Calhoun County, Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan

February 2024

Encompassing the Jurisdictions of:
Calhoun County, City of Albion, City of Battle Creek, City of Marshall, City of Springfield, Village of Athens, Village of Burlington, Village of Homer, Village of Tekonsha, Athens Township, Emmett Charter Township, Leroy Township, Sheridan Township, Tekonsha Township, Athens Area Schools, Battle Creek Public Schools, Calhoun Intermediate School District, Harper Creek Community Schools, Homer Community Schools, Lakeview School District, Mar Lee School District, Marshall Public Schools, Tekonsha Community Schools, and Nottawaseppi Huron Band of the Potawatomi

Prepared and submitted by:

480 Duke Drive, Suite 130
Franklin, Tennessee 37067

James Woulfe, CBCP, PCP
Manager, Global Solutions

Matt Eyer, PMP, PCP, CBCP
Mitigation Project Lead

Table of Contents

SECTION **PAGE**

List of Appendices

List of Commonly Used Acronyms

Acronym	Meaning
BIA	Bureau of Indian Affairs
BRIC	Building Resilient Infrastructure and Communities
CFR	Code of Federal Regulations
CRS	Community Rating System
CCOEM	Calhoun County (Michigan) Office of Emergency Management
DFRIM	Digital Flood Insurance Rate Map
DMA	Disaster Mitigation Act
EMAC	Emergency Management Advisory Council
FEMA	Federal Emergency Management Agency
FMA	Flood Mitigation Assistance
HAZUS	FEMA Loss Estimation Software
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Planning
MSP/EMHSD	Michigan State Police, Emergency Management and Homeland Security Division
MPC	Mitigation Planning Committee
NCEI	National Centers for Environmental Information
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NRI	National Risk Index
NWS	National Weather Service
NHBP	Nottawaseppi Huron Band of the Potawatomi
PDI	Palmer Drought Index
RL	Repetitive Loss
SRL	Severe Repetitive Loss
SFHA	Special Flood Hazard Area
SPI	Standardized Precipitation Index

Section 1 – Planning Process

1.1 Introduction

Hazard mitigation is commonly defined as sustained action taken to reduce or eliminate long-term risk to people and their property from hazards and their effects. Hazard mitigation planning provides communities with a roadmap to aid in the creation and revision of policies and procedures, and the use of available resources, to provide long-term, tangible benefits to the community. A well-designed hazard mitigation plan provides communities with realistic actions that can be taken to reduce potential vulnerability and exposure to identified hazards.

This Multi-Jurisdictional Natural Hazard Mitigation Plan (HMP) was prepared to provide sustained actions to eliminate or reduce risk to people and property from the effects of natural and man-made hazards. This plan documents Calhoun County, its participating jurisdictions, and the Nottawaseppi Huron Band of the Potawatomi (NHBP) planning process and identifies applicable hazards, vulnerabilities, and hazard mitigation strategies. This plan will serve to direct available community and regional resources towards creating policies and actions that provide long-term benefits to the community. Local and regional officials can refer to the plan when making decisions regarding regulations and ordinances, granting permits, and in funding capital improvements and other community initiatives.

Specifically, this hazard mitigation plan was developed to:

- Update the December 2017 Calhoun County, Michigan Hazard Mitigation Plan
- Build for a safer future for all citizens
- Foster cooperation for planning and resiliency
- Identify, prioritize and mitigate hazards
- Assist with sensible and effective planning and budgeting
- Educate citizens about hazards, mitigation and preparedness
- Comply with federal requirements

Federally approved mitigation plans are a prerequisite for mitigation project grants. Federal Emergency Management Agency (FEMA) approval this plan will ensure future eligibility for federal disaster mitigation funds through the Hazard Mitigation Grant Program, Building Resilient Infrastructure and Communities, Repetitive Flood Claims, and a variety of other state and federal program.

In an effort to reduce natural disaster losses, the United States Congress passed the Disaster Mitigation Act of 2000 (DMA 2000) in order to amend the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act). DMA 2000 amended the Stafford Act by repealing the previous Mitigation Planning section (409) and replacing it with a new Mitigation Planning section (322). Section 322 of the DMA makes the development of a hazard mitigation plan a specific eligibility requirement for any local government applying for Federal mitigation grant funds. This HMP was prepared to meet the requirements of the DMA 2000, as defined in regulations set forth by the Interim Final Rule (44 Code of Federal Regulations (CFR) Part 201.6 and CFR Part 201.7).

This plan has been designed to be a living document, a document that will evolve to reflect changes, correct any omissions, and constantly strive to ensure the safety of Calhoun County's citizens.

1.2 Participating Jurisdictions

All eligible jurisdictions were invited to participate in the organization, drafting, completion, and adoption of this plan. The following Calhoun County jurisdictions elected to participate in this plan. Except where noted, all participants are continuing plan participants.

- Calhoun County
- City of Albion
- City of Battle Creek

- City of Marshall
- City of Springfield
- Village of Athens
- Village of Burlington
- Village of Homer
- Village of Tekonsha
- Athens Township (new participant)
- Emmett Charter Township (new participant)
- Leroy Township (new participant)
- Sheridan Township (new participant)
- Athens Area Schools
- Battle Creek Public Schools
- Calhoun Intermediate School District
- Harper Creek Community Schools
- Homer Community Schools
- Lakeview School District,
- Mar Lee School District (new participant)
- Marshall Public Schools (new participant)
- Tekonsha Community Schools (new participant)
- Nottawaseppi Huron Band of the Potawatomi

Engagement attempts with these jurisdictions will continue over the life of this plan in order to encourage future participation.

1.3 Assurances

Calhoun County, NHBP, and all participating jurisdictions certify that they will comply with all applicable Federal statutes and regulations during the periods for which it receives grant funding and will amend its plan whenever necessary to reflect changes in State or Federal laws and statutes.

This hazard mitigation plan was prepared to comply with all relevant requirements of the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988, as amended by the DMA 2000. This plan complies with all the relevant requirements of:

- Code of Federal Regulation (44 CFR) pertaining to hazard mitigation planning
- FEMA planning directives and guidelines
- Interim final, and final rules pertaining to hazard mitigation planning and grant funding
- Relevant presidential directives
- Office of Management and Budget circulars
- Any additional and relevant federal government documents, guidelines, and rules.

1.4 Adoption Resolutions

FEMA approval documentation may be found in Appendix A. Jurisdictional adoption resolutions may be found in Appendix B.

1.5 2024 Plan Update

In 2023 Calhoun County, NHBP, and participating jurisdictions began the process to update the Calhoun County HMP. It was determined that Calhoun County Office of Emergency Management's (CCOEM) Emergency Management Coordinator would serve as the project manager, directing this plan update and acting as the primary point-of-contact throughout the project. The Director's primary roles included:

- Coordinating meetings and interviews
- Collecting data for the consultants to utilize
- Reviewing deliverables
- Monitoring the overall development of the plan

Calhoun County contracted with BOLDplanning to assist in updating their 2017 HMP. BOLDplanning's roles included:

- Ensure that the hazard mitigation plan meets all regulatory requirements
- Assist with the determination and ranking of hazards
- Assist with the assessment of vulnerabilities to identified hazards
- Assist with capability assessments
- Identify and determine all data needs and solicit the information from relevant sources
- Assist with the revision and development of the mitigation actions
- Development of draft and final planning documents

The Calhoun County HMP has undergone significant revision and upgrading since its last edition. Not only has the county and NHBP made significant efforts to improve the functionality and effectiveness of the plan itself, but it has significantly improved its hazard mitigation program. Additionally, the level of analysis and detail included in this risk assessment is greater than the previous edition of the plan. This grants all participating jurisdictions a better base to further mold and improve its mitigation strategy over the next five years.

As part of this planning effort, each section of the previous mitigation plan was reviewed and completely revised. The sections were reviewed and revised against the following elements:

- Compliance with the current regulatory environment
- Completeness of data
- Correctness of data
- Capability differentials
- Current state environment

During this process, and after a thorough review and discussion with all participating jurisdictions and stakeholders, it was determined that the priorities of the overall community in relation to hazard mitigation planning have not changed during the five years of the previous planning cycle.

While the Calhoun County and NHBP hazard mitigation programs have matured over the years, an unfortunate lack of funding and grant opportunities has prevented the completion of any major hazard mitigation projects. As such, this revised plan reflects the static state of proposed mitigation actions. However, continuing programs in hazard mitigation education and continued participation in flood insurance programs have been a continued success.

