Intensity Category	Diameter (mm)	Diameter (inches)	Size Description	Typical Damage Impacts
Hard Hail	5-9	0.2-0.4	Pea	No damage
Potentially Damaging	10-15	0.4-0.6	Mothball	Slight general damage to plants, crops
Significant	16-20	0.6-0.8	Marble, grape	Significant damage to fruit, crops, vegetation
Severe	21-30	0.8-1.2	Walnut	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
Severe	31-40	1.2-1.6	Pigeon's egg > squash ball	Widespread glass damage, vehicle bodywork damage
Destructive	41-50	1.6-2.0	Golf ball > Pullet's egg	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
Destructive	51-60	2.0-2.4	Hen's egg	Bodywork of grounded aircraft dented, brick walls pitted
Destructive	61-75	2.4-3.0	Tennis ball > cricket ball	Severe roof damage, risk of serious injuries
Destructive	76-90	3.0-3.5	Large orange > Soft ball	Severe damage to aircraft bodywork
Super Hailstorms	91-100	3.6-3.9	Grapefruit	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
Super Hailstorms	>100	4.0+	Melon	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

**Geographic Location**

Thunderstorms/high winds/hail/lightning events are an area-wide hazard that can happen anywhere in the county. Although these events occur similarly throughout the planning area, they are more frequently reported in more urbanized areas. In addition, damages are more likely to occur in more densely developed urban areas.

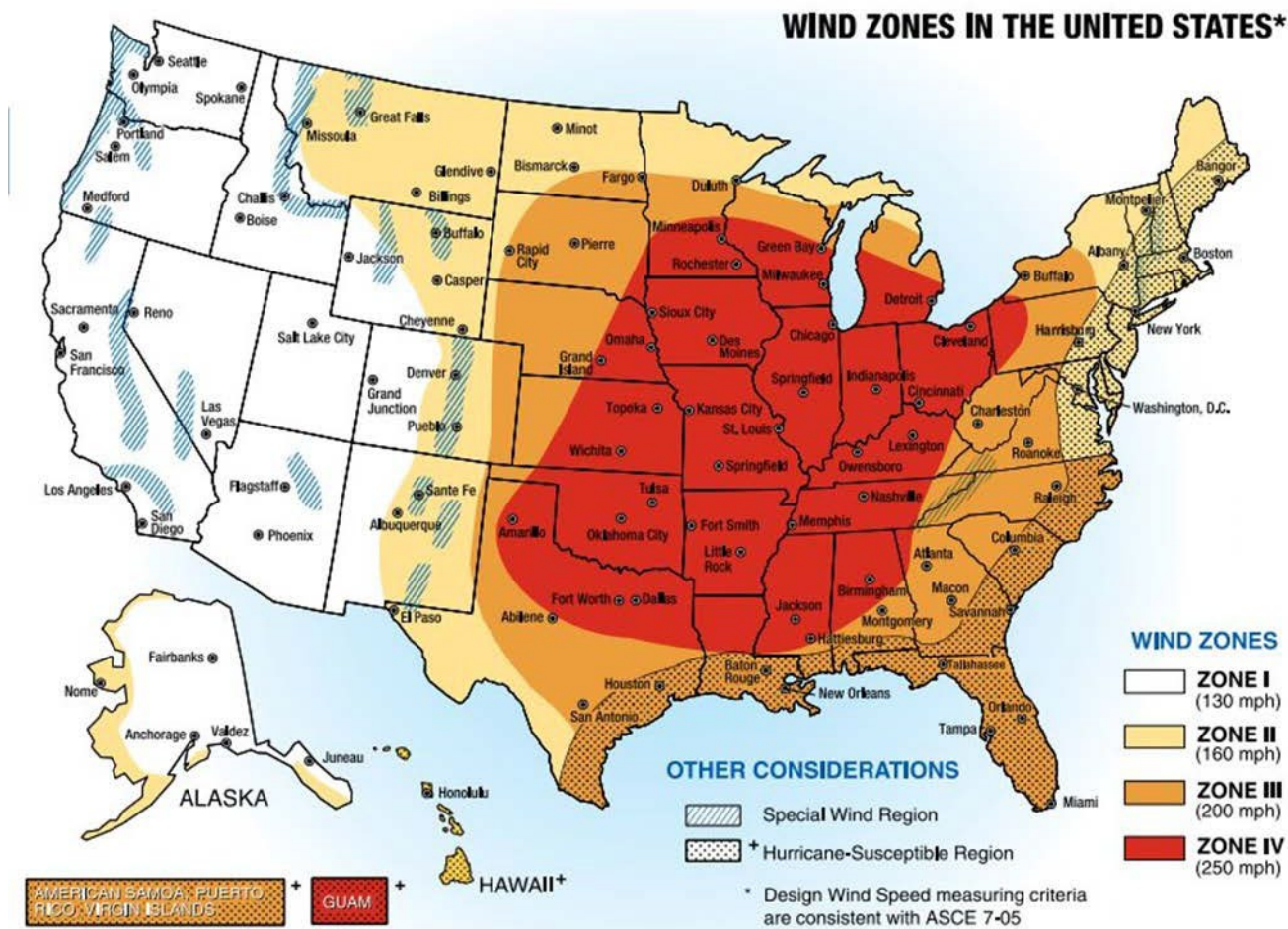
**Figure 3.19. Location and Frequency of Lightning in Missouri**



Source: National Weather Service, <https://www.vaisala.com/en/product/1256>

Figure 3.20 shows wind zones in the United States. Oregon County lies in Zone IV, the zone with the highest possible wind speeds in the country.

**Figure 3.20. U.S. Wind Zones**



Source: Tornado and Storm Research Organization (TORRO), Department of Geography, Oxford Brookes University

Notes: In addition to hail diameter, factors including number and density of hailstones, hail fall speed and surface wind speeds affect severity. <http://www.torro.org.uk/site/hyscale.php>

Straight-line winds are defined as any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 miles per hour, which represent the most common type of severe weather. They are responsible for most wind damage related to thunderstorms. Since thunderstorms do not have narrow tracks like tornadoes, the associated wind damage can be extensive and affect entire (and multiple) counties. Objects like trees, barns, outbuildings, high-profile vehicles, and power lines/poles can be toppled or destroyed, and roofs, windows, and homes can be damaged as wind speeds increase.

The onset of thunderstorms with lightning, high wind, and hail is generally rapid. Duration is less than six hours and warning time is generally six to twelve hours. Nationwide, lightning kills 75 to 100 people each year. Lightning strikes can also start structural and wildland fires, as well as damage electrical systems and equipment.

## Previous Occurrences

### Thunderstorm Wind

There are 77 Thunderstorm wind events reported to the NCEI from 2010-2020. There were 19 events with reported damages. The total damages from these events include \$1,452,500 in property damages with average losses per damaging event totaling \$76,447.

The costliest event occurred on May 8, 2009 when sixty to eighty mile per hour wind gusts impacted all of Oregon County resulting in an estimated \$1,000,000 in property damages. Significant tree damage was observed countywide, while numerous outbuildings and homes sustained damage. It was relayed to the National Weather Service that several homes in the community of Koshkonong had windows that were blown out. Roof damage was widespread in all communities of Oregon County.

**Table 3.35. NCEI T-Storm Wind Events in Oregon County 2010-2020**

Location	# of Events	Deaths	Injuries	Property Damage	Crop Damage
Unincorporated Oregon County	42	0	0	\$1,308,500	\$0
Alton	10	0	0	\$33,000	\$0
Koshkonong	1	0	0	\$2,000	\$0
Thayer	18	0	0	\$109,000	\$0
<b>Total</b>	<b>77</b>	<b>0</b>	<b>0</b>	<b>\$1,452,500</b>	<b>\$0</b>

### Hail

There are 79 Hail events reported to the NCEI from 2010-2020. The largest magnitude event was on April 2, 2006 when hailstones 4.25 inches in diameter were reported near Rover in unincorporated Oregon County. There were two events with reported damages. Table 3.36 provides information about damaging hail events in the county.

**Table 3.36. NCEI Hail Events in Oregon County 2010-2020**

Location	Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Oregon Co. (Couch)	5/25/2011	1.75 in.	0	0	\$10,000	0
City of Alton	6/7/2014	1.75 in.	0	0	\$10,000	0
<b>TOTALS</b>	-	-	<b>0</b>	<b>0</b>	<b>\$20,000</b>	<b>0</b>

Source: NCEI; 2016

### Lightning

Limitation to the use of NCEI reported lightning events include the fact that only lightning events that result in fatality, injury, and/or property and crop damage are in the NCEI. There are zero lightning events recorded in the NCEI data from 2010-2020.

**Table 3.37. NCEI Lightning Events in Oregon County 2010-2020**

Location	# of Events	Deaths	Injuries	Property Damage	Crop Damage
Unincorporated Oregon County	0	0	0	\$0	\$0
Alton	0	0	0	\$0	\$0
Koshkonong	0	0	0	\$0	\$0
Thayer	0	0	0	\$0	\$0
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>\$0</b>	<b>\$0</b>

**Probability of Future Occurrence**

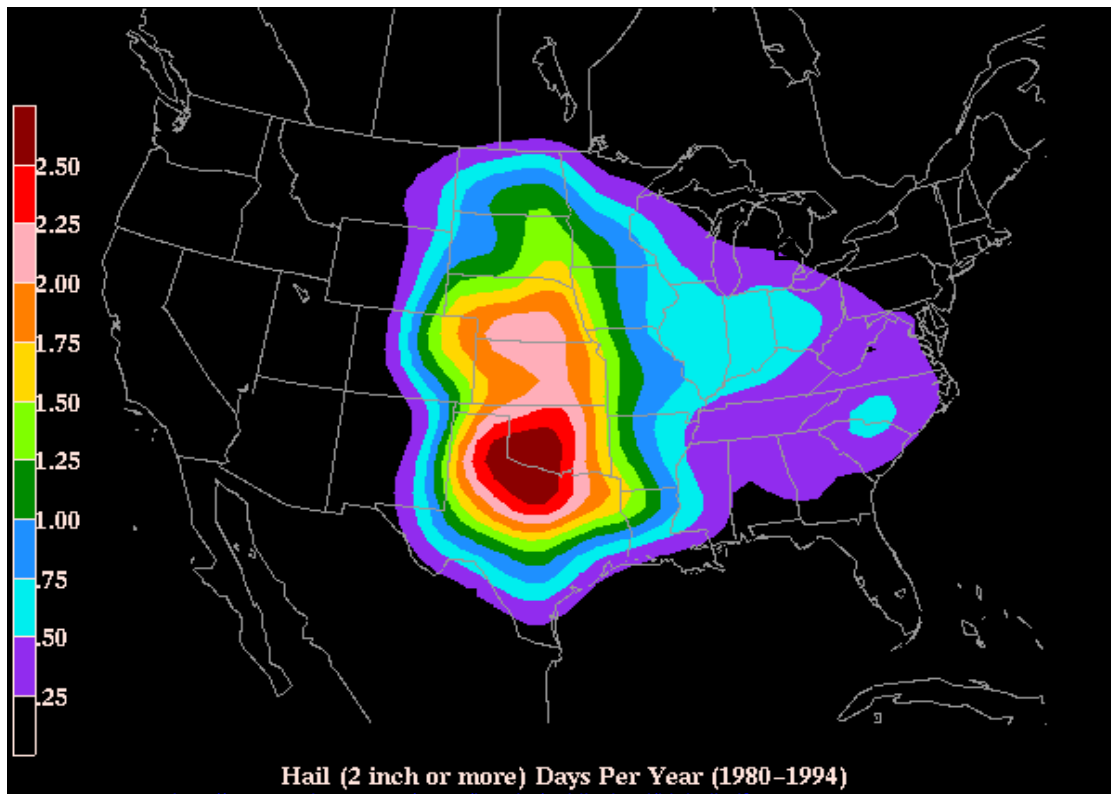
Thunderstorm Wind

There have been 42 recorded unique thunderstorm wind events over a 11-year period from 2010- 2020. This equates to nearly four and a half (3.8) thunderstorm wind occurrences in any given year with a 100% probability of occurrence. There were 20 events that resulted in \$1,452,500 in property damages. This equates to an average of one damaging event per year with annualized losses of \$145,250.

Hail

There have been 51 recorded hail events over a 11-year period from 2010-2020. This equates to nearly five hail events in any given year with a 100% probability of occurrence. There were only two events that resulted in \$20,000 in property damage. This equates approximately to one damaging event every ten years or 10% probability of occurrence. Annualized losses from damaging hail events is \$1,000 per year. Figure 3.21 below is a map based on hailstorm data from 1980 to 1994. It shows the probability of hailstorm occurrence (2" diameter or larger) based on number of days per year. Oregon County is bisected by the dark blue and light blue zones on the map meaning that the county can be expected to experience hail greater than 2" in diameter .75 to 1 day per year.

**Figure 3.21. Annual Hailstorm Probability - 2" diameter or larger - 1980- 1994**



## Lightning

It is known that the occurrence of severe thunderstorms includes the risk of damaging and potentially life-threatening lightning strikes. However, the NCEI database does not include any recorded occurrences of lightning events from the years 2010-2020. Though unlikely, the statistical occurrence probability of lightning events based on a 11-year record period is 0%.

### ***Changing Future Conditions Considerations***

Increases in temperature and more frequent droughts will accelerate the evaporation of water into the atmosphere, which will produce higher water concentrations. Elevated levels of moisture raise the likelihood of severe thunderstorms and tornadoes. Lives and property are endangered when the risk of these events increases, especially in jurisdictions that do not have a community safe room or the funds to construct one. This kind of event also possesses the threat of increasing the magnitude and frequency of other hazard events like riverine flooding, sinkhole occurrence, and flash flooding, putting residents in even greater danger.

## **Vulnerability**

### ***Vulnerability Overview***

High winds, hail, and lightning pose varying risk for jurisdictions in Oregon County. Downbursts resulting from thunderstorms can be just as damaging as an EF-1 tornado. High winds have resulted in \$1,216,000 in total property damage. Poorly built structures, barns, and outbuildings are most vulnerable to the impact of high winds during thunderstorms. Both high winds and hail can damage roofs. Hail can also damage crops and dent the exterior of vehicles. Total hail damage recorded in the NCEI database for Oregon County over a 10-year record period has been \$20,000 for an annualized loss of \$1,000 per year. Lightning can cause wildfires and structure fires, damage utilities causing power outages, or result in injury or death. The NCEI reports no lightning storm events for Oregon County in their database for the 10-year record period.

### ***Potential Losses to Existing Development***

The average annual loss determined from historical losses for high wind and hail are indicators of the potential losses to existing development. High wind events in the county have the potential to damage critical facilities, school facilities, local government properties, and private property alike. Potential annual losses for high wind and hail events are \$145,250 and \$1,000, respectively.

### ***Future Development***

The City of Thayer is the fastest growing community in Oregon County. The unincorporated County, Koshkonong and Thayer are losing population according to 2019 Census Estimates. Additional development in these areas will result in the exposure of more households and business vulnerable to damages from high winds, hail and lightning.

### ***Hazard Summary by Jurisdiction***

Although thunderstorm high winds, hail and lightning are area-wide events, the communities of Oregon County have varying degrees of percentage of structure built prior to 1939 – which are considered to be more vulnerable to the impacts of these events. The City of Thayer is home to the highest percentage of structures built prior to 1939 at 22.9%, followed by Koshkonong (20.3%), Alton (19.6%) and the unincorporated County (6.8%). The county’s school districts have mostly modernized facilities and are considered well-built structures. The Couch School campus has two buildings that were constructed in the 1930s by the Civilian Conservation Corps which are still in use. Most districts have outbuildings used for storage and maintenance that may be at higher risk to high wind and hail events.