1.6 Planning Process

Calhoun County, NHBP, and participating jurisdictions undertook the following steps to update and create a revised HMP:

- Review of the 2017 HMP
- Review of current related planning documents
- Delivery of organizational and planning meetings
- Solicitation of public input as to plan development
- Assessment of potential risks
- Assessment of vulnerabilities and assets
- Development of the mitigation actions
- Development of a draft multi-hazard mitigation plan

- Implementation, adoption, and maintenance of the plan

The process established for this planning effort is based on DMA 2000 planning and update requirements and the FEMA associated guidance for hazard mitigation plans. The FEMA four step recommended mitigation planning process, as detailed below, was followed:

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

To accomplish this, the following planning process methodology was followed:

- Inform, invite, and involve other mitigation plan stakeholders throughout the state, including federal agencies, state agencies, regional groups, businesses, non-profits, and local emergency management organizations.
- Conduct a thorough review of all relevant current and historic planning efforts
- Collect data on all related state and local plans and initiatives. Additionally, all related and relevant local plans were reviewed for integration and incorporation.
- Develop the planning and project management process, including methodology, review procedures, details about plan development changes, interagency coordination, planning integration, and the organization and contribution of stakeholders.
- Develop the profile of the county and participating jurisdictions.
- Complete a risk and vulnerability assessment using a Geographic Information System (GIS) driven approach using data from the Calhoun County, the State of Michigan, FEMA, and other federal and state agency resources. Analyses were conducted at the county and jurisdictional level.
- Develop a comprehensive mitigation strategy effectively addressing their hazards and mitigation program objectives. This included identifying capabilities, reviewing pre and post disaster policies and programs, identifying objectives and goals, identifying mitigation actions and projects, and assessing mitigation actions and projects.
- Determination and implementation of a plan maintenance cycle, including a timeline for plan upgrades and improvements.
- Submission of the plan to FEMA for review and approval and the petition to all participating jurisdictional governments for a letter of formal plan adoption.

1.7 Project Timeline

The following represents the HMP project timeline.

Chart 1: Project Timeline

1.8 Mitigation Planning Committee

Project initiation began with a selection and meeting of the primary stakeholders to establish the Mitigation Planning Committee (MPC). The core members of the MPC then established and wrote the projects operating procedures, established expectations, solidified the plan development timeline, and created project milestones. Additionally, the team reviewed and discussed how the plan would incorporate FEMA requirement and other emergency management planning efforts. The following participants were selected for the MPC.

Table 1: Mitigation Planning Committee

MPC Member	Title	Jurisdiction
Lieutenant Chris Young	Emergency Management Coordinator	Calhoun County
Lieutenant Bill Timmins	Lieutenant	City of Albion
Jared D. Hall	Emergency Manager	City of Battle Creek
Chief Mary Erskine	Fire Chief	City of Marshall
Chief Josh Lankerd	Police Chief	City of Marshall
Vester Davis Jr.	City Manager	City of Springfield
Joe Donato	Assistant Fire Chief	Village of Athens
Norman Smith	Fire Chief	Village of Burlington
Kurt Swope	Fire Chief	Village of Homer
Daryl Cummins	Fire Chief	Village and Township of Tekonsha
Joe Donato	Assistant Fire Chief	Athens Township
Deb Belles	Township Supervisor	Emmett Charter Township
Laveta Hardish	Township Supervisor	Leroy Township
Richard Porter	Township Supervisor	Sheridan Township
Joe Huepenbecker	Superintendent	Athens Area Schools
Tony Geigle	Public Safety Lieutenant	Emmett Charter Township
Kimberly Carter	Superintendent	Battle Creek Public Schools
Jerry Johnson	Legislation & Education Policy	Calhoun Intermediate School District
Rob Ridgeway	Superintendent	Harper Creek Community Schools
Michael Leskowich	Superintendent	Homer Community Schools
Leo Rivera	Director of Security	Lakeview School District
Chad Holt	Administrator	Mar Lee School
Becky Jones	Superintendent	Marshall Public Schools
JoEllen O'Keefe	Superintendent	Tekonsha Community Schools
Michael Armitage	Director	Calhoun County Dispatch Authority
James Zoss	Emergency Manager	NHBP

Each MPC member was thoroughly interviewed regarding their jurisdiction's mitigation related activities. These interviews were invaluable in fully integrating the resources necessary to produce this plan, document mitigation activities, and document the mitigation resources available to better increase resiliency.

In general, all MPC members were asked to participate in the following ways:

- Attend and participate in meetings
- Assist with the collection of data and information
- Review planning elements and drafts
- Integrate hazard mitigation planning elements with other planning mechanisms
- Facilitate agency coordination and cooperation
- Assist with the revision and development of mitigation actions

MPC members who were unable to attend meetings due to budgetary or personnel constraints were contacted via email or phone to discuss hazard mitigation planning, including the process, goals, mitigation actions, local planning concerns and plan review.

1.9 Hazard Mitigation Planning Equity

Planning equity refers to the principle of fairness and justice in planning and development processes. It emphasizes the equitable distribution of resources, opportunities, and benefits among all members of a community, particularly those who have historically been marginalized or disadvantaged. The concept of planning equity recognizes that planning decisions can have significant impacts on different groups of people and aims to ensure that these decisions promote social justice and inclusivity. It involves addressing spatial inequalities, such as disparities in access to housing, transportation, public services, green spaces, and employment opportunities.

Planning equity entails involving diverse stakeholders in decision-making processes, including community members, advocacy groups, and underrepresented populations. It seeks to empower marginalized communities by giving them a voice in shaping the development and planning policies that directly affect their lives.

Planning equity and hazard mitigation planning are closely related, as both aim to create more resilient and inclusive communities. As part of this planning effort, the following intersections were considered between planning equity and hazard mitigation planning:

- Vulnerability assessment: Planning equity recognizes that certain communities, particularly marginalized and disadvantaged populations, may be more vulnerable to hazards due to social, economic, and environmental factors. When conducting a vulnerability assessment as part of hazard mitigation planning, it is important to consider equity issues and identify areas or groups that may experience disproportionate impacts.
- Engaging marginalized communities: Planning equity emphasizes the inclusion and participation of diverse stakeholders, including marginalized communities, in decision-making processes. In hazard mitigation planning it is crucial to engage these communities to understand their unique needs, concerns, and perspectives regarding hazards.
- Addressing social disparities: Hazard mitigation planning can help address social disparities by considering the unequal distribution of resources and opportunities in the context of hazards. This can involve implementing mitigation measures that specifically target vulnerable populations, such as affordable housing in safer areas or improved access to emergency services and transportation for underserved communities.
- Equitable distribution of resources: Planning equity promotes the equitable distribution of resources, and this principle can be applied to hazard mitigation planning. It involves ensuring that mitigation measures and investments are allocated fairly, with consideration given to communities that have historically received less attention or investment. This can help reduce existing disparities and enhance the resilience of marginalized communities.

By integrating planning equity into hazard mitigation planning, it becomes possible to develop strategies and actions that not only reduce the risks associated with hazards but also promote social justice, inclusivity, and resilience for all members of the community.

As part of this planning process, the MPC considered potential inequities within the county and encouraged the participation of potentially vulnerable citizens and communities. This process began with recognizing that disparities exist within the county, including health outcomes and living conditions for people of color, people with disabilities, and historically disadvantaged communities. It was recognized that these populations may be at greater risk to the hazards identified in this plan and may be limited in their ability to adapt, respond, and recover if an event were to occur.

As recommended in FEMA's "Guide to Expanding Mitigation," Calhoun County took a whole community approach to this planning effort, including:

- Inviting though outreach from MPC members historically underserved populations to participate in the planning and decision-making processes
- Inviting though outreach from MPC members faith based and community organizations, nonprofit groups, schools, and academia to be plan stakeholders

1.10 Plan Stakeholders

All eligible jurisdictions were invited to participate in the organization, drafting, completion and adoption of this plan. Invited jurisdictions included, but were not limited to, elected officials, relevant State of Michigan agencies, counties, cities, school districts, non-profit agencies, and businesses.

In order to have an approved hazard mitigation plan, DMA 2000 requires that each jurisdiction participate in the planning process. Each jurisdiction choosing to participate in the development of the plan were required to meet detailed participation requirements, which included the following:

- When practical and affordable, participation in planning meetings
- Provision of information to support the plan development
- Identification of relevant mitigation actions
- Review and comment on plan drafts
- Formal adoption of the plan

Based on the above criteria, the following jurisdictions participated in the planning process, and will individually as a jurisdiction adopt the approved hazard mitigation plan:

Table 2: Participating Jurisdictions

Jurisdiction	Requirements Met	Representative	Title
Calhoun County	x	Lt. Chris Young	Emergency Manager
City of Albion	x	Haley Snyder	City Manager
City of Battle Creek	x	Bill Beaty	Fire Chief
City of Marshall	x	Josh Lankerd	Chief of Police
City of Springfield	x	Vester Davis, Jr	City Manager
Village of Athens	x	Michael Alverson	President
Village of Burlington	x	Lee Edwards	President
Village of Homer	x	Brent Michael	Village Manager
Village of Tekonsha	x	Thomas Bowling	President
Athens Township	x	Steve Irons	Supervisor
Emmett Charter Township	x	Debre Belles	Supervisor
Leroy Township	x	Laveta Hardish	Supervisor
Sheridan Township	x	Dick Porter	Supervisor
Tekonsha Township	x	Bob Overley	Supervisor
Athens Area Schools	x	Joseph Huepenbecker	Superintendent
Battle Creek Public Schools	x	Kimberly Carter	Superintendent
Calhoun Intermediate School District	x	Jenny Johnson	Assistant Superintendent
Harper Creek Community Schools	x	Rob Ridgeway	Superintendent
Homer Community Schools	x	Dr. Craig Schoppe	Superintendent
Lakeview School District	x	Dr. William Patterson	Superintendent
Mar Lee School District	x	Chad M. Holt	Superintendent
Marshall Public Schools	x	Rebecca Jones	Superintendent
Tekonsha Community Schools	x	JoEllen O'Keefe	Superintendent
NHBP	x	Jim Zoss	Emergency Manager

The Calhoun County MPC provided the opportunity for additional HMP stakeholders, including agencies involved in regulating and overseeing development, neighboring communities, agencies, businesses, academia, non-profits, underserved or marginalized communities, and other interested parties to be involved in the mitigation planning process. Stakeholders were notified of the process through direct communication with the Calhoun County HMP project manager. In addition, jurisdictional departments overseeing planning and development were invited to participate.

Local building departments played a critical role in creating and reviewing this HMP. Their expertise was used to help identify local vulnerabilities and develop building-related mitigation measures (please see section 5.3)

Jurisdictional NFIP coordinators played a key role in mitigation planning at the community level. These coordinators were actively engaged and for their expertise on flood risk, mitigation strategies, and NFIP compliance (please see Section 5.4).

Emergency Managers from neighboring Michigan counties were personally invited to attend public meetings by Calhoun County Emergency Management. Emergency Managers form Clinton County (Larry St. George), Genesee County (Christopher Metropoulos) Ingram County Sgt Bob Boerkoel), Livingston County (Therese Cremonte), and Saginaw County (Lt. Mark Przybylski). None elected to attend.

Any jurisdiction not covered in this HMP is either covered under another plan or declined to participate.

1.11 Planning Meetings

The Calhoun County MPC held various public meetings to discuss the mitigation planning process as well as gain public support and input for the plan update. The following is a brief synopsis of those meetings.

- HMP Update Kick-Off and Public Information Meeting – July 19, 2023: BOLDplanning hosted a kick-off meeting for the Calhoun County HMP, stakeholders, and the public. Prior to the meeting, a public announcement was published on participating jurisdiction websites. At the meeting, MPC members, plan stakeholders, and the public were invited to voice any concerns, ask questions, and provide input on the mitigation plan update. Additionally, BOLDplanning worked with MPC members and plan stakeholders to collect contact information, hazard history, facility information, and other pertinent jurisdictional information.
- HMP Final Review Meeting – November 2, 2023: BOLDplanning hosted a public final plan review meeting for the Calhoun County HMP. Prior to the meeting, a public announcement was published on participating jurisdiction websites. At the meeting, MPC members, plan stakeholders, and the public were invited to voice any concerns, ask questions, and provide input on the mitigation plan update. Additionally, members of the public were invited to review a draft copy of the Calhoun County HMP update posted to County's website for two weeks prior to the final meeting, and prior to its submission to Michigan State Police/Emergency Management and Homeland Security Division (MSP/EMHS).

Other planning events included conference phone calls with participating jurisdiction officials who could not attend scheduled meetings. Additionally, there were monthly situation reports and calls provided to Calhoun County and its participating jurisdictions to provide updates concerning the phases of plan development and to review plan data. These situation report calls were issued and held at the beginning of each month and were facilitated by BOLDplanning.

1.12 Community Involvement

As part of the overall planning process, members of the community (the public) were provided with numerous opportunities to contribute and comment on the creation and adoption of the plan. For participating non-tribal jurisdictions, the public was defined as any person with an interest in the resilience and welfare of Calhoun County. For NHBP, the public was defined as any member of NHBP Tribe, or any person with a vested interest in the welfare and wellbeing of NHBP and the county as a whole. These opportunities included:

- Advertised meeting invitations

- Comment period upon completion of draft plan
- Online surveys

The public was notified of open meetings via participating jurisdiction websites. Further, an online HMP survey was created for Calhoun County. The Calhoun County, MI Hazard Mitigation Plan Update Survey (https://publicinput.com/b2407) allowed all plan stakeholders and the public to provide feedback and input on the HMP update prior to its submission to MSP/EMHSD and FEMA. As part of this process, a draft copy of the HMP was made available for public review prior to submission on the CCOEM web page. Comments from this survey are included in Appendix C.

Input from the general public provided the MPC with a clearer understanding of local concerns, increased the likelihood of citizen buy-in concerning proposed mitigation actions, and provided elected officials with a guide and tool to set regional ordinances and regulations. This public outreach effort was also an opportunity for adjacent jurisdictions and entities to be involved in the planning process. Relevant feedback from community members, including hazard occurrence, impacts felt by the community, and mitigation actions, was used in the formation of this plan. Additionally, as citizens were made more aware of potential hazards and the local process to mitigation against their impacts, it was believed that they would take a stronger role in making their homes, neighborhoods, schools, and businesses safer from the potential effects of natural hazards.

Section 2 – Plan Documentation, Development, and Maintenance

2.1 Planning Document Resources

The hazard mitigation plan is an overarching document that is both comprised of, and contributes to, various other jurisdictional plans. In creating this plan, all the planning documents identified below were consulted and reviewed, often extensively. In turn, when each of these other plans is updated, they will be measured against the contents of the hazard mitigation plan.

Below is a list of the various planning efforts, sole or jointly administered programs, and documents reviewed and included in this hazard mitigation plan. While each plan can stand alone, their review and functional understanding was pivotal in the development of this plan and further strengthens and improves Calhoun County's resilience to disasters.

- **Calhoun County 2017 Multi-Jurisdictional Natural Hazard Mitigation Plan**
  The previous HMP has been reviewed and is incorporated throughout this plan per FEMA requirements.
- **Calhoun County Comprehensive Plan, 2013**
  The plan sets policies that help the county address critical issues facing the community, achieve goals based on priority, and coordinate public and private efforts for mutual success. It also provides the historical context, background, and current data necessary to understand issues and choose solutions as well as seek various forms of funding.
- **Participating Jurisdictions Master and/or Comprehensive Plans:**
  These plans help jurisdictions set policies that help address critical issues facing the community, achieve goals based on priority, and coordinate public and private efforts for mutual success. They also provide the historical context, background, and current data necessary to understand issues and choose solutions as well as seek various forms of funding.
- **Calhoun County and Participating Jurisdictions Critical Facilities List, 2022**
  The MPC compiled a list of critical facilities and pertinent information on those facilities. This list is used throughout the plan and is the basis for the vulnerability assessments and loss estimates. The complete list is posted in Appendix D.
- **Calhoun County Comprehensive Emergency Management Plan**
  CCOEM developed this plan to develop procedures for the protection of personnel, equipment, and critical records to help determine existing established policies that ensure the continuity of government and essential services during and after disasters.
- **State of Michigan Hazard Mitigation Plan, 2019**
  The State of Michigan Hazard Mitigation Plan is intended to provide the framework for hazard mitigation. This plan set a baseline for standards and practices for hazard mitigation planning and was used as a resource for information and data.
- **Calhoun County and Participating Jurisdiction Planning and Zoning Documents and Ordinances**
  Calhoun County and participating jurisdictions provided a host of planning, zoning, and development related documents. These documents were reviewed, assessed, and cataloged to compile each participating jurisdiction's capabilities.
- **Nottawaseppi Huron Band of the Potawatomi Tribal Constitution and Code**

Information from each of these plans and programs is utilized within the applicable hazard sections to provide data and fully inform decision making and prioritization.

2.2 Technical Resources

The Calhoun County MPC employed a variety of technical resources in its plan development. These technical resources were instrumental in completing an accurate vulnerability and risk assessment.