### **Problem Statement**

Poorly built structures, barns, outbuildings are more vulnerable to the impact of high winds during thunderstorms. High winds can topple utility poles and lead to widespread or localized power outages. Both high winds and hail can damage roofs. Hail can also damage crops and vehicles. People are also at risk to injury and death during high wind and lightning events. Crop insurance can mitigate the risk to farmers and the agriculture sector within the county. Lightning events have also been known to cause structure fires.

The risk of property damage, injury and death in the county can potentially be mitigated by identifying safe refuge areas in public buildings, nursing homes and other facilities that house vulnerable populations that do not currently have a safe room. Retrofitting school district facilities with protective filming of windows and installation of blast proof doors will provide more protection for students and staff at school facilities. Additional warnings and alerts will also provide the public and schools more time to take cover during high wind events. In addition, public safety fairs and expos in the county could provide an opportunity to disseminate information to citizens about individual saferoom construction. Education and hazard awareness programs in public schools would also increase public safety in the event of severe thunderstorm occurrence.



### 3.4.8 Severe Winter Weather

#### Hazard Profile

##### *Hazard Description*

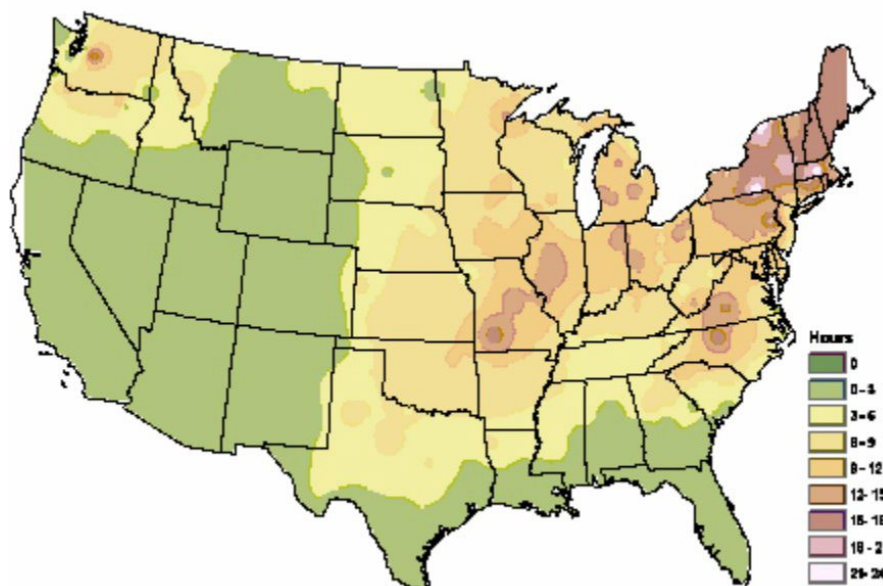
A major winter storm can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall, and cold temperatures. The National Weather Service describes different types of winter storm events as follows.

- **Blizzard**—Winds of 35 miles per hour or more with snow and blowing snow reducing visibility to less than ¼ mile for at least three hours.
- **Blowing Snow**—Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.
- **Snow Squalls**—Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant.
- **Snow Showers**—Snow falling at varying intensities for brief periods of time. Some accumulation is possible.
- **Freezing Rain**—Measurable rain that falls onto a surface with a temperature below freezing. This causes it to freeze to surfaces, such as trees, cars, and roads, forming a coating or glaze of ice. Most freezing-rain events are short lived and occur near sunrise between the months of December and March.
- **Sleet**—Rain drops that freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects.

##### *Geographic Location*

The entire county is vulnerable to heavy snow, ice, extreme cold temperatures and freezing rain. Figure 3.22 depicts the average number of hours per year with freezing rain. Oregon County is located in a zone that can expect 9-12 hours of freezing rain per year.

**Figure 3.22. NWS Statewide Average Number of Hours per Year with Freezing Rain**



Source: American Meteorological Society. "Freezing Rain Events in the United States." <http://ams.confex.com/ams/pdfpapers/71872.pdf>



### ***Severity/Magnitude/Extent***

Severe winter storms include extreme cold, heavy snowfall, ice, and strong winds which can push the wind chill well below zero degrees in the planning area. Heavy snow can bring a community to a standstill by inhibiting transportation (in whiteout conditions), weighing down utility lines, and by causing structural collapse in buildings not designed to withstand the weight of the snow. Repair and snow removal costs can be significant. Ice buildup can collapse utility lines and communication towers, as well as make transportation difficult and hazardous. Ice can also become a problem on roadways if the air temperature is high enough that precipitation falls as freezing rain rather than snow.

Extreme cold often accompanies severe winter storms and can lead to hypothermia and frostbite in people without adequate clothing protection. Cold can cause fuel to congeal in storage tanks and supply lines, stopping electric generators. Cold temperatures can also overpower a building's heating system and cause water and sewer pipes to freeze and rupture. Extreme cold also increases the likelihood for ice jams on flat rivers or streams. When combined with high winds from winter storms, extreme cold becomes extreme wind chill, which is hazardous to health and safety.

The National Institute on Aging estimates that more than 2.5 million Americans are elderly and especially vulnerable to hypothermia, with the isolated elders being most at risk. About 10 percent of people over the age of 65 have bodily temperature-regulating defect, and 3-4 percent of all hospital patients over 65 are hypothermic.

Also, at risk are those without shelter, those who are stranded, or who live in a home that is poorly insulated or without heat. Other impacts of extreme cold include asphyxiation (unconsciousness or death from a lack of oxygen) from toxic fumes from emergency heaters; household fires, which can be caused by fireplaces and emergency heaters; and frozen/burst pipes.

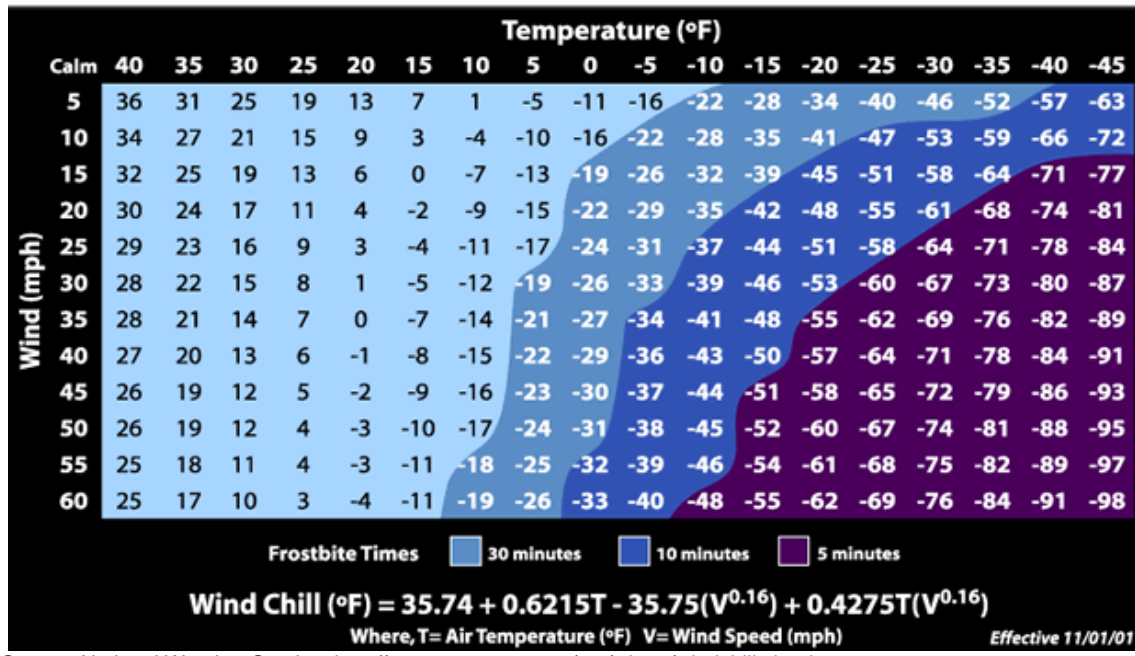
Buildings with overhanging tree limbs are more vulnerable to damage during winter storms when limbs fall. Businesses experience loss of income as a result of closure during power outages. In general, heavy winter storms increase wear and tear on roadways though the cost of such damages is difficult to determine. Businesses can experience loss of income as a result of closure during winterstorms.

Overhead power lines and infrastructure are also vulnerable to damages from winter storms. Ice accumulation during winter storm events damage to power lines due to the ice weight on the lines and equipment. Damages also occur to lines and equipment from falling trees and tree limbs weighted down by ice. Potential losses could include cost of repair or replacement of damaged facilities and lost economic opportunities for businesses.

Secondary effects from loss of power could include burst water pipes in homes without electricity during winter storms. Public safety hazards include risk of electrocution from downed power lines. Specific amounts of estimated losses are not available due to the complexity and multiple variables associated with this hazard. Standard values for loss of service for utilities reported in FEMA's 2009 BCA Reference Guide, the economic impact as a result of loss of power is \$126 per person per day of lost service.

Wind can greatly amplify the impact of cold ambient air temperatures. Provided by the National Weather Service, Figure 3.23 below shows the relationship of wind speed to apparent temperature and typical time periods for the onset of frostbite.

**Figure 3.23. Wind Chill Chart**



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

**Previous Occurrences**

Table 3.38 below details the number of winter weather events that have occurred in Oregon County between the years 2000-2020.

**Table 3.38. NCEI Oregon County Winter Weather Events Summary, 2000-2020**

Type of Event	Inclusive Dates	# of Injuries	Property Damages	Crop Damages
Heavy Snow	12/2000	0	0	0
Ice Storm	12/2000	0	0	0
Winter Storm	12/2000	0	0	0
Ice Storm	2/2001	0	0	0
Winter Storm	12/2002	0	0	0
Ice Storm	12/2002	0	0	0
Winter Storm	2/2003	0	0	0
Winter Storm	2/2003	0	0	0
Winter Storm	2/2004	0	0	0
Winter Storm	12/2004	0	0	0
Ice Storm	2/2008	0	0	0
Ice Storm	1/2009	0	0	0
Winter Storm	2/2009	0	0	0
Winter Storm	1/2010	0	0	0
Winter Storm	2/2013	0	0	0
Winter Storm	3/2014	0	0	0
Winter Storm	2/2015	0	0	0
--	--	0	\$0	0

Source: NCEI, 2021

Of the 17 events listed in the NCEI data, five were Ice Storms, one was Heavy Snow event, and the remainder term generally as “Winter Storm”. While not listed within this updates 20-year period of record, the most damaging Oregon County winter storm event listed in the NCEI database was the March 1999 Winter Storm in which \$150,000 in property damages were reported. There are no reported deaths, injuries, or crop damage associated with these winter weather events.

### Ice Storm

The most significant Ice Storm event in terms of regional impact was the January 2009 event when a significant winter storm brought a combination freezing drizzle, freezing rain, sleet and snow to the Missouri Ozarks January 26 and 27, 2009. Freezing drizzle and light freezing rain developed area wide at the onset of the event causing multiple traffic accidents. Freezing rain persisted for much of the event across far southern Missouri resulting in significant ice accretion of one half to one inch. This ice storm downed tree limbs and power lines causing numerous power outages. As many as 20,000 residences lost power along the Arkansas border from Branson to Alton (Oregon County). Sleet was the predominant precipitation type for much of the area with accumulations of 1 to 3 inches common. As much as 6 inches of sleet fell across far south-central Missouri. The weight of freezing rain and sleet across far southern Missouri caused the roofs of several buildings and a boat dock to collapse. The sleet transitioned to snow toward the end of the event with 2 to 4 inches of snow common on top of the freezing rain and sleet. Despite the significance of the event, no property damage was publicly reported in Oregon County.

### ***Changing Future Conditions Considerations***

Shorter overall winter seasons and fewer days of extreme cold may have both positive and negative indirect impacts. Warmer winter temperatures may result in changing distributions of native plant and animal species and/or an increase in pests and non-native species. Warmer winter temperatures will result in a reduction of lake ice cover. Reduced lake ice cover impacts aquatic ecosystems by raising water temperatures. Water temperature is linked to dissolved oxygen levels and many other environmental parameters that affect fish, plant, and other animal populations. A lack of ice cover also leaves lakes exposed to wind and evaporation during a time of year when they are normally protected.

As both temperature and precipitation increase during the winter months, freezing rain will be more likely. Additional wintertime precipitation in any form will contribute to saturation and increase the risk and/or severity of spring flooding. A greater proportion of wintertime precipitation may fall as rain rather than snow

### ***Probability of Future Occurrence***

The probability for all of the different types of winter weather is included as one probability, since one storm generally includes a lot of the different types of events. There were 17 severe winter weather events in Oregon County from 2010-2020. This equates to an 85% probability of occurrence in any given year with approximately 0.85 events in any given year.

## **Vulnerability**

### ***Vulnerability Overview***

Severe winter storms include extreme cold, heavy snowfall, ice and strong winds which can push the wind chill well below zero degrees in the planning area. Heavy snow can bring a community to a standstill by inhibiting transportation (in whiteout conditions), weighing down utility lines, and by causing structural collapse in buildings not designed to withstand the weight of the excessive snow. Repair and snow removal costs can be significant. Ice buildup can collapse utility lines and communication towers, as well as make transportation difficult and hazardous. People over 65 and those living in poverty have an increased risk of hypothermia and frostbite due to extreme cold and wind chill hazards.

In the 2018 State Plan, seven factors were considered in determining overall severe winter storm vulnerability as follows: housing density, likelihood of occurrence, building exposure, crop exposure, average annual property loss ratio, average annual crop insurance claims and social vulnerability. The state ranked each of these criteria using a scale from one to five, one being lowest and five being the highest, to rank each county’s vulnerability to severe winter weather. Oregon County received a vulnerability rating of medium with Property Loss Ratio being rated “4” and Social Vulnerability being rated “5”.

**Potential Losses to Existing and Future Development**

During the 11-year period of record from 2010-2020, no property damage was reported as a result of severe winter storms.

**Future Development**

Increased development and resulting increase in population will increase exposure to damage from severe winter weather. Future commercial development can expect functional downtime and decreased revenues during periods of severe winter weather. Road construction in the county will increase the need for snow removal and slat to keep transportation lifelines open during periods of severe winter weather.

**Hazard Summary by Jurisdiction**

Severe winter weather can cause power outages and put structures at risk to fires when individuals in homes resort fuel heaters. The risk of extreme cold deaths and frostbite varies among segments of the populations. People over 65 and those living below the poverty level have an increased vulnerability to severe winter weather. Table 3.39 includes information on population over 65 and the percent living below the poverty level by jurisdiction.

**Table 3.39. Population over 65 and Percent Living Below the Poverty Level by Jurisdiction**

Jurisdiction	% of Families Living Below Poverty Level	% Population over 65
Oregon County	19.8	21.4
City of Alton	38.1	19.9
City of Koshkonong	15.9	16.5
City of Thayer	17.9	18.6

Source: ACS Profiles; ACS five year estimates 2010-2014

All jurisdictions have large percentages of families living below the poverty level. The Cities of Alton and Unincorporated Oregon County have the highest percentages of impoverished families. The largest populations of people over 65—by percentage—also reside in these two jurisdictions. These communities have the greatest risk based on these populations. The City of Koshkonong could be considered to have the lowest vulnerability to severe winter storm events.

## **Problem Statement**

Heavy snow can bring a community to a standstill by inhibiting transportation (in whiteout conditions), weighing down utility lines, and by causing structural collapse in buildings not designed to withstand the weight of the snow. Repair and snow removal costs can be significant. Ice buildup can collapse utility lines and communication towers, as well as make travel extremely difficult and hazardous. People over 65 and those living in poverty have an increased risk of hypothermia and frostbite due to extreme cold and wind chill.