- **BOLDplanning Inc.:** With over 18 years of experience in hazard mitigation planning, BOLDplanning was the principal plan writer.
- **ESRI ArcGIS v10:** Assisted with the development of maps for this plan, along with the HAZUS® models.
- **FEMA Digital Flood Insurance Rate Maps (DFIRM**s): FEMA's National Flood Hazard Layer data was instrumental in mapping floodplain locations and estimating potential flood impacts and loss estimates.
- **FEMA National Risk Index (NRI):** An online mapping application that identifies communities most at risk to natural hazards. The mapping service visualizes natural hazard risk metrics and includes data about expected annual losses from natural hazards, social vulnerability, and community resilience. The NRI's interactive web maps are at the county and Census tract level and made available via geographic information system services for custom analyses.
- **National Oceanic and Atmospheric Administration (NOAA)/National Centers for Environmental Information (NCEI):** Weather data and historical events were primarily provided by NCEI.

In addition, relevant federal, regional, state, local, and any private and non-profit entities were also invited to provide input and utilized for information and technical expertise. The following table indicates these entities.

Table 3: Technical Input Agencies

Agency	Entities	Data Input
Federal Agencies	NOAA, U.S. Army Corps of Engineers (USACE), U.S. Department of Agriculture National Resources Conservation Service, U.S. Geological Survey, National Weather Service, Bureau of Indian Affairs (BIA)	Provided weather data, dam data, land use data, geological data, and Tribal data
State Agencies	MSP/EMHSD, Michigan Department of Natural Resources	Provided oversight and technical assistance; provided hazard records
Local Governments	Calhoun County Emergency Management, Participating Municipalities	Provided input as MPC members / principal subjects
Private Organizations	BOLDplanning	Directed planning effort as principal planners

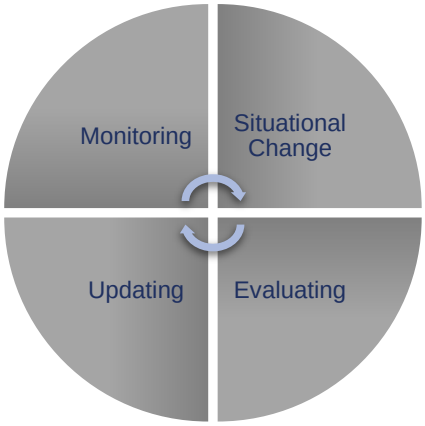
2.3 Plan Maintenance Responsibilities

CCOEM will serve as the lead coordinating agency for plan maintenance. Additional assistance in the plan maintenance process is provided by members of the MPC, NHBP, subject matter experts, and representatives of local jurisdictions.

CCOEM and the MPC will facilitate the review and revision of the HMP every five years. The review and revision will be an ongoing process. This process will incorporate all of the revisions made during the life of the plan, especially new data obtained from participating jurisdictions.

2.4 Plan Maintenance Process

The Calhoun County MPC has developed a method to ensure the monitoring, evaluation, and updating of its HMP. Upon adoption of the Calhoun County HMP update, CCOEM will utilize its Emergency Management Advisory Council (EMAC) to provide plan updates, revisions, and data collection for future HMP planning purposes. The EMAC chair will form a subcommittee for proposed mitigation projects comprised of CCOEM's director, an NHBP representative, and jurisdictional representatives from the MPC. The chair of the subcommittee will be determined by a vote in the subcommittee. Additional members may be added based on necessity. The sub-committee will submit a regular report to the EMAC, which in turn, will submit a report to CCOEM and NHBP. The Calhoun County HMP Update Report is as follows:



Local Emergency Planning Committee
Multi-Jurisdictional Natural Hazard Mitigation Plan
Evaluation Report

Pre-Disaster Mitigation Plan Sub-Committee Chair: _____
Meeting Date: _____
Plan Approval Date:_____
Plan Expiration Date: _____
Have there been any disasters or training event since the last report? If so, list them below:

Disaster Number/ Training Event	Hazard Type(s)	Was the hazard expected or unforeseen?	Is a plan update required?
Example: DR-1000	*Volcanic Eruption*	*Unforeseen*	*Yes*
Example: Annual Training	*Flash Flooding*	*Expected*	*No*

Mitigation Projects:

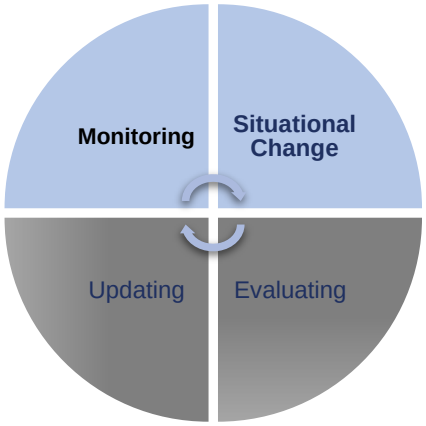
Mitigation Project	Participating Jurisdictions	Proposed/Scheduled /In Progress/ Completed	Behind/Ahead/ On-Schedule	Estimated Completion Date
Example: Tornado Safe Room	*Cash*	*In Progress*	*On-Schedule*	*1/1/2021*

Miscellaneous Notes:

CCOEM may request a non-scheduled report on the monitoring, evaluation, or updating of any portion of the HMP due to irregular progress on mitigation actions and or projects, in the aftermath of a hazard event, or for any reason deemed appropriate.

Plan Monitoring and Situational Change

Plan monitoring can be defined as the ongoing process by which stakeholders obtain regular feedback on the progress being made towards achieving their goals and objectives. In the more limited approach, monitoring may focus on tracking projects and the use of the agency's resources. In the broader approach, monitoring also involves tracking strategies and actions being taken by partners and non-partners, and figuring out what new strategies and actions need to be taken to ensure progress towards the most important results.



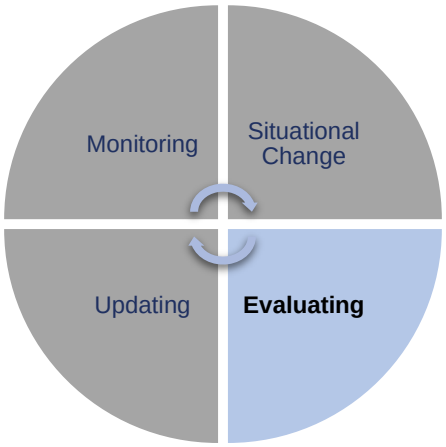
A monitoring report will be written and submitted for review to the EMAC and after the annual MPC meeting or when triggered by situational change. The monitoring report answers the following questions:

- Is the mitigation project under, over, or on budget?
- Is the mitigation project behind, ahead of, or on schedule?
- Are there any changes in jurisdictional capabilities?
- Are there any changes in hazards?
- Has the mitigation action been initiated, or its initiation planned?
- Is the current process of prioritizing mitigation actions and projects appropriate and accurate?
- Has the current method of incorporating mitigation actions and projects yielded a comprehensive action and project strategy to address seen and unforeseen hazards?
- If applicable, has participation in a mitigation action's collaboration been regular?
- Was a negative result caused directly or indirectly by insufficient levels of public outreach?
- If any, what plan updates occurred, why they occurred, and what is their impact?

The plan maintenance process is cyclical and maintenance items can operate simultaneously within the process.

Plan Evaluation

A plan evaluation is a rigorous and independent assessment of either completed or ongoing activities to determine the extent to which they are achieving stated objectives and contributing to decision making.



An evaluation report will be written and submitted to Calhoun County's EMAC when the situation dictates.

The following situations are typical examples of when an evaluation will be necessary.

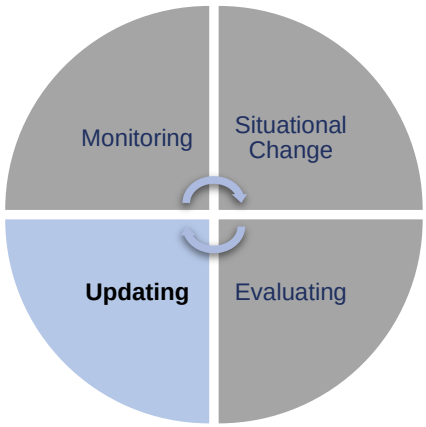
- Post hazard event
- Post training exercise
- Post tabletop or drill exercise
- Significant change or completion of a mitigation project
- Significant change or completion of a mitigation action

An evaluation report will ask the following questions in response to the previously listed events.

- Do the mitigation objectives and goals continue to address the current hazards?
- Are there new or previously unforeseen hazards?
- Does a change in hazard vulnerability demand a change of or addition of mitigation actions or projects?
- Does a change in the mitigation strategy demand a change of or addition of mitigation actions or projects?
- Are current resources appropriate for implementing a mitigation project?
- Was the outcome of a mitigation action/project expected?
- Are there implementation problems?
- Was the public engaged to the point where they were satisfied with current engagement strategies?
- Did the public participate in a number that produced a positive yield on the plan, action, or project?
- Are there coordination problems?

Plan Updates

Typically, the updating of a HMP is initiated upon the completion of a plan evaluation and even then, only when the evaluation determines an update is appropriate. A plan update also occurs every five years per FEMA guidelines. Additionally, when new hazard data becomes available it will be added to the HMP. New data will be confirmed or denied at annual MPC meetings. Additionally, a plan update can be written any time it is deemed necessary by CCOEM.



According to FEMA DMA 2000 guidelines for mitigation planning, Calhoun County will begin the update process three years from this plan's adoption. It will do so under the direction of the County's Emergency Management Director. CCOEM will coordinate and facilitate a bi-annual meeting within the five-year cycle with stakeholders from participating jurisdictions and stakeholders from neighboring counties.

These meetings will allow CCOEM, the MPC Chair, MPC members, and stakeholders to gather relevant information needed for the next plan update. These meetings will ensure the appropriate status of certain goals (mitigation activities and projects) identified in mitigation strategy are up to date to be included in the next FEMA-required, five-year plan update.

The following indicates the tasks to be performed during this plan update period:

- **2026 Fall Meeting:** The MPC will begin updating the risk assessment portion of the plan. Hazards will be analyzed to determine if they are still relevant, if location should be updated, and if new hazards should be added. Previous occurrences will be reviewed to help determine the probability of future events.
- **2026 Spring Meeting:** The MPC will begin updating the vulnerability assessment. The MPC will update the vulnerability assessment portion of the plan. Data will need to be gathered for assets, critical facilities, building stock values, jurisdictional damages, etc.
- **2027 Fall Meeting:** The MPC will review information received and determine if the goals and objectives are still relevant and if new ones should be added. Actions will be reviewed to determine if they should remain in the plan, have been completed, or are no longer relevant. The MPC will review the potential funding sources for each action.
- **2027 Spring Meeting:** The MPC will evaluate the policies, programs, capabilities, and funding sources from the previous plan to determine if they are still accurate and if any new items should be added.
- **2028 Fall Meeting:** The MPC will review the draft copy of the mitigation plan and make comments and updates if necessary. Formal submittal to FEMA for re-approval will follow.

In general, the following steps will be taken to complete the next HMP revision:

- Evaluate and update the planning process.
- Review the stakeholder contact list and identify new stakeholders.
- Initiate plan outreach and discussion, including a stakeholder meeting.
- Consider the addition, removal, or modification of hazards identified in the plan.
- Update and revise membership of the MPC.
- Evaluate risk assessment methodologies and data sources.
- Evaluate and update critical facility inventory information.
- Evaluate and update the hazard profiles.
- Evaluate and update the risk assessment summary.
- Evaluate and update the mitigation strategy, including proposed mitigation actions.
- Evaluate and update the mitigation implementation system.
- Integrate new and updated local plans.
- Evaluate and update other plans sections.
- Identify and add any additional sections or information needed.
- Review updated plan in its entirety.
- Conduct updated plan outreach, including public information, comment period, and meetings.
- Integrate additional comments received.
- Finalize plan document.
- Complete crosswalk and submit final plan to FEMA for review and approval.
- Make additional modifications as required.
- Obtain jurisdictional adoption resolutions.

2.5 HMP Incorporation

The hazard mitigation plan is an overarching document that is both comprised of, and contributes to, various county, tribal, and local plans. Unfortunately, previous versions of the Calhoun County HMP have not been incorporated into jurisdictional planning efforts. Under the leadership of the MPC, it is hoped that when future revisions occur to these other plans, they will be measured against the contents of this HMP. Plan integration will help:

- Align community goals, objectives, and prime concerns
- Avoid lost opportunities
- Eliminate duplication of effort

In cooperation with the MPC, each participating jurisdiction will be actively courted on incorporating elements of this hazard mitigation plan for any relevant plan, code or ordinance revision or creation. Each participating jurisdiction has committed to actively encourage all departments to implement actions that minimize loss of life and property damage from hazards. Whenever possible, each participating jurisdiction will use existing plans, policies, procedures, and programs to aid in the implementation of identified hazard mitigation actions. Potential avenues for implementation may include:

- Operation plans
- General or master plans
- Ordinances
- Capital improvement plans
- Budget revisions or adoptions
- Hiring of staff
- Stormwater planning
- Land use planning

- Tribal codes

Plan incorporation and integration is crucial for creating a cohesive and coordinated approach to address various aspects of hazard mitigation. While are stakeholders and participating jurisdictions will utilize their internal procedures for plan incorporation and integration, the following represent commonly utilized methods:

- Cross-Referencing: Identify and cross-reference relevant sections of different plans and policies. This involves explicitly noting connections between the goals, strategies, and actions outlined in one plan with those in others.
- Consistency Checks: Conduct consistency checks to ensure that the language, objectives, and strategies in different plans and policies align with each other. This involves reviewing documents side by side to identify any conflicting or contradictory elements that need to be addressed.
- Joint Planning Committees: Establish joint planning committees or task forces that involve representatives from different departments or agencies responsible for various plans (for example, the MPC). These committees facilitate communication, collaboration, and the coordination of planning efforts across sectors.
- Collaborative Workshops and Meetings: Organize collaborative workshops and meetings to bring together stakeholders involved in different planning processes (as seen in the planning meetings for the HMP). These forums provide an opportunity for stakeholders to share information, discuss common goals, and identify areas of overlap or potential conflict.
- Alignment with State and Regional Plans: Ensure that local plans align with broader regional and state plans. This involves considering regional and state priorities and incorporating them into local planning efforts to create a harmonized approach to development.
- Data Sharing and Analysis: Share relevant data among planning efforts and conduct joint data analysis. This helps in creating a common understanding of the challenges and opportunities, facilitating evidence-based decision-making across different plans.
- Unified Implementation Strategies: This involves identifying common actions and initiatives that contribute to the achievement of multiple goals outlined in various plans.

All participating jurisdictions within Calhoun County have good working relationships with both each other, the State of Michigan, and FEMA indicating great potential for plan incorporation and integration across the planning area. Where appropriate, CCOEM and NHBP will take the lead in integrating this HMP into overarching plans, codes, ordinances and any other relevant documents, policies, or procedures.

2.6 Continued Public Involvement

Calhoun, NHBP, and all participating jurisdictions are dedicated to involving the public in the continual shaping of the HMP and in the development of its mitigation projects and activities.

The Calhoun County MPC will continue to keep the public informed about its hazard mitigation projects and activities through County's website. The public will also be invited to participate in regular MPC meetings to review and discuss the mitigation-related events of the past year. Additionally, participating jurisdictions will present to public and tribal officials in a public forum concerning the progress of mitigation actions identified in this plan as progress is made.

Copies of the FEMA approved Calhoun County HMP will be available online at County's website, NHBP's website, and distributed to all the participating jurisdictions and made available to the public.