It is important that the Oregon County EMA maintain a list of heating centers throughout the county as they become available. These locations could be promoted through avenues such as radio, Facebook or the county government's website. These locations can provide individuals who are at risk refuge from periods of extreme cold. Public works departments can develop snow removal plans and maintain adequate snow removal equipment and staff to quickly open roads after periods of heavy snow and freezing rain. The county and cities can work with local electric cooperatives to develop vegetation management programs in rights of way to minimize damages of falling tree limbs laden with ice resulting from ice storms to minimize power outages throughout the county.

## 3.4.9 Tornado

### Hazard Profile

#### *Hazard Description*

Essentially, tornadoes are a vortex storm with two components of winds. The first is the rotational winds that can measure up to 500 miles per hour, and the second is an uplifting current of great strength. The dynamic strength of both these currents can cause vacuums that can overpressure structures from the inside.

Although tornadoes have been documented in all 50 states, most of them occur in the central United States. The unique geography of the central United States allows for the development of thunderstorms that spawn tornadoes. The jet stream, which is a high-velocity stream of air, determines which area of the central United States will be prone to tornado development. The jet stream normally separates the cold air of the north from the warm air of the south. During the winter, the jet stream flows west to east from Texas to the Carolina coast. As the sun “moves” north, so does the jet stream, which at summer solstice flows from Canada across Lake Superior to Maine. During its move northward in the spring and its recession south during the fall, the jet stream crosses Missouri, causing the large thunderstorms that breed tornadoes.

Tornadoes spawn from the largest thunderstorms. The associated cumulonimbus clouds can reach heights of up to 55,000 feet above ground level and are commonly formed when Gulf air is warmed by solar heating. The moist, warm air is overridden by the dry cool air provided by the jet stream. This cold air presses down on the warm air, preventing it from rising, but only temporarily. Soon, the warm air forces its way through the cool air and the cool air moves downward past the rising warm air. This air movement, along with the deflection of the earth’s surface, can cause the air masses to start rotating. This rotational movement around the location of the breakthrough forms a vortex, or funnel. If the newly created funnel stays in the sky, it is referred to as a funnel cloud. However, if it touches the ground, the funnel officially becomes a tornado.

A typical tornado can be described as a funnel-shaped cloud that is “anchored” to a cloud, usually a cumulonimbus that is also in contact with the earth’s surface. This contact on average lasts 30 minutes and covers an average distance of 15 miles. The width of the tornado (and its path of destruction) is usually about 300 yards. However, tornadoes can stay on the ground for upward of 300 miles and can be up to a mile wide. The National Weather Service, in reviewing tornadoes occurring in Missouri between 1950 and 1996, calculated the mean path length at 2.27 miles and the mean path area at 0.14 square mile.

The average forward speed of a tornado is 30 miles per hour but may vary from nearly stationary to 70 miles per hour. The average tornado moves from southwest to northeast, but tornadoes have been known to move in any direction. Tornadoes are most likely to occur in the afternoon and evening but have been known to occur at all hours of the day and night.

#### *Geographic Location*

Tornadoes can occur anywhere in the planning area.

**Strength/Magnitude/Extent**

Tornadoes are the most violent of all atmospheric storms and are capable of tremendous destruction. Wind speeds can exceed 250 miles per hour and damage paths can be more than one mile wide and 50 miles long. Tornadoes have been known to lift and move objects weighing more than 300 tons a distance of 30 feet, toss homes more than 300 feet from their foundations, and siphon millions of tons of water from water bodies. Tornadoes also can generate a tremendous amount of flying debris or “missiles,” which often become airborne shrapnel that causes additional damage. If wind speeds are high enough, missiles can be thrown at a building with enough force to penetrate windows, roofs, and walls. However, the less spectacular damage is much more common.

Tornado magnitude is classified according to the EF- Scale (or the Enhance Fujita Scale, based on the original Fujita Scale developed by Dr. Theodore Fujita, a renowned severe storm researcher). The EF- Scale (see Table 3.40) attempts to rank tornadoes according to wind speed based on the damage caused. This update to the original F Scale was implemented in the U.S. on February 1, 2007.

**Table 3.40. Enhanced F Scale for Tornado Damage**

FUJITA SCALE			DERIVED EF SCALE		OPERATIONAL EF SCALE	
F Number	Fastest ¼-mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

Source: The National Weather Service, [www.spc.noaa.gov/faq/tornado/ef-scale.html](http://www.spc.noaa.gov/faq/tornado/ef-scale.html)

The wind speeds for the EF scale and damage descriptions are based on information on the NOAA Storm Prediction Center as listed in Table 3.41. The damage descriptions are summaries. For the actual EF scale, it is necessary to look up the damage indicator (type of structure damaged) and refer to the degrees of damage associated with that indicator. Information on the Enhanced Fujita Scale’s damage indicators and degrees or damage is located online at: [www.spc.noaa.gov/efscale/ef-scale.html](http://www.spc.noaa.gov/efscale/ef-scale.html).

*Safe Room Construction, Alton R-II School District*



**Table 3.41. Enhanced Fujita Scale with Potential Damage**

Enhanced Fujita Scale			
Scale	Wind Speed (MPH)	Relative Frequency	Potential Damage
EF0	65-85	53.5%	Light. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e. those that remain in open fields) are always rated EF0).
EF1	86-110	31.6%	Moderate. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	10.7%	Considerable. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes complete destroyed; large trees snapped or uprooted; light object missiles generated; cars lifted off ground.
EF3	136-165	3.4%	Severe. Entire stores of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	0.7%	Devastating. Well-constructed houses and whole frame houses completely levelled; cars thrown and small missiles generated.
EF5	>200	<0.1%	Explosive. Strong frame houses levelled off foundations and swept away; automobile-sized missiles fly through the air in excess of 300 ft.; steel reinforced concrete structure badly damaged; high rise buildings have significant structural deformation; incredible phenomena will occur.

Source: NOAA Storm Prediction Center, <http://www.spc.noaa.gov/efscale/ef-scale.html>

Enhanced weather forecasting has provided the ability to predict severe weather likely to produce tornadoes days in advance. Tornado watches can be delivered to those in the path of these storms several hours in advance. Lead time for actual tornado warnings is about 30 minutes. Tornadoes have been known to change paths very rapidly, thus limiting the time in which to take shelter. Tornadoes may not be visible on the ground if they occur after sundown or due to blowing dust or driving rain and hail.

**Previous Occurrences**

There are limitations to the use of NCEI tornado data that must be noted. For example, one tornado may contain multiple segments as it moves geographically. A tornado that crosses a county line or state line is considered a separate segment for the purposes of reporting to the NCEI. Also, a tornado that lifts off the ground for less than 5 minutes or 2.5 miles is considered a separate segment. If the tornado lifts off the ground for greater than 5 minutes or 2.5 miles, it is considered a separate tornado. Tornadoes reported in Storm Data and the Storm Events Database are insegments.

**Table 3.42. Recorded Tornadoes in Oregon County, 2000-2020**

Date	Beginning Location	Ending Location	Length (miles)	Width (yards)	F/EF Rating	Death	Injury	Property Damage	Crop Damages
11-5-2005	Thayer	Myrtle	9	300	EF2	0	0	1,500,000	0
4-25-2006	Alton	SE of Alton	8	50	EF0	0	0	0	0
5-3-2006	Alton	SE of Alton	2	20	EF0	0	0	0	0
1-8-2008	Alton	S of Alton	1.1	50	EF0	0	0	1,000	0
6-9-2009	Thomasville	E of Thomasville	0.03	20	EF0	0	0	0	0
5-25-2011	Billmore	Job	2.5	100	EF1	0	0	20,000	0
5-19-2017	Thayer	E of Thayer	1.25	50	EF0	0	0	50,000	0
	<b>Total</b>	-	-	-	-	<b>0</b>	<b>0</b>	<b>\$1,571,000</b>	<b>0</b>

Source: National Centers for Environmental Information, <http://www.NCEI.noaa.gov/stormevents/>



Figure 3.24. Oregon County Map of Historic Tornado Events



Source: Missouri Tornado History Project, <http://www.tornadohistoryproject.com/tornado/Missouri>

### Probability of Future Occurrence

According to the NCEI, seven tornadoes have occurred during the 21-year period from 2000-2020 resulting in a probability percentage of 30% of a tornado of any magnitude event in the planning area in any given year.

### Changing Future Conditions Considerations

Scientists do not know how the frequency and severity of tornadoes will change. Research published in 2015 suggests that changes in heat and moisture content in the atmosphere, brought on by a warming world, could be playing a role in making tornado outbreaks more common and severe in the U.S. The research concluded that the number of days with large outbreaks have been increasing since the 1950s and that densely concentrated tornado outbreaks are on the rise. It is notable that the research shows that the area of tornado activity is not expanding, but rather the areas already subject to tornado activity are seeing the more densely packed tornadoes. Because Missouri experiences

on average, around 39.6 tornadoes a year, such research is closely followed by meteorologists in the state.

## **Vulnerability**

### ***Vulnerability Overview***

According to the 2018 State Plan, the following six factors were considered in determining overall tornado vulnerability: building exposure, population density, social vulnerability, percentage of mobile homes, likelihood of occurrence, and annual property loss. The state ranked each of these criteria using a scale from one to five, one being lowest and five being the highest, ranking each county's vulnerability to tornadoes.

Oregon County received the following vulnerability rating for each factor: building exposure – low medium (2), population density – low (1), social vulnerability – medium (3), percentage of mobile homes – medium high (4), likelihood of occurrence – high (5), and annual property loss – high (2). This equates to an overall vulnerability rating of High.

**Figure 3.25. Tornado Alley in the U.S.**



Source: <http://www.tornadochaser.net/tornalley.html>

### ***Potential Losses to Existing Development***

During the 21-year period from 2000-2020, a total of \$1,571,000 in property losses equates to \$74,809 in average annual losses countywide. This value indicates that potential future losses in the county will remain significant. The most common tornado events recorded in the county are EF0 magnitude. The average magnitude for tornado events in the county is 0.43 on the Enhanced Fujita Scale.

### ***Previous and Future Development***

Oregon County as whole is experiencing slow growth. The fastest growing community is the City of Alton, the County Seat. It is anticipated that the unincorporated county will see the most growth on the western half of the county. This part of the county is nearest to the region's largest city, West Plains, and does not have nearly as much land that is controlled by state and federal government interests. Additional population growth and development will increase exposure and risk to tornado events due to the area-wide geographic nature of this hazard.

### ***Hazard Summary by Jurisdiction***

Although tornado events are area-wide hazards, communities with a greater percentage of structures built prior to 1939 are considered to be more vulnerable to the impact of tornadoes. The City of Thayer is home to the highest percentage of structures built prior to 1939 at 22.1%, followed by Koshkonong (20.1%), Alton (19.2%) and the unincorporated County (6.2%). The county's school districts have mostly modernized facilities and are considered well-built structures. The Couch School campus has two buildings that were constructed in the 1930s by the Civilian Conservation Corps which are still in use. Most districts have outbuildings used for storage and maintenance that may be at higher risk to high wind and hail events.

School district facilities are at risk to the damages of tornadoes. Risk to student population has been mitigated by the construction of a saferoom at the Alton School. The Couch School District has had their Notice of Interest selected and is currently in the process of developing their full application for submittal. The Thayer School District has a Notice of Interest for a saferoom on file with the State Emergency Management Agency.

### **Problem Statement**

Tornadoes are the most violent of all atmospheric storms and are capable of tremendous destruction. Wind speeds can exceed 250 miles per hour and damage paths can be more than one mile wide and 50 miles long. Significant tornado events in Oregon County since 1950 have resulted in numerous injuries (16) and millions of dollars in property damage (\$9.63MM). Information in the 2018 State Plan indicates that Oregon County has a moderate vulnerability to tornadoes based on frequency of occurrence and previous damages.

The risk of property damage, injury and death in the county can be mitigated by constructing FEMA standard saferooms in facilities that house vulnerable populations such as nursing homes, government buildings, and schools. In addition, identifying safe refuge areas in public buildings, nursing homes and other facilities with protective filming of windows and installation of blast proof doors will provide more protection for students and staff and school facilities that are not served by FEMA standard saferooms. Additional warnings and alerts will also provide the public and schools more time to take cover during tornado warnings. Also, public safety fairs and expos in the county hosted by communities provide an opportunity to disseminate information to homeowners about individual saferoom construction in residences.

Cities can adopt or update and enforce IBC 2012 building codes that include construction techniques such as roof tie down straps to mitigate damage to future development.

## 3.4.10 Wildfire

### Hazard Profile

#### *Hazard Description*

The fire incident types for wildfires include: 1) natural vegetation fire, 2) outside rubbish fire, 3) special outside fire, and 4) cultivated vegetation, crop fire.

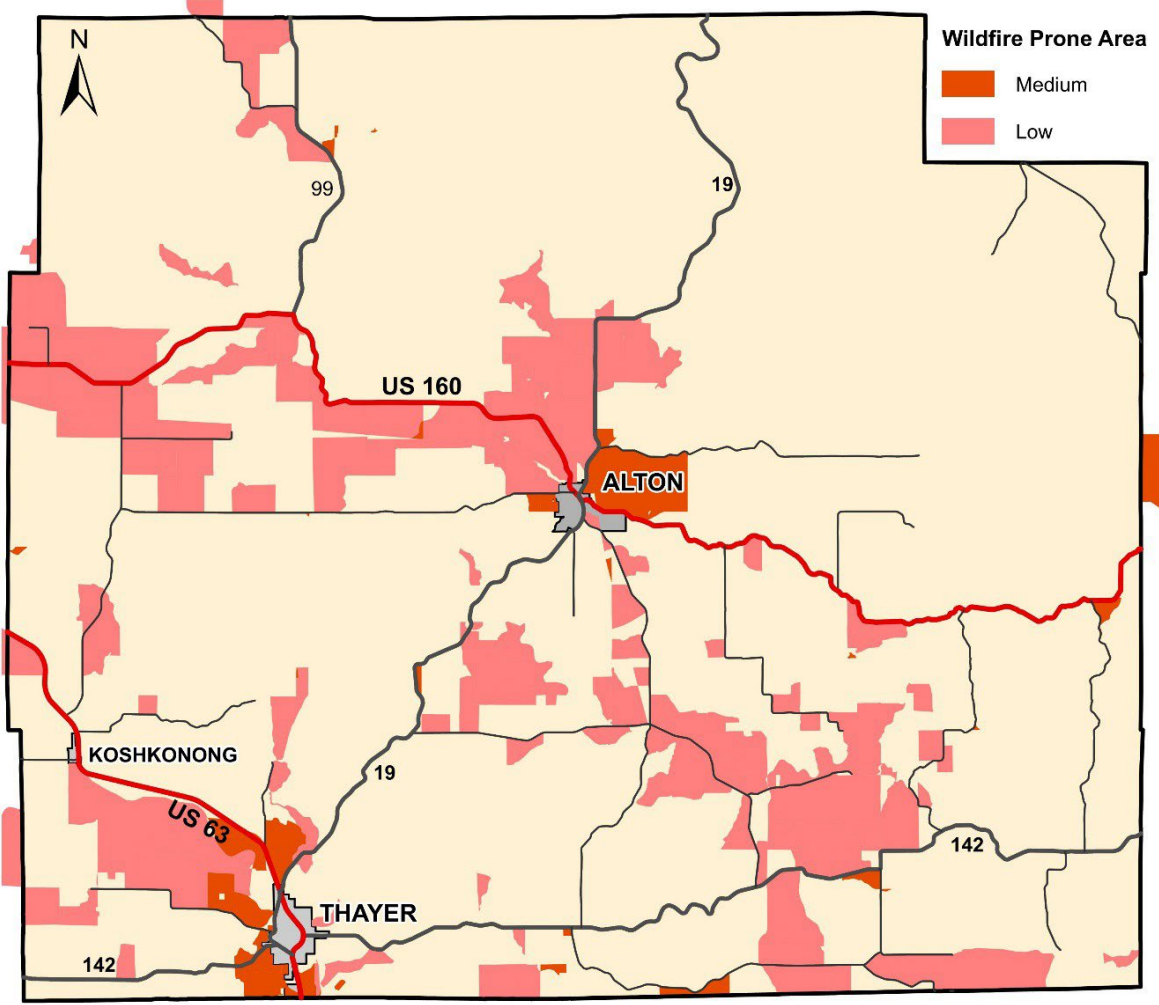
The Forestry Division of the Missouri Department of Conservation (MDC) is responsible for protecting privately owned and state-owned forests and grasslands from wildfires. To accomplish this task, eight forestry regions have been established in Missouri for fire suppression. The Forestry Division works closely with volunteer fire departments and federal partners to assist in fire suppression activities. Currently, more than 900 rural fire departments in Missouri have mutual aid agreements with the Forestry Division to obtain assistance in wildfire protection if needed.