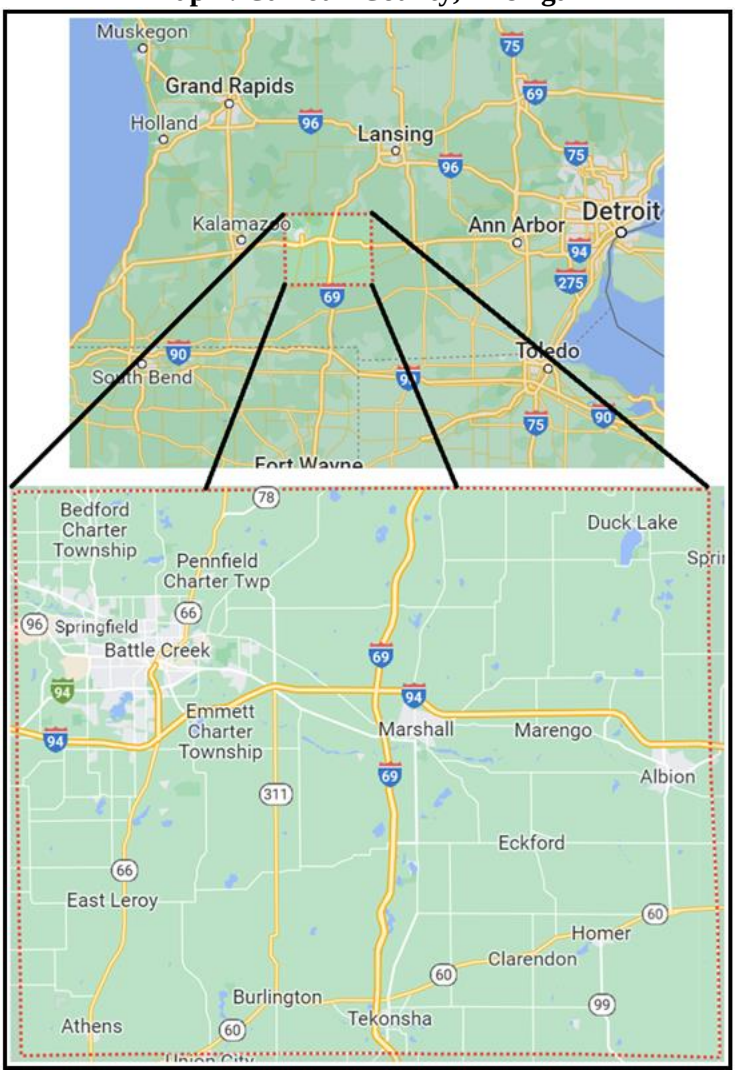
Section 3 – Planning Area

3.1 Introduction to the Planning Area

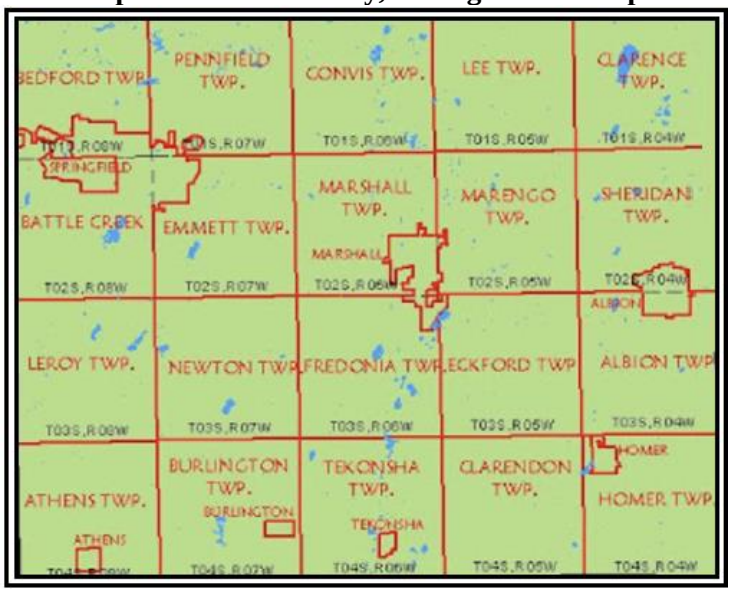
Calhoun County is located in the southwestern part of Michigan and encompasses 718 square miles of land. It is situated in the southern Lower Peninsula of Michigan. The county is located roughly midway between Detroit and Chicago and a major interstate connecting the two crosses through the county, interstate 94, while interstate 69 traverses north south. Albion, Marshall, and Battle Creek are the three largest population centers.

The following map details the Calhoun County planning area and participating jurisdictions.

Map 1: Calhoun County, Michigan



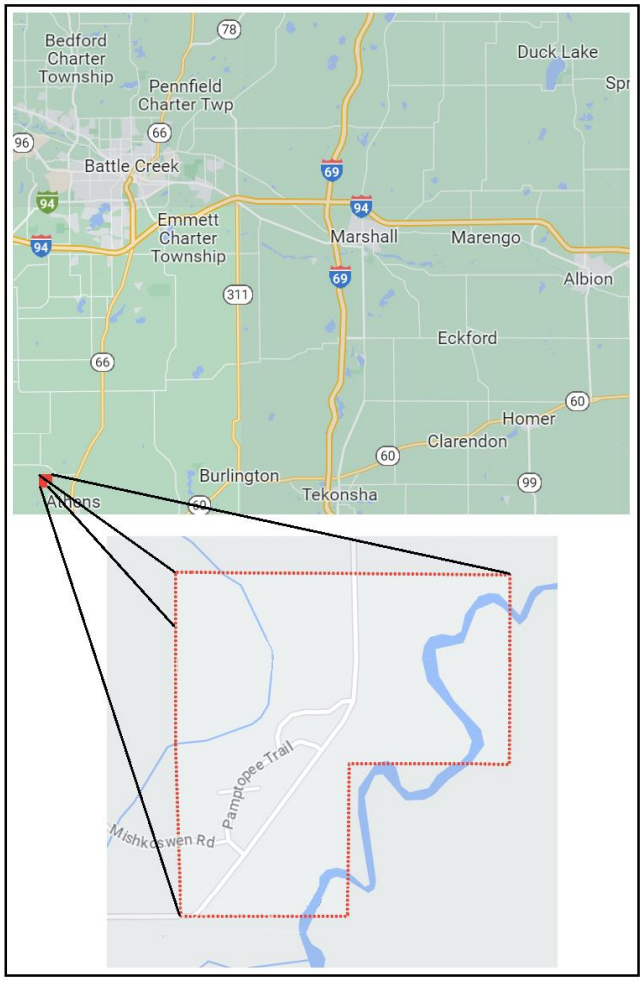
Map 2: Calhoun County, Michigan Townships



3.2 NHBP Tribal Reservation

The following map details the location of the NHBP tribal reservations within Calhoun County.

Map 3: NHBP Tribal Reservation



3.3 Demographic Trends

In general, Calhoun County is a rural area with smaller to medium sized urban centers. Data from the United States Census Bureau from the 2020 Decennial Census in the table below details the participating jurisdictions' demographic information.

Table 4: Population Data

Jurisdiction	Land Area (Square Miles)	Population			Change	Population Density (Per Square Mile)
		2000	2010	2020	2000-2020	
Calhoun County	718.0	138,014	136,146	134,310	-2.7%	187
Albion	4.51	9,144	8,616	7,700	-15.8%	1,707
Athens	1.02	1,111	1,024	936	-15.8%	918
Battle Creek	43.73	53,364	52,347	52,721	-1.2 %	1,206
Burlington	0.68	405	261	281	-30.6%	413
Homer	1.45	1,851	1,668	1,575	-13.2%	1,086
Marshall	6.40	7,459	7,088	6,822	-8.5%	1,066
Springfield	3.70	5,189	5,260	5,292	2.0%	1,430
Tekonsha	0.73	712	717	653	-8.3 %	895
Athens Township	36.1	2,530	2,544	2,444	-3.4%	68
Emmett Charter Township	32.5	12,037	11,770	11,774	-2.2%	362
Leroy Township	36.4	3,733	3,638	3,718	-0.4%	102
Sheridan Township	33.2	2,132	1,962	1,809	-15.1%	54
Tekonsha Township	36.3	1,751	1,645	1,520	-22.8%	42
NHBP*	0.33	17	52	83	388.2%	252

Source: U.S. Census Bureau

*: Data indicates total tribal population living on Tribal Reservation. Information provided by NHBP Planning Department

3.4 Social Vulnerability

Each participating jurisdiction has socially vulnerable and at-risk populations, populations that may have difficulty with medical issues, poverty, extremes in age, and communications due to language barriers. Several principles may be considered when discussing potentially at-risk populations, including:

- Not all people who are considered at risk are at risk
- Outward appearance does not necessarily mark a person as at risk
- The hazard event will, in many cases, affect at risk population in differing ways

The National Response Framework defines at risk populations as "populations whose members may have additional needs before, during, and after an incident in functional areas, including but not limited to: maintaining independence, communication, transportation, supervision, and medical care." The following tables present information on potentially at-risk populations within Calhoun County.