Most of Missouri fires occur during the spring season between February and May. The length and severity of wildland fires depend largely on weather conditions. Spring in Missouri is usually characterized by low humidity and high winds. These conditions result in higher fire danger. In addition, due to the recent lack of moisture throughout many areas of the state, conditions are likely to increase the risk of wildfires. Drought conditions can also hamper firefighting efforts, as decreasing water supplies may not prove adequate for firefighting. It is common for rural residents to burn their garden spots, brush piles, and pastures in the spring. Some landowners also believe it is necessary to burn their forests in the spring to promote grass growth, kill ticks, and reduce brush accumulation. Therefore, spring months are the more dangerous for wildfires. The second most critical period of the year is fall. Depending on the weather conditions, a sizeable number of fires may occur between mid-October and late November.

#### *Geographic Location*

Absent demographic information indicating otherwise, the risk of structural fire probably does not vary widely across the planning area. However, damages due to wildfires would be higher in communities with more wildland–urban interface (WUI) areas. The term refers to the zone of transition between unoccupied land and human development and needs to be defined in the plan. Within the WUI, there are two specific areas identified: 1) Interface and 2) Intermix. The interface areas are those areas that abut wildland vegetation and the Intermix areas are those areas that intermingle with wildland areas. Figure 3.26 shows WUI areas in Oregon County.

**Figure 3.26. Oregon County Wildland Urban Intermix, Interface**



**Severity/Magnitude/Extent**

Wildfires damage the environment, killing some plants and occasionally animals. Firefighters have been injured or killed, and structures can be damaged or destroyed. The loss of plants can heighten the risk of soil erosion and landslides. Although Missouri wildfires are not the size and intensity of those in the Western United States, they could impact recreation and tourism in and near the fires.

Wildland fires in Missouri have been mostly a result of human activity rather than lightning or some other natural event. Wildfires in Missouri are usually surface fires, burning the dead leaves on the ground or dried grasses. They do sometimes “torch” or “crown” out in certain dense evergreen stands like eastern red cedar and shortleaf pine. However, Missouri does not have the extensive stands of evergreens found in the western US that fuel the large fire storms seen on television newsstories.

While very unusual, crown fires can and do occur in Missouri native hardwood forests during prolonged periods of drought combined with extreme heat, low relative humidity, and high wind. Tornadoes, high winds, wet snow and ice storms in recent years have placed a large amount of woody material on the forest floor that causes wildfires to burn hotter and longer. These conditions also make it more difficult for fire fighters suppress fires safely.

Often wildfires in Missouri go unnoticed by the general public because the sensational fire behavior that captures the attention of television viewers is rare in the state. Yet, from the standpoint of destroying homes and other property, Missouri wildfires can be quite destructive.

**Previous Occurrences**

According to MDC Wildfire Data, there have been 399 wildfires reported in Oregon County from 2010 to 2020. A total of 9,732.02 acres were burned as a result of these reported wildfires. In addition, 15 buildings were destroyed, 16 structures were damaged and 399 structures were threatened as a result of the wildfires in the county. Table 3.43 below contains a summary of MDC wildfire statistics by year.

**Table 3.43. Oregon County Wildfires 2010 - 2020**

Year	# Wildfires	Buildings Destroyed	Buildings Damaged	Buildings Threatened	Acres Burned
2006	39	0	0	37	1178
2007	24	2	2	33	570
2008	9	0	3	14	481
2009	53	5	4	93	2356.5
2010	60	3	1	62	1058.35
2011	41	1	0	25	988
2012	41	2	1	53	1218.7
2013	22	0	0	17	321.10
2014	53	2	4	48	1186.35
2015	22	0	1	16	253.25
2016	15	0	0	1	120.77
<b>Total</b>	399	15	16	3049	9,732.02

There are no records from school districts and special districts about previous wildfire events and the damages resulting from them.

**Probability of Future Occurrence**

Based on the last eleven years of fire reporting statistics from the MDC in Table 3.43, there were a total of 399 reported wildfires from 2010 to 2021. This equates to an average of 36 wildfire events annually and a 100% probability of occurrence in any given year.

**Vulnerability**

**Vulnerability Overview**

Wildfires occur throughout wooded and open vegetation areas of Missouri. They can occur any time of year, but mostly occur during long, dry hot spells. Any small fire, if not quickly detected and suppressed, can get out of control. Most wildfires are caused by human carelessness or negligence. However, some are precipitated by lightning strikes, and in rare instances, spontaneous combustion. Structures and people in Wildland-Urban Interface areas in the county and cities are more vulnerable to the impact of wildfires due to the level of fuel mixed with structures.

### ***Potential Losses to Existing Development***

In looking at the statistics over the last eleven years, an average of 1.3 buildings are destroyed every year, and 1.4 buildings per year are damaged. Another 27 structures are threatened per year with an average of 884 acres burned annually.

### ***Impact of Future Development***

It is anticipated that there will be future development in WUI areas throughout incorporated and unincorporated areas of the county. Future growth in WUI areas of the county will increase the risk and exposure to wildfires.

### ***Hazard Summary by Jurisdiction***

The vulnerability to wildfire damages are greatest near the counties two most populous communities Alton and Thayer. More specifically, the areas with highest risk areas east and north of Alton and west of Thayer. Areas identified as WUI, but with lower associated risk are along US 160 west of Alton, US Highway 63 north of Thayer, and areas near and northwest of the unincorporated community of Myrtle in southeast Oregon County. All school district campuses in the county are located outside areas identified as WUI.

### **Problem Statement**

Wildfire occurrence is frequent within Oregon County. These events can destroy, damage, and threaten structures in hazard prone areas. Populations and structures in WUI areas of the county have an increased risk to wildfires due to the level of fuel mixed with built environments. Cities have not adopted landscape ordinances that could potentially include fire safe landscape design requirements. The unincorporated areas of the county have the highest risk and exposure to wildfires. Thankfully, many of these areas are sparsely populated. However, when new construction is occurring promoting the use of fire-resistant construction materials is highly advisable. More information about these materials and techniques are available in the MDC publication *Living with Wildfire*.

# 4 MITIGATION STRATEGY

4	MITIGATION STRATEGY .....	4.1
4.1	Goals.....	4.1
4.2	Identification and Analysis of Mitigation Actions.....	4.2
4.3	Implementation of Mitigation Actions.....	4.5

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

This section presents the mitigation strategy updated by the Mitigation Planning Committee (MPC) based on the [updated] risk assessment. The mitigation strategy was developed through a collaborative group process. The process included review of [updated] general goal statements to guide the jurisdictions in lessening disaster impacts as well as specific mitigation actions to directly reduce vulnerability to hazards and losses. The following definitions are taken from FEMA’s *Local Hazard Mitigation Review Guide (October 1, 2016)*.

- **Mitigation Goals** are general guidelines that explain what you want to achieve. Goals are long-term policy statements and global visions that support the mitigation strategy. The goals address the risk of hazards identified in the plan.
- **Mitigation Actions** are specific actions, projects, activities, or processes taken to reduce or eliminate long-term risk to people and property from hazards and their impacts. Implementing mitigation actions helps achieve the plan’s mission and goals.



## 4.1 Goals

---

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

This planning effort is an update to Oregon County's 2016 hazard mitigation plan. Therefore, the goals from the 2016 Oregon County Hazard Mitigation Plan were reviewed to see if they were still valid, feasible, practical, and applicable to the defined hazard impacts. During planning meetings, MPC members and local stakeholders held a discussion in order to review and update the plan goals. To ensure that the goals developed for this update were comprehensive and supported State goals, the 2018 State Hazard Mitigation Plan goals were reviewed. The MPC also reviewed the goals from current surrounding county plans.

**Listed below are the 2021 Oregon County Hazard Mitigation Plan Goals:**

### **Goal 1: Protect the Lives and Property of all Citizens of Oregon County**

- Identify and provide sufficient emergency shelters.
- Review and maintain current warning systems for sufficient coverage.

### **Goal 2: Preserve the Functioning of Civil Government During Natural Disasters**

- Implement proper maintenance and necessary upgrades of critical buildings and infrastructures in the county.
- Improve the efficiency, timing, and effectiveness of response and recovery efforts for natural hazard disasters.

### **Goal 3: Maintain Economic Activities Essential to the Survival and Recovery from Natural Disasters**

- Periodically review chain of command of government organizations for emergency situations and keep up-to-date.
- Continuously review communications systems and keep in good working order.

## 4.2 Identification and Analysis of Mitigation Actions

---

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

During the hazard mitigation planning meetings in the county and at the final MPC work session, the results of the risk assessment update were provided to the participants for review and the key issues were identified for specific hazards. Changes in risk since adoption of the previously approved plan were discussed. The meetings concluded with the distribution of a list of possible mitigation actions submit to the MPC for their review and approval. The list included possible new mitigation actions, as well as actions from the previously approved plan that were candidates for removal, due to the nature of them not being measurable or fundable. Actions from the previous plan included completed actions, on-going actions, and actions upon which progress had not been made. SCOCOG planners discussed SEMA's identified funding priorities and the types of mitigation actions generally recognized by FEMA.

The focus of the MPC work session then shifted to development the mitigation strategy. For a comprehensive range of mitigation actions to consider, the SCOCOG planners provided information to the MPC reviewing the following information:

- A list of actions proposed in the previous mitigation plan, the current State Plan, and approved plans in surrounding counties;
- Key issues from the risk assessment and vulnerability analysis;
- State priorities established for Hazard Mitigation Assistance grants, and
- Public input via the online survey tool, and other efforts to involve the public in the plan development process.

Table 4.1 provides a summary of the completed and deleted actions from the previous plan. Based on the status updates, there were three completed actions and zero deleted actions.

**Table 4.1. Summary of Completed and Deleted Actions from the Previous Plan**

Completed Actions	Completion Details (date, amount, funding source)
Installation of new outdoor warning sirens in the City of Koshkonong	Koshkonong was awarded an HMGP grant to purchase and install sirens in 2019
Develop a coordinated plan to test outdoor warning sirens on a consistent basis in the City of Koshkonong	After being notified of their HMPG award, city officials worked with the Emergency Management Director in neighboring Howell County to establish a consistent siren testing procedure.
Replace the water lines in the City of Alton	The city passed a bond issue in 2017 to match grant funding from the USDA-Rural Development Agency and the Missouri Community Development Block Grant program to replace many thousands of feet of derelict and decrepit municipal water distribution lines.

Source: Previously approved County Hazard Mitigation Plan; Data Collection Questionnaires.

### 4.3 Implementation of Mitigation Actions

**44 CFR Requirement §201.6(c)(3)(ii): The mitigation strategy shall include an action strategy describing how the actions identified in paragraph (c)(2)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefits review of the proposed projects and their associated costs.**

A cost benefit review of all new and continuing actions in the finalized plan was conducted at the MPC work session. Throughout the MPC consideration and discussion, emphasis was placed on the importance of a benefit-cost analysis in determining project priority. The Disaster Mitigation Act requires benefit-cost review as the primary method by which mitigation projects should be prioritized. The MPC decided to pursue implementation according to when and where damage occurs, available funding, political will, jurisdictional priority, and priorities identified in the Missouri State Hazard Mitigation Plan. The benefit/cost review at the planning stage primarily consisted of a qualitative analysis, and was not the detailed process required grant funding application. For each action, the plan sets forth a narrative describing the types of benefits that could be realized from action implementation. The cost was estimated as closely as possible, with further refinement to be supplied as project development occurs.

FEMA’s STAPLEE methodology was used to assess the costs and benefits, overall feasibility of mitigation actions, and other issues impacting project. During the prioritization process, the MPC used worksheets to assign scores. The worksheets posed questions based on the STAPLEE elements as well as the potential mitigation effectiveness of each action. Scores were based on the responses to the following questions and ensuing discussion:

	<b>Definitely “YES”</b> 3 points	<b>Maybe “YES”</b> 2 points	<b>Probably “NO”</b> 1 point	<b>Definitely “NO”</b> Zero points
<b>S</b>	Is the action <i>socially</i> acceptable?			
<b>T</b>	Is the action <i>technically feasible</i> and potentially successful?			
<b>A</b>	Does the jurisdiction have the <i>administrative capability</i> to successfully implement this action?			
<b>P</b>	Is the action <i>politically</i> acceptable?			
<b>L</b>	Does the jurisdiction have the <i>legal authority</i> to implement the action?			
<b>E</b>	Is the action <i>economically beneficial</i> ?			
<b>E</b>	Will the project have an <i>environmental impact</i> that is either beneficial or neutral? (score “3” if positive and “2” if neutral)			

The resulting list of actions were summed and divided into classes and labeled as high, medium, or low priorities. The result of the STAPLEE analysis is found in the forthcoming mitigation action worksheets.

Figure 4.1. Blank STAPLEE Worksheet

**XXXXXX COUNTY  
MULTI-JURISDICTIONAL  
LOCAL HAZARD MITIGATION PLAN**

<b>Action Title:</b>		<b>Jurisdiction:</b>	
<b>Action ID:</b>			
STAPLEE Criteria	Evaluation Rating Definitely YES = 3 Maybe YES = 2 Probably NO = 1 Definitely NO = 0	Score	
S: Is it Socially acceptable?			
T: Is it Technically feasible and potentially successful?			
A: Does the jurisdiction have the administrative capacity to execute this action?			
P: Is it Politically acceptable?			
L: Is there Legal authority to implement?			
E: Is it Economically beneficial?			
E: Will the project have either a neutral or positive impact on the natural environment? (score a 3 if positive impact, 2 if neutral impact)			
Will historic structures be saved or protected?			
Could it be implemented quickly?			
<b>STAPLEE Score</b>			
Mitigation Effectiveness Criteria	Evaluation Rating	Score	
Will the implemented action result in lives saved?	Assign from 5-10 points based on the likelihood that lives would be saved.		
Will the implemented action result in a reduction of disaster damages?	Assign from 5-10 points based on the relative reduction of disaster damages.		
<b>Mitigation Effectiveness Score</b>			

Total Score (STAPLEE Score + Mitigation Effectiveness Score): \_\_\_\_\_

Priority Level:  High (30+ points)       Medium (25-29 points)       Low (less than 25 points)

Completed by (name/title/phone #): \_\_\_\_\_

In addition to the STAPLEE cost benefit review prioritization at the final MPC meeting, an implementation plan for each action was discussed. An action worksheet was used to development the implementation plan. The action worksheets are presented on the following pages.

## MITIGATION ACTIONS

### Goal 1: Protect the Lives and Property of all Citizens of Oregon County

Mitigation Action Worksheet	
<b>Name of Jurisdiction:</b>	City of Alton
Risk / Vulnerability	
<b>Problem being Mitigated:</b>	The threat to human life result from tornadic storms in and around the City of Alton, Missouri
<b>Hazard(s) Addressed:</b>	Tornado
Action or Project	
<b>Action/Project Number:</b>	1.1
<b>Name of Action or Project:</b>	Siren Testing
<b>Action or Project Description:</b>	Develop a coordinated plan to test outdoor warning sirens on a consistent basis
<b>Applicable Goal Statement:</b>	Goal 1
<b>Estimated Cost:</b>	Little or no cost
<b>Benefits:</b>	Ensure sirens are functioning properly
Plan for Implementation	
<b>Responsible Organization/Department:</b>	City Emergency Management
<b>Action/Project Priority:</b>	16 - MED
<b>Timeline for Completion:</b>	2-3 years
<b>Potential Fund Sources:</b>	Local/RHSOC
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Hazard Mitigation Plan
Progress Report	
<b>Action Status</b>	Continue Not Started
<b>Report of Progress</b>	No formal testing schedule has been established in Oregon County

<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	City of Alton
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Threat of flooding to the built environment
<b>Hazard(s) Addressed:</b>	Flooding (Flash and River)
<b>Action or Project</b>	
<b>Action/Project Number:</b>	1.2
<b>Name of Action or Project:</b>	NFIP
<b>Action or Project Description:</b>	The city will attempt to improve floodplain management efforts by identification of map amendments/updates
<b>Applicable Goal Statement:</b>	Goal 1
<b>Estimated Cost:</b>	Little or no cost
<b>Benefits:</b>	Improve the delivery of floodplain management services
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	City Floodplain Administrator
<b>Action/Project Priority:</b>	14 - LOW
<b>Timeline for Completion:</b>	1-2 years
<b>Potential Fund Sources:</b>	Local
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Floodplain Management Ordinance
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	New

<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Alton R-IV School District
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	The lack of defined shelter areas in the rural Ozarks
<b>Hazard(s) Addressed:</b>	Tornado, Earthquake, Extreme Heat, Wildfire
<b>Action or Project</b>	
<b>Action/Project Number:</b>	1.3
<b>Name of Action or Project:</b>	Mass-Care Sheltering
<b>Action or Project Description:</b>	Work with city and county emergency management agencies and the local Red Cross to establish strategies for short term mass-care sheltering utilizing available school facilities
<b>Applicable Goal Statement:</b>	Goal 1
<b>Estimated Cost:</b>	Little or no cost
<b>Benefits:</b>	Identification of usable facilities for mass care operations
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	City and/or County EMD; School District
<b>Action/Project Priority:</b>	20 – HIGH
<b>Timeline for Completion:</b>	1 year
<b>Potential Fund Sources:</b>	Local
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Threat Hazard Identification Risk Assessment
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	New



<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Couch School District
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	The threat to human life result from tornadic storms in and around the City of Thayer, Missouri
<b>Hazard(s) Addressed:</b>	Tornado
<b>Action or Project</b>	
<b>Action/Project Number:</b>	1.4
<b>Name of Action or Project:</b>	Community Safe Room
<b>Action or Project Description:</b>	Construct a 361 design tornado saferoom on the school campus
<b>Applicable Goal Statement:</b>	Goal 1
<b>Estimated Cost:</b>	\$100,000 to \$500,000
<b>Benefits:</b>	Protect the lives of the students and local citizens
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	Superintendent's Office
<b>Action/Project Priority:</b>	19 - HIGH
<b>Timeline for Completion:</b>	3-5 years
<b>Potential Fund Sources:</b>	FEMA
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Hazard Mitigation Plan
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	New

<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Oregon-Howell School District
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	The threat to human life result from tornadic storms in and around the City of Koshkonong Missouri
<b>Hazard(s) Addressed:</b>	Tornado
<b>Action or Project</b>	
<b>Action/Project Number:</b>	1.5
<b>Name of Action or Project:</b>	Community Safe Room
<b>Action or Project Description:</b>	Construct a 361 design tornado saferoom on the school campus
<b>Applicable Goal Statement:</b>	Goal 1
<b>Estimated Cost:</b>	\$100,000 to \$500,000
<b>Benefits:</b>	Protect the lives of the students and local citizens
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	Superintendent's Office
<b>Action/Project Priority:</b>	21 - HIGH
<b>Timeline for Completion:</b>	3-5 years
<b>Potential Fund Sources:</b>	FEMA
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Hazard Mitigation Plan
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	New

<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	City of Thayer
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	The threat to human life result from tornadic storms in and around the City of Thayer, Missouri
<b>Hazard(s) Addressed:</b>	Tornado
<b>Action or Project</b>	
<b>Action/Project Number:</b>	<b>1.6</b>
<b>Name of Action or Project:</b>	Siren Testing
<b>Action or Project Description:</b>	Develop a coordinated plan to test outdoor warning sirens on a consistent basis
<b>Applicable Goal Statement:</b>	Goal 1
<b>Estimated Cost:</b>	Little or no cost
<b>Benefits:</b>	Ensure sirens are functioning properly
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	City/County Emergency Management
<b>Action/Project Priority:</b>	15 – MED
<b>Timeline for Completion:</b>	1 year
<b>Potential Fund Sources:</b>	Local
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Hazard Mitigation Plan
<b>Progress Report</b>	
<b>Action Status</b>	Continue Not Started
<b>Report of Progress</b>	No formal testing schedule has been established in Oregon County

<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	City of Alton
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Currently the City of Alton's outdoor warning sirens are outdated and in poor condition
<b>Hazard(s) Addressed:</b>	Tornado
<b>Action or Project</b>	
<b>Action/Project Number:</b>	1.7
<b>Name of Action or Project:</b>	Outdoor Warning Sirens
<b>Action or Project Description:</b>	Install four new outdoor warning sirens at strategic locations throughout the city
<b>Applicable Goal Statement:</b>	Goal 1
<b>Estimated Cost:</b>	\$10,000 to \$50,000
<b>Benefits:</b>	Protect the lives of the local citizens
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	City Emergency Management
<b>Action/Project Priority:</b>	20 - HIGH
<b>Timeline for Completion:</b>	1 year
<b>Potential Fund Sources:</b>	FEMA
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Hazard Mitigation Plan
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	New

<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	City of Thayer
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	The threat of flooding to the built environment
<b>Hazard(s) Addressed:</b>	Flooding (Flash and River)
<b>Action or Project</b>	
<b>Action/Project Number:</b>	1.8
<b>Name of Action or Project:</b>	NFIP
<b>Action or Project Description:</b>	The city will attempt to improve floodplain management by identification of map amendments/updates
<b>Applicable Goal Statement:</b>	Goal 1
<b>Estimated Cost:</b>	Little or no cost
<b>Benefits:</b>	Improve the delivery of floodplain management services
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	Floodplain Administrator
<b>Action/Project Priority:</b>	16 - MED
<b>Timeline for Completion:</b>	1 year
<b>Potential Fund Sources:</b>	Local
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Floodplain Management Ordinance
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	New

<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	City of Thayer
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Currently the City of Thayer's outdoor warning sirens are outdated and in poor condition
<b>Hazard(s) Addressed:</b>	Tornado
<b>Action or Project</b>	
<b>Action/Project Number:</b>	<b>1.9</b>
<b>Name of Action or Project:</b>	Outdoor Warning Sirens
<b>Action or Project Description:</b>	Install four new outdoor warning sirens at strategic locations throughout the city
<b>Applicable Goal Statement:</b>	Goal 1
<b>Estimated Cost:</b>	\$10,000 to \$50,000
<b>Benefits:</b>	Protect the lives of the local citizens
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	City Emergency Management
<b>Action/Project Priority:</b>	20 - HIGH
<b>Timeline for Completion:</b>	1 year
<b>Potential Fund Sources:</b>	FEMA
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Hazard Mitigation Plan
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	New

<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Thayer School District
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	The threat to human life result from tornadic storms in and around the City of Thayer, Missouri
<b>Hazard(s) Addressed:</b>	Tornado
<b>Action or Project</b>	
<b>Action/Project Number:</b>	<b>1.10</b>
<b>Name of Action or Project:</b>	Community Safe Room
<b>Action or Project Description:</b>	Construct a 361 design tornado saferoom on the school campus
<b>Applicable Goal Statement:</b>	Goal 1
<b>Estimated Cost:</b>	Over \$1,000,000
<b>Benefits:</b>	Protect the lives of the students and local citizens
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	Superintendent's Office
<b>Action/Project Priority:</b>	20 - HIGH
<b>Timeline for Completion:</b>	3-5 years
<b>Potential Fund Sources:</b>	FEMA
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Hazard Mitigation Plan Master Facilities Plan
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	New

<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	City of Koshkonong
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	The threat of flooding to the built environment
<b>Hazard(s) Addressed:</b>	Flooding (Flash and River)
<b>Action or Project</b>	
<b>Action/Project Number:</b>	1.11
<b>Name of Action or Project:</b>	NFIP
<b>Action or Project Description:</b>	The city will attempt to improve floodplain management by identification of map amendments/updates
<b>Applicable Goal Statement:</b>	Goal 1
<b>Estimated Cost:</b>	Little or no cost
<b>Benefits:</b>	Improve the delivery of floodplain management services
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	Floodplain Administrator
<b>Action/Project Priority:</b>	16 - MED
<b>Timeline for Completion:</b>	1 year
<b>Potential Fund Sources:</b>	Local
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Floodplain Management Ordinance
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	New



<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Alton R-IV School District
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Repetitive Flooding of the school's baseball and softball fields causes extensive damage to the playing surface, resulting in expensive repairs
<b>Hazard(s) Addressed:</b>	Flash Flooding
<b>Action or Project</b>	
<b>Action/Project Number:</b>	<b>1.12</b>
<b>Name of Action or Project:</b>	Localized Flood Mitigation - Ballfields
<b>Action or Project Description:</b>	Work with the Council of Governments to identify and pursue funding opportunities
<b>Applicable Goal Statement:</b>	Goal 1
<b>Estimated Cost:</b>	\$10,000 to \$50,000
<b>Benefits:</b>	Mitigation of repetitive property damage
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	School District Superintendent's Office
<b>Action/Project Priority:</b>	17 – MED
<b>Timeline for Completion:</b>	1 year
<b>Potential Fund Sources:</b>	FEMA
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	County Hazard Mitigation Plan
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	New

**Goal 2: Preserve the Functioning of Civil Government During Natural Disasters**

<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	City of Alton
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Lack of back-up power source at the city's sewage treatment facility
<b>Hazard(s) Addressed:</b>	Thunderstorm/High Winds/Lightning/Hail
<b>Action or Project</b>	
<b>Action/Project Number:</b>	2.1
<b>Name of Action or Project:</b>	Sewage Plant Backup
<b>Action or Project Description:</b>	Purchase and install a backup generator at the sewage treatment facility
<b>Applicable Goal Statement:</b>	Goal 2
<b>Estimated Cost:</b>	\$10,000 to \$50,000
<b>Benefits:</b>	Provide emergency backup power
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	City Public Works
<b>Action/Project Priority:</b>	19 – HIGH
<b>Timeline for Completion:</b>	2-3 years
<b>Potential Fund Sources:</b>	FEMA, RHSOC
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Hazard Mitigation Plan
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	New

<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	City of Koshkonong
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Lack of back-up power source at the city's sewage treatment facility
<b>Hazard(s) Addressed:</b>	Thunderstorm/High Winds/Lightning/Hail
<b>Action or Project</b>	
<b>Action/Project Number:</b>	<b>2.2</b>
<b>Name of Action or Project:</b>	Sewage Plant Backup
<b>Action or Project Description:</b>	Purchase and install a backup generator at the sewage treatment facility
<b>Applicable Goal Statement:</b>	Goal 2
<b>Estimated Cost:</b>	\$10,000 to \$50,000
<b>Benefits:</b>	Provide emergency backup power
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	City Public Works
<b>Action/Project Priority:</b>	19 – HIGH
<b>Timeline for Completion:</b>	2-3 years
<b>Potential Fund Sources:</b>	FEMA, RHSOC
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Hazard Mitigation Plan
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	New

<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	City of Koshkonong
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Lack of back-up power source at the city's public well and pump house
<b>Hazard(s) Addressed:</b>	Thunderstorm/High Winds/Lightning/Hail
<b>Action or Project</b>	
<b>Action/Project Number:</b>	<b>2.3</b>
<b>Name of Action or Project:</b>	Well and Pump Backup
<b>Action or Project Description:</b>	Purchase and install a backup generator at the public well and pump house
<b>Applicable Goal Statement:</b>	Goal 2
<b>Estimated Cost:</b>	\$10,000 to \$50,000
<b>Benefits:</b>	Provide emergency backup power
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	City Public Works
<b>Action/Project Priority:</b>	19 – HIGH
<b>Timeline for Completion:</b>	2-3 years
<b>Potential Fund Sources:</b>	FEMA, RHSOC
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Hazard Mitigation Plan
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	New

<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Oregon County Commission
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Lack of back-up power source at the County Office Headquarters
<b>Hazard(s) Addressed:</b>	Thunderstorm/High Winds/Lightning/Hail
<b>Action or Project</b>	
<b>Action/Project Number:</b>	<b>2.4</b>
<b>Name of Action or Project:</b>	CountyGenerator
<b>Action or Project Description:</b>	Purchase and install a backup generator at the County Headquarters
<b>Applicable Goal Statement:</b>	Goal 2
<b>Estimated Cost:</b>	\$50,000 to \$100,000
<b>Benefits:</b>	Provide emergency backup power
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	County Commission
<b>Action/Project Priority:</b>	19 – HIGH
<b>Timeline for Completion:</b>	2-3 years
<b>Potential Fund Sources:</b>	FEMA, RHSOC
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Hazard Mitigation Plan
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	New

<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	City of Alton
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Lack of back-up power source at the City Hall
<b>Hazard(s) Addressed:</b>	Thunderstorm/High Winds/Lightning/Hail
<b>Action or Project</b>	
<b>Action/Project Number:</b>	<b>2.5</b>
<b>Name of Action or Project:</b>	City Hall Generator
<b>Action or Project Description:</b>	Purchase and install a backup generator at City Hall
<b>Applicable Goal Statement:</b>	Goal 2
<b>Estimated Cost:</b>	\$10,000 to \$50,000
<b>Benefits:</b>	Provide emergency backup power
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	City Public Works
<b>Action/Project Priority:</b>	19 – HIGH
<b>Timeline for Completion:</b>	2-3 years
<b>Potential Fund Sources:</b>	FEMA, RHSOC
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Hazard Mitigation Plan
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	New

<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Alton R-IV School District
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Improve communication of local jurisdiction with emergency management agencies
<b>Hazard(s) Addressed:</b>	All natural disaster events
<b>Action or Project</b>	
<b>Action/Project Number:</b>	<b>2.6</b>
<b>Name of Action or Project:</b>	NIMS Training
<b>Action or Project Description:</b>	Encourage school officials to participate in National Incident Management System (NIMS) training and compliance programs
<b>Applicable Goal Statement:</b>	Goal 2
<b>Estimated Cost:</b>	Little or no cost
<b>Benefits:</b>	Community Resilience
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	Superintendent's Office
<b>Action/Project Priority:</b>	14 – LOW
<b>Timeline for Completion:</b>	2-3 years
<b>Potential Fund Sources:</b>	Local
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Threat Hazard Identification Risk Assessment
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	New

<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	City of Thayer
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Flash flooding causing damage to the city's infrastructure
<b>Hazard(s) Addressed:</b>	Flooding (Flash and River)
<b>Action or Project</b>	
<b>Action/Project Number:</b>	<b>2.7</b>
<b>Name of Action or Project:</b>	Stormwater Drainage
<b>Action or Project Description:</b>	Replacement of 14 box and metal culverts. Mitigation for undersize culverts within the community. Locations flood easily creating difficult situation for emergency access and response
<b>Applicable Goal Statement:</b>	Goal 2
<b>Estimated Cost:</b>	\$100,000 to \$500,000
<b>Benefits:</b>	Mitigate the effects of repetitive flooding in Thayer
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	City Public Works
<b>Action/Project Priority:</b>	20 - HIGH
<b>Timeline for Completion:</b>	3-5 years
<b>Potential Fund Sources:</b>	FEMA
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Hazard Mitigation Plan
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	New



**Goal 3: Maintain Economic Activities Essential to the Survival and Recovery from Natural Disasters**

<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Oregon County
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Inundation of the roadway east of the Eleven Point River bridge
<b>Hazard(s) Addressed:</b>	Flooding (Flash and River)
<b>Action or Project</b>	
<b>Action/Project Number:</b>	3.1
<b>Name of Action or Project:</b>	Highway 142 Flood Mitigation
<b>Action or Project Description:</b>	Elevate the roadway east of the Eleven Point River bridge in southeastern Oregon County
<b>Applicable Goal Statement:</b>	Goal 3
<b>Estimated Cost:</b>	\$500,000 to \$1,000,000
<b>Benefits:</b>	Alleviate the roadway flooding that inundates the site
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	MoDOT
<b>Action/Project Priority:</b>	20 - HIGH
<b>Timeline for Completion:</b>	3-5 years
<b>Potential Fund Sources:</b>	MoDOT, FEMA
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Regional Transportation Plan
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	New

<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Oregon County
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	Soil erosion threatening the structural stability of the Barren Fork Bridge on US Highway 160
<b>Hazard(s) Addressed:</b>	Flooding (Flash and River)
<b>Action or Project</b>	
<b>Action/Project Number:</b>	<b>3.2</b>
<b>Name of Action or Project:</b>	Highway 142 Flood Mitigation
<b>Action or Project Description:</b>	Bridge replacement or bank stabilization to protect the structural stability of the Barren Fork Bridge on US Highway 160
<b>Applicable Goal Statement:</b>	Goal 3
<b>Estimated Cost:</b>	\$500,000 to \$1,000,000
<b>Benefits:</b>	Protect the structural stability of the Barren Fork Bridge on US Highway 160
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	MoDOT
<b>Action/Project Priority:</b>	16 - MED
<b>Timeline for Completion:</b>	3-5 years
<b>Potential Fund Sources:</b>	MoDOT, FEMA
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Regional Transportation Plan
<b>Progress Report</b>	
<b>Action Status</b>	New
<b>Report of Progress</b>	New

<b>Mitigation Action Worksheet</b>	
<b>Name of Jurisdiction:</b>	Countywide
<b>Risk / Vulnerability</b>	
<b>Problem being Mitigated:</b>	The failure and increasing vulnerability of aging infrastructure and community failures
<b>Hazard(s) Addressed:</b>	Tornado
<b>Action or Project</b>	
<b>Action/Project Number:</b>	3.3
<b>Name of Action or Project:</b>	Asset Management
<b>Action or Project Description:</b>	Continuously identify funding sources to update buildings and infrastructure to ensure that community assets are resilient to natural disaster
<b>Applicable Goal Statement:</b>	Goal 3
<b>Estimated Cost:</b>	Little or no cost
<b>Benefits:</b>	Ensure that the local governments are aware of the resources available to them
<b>Plan for Implementation</b>	
<b>Responsible Organization/Department:</b>	County Emergency Management Regional Planning Commission
<b>Action/Project Priority:</b>	20 - HIGH
<b>Timeline for Completion:</b>	Less than one year
<b>Potential Fund Sources:</b>	Local
<b>Local Planning Mechanisms to be Used in Implementation, if any:</b>	Comprehensive Economic Development Strategy
<b>Progress Report</b>	
<b>Action Status</b>	Continue In-Progress
<b>Report of Progress</b>	Local jurisdictions are continuously kept up to date by SCOCOG staff on hazard mitigation funding availability

# 5 PLAN MAINTENANCE PROCESS

---

<b>5 PLAN MAINTENANCE PROCESS .....</b>	<b>5.1</b>
<i>5.1 Monitoring, Evaluating, and Updating the Plan .....</i>	<i>5.2</i>
5.1.1 Responsibility for Plan Maintenance.....	5.2
5.1.2 Plan Maintenance Schedule.....	5.3
5.1.3 Plan Maintenance Process.....	5.3
<i>5.2 Incorporation into Existing Planning Mechanisms.....</i>	<i>5.4</i>
<i>5.3 Continued Public Involvement.....</i>	<i>5.5</i>

This chapter provides an overview of the overall strategy for plan maintenance and outlines the method and schedule for monitoring, updating, and evaluating the plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

## 5.1 Monitoring, Evaluating, and Updating the Plan

---

**44 CFR Requirement 201.6(c)(4): The plan maintenance process shall include a section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.**

### 5.1.1 Responsibility for Plan Maintenance

The MPC is not a standing committee, with oversight by a responsible agency or elected body. The MPC representatives and stakeholders are represented on the Local Emergency Planning Committee (LEPC) in Oregon County and the Regional Homeland Security Oversight Committee (RHSOC). The LEPC is responsible for developing and implementing the Local Emergency Operations Plan and is a standing committee that meets regularly and is administered through the Oregon County Emergency Management agency. The RHSOC is responsible for developing and implementing the Threat Hazard Identification Risk Assessment for the region, including Oregon County. The goals and actions and representation are aligned with the missions of the RHSOC, which is a standing committee. As such, the RHSOC will be responsible for plan monitoring, evaluation and maintenance.

- Meet annually, and after a disaster event, to monitor and evaluate the implementation of the plan;
- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high priority, low- or no-cost recommended actions;
- Maintain vigilant monitoring of multi-objective, cost-share, and other funding opportunities to help the community implement the plan's recommended actions for which no current funding exists;
- Monitor and assist in implementation and update of this plan;
- Keep the concept of mitigation in the forefront of community decision making by identifying plan recommendations when other community goals, plans, and activities overlap, influence, or directly affect increased community vulnerability to disasters;
- Report on plan progress and recommended changes to the County Board of Supervisors and governing bodies of participating jurisdictions; and
- Inform and solicit input from the public.

The RHSOC is an advisory body only, and can only make recommendations to county, city, town, or district elected officials. Its primary duty is to see the plan successfully carried out and to report to the community governing boards and the public on the status of plan implementation and mitigation opportunities. Other duties include reviewing and promoting mitigation proposals, hearing stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information in areas accessible to the public.

## 5.1.2 Plan Maintenance Schedule

The RHSOC agrees to meet annually and after a state or federally declared hazard event as appropriate to monitor the progress and update the mitigation strategy. The Oregon County Emergency Management Director, who also serves on the RHSOC, will be responsible for initiating the plan reviews and will invite members of the Oregon County contingent to the RHSOC meeting.

In coordination with all participating jurisdictions, a five-year written update of the plan will be submitted to the Missouri State Emergency Management Agency (SEMA) and FEMA Region VII per Requirement §201.6(c)(4)(i) of the Disaster Mitigation Act of 2000, unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule.

## 5.1.3 Plan Maintenance Process

Progress on the proposed actions can be monitored by evaluating changes in vulnerabilities identified in the plan. The RHSCOC during the annual meeting should review changes in vulnerability identified as follows:

- Decreased vulnerability as a result of implementing recommended actions,
- Increased vulnerability as a result of failed or ineffective mitigation actions,
- Increased vulnerability due to hazard events, and/or
- Increased vulnerability as a result of new development (and/or annexation).

Future 5-year updates to this plan will include the following activities:

- Consideration of changes in vulnerability due to action implementation,
- Documentation of success stories where mitigation efforts have proven effective,
- Documentation of unsuccessful mitigation actions and why the actions were not effective,
- Documentation of previously overlooked hazard events that may have occurred since the previous plan approval,
- Incorporation of new data or studies with information on hazard risks,
- Incorporation of new capabilities or changes in capabilities,
- Incorporation of growth data and changes to inventories, and
- Incorporation of ideas for new actions and changes in action prioritization.

In order to best evaluate any changes in vulnerability as a result of plan implementation, the participating jurisdictions will adopt the following process:

- Each proposed action in the plan identified an individual, office, or agency responsible for action implementation. This entity will track and report on an annual basis to the jurisdictional RHSOC member on action status. The entity will provide input on whether the action as implemented meets the defined objectives and is likely to be successful in reducing risk.

- If the action does not meet identified objectives, the jurisdictional RHSOC member will determine necessary remedial action, making any required modifications to the plan.

Changes will be made to the plan to remedy actions that have failed or are not considered feasible. Feasibility will be determined after a review of action consistency with established criteria, time frame, community priorities, and/or funding resources. Actions that were not ranked high but were identified as potential mitigation activities will be reviewed as well during the monitoring of this plan. Updating of the plan will be accomplished by written changes and submissions, as the RHSOC deems appropriate and necessary. Changes will be approved by the Oregon County Commission and the governing boards of the other participating jurisdictions.

## 5.2 Incorporation into Existing Planning Mechanisms

---

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

Where possible, plan participants, including school and special districts, will use existing plans and/or programs to implement hazard mitigation actions. Those existing plans and programs were described in Section Two of this plan. Based on the capability assessments of the participating jurisdictions, communities in Oregon County will continue to plan and implement programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through the following plans:

- General or master plans of participating jurisdictions;
- Ordinances of participating jurisdictions;
- Oregon Co. Emergency Operations Plan;
- Capital improvement plans and budgets;
- Other community plans within the County, such as water conservation plans, storm water management plans, and parks and recreation plans;
- School and Special District Plans and budgets; and
- Other plans and policies outlined in the capability assessment sections for each jurisdiction in Chapter 2 of this plan.

The RHSOC members involved in updating these existing planning mechanisms will be responsible for integrating the findings and actions of the mitigation plan, as appropriate. The RHSOC is also responsible for monitoring this integration and incorporation of the appropriate information into the five-year update of the multi-jurisdictional hazard mitigation plan.

Additionally, after the annual review of the Hazard Mitigation Plan, the Oregon County Emergency Management Director will provide the updated Mitigation Strategy with current status of each mitigation action to the County (Boards of Supervisors or Commissions) as well as all Mayors, City Clerks, and School District Superintendents. The Emergency Manager Director will request that the mitigation

strategy be incorporated, where appropriate, in other planning mechanisms.

Table 5.1 below lists the planning mechanisms by jurisdiction into which the Hazard Mitigation Plan will be integrated.

**Table 5.1. Planning Mechanisms Identified for Integration of Hazard Mitigation Plan**

<b>Jurisdiction</b>	<b>Planning Mechanisms</b>	<b>Integration Process for Previous Plan</b>	<b>Integration Process for Current Plan</b>
Unincorporated County	Highway Department Capital Improvement Project List	Highway Department attended all planning meetings and identified actions relating to transportation infrastructure were included in annual update to CIP List	Highway Department attended all planning meetings. Identified new actions or ongoing actions relating to transportation infrastructure will be included in annual update to CIP List
South Central Region	Comprehensive Economic Development Strategy	Oregon County Jurisdictions acknowledged some of their emergency management and response needs in the Community Improvement Project List	Federal Emergency Management Agency DFIRM maps were utilized to delineate flood hazard areas and at risk structures in the county. NOAA data was used to compile event history for hazard profiles.
South Central Region	Regional Transportation Plan	Acknowledgment of the impact of natural hazards on the prioritization of long-range improvement planning	Federal Emergency Management Agency DFIRM maps were utilized to delineate flood hazard areas and at risk structures in the county. NOAA data was used to compile event history for hazard profiles.
City of Alton	Comprehensive Economic Development Strategy	Oregon County Jurisdictions acknowledged some of their emergency management and response needs in the Community Improvement Project List	Federal Emergency Management Agency DFIRM maps were utilized to delineate flood hazard areas and at risk structures in the county. NOAA data was used to compile event history for hazard profiles.
City of Koshkonong	Comprehensive Economic Development Strategy	Oregon County Jurisdictions acknowledged some of their emergency management and response needs in the Community Improvement Project List	Federal Emergency Management Agency DFIRM maps were utilized to delineate flood hazard areas and at risk structures in the county. NOAA data was used to compile event history for hazard profiles.
City of Thayer	Comprehensive Economic Development Strategy	Oregon County Jurisdictions acknowledged some of their emergency management and response needs in the Community Improvement Project List	Federal Emergency Management Agency DFIRM maps were utilized to delineate flood hazard areas and at risk structures in the county. NOAA data was used to compile event history for hazard profiles.
Alton R-IV School District	Comprehensive Economic Development Strategy	Oregon County Jurisdictions acknowledged some of their emergency management and response needs in the Community Improvement Project List	Federal Emergency Management Agency DFIRM maps were utilized to delineate flood hazard areas and at risk structures in the county. NOAA data was used to compile event history for hazard profiles.



Couch R-I School District	Comprehensive Economic Development Strategy	Oregon County Jurisdictions acknowledged some of their emergency management and response needs in the Community Improvement Project List	Federal Emergency Management Agency DFIRM maps were utilized to delineate flood hazard areas and at risk structures in the county. NOAA data was used to compile event history for hazard profiles.
Oregon-Howell R-III School District	Comprehensive Economic Development Strategy	Oregon County Jurisdictions acknowledged some of their emergency management and response needs in the Community Improvement Project List	Federal Emergency Management Agency DFIRM maps were utilized to delineate flood hazard areas and at risk structures in the county. NOAA data was used to compile event history for hazard profiles.
Thayer R-II School District	Comprehensive Economic Development Strategy	Oregon County Jurisdictions acknowledged some of their emergency management and response needs in the Community Improvement Project List	Federal Emergency Management Agency DFIRM maps were utilized to delineate flood hazard areas and at risk structures in the county. NOAA data was used to compile event history for hazard profiles.

### 5.3 Continued Public Involvement

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

The hazard mitigation plan update process provides an opportunity to publicize success stories resulting from the plan’s implementation and seek additional public comment. Information about the annual reviews will be posted in the local newspaper, as well as, on the South Central Ozark Council of Governments website following each annual review of the mitigation plan and will solicit comments from the public based on the annual review. When the MPC reconvenes for the five-year update, it will coordinate with all stakeholders participating in the planning process. Included in this group will be those who joined the MPC after the initial effort, to update and revise the plan. Public notice will be posted and public participation will be actively solicited, at a minimum, through available website postings and press releases to local media outlets, primarily newspapers.

## **Appendix A – Planning Participation Documentation**

APPENDIX A: PLANNING PARTICIPATION DOCUMENTATION

MEETING SIGN-IN SHEET PLEASE PRINT CLEARLY

Project: HMGP Project Meetings

Meeting Date: 9/2/2021

Facilitator: David Stubblefield

Place/Room: Courthouse

Name	Occupation/Affiliation	Phone	E-Mail
Gann Kemper	Associate	417-778-7475	Oregon@SOS.mo.gov
Terry Clina	Associate	417-778-7475	" " " "
David A Stubblefield	Presiding	417-778-7475	" " " "
Tracy Bridges	Clerk	417-778-7475	" " " "
Trent Courtney	Sec 06	417.256.4226	

**MEETING SIGN-IN SHEET PLEASE PRINT CLEARLY**

Project: HMGP Project Meetings

Meeting Date: 9/1/2021

Facilitator: Rusty

Place/Room: City Hall - ATON

Name	Occupation/Affiliation	Phone	E-Mail
------	------------------------	-------	--------

David Weyland	Maintenance		
---------------	-------------	--	--

Rusty W	City of Polun		
---------	---------------	--	--

Amy Hamington	City Clerk		
---------------	------------	--	--

Trent Courtney	Scoco		
----------------	-------	--	--















## **Appendix B – Completed & Deleted Mitigation Actions**

Completed Actions	Completion Details
<p><b>City of Koshkonong, MO</b> Installation of new outdoor warning sirens</p>	<p>Koshkonong was awarded an HMGP grant in the amount of \$58,667 to purchase and install sirens in 2019</p>
<p><b>City of Koshkonong, MO</b> Develop a coordinated plan to test outdoor warning sirens on a consistent basis</p>	<p>After being notified of their HMPG award, city officials worked with the Emergency Management Director in neighboring Howell County to establish a consistent siren testing procedure.</p>
<p><b>City of Alton</b> Replace failing water distribution infrastructure.</p>	<p>The city passed a bond issue in 2017 to match grant funding from the USDA-Rural Development Agency and the Missouri Community Development Block Grant program to replace many thousands of feet of derelict and decrepit municipal water distribution lines.</p>
Deleted Actions	Reason for Deletion
<p>NONE</p>	<p>N/A</p>

## **Appendix C – Public Engagement**

**AFFIDAVIT OF PUBLICATION**

Date: SCOCOG  
Name: April 15, 2021

STATE OF MISSOURI )  
COUNTY OF OREGON )

I, Janie Flynn, being duly sworn according to law, state that I am the Business Manager of the South Missourian News, a weekly newspaper of general circulation in the County of Oregon, State of Missouri, where located; which newspaper has been admitted to the Post Office as periodical class matter in the City of Thayer, Missouri, the city of publication; which newspaper has been published regularly and consecutively for a period of three years and has a list of bona fide subscribers, voluntarily engaged as such who have paid or agreed to pay a stated price for a subscription for a definite period of time, and that such newspaper has complied with the provisions of Section 493.050, Revised Statutes of Missouri 2000, and Section 59.310, Revised Statutes of Missouri 2000. The affixed notice appeared in said newspaper in the following consecutive issues:

1st  
Insertion: Vol. 149 No. 23, 15th day of April, 2021  
2nd  
Insertion: Vol. \_\_\_\_\_ No. \_\_\_\_\_, \_\_\_\_\_ day of \_\_\_\_\_  
3rd  
Insertion: Vol. \_\_\_\_\_ No. \_\_\_\_\_, \_\_\_\_\_ day of \_\_\_\_\_  
4th  
Insertion: Vol. \_\_\_\_\_ No. \_\_\_\_\_, \_\_\_\_\_ day of \_\_\_\_\_

\$ 56.00

*Janie Flynn*  
Business Managers Signature

Subscribed and sworn to before me on this 15th day of April, 2021

*Debra K. Perryman*  
Notary Public  
Notary Public  
State of Arkansas  
County of Fulton  
Debra K. Perryman  
My appointment expires June 15, 2021  
#12382703

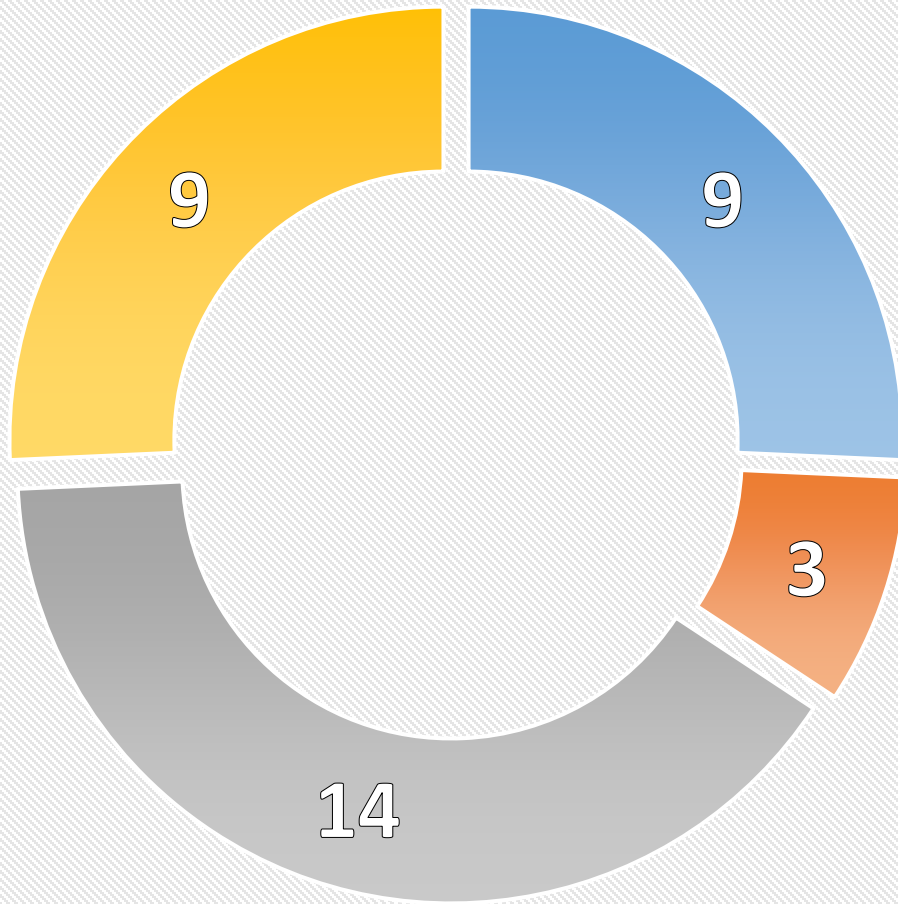
**Update of the Oregon County Hazard Mitigation Plan**

The Oregon County Hazard Mitigation Plan is currently in process of its mandatory 5-year update. The purpose of Hazard Mitigation Plans are to devise and retain a strategy to reduce the impact of risks posed by disastrous natural events, such as tornados, ice storms and floods. The Plan must be updated by the county every five years and approved by the Federal Emergency Management Agency in order for the County and its municipalities & school districts to remain eligible for FEMA grant funding for current and ongoing Hazard Mitigation projects such as Tornado Safe Rooms, Flood Mitigation projects, and purchases of disaster response equipment.

An essential part of the Hazard Mitigation planning process is to gain public input during the development of the Plan. The South Central Ozark Council of Governments has created an online survey tool to obtain input from citizens of Oregon County regarding the natural hazards that threaten your county and potential solutions to address those vulnerabilities. Please navigate to the following web address and take a few minutes to respond to the survey. The survey for Oregon County can be found at [www.SCOCOG.org/hazard-mitigation-planning](http://www.SCOCOG.org/hazard-mitigation-planning)

## ONLINE SURVEY RESULTS

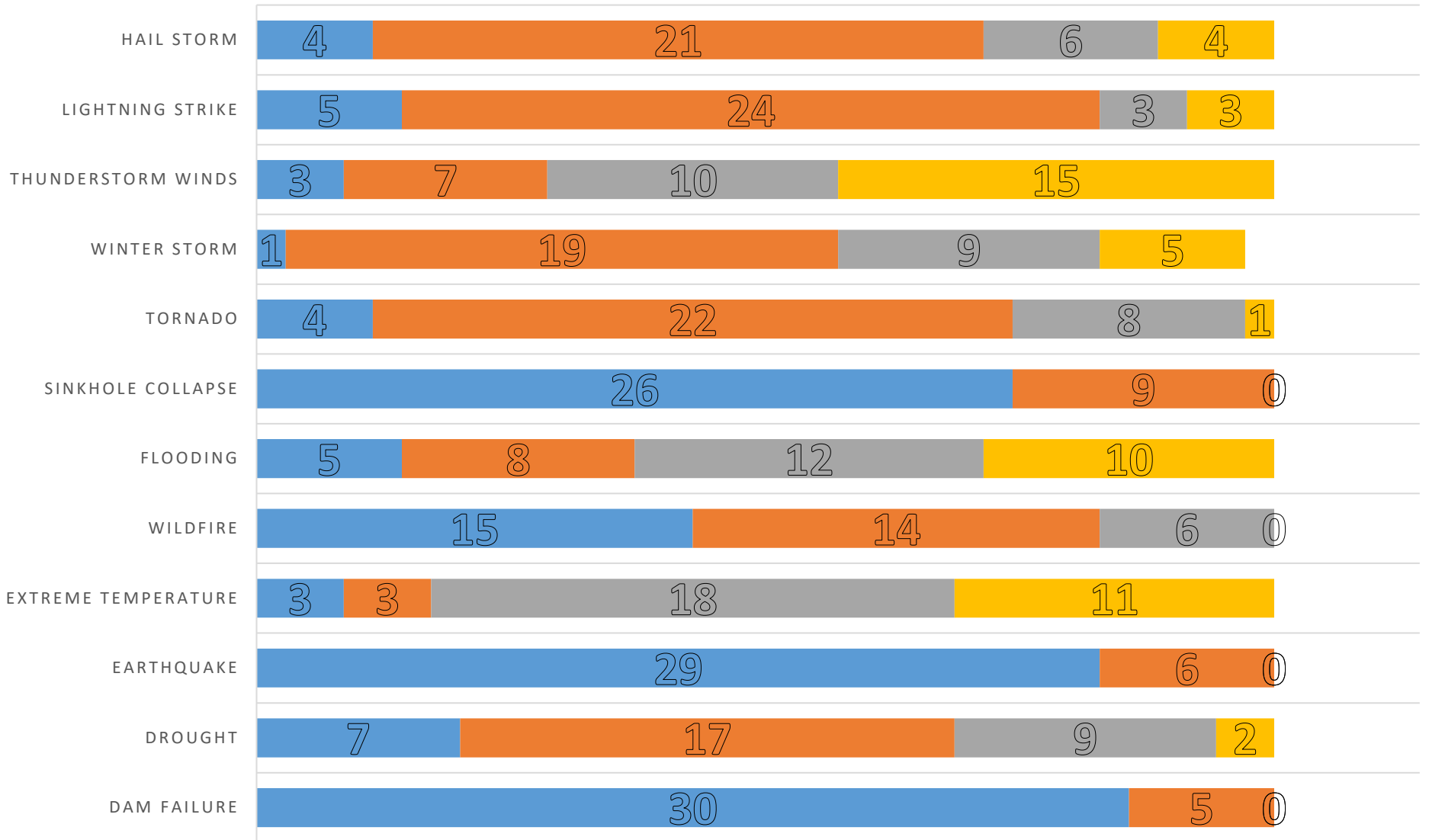
Please select the community or jurisdiction in which you reside:



- City of Alton
- City of Koshkonong
- City of Thayer
- Unincorporated Oregon County

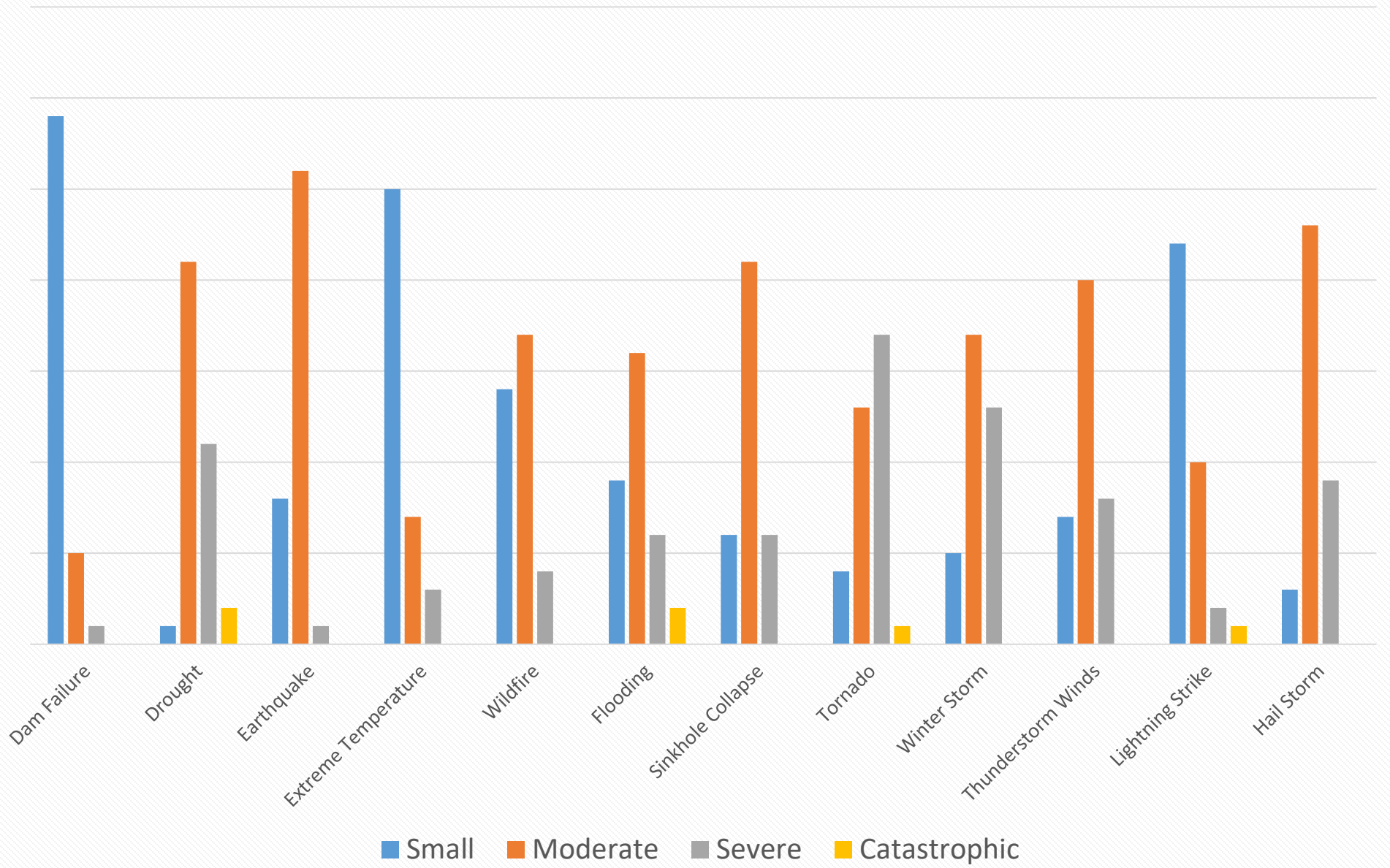
PLEASE INDICATE YOUR OPINION ON THE LIKELIHOOD FOR EACH HAZARD TO IMPACT YOUR COMMUNITY OR JURISDICTION

Very Unlikely Unlikely Likely Probable

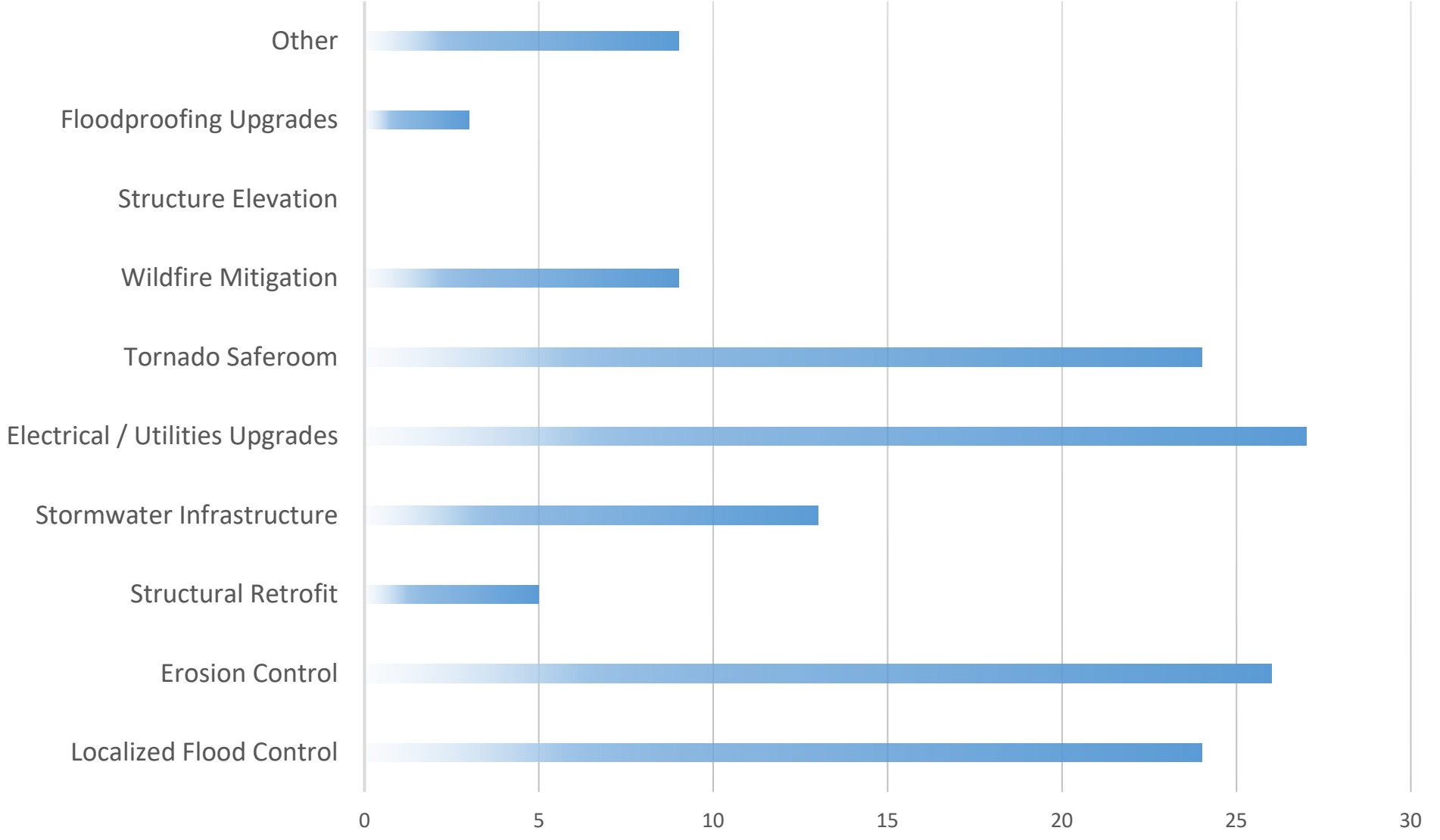




PLEASE INDICATE YOUR OPINION ON THE POTENTIAL MAGNITUDE OR IMPACT SEVERITY OF EACH NATURAL HAZARD ON YOUR JURISDICTION



**PLEASE SELECT THE TYPES OF HAZARD MITIGATION PROJECT(S) THAT YOU FEEL COULD BENEFIT YOUR COMMUNITY OR JURISDICTION:**



DRAFT PLAN REVIEW NOTICE PUBLISHED ON 11/11/2021

(Space above for recording information)

**AFFIDAVIT OF PUBLICATION**

Date: SCOCOG  
Name: November 11, 2021

STATE OF MISSOURI )  
COUNTY OF OREGON )

I, Janie Flynn, being duly sworn according to law, state that I am the Business Manager of the South Missourian News, a weekly newspaper of general circulation in the County of Oregon, State of Missouri, where located; which newspaper has been admitted to the Post Office as periodical class matter in the City of Thayer, Missouri, the city of publication; which newspaper has been published regularly and consecutively for a period of three years and has a list of bona fide subscribers, voluntarily engaged as such who have paid or agreed to pay a stated price for a subscription for a definite period of time, and that such newspaper has complied with the provisions of Section 493.050, Revised Statutes of Missouri 2000, and Section 59.310, Revised Statutes of Missouri 2000. The affixed notice appeared in said newspaper in the following consecutive issues:

- 1st  
Insertion: Vol. 150 No. 01, 11th day of November, 2021
- 2nd  
Insertion: Vol. \_\_\_\_\_ No. \_\_\_\_\_, \_\_\_\_\_ day of \_\_\_\_\_
- 3rd  
Insertion: Vol. \_\_\_\_\_ No. \_\_\_\_\_, \_\_\_\_\_ day of \_\_\_\_\_
- 4th  
Insertion: Vol. \_\_\_\_\_ No. \_\_\_\_\_, \_\_\_\_\_ day of \_\_\_\_\_

\$ 35.00

*Janie Flynn*  
Business Managers Signature

Subscribed and sworn to before me on this 11th day of November, 2021



*Debra K. Perryman*  
Notary Public

**Notice to Public:**  
Oregon County Hazard Mitigation Plan Update  
Oregon County, with the assistance of the South Central Ozark Council of Governments, has finalized the 2021 update of the Multi-Jurisdictional Hazard Mitigation Plan. This plan is pursuant to Federal Emergency Management Agency's (FEMA) requirements.

A final draft of the plan is available at the SCOCOG office located at 4407 County Road 2340 Pomona, MO or at the SCOCOG website: www.SCOCOG.org. Please direct comments to: mail@scocog.org. Planning staff will be available for discussion, comments, or suggestions on or about the Hazard Mitigation Plan at the SCOCOG office Monday-Friday 8:00-4:00 until the plan is submitted to FEMA.

The purpose of the plan is to devise and retain a strategy to reduce the impact and risks posed by disastrous natural events, such as tornadoes, ice storms and floods. The plan must be updated by the County and approved by FEMA every five years in order for the County and its jurisdictions—including school districts—to remain eligible for FEMA grant funding for current and ongoing hazard mitigation projects.

## **Appendix D – Jurisdictional Adoption Documentation**

**RESOLUTION OF THE OREGON COUNTY COMMISSION  
ADOPTING THE 2021 OREGON COUNTY HAZARD MITIGATION PLAN**

WHEREAS the Oregon County Commission recognizes the threat that natural hazards pose to people and property within Oregon County; and

WHEREAS the Oregon County Commission has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Plan, hereafter referred to as the Plan, in accordance with the Disaster Mitigation Act of 2000; and


WHEREAS the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Oregon County from the impacts of future hazards and disasters; and

WHEREAS the Oregon County Commission recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the Oregon County Commission will endeavor to integrate the Plan into the comprehensive planning process; and

WHEREAS adoption by the Oregon County Commission demonstrates their effort toward achieving the goals outlined in the Plan.

NOW THEREFORE, BE IT RESOLVED that the Oregon County Commission has adopted the 2021 Oregon County Multi-Jurisdictional Local Hazard Mitigation Plan as an official plan

*ADOPTED*

on this 13 day of January, 2022  
By (Sign.):   
Print name: David A. Stubblefield  
ATTEST: David A. Stubblefield  
By (Sign.):   
Print name: Paul Conroy

RESOLUTION NO. \_\_\_\_\_

**RESOLUTION OF THE CITY OF ALTON  
ADOPTING THE 2021 OREGON COUNTY HAZARD MITIGATION PLAN**

WHEREAS the City of Alton recognizes the threat that natural hazards pose to people and property within the City of Alton; and

WHEREAS the City of Alton has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Plan, hereafter referred to as the Plan, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the City of Alton from the impacts of future hazards and disasters; and

WHEREAS the City of Alton recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the City of Alton will endeavor to integrate the Plan into the comprehensive planning process; and

WHEREAS adoption by the City of Alton demonstrates their effort toward achieving the goals outlined in the Plan.

NOW THEREFORE, BE IT RESOLVED that the City of Alton has adopted the 2021 Oregon County Multi-Jurisdictional Local Hazard Mitigation Plan as an official plan

ADOPTED

on this 3<sup>rd</sup> day of January, 2022

By (Sign.): Paul Haddock  
Print name: Paul Haddock Mayor

ATTEST:  
By (Sign.): Amy Harrington  
Print name: Amy Harrington, City Clerk

**RESOLUTION OF THE CITY OF KOSHKONONG  
ADOPTING THE 2021 OREGON COUNTY HAZARD MITIGATION PLAN**

WHEREAS the City of Koshkonong recognizes the threat that natural hazards pose to people and property within the City of Koshkonong; and

WHEREAS the City of Koshkonong has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Plan, hereafter referred to as the Plan, in accordance with the Disaster Mitigation Act of 2000; and

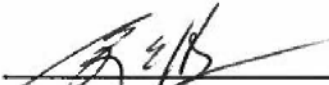


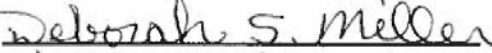
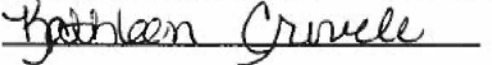

WHEREAS the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the City of Koshkonong from the impacts of future hazards and disasters; and

WHEREAS the City of Koshkonong recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the City of Koshkonong will endeavor to integrate the Plan into the comprehensive planning process; and

WHEREAS adoption by the City of Koshkonong demonstrates their effort toward achieving the goals outlined in the Plan.

NOW THEREFORE, BE IT RESOLVED that the City of Koshkonong has adopted the 2021 Oregon County Multi-Jurisdictional Local Hazard Mitigation Plan as an official plan

**NOW THEREFORE BE IT RESOLVED by the Board of Alderman of the City of Koshkonong, Missouri this 24<sup>th</sup> day of January 2022.**

  
\_\_\_\_\_  
  
\_\_\_\_\_  
  
\_\_\_\_\_  
  
\_\_\_\_\_  
  
\_\_\_\_\_  
  
\_\_\_\_\_

Mayor, George Hunt  
Alderman, Keith Frealy  
Alderman, Hope Reed  
Alderman, Mark Sander  
Alderman, Deborah Miller  
City Clerk, Kathleen Crivello





**RESOLUTION OF THE CITY OF THAYER  
ADOPTING THE 2021 OREGON COUNTY HAZARD MITIGATION PLAN**

WHEREAS the City of Thayer recognizes the threat that natural hazards pose to people and property within the City of Thayer; and

WHEREAS the City of Thayer has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Plan, hereafter referred to as the Plan, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the City of Thayer from the impacts of future hazards and disasters; and

WHEREAS the City of Thayer recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the City of Thayer will endeavor to integrate the Plan into the comprehensive planning process; and

WHEREAS adoption by the City of Thayer demonstrates their effort toward achieving the goals outlined in the Plan.

NOW THEREFORE, BE IT RESOLVED that the City of Thayer has adopted the 2021 Oregon County Multi-Jurisdictional Local Hazard Mitigation Plan as an official plan

*ADOPTED*

on this 15 day of February, 2022

By: 

Print name: Ken Cotham

ATTEST:

By: 

Print name: Brent Collins



RESOLUTION NO. \_\_\_\_\_

**RESOLUTION OF THE ALTON R-IV SCHOOL DISTRICT  
ADOPTING THE 2021 OREGON COUNTY HAZARD MITIGATION PLAN**

WHEREAS the Alton R-IV School District recognizes the threat that natural hazards pose to people and property within the Alton R-IV School District; and

WHEREAS the Alton R-IV School District has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Plan, hereafter referred to as the Plan, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the Alton R-IV School District from the impacts of future hazards and disasters; and

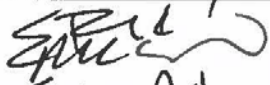
WHEREAS the Alton R-IV School District recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the Alton R-IV School District will endeavor to integrate the Plan into the comprehensive planning process; and

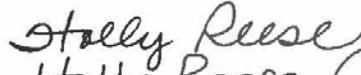
WHEREAS adoption by the Alton R-IV School District demonstrates their effort toward achieving the goals outlined in the Plan.

NOW THEREFORE, BE IT RESOLVED that the Alton R-IV School District has adopted the 2021 Oregon County Multi-Jurisdictional Local Hazard Mitigation Plan as an official plan

**ADOPTED**

on this 3<sup>rd</sup> day of January, 2022

By (Sign.):   
Print name: Eric Aden, Supt Alton R-IV

ATTEST:  
By (Sign.):   
Print name: Holly Reese, Coordinator of Special Programs

**RESOLUTION OF THE COUCH R-1 SCHOOL DISTRICT  
ADOPTING THE 2021 OREGON COUNTY HAZARD MITIGATION PLAN**

WHEREAS the Couch R-1 School District recognizes the threat that natural hazards pose to people and property within the Couch R-1 School District and

WHEREAS the Couch R-1 School District has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Plan, hereafter referred to as the Plan, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the Couch R-1 School District from the impacts of future hazards and disasters; and

WHEREAS the Couch R-1 School District recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the Couch R-1 School District will endeavor to integrate the Plan into the comprehensive planning process; and

WHEREAS adoption by the Couch R-1 School District demonstrates their effort toward achieving the goals outlined in the Plan.

NOW THEREFORE, BE IT RESOLVED that the Couch R-1 School District has adopted the 2021 Oregon County Multi-Jurisdictional Local Hazard Mitigation Plan as an official plan

ADOPTED

on this 10<sup>th</sup> day of January, 2022

By (Sign.):   
Print name: Jan Ormoy

ATTEST:  
By (Sign.):   
Print name: Melissa Bennett

RESOLUTION NO. \_\_\_\_\_

**RESOLUTION OF THE THAYER R-II SCHOOL DISTRICT  
ADOPTING THE 2021 OREGON COUNTY HAZARD MITIGATION PLAN**

WHEREAS the Thayer R-II School District recognizes the threat that natural hazards pose to people and property within the Thayer R-II School District; and

WHEREAS the Thayer R-II School District has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Plan, hereafter referred to as the Plan, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the Thayer R-II School District from the impacts of future hazards and disasters; and

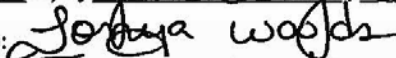
WHEREAS the Thayer R-II School District recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the Thayer R-II School District will endeavor to integrate the Plan into the comprehensive planning process; and


WHEREAS adoption by the Thayer R-II School District demonstrates their effort toward achieving the goals outlined in the Plan.

NOW THEREFORE, BE IT RESOLVED that the Thayer R-II School District has adopted the 2021 Oregon County Multi-Jurisdictional Local Hazard Mitigation Plan as an official plan

*ADOPTED*

on this 11 day of January, 2022

By (Sign.):   
Print name: Tonya Woods

ATTEST:  
By (Sign.):   
Print name: Megan Breedlove

RESOLUTION NO. \_\_\_\_\_

**RESOLUTION OF THE OREGON-HOWELL R-III SCHOOL DISTRICT  
ADOPTING THE 2021 OREGON COUNTY HAZARD MITIGATION PLAN**

WHEREAS the Oregon-Howell R-III School District recognizes the threat that natural hazards pose to people and property within the Oregon-Howell R-III School District; and

WHEREAS the Oregon-Howell R-III School District has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the Plan, hereafter referred to as the Plan, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the Oregon-Howell R-III School District from the impacts of future hazards and disasters; and

WHEREAS the Oregon-Howell R-III School District recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the Oregon-Howell R-III School District will endeavor to integrate the Plan into the comprehensive planning process; and

WHEREAS adoption by the Oregon-Howell R-III School District demonstrates their effort toward achieving the goals outlined in the Plan.

NOW THEREFORE, BE IT RESOLVED that the Oregon-Howell R-III School District has adopted the 2021 Oregon County Multi-Jurisdictional Local Hazard Mitigation Plan as an official plan

ADOPTED

on this 3<sup>rd</sup> day of January, 2022

By (Sign.): Setn J. Bryant  
Print name: Setn J. Bryant

ATTEST:  
By (Sign.): Rhonda Spreutels  
Print name: RHONDA SPREUTELS