Table 5: Potential at Risk Population Data

Jurisdiction	Population 5 and Under (2021)	Population Over 65 (2021)	Speak a Language Other Than English (2021)	Estimated People in Poverty (2021)
Calhoun County	7,977 (5.9%)	23,659 (17.6%)	8,864 (6.6 %)	17,197 (12.8 %)
Albion	649 (8.4%)	978 (12.7%)	347 (4.5%)	2,195 (28.5%)
Athens	77 (8.2%)	141 (15.1%)	0 (0%)	100 (10.7%)
Battle Creek	3,659 (6.9 %)	8,131 (15.4 %)	6,062 (11.5 %)	11,599 (22.0 %)
Burlington	11 (3.9%)	57 (20.3%)	4 (1.6%)	42 (14.9%)
Homer	120 (7.6%)	159 (10.1%)	14 (0.9 %)	250 (15.9 %)

Table 5: Potential at Risk Population Data

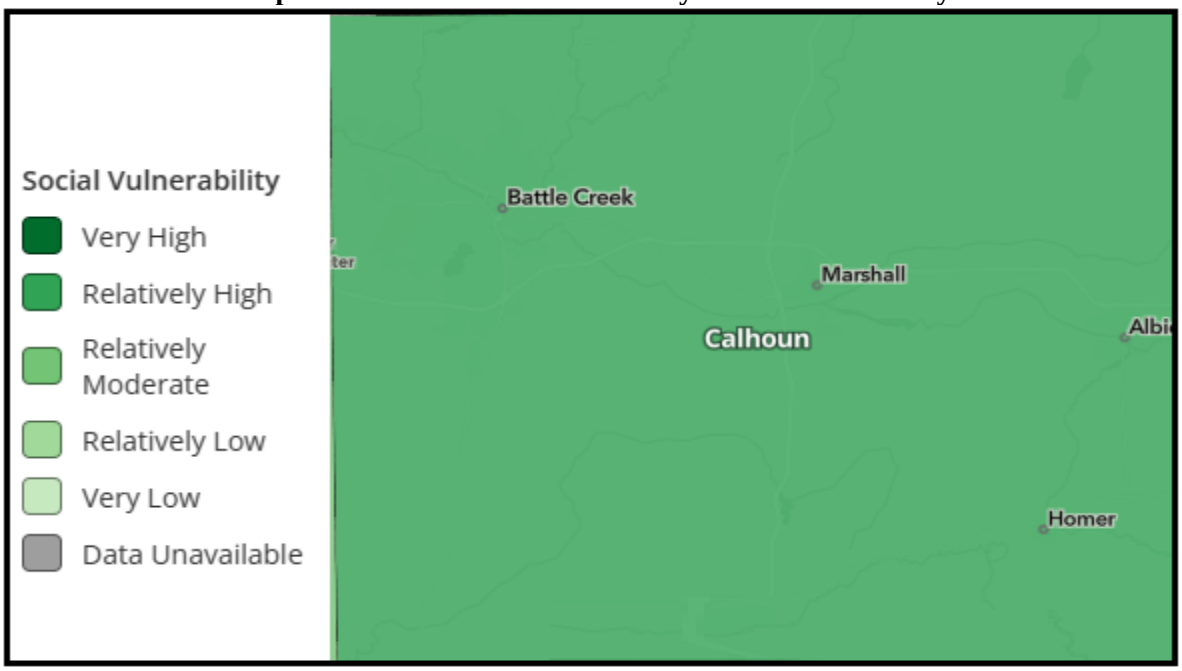
Jurisdiction	Population 5 and Under (2021)	Population Over 65 (2021)	Speak a Language Other Than English (2021)	Estimated People in Poverty (2021)
Marshall	360 (5.3%)	1,521 (22.2%)	160 (2.3%)	553 (8.1%)
Springfield	373 (7.0 %)	686 (13.0 %)	667 (12.6 %)	1,196 (22.4 %)
Tekonsha	22 (3.4%)	84 (12.8%)	5 (0.8%)	158 (24.2%)
Athens Township	107 (4.4%)	554 (22.7%)	22 (0.9%)	221 (9.0%)
Emmett Charter Township	352 (3.0%)	2,637 (22.4%)	612 (5.2%)	966 (8.2%)
Leroy Township	345 (9.3%)	677 (18.2%)	115 (3.1%)	257 (6.9%)
Sheridan Township	95 (5.2%)	310 (17.1%)	40 (2.2%)	217 (12.0%)
Tekonsha Township	60 (4.0%)	272 (17.9%)	353 (23.3)	178 (11.7%)
NHBP*	4 (4.8%)	11 (13.3%)	0 (0%)	20 (25.3%)

Source: United States Census Bureau
*: Data indicates total tribal population living on Tribal Reservation. Information provided by NHBP Planning Department

Using data from the Centers for Disease Control and Prevention (CDC)/Agency for Toxic Substances and Disease Registry Social Vulnerability Index FEMA's NRI creates and maps a Social Vulnerability score. In this context, social vulnerability is the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. This score represents the relative level of a community's social vulnerability compared to all other communities at the same level. A qualitative rating that describes the community in comparison to all other communities at the same level, ranging from "Very Low" to "Very High" is used quantify Social Vulnerability. Census tracts with the social vulnerability score highest qualify for designation as a community disaster resilience zone. Census tracts designated as a community disaster resilience zone may receive special technical assistance, planning assistance, and a 90% federal funding match (as opposed to the standard 75% federal match) for mitigation projects. Currently there are no designated community disaster resilience zones in Calhoun County.

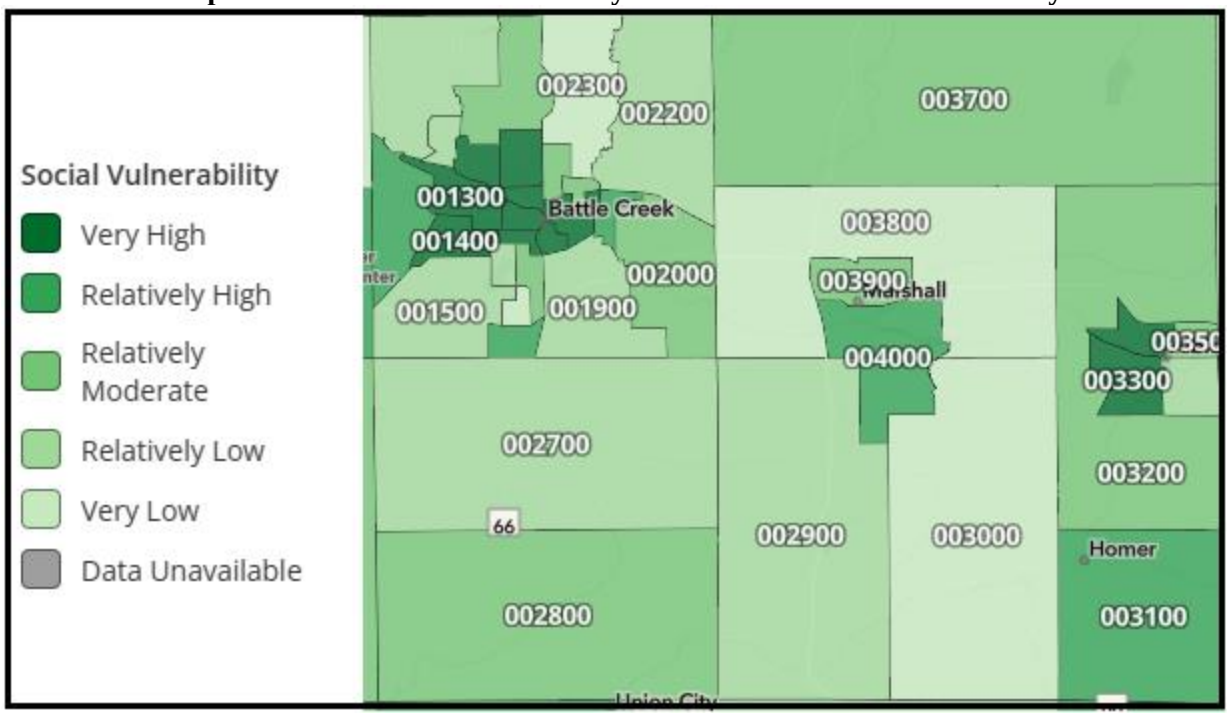
Data concerning social vulnerability is reported by county and by census tract, which can be analogous with jurisdictions. The following maps details the social vulnerability both county (relatively high) and census tract for Calhoun County:

Map 4: FEMA NRI Calhoun County Social Vulnerability



Source: FEMA

Map 5: FEMA NRI Calhoun County Jurisdictional Social Vulnerability



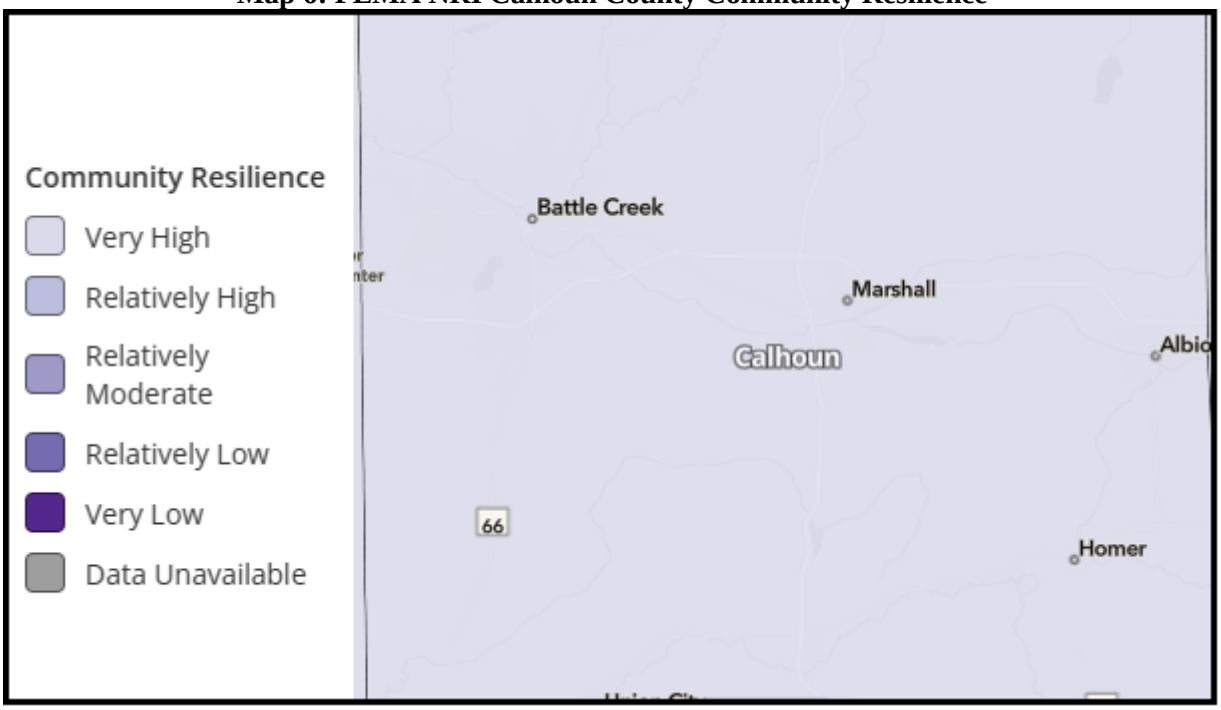
Source: FEMA

Augmenting these maps, full NRI census tract data is available in Appendix E detailing specific information for each census tract in each Calhoun County.

Community resilience is the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. Factors that are considered when calculating community resilience include governance, infrastructure, education, and other capabilities that help communities deal with hazards on their own. As a consequence reduction risk component of the NRI, a community resilience score and rating represent the relative level of a community's resilience compared to all other communities at the same level. A community resilience score is inversely proportional to a community's risk. The following map indicates the community resilience scores for Calhoun County counties:

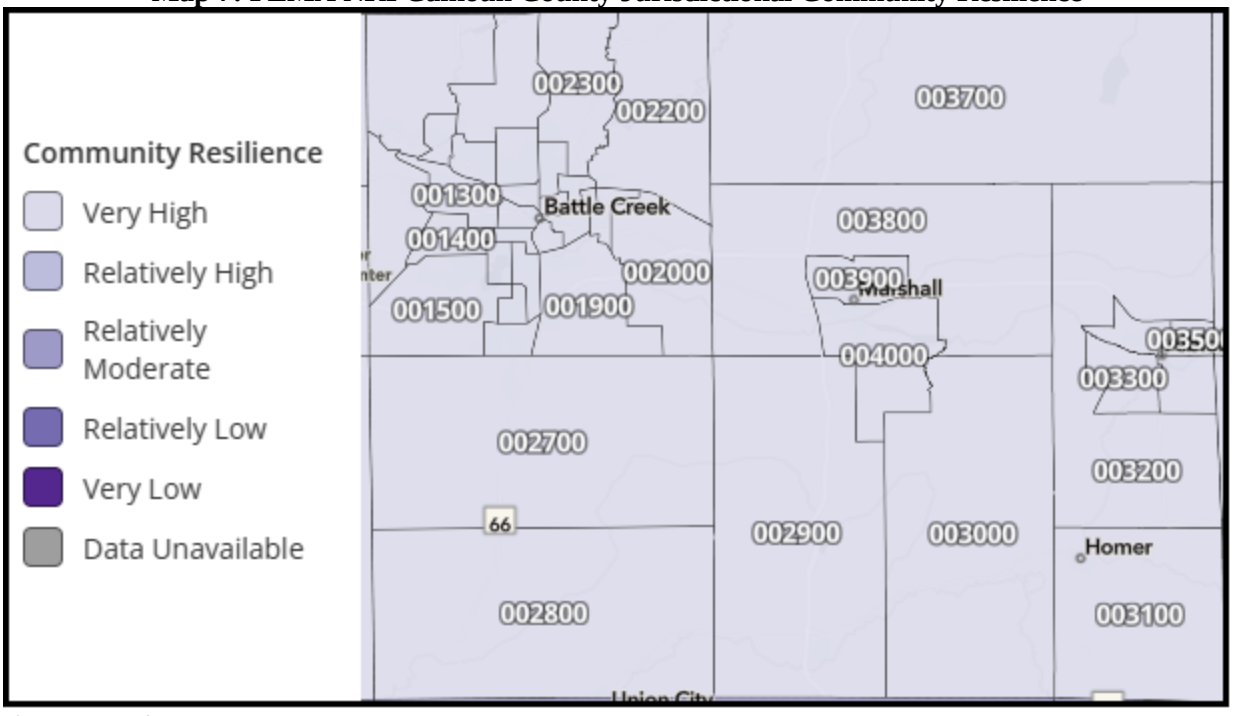
Data concerning community resilience is reported on the county level and by census tract, which can be analogous with jurisdictions. The following maps detail community resilience by both county (very high) and census tract (all very high) for Calhoun County:

Map 6: FEMA NRI Calhoun County Community Resilience



Source: FEMA

Map 7: FEMA NRI Calhoun County Jurisdictional Community Resilience



Source: FEMA

Augmenting these maps, full NRI census tract data is available in Appendix E detailing specific information for each census tract in each Calhoun County.

3.5 Housing Trends

Data from the United States Census Bureau in the table below details the participating jurisdictions' housing information.

Table 6: Calhoun County Housing Data

Jurisdiction	Occupied Housing Units (2010)	Occupied Housing Units (2020)	Percentage Change in Occupied Housing Units (2010-2020)
Calhoun County	54,016	54,406	0.72%
Albion	2,923	2,763	-5.47%
Athens	387	402	3.87%
Battle Creek	21,118	21,466	1.64%
Burlington	96	113	17.7%
Homer	615	636	3.41%
Marshall	3,092	3,072	-0.64%
Springfield	2,156	2,218	2.87%
Tekonsha	282	287	1.77%
Athens Township	996	1,034	3.8%
Emmett Charter Township	4,584	4,715	2.8%
Leroy Township	1,503	1,398	-7.0%
Sheridan Township	725	670	-7.6%
Tekonsha Township	644	576	-10.6%
NHBP	24	37	54.2%

Source: United States Census Bureau

*: Data indicates total housing units on Tribal Reservation. Information provided by NHBP Planning Department

Data from the FEMA Hazus system indicates the total value of property within Calhoun County is $25,481,727,000, as detailed in the following table:

Table 7: Calhoun County Hazus Property Valuations

Agricultural	Commercial	Government	Industrial	Residential	Educational	Religious
$106,945,000	$7,515,550,000	$258,661,000	$2,259,765,000	$13,695,000,000	$1,370,751,000	$382,000,000

Source: FEMA HAZUS

Of particular concern are mobile home residences. Data from the NOAA National Severe Storms Laboratory indicates that since 1975 fatalities in mobile homes have accounted for one-third of all tornado deaths in the United States. Additionally, study data from Michigan State University reported that the two biggest factors related to tornado fatalities were housing quality (measured by mobile homes as a proportion of housing units) and income level. When a tornado strikes, a county with double the number of mobile homes as a proportion of all homes will experience 62% more fatalities than a county with fewer mobile homes, according to the study data. The following indicates the percentage of mobile homes for each participating jurisdiction:

Table 8: Calhoun County Mobile Home Data

Jurisdiction	Occupied Housing Stock as Mobile Homes (2010)	Occupied Housing Stock as Mobile Homes (2020)	Percentage Change in Mobile Homes (2010-2020)
Calhoun County	5.5%	4.7%	-0.8%
Albion	0.3%	0.23%	-0.07%
Athens	3.2%	2.4%	-0.8%
Battle Creek	1.8%	2.4%	0.6%
Burlington	24.8%	19.1%	-5.7%
Homer	10.4%	17.0%	6.6%

Table 8: Calhoun County Mobile Home Data

Jurisdiction	Occupied Housing Stock as Mobile Homes (2010)	Occupied Housing Stock as Mobile Homes (2020)	Percentage Change in Mobile Homes (2010-2020)
Marshall	1.0%	1.1%	0.1%
Springfield	8.4%	12.3%	3.9%
Tekonsha	19.4%	7.5%	-11.9%
Athens Township	11.3%	8.2%	-3.1%
Emmett Charter Township	4.2%	3.0%	-1.2%
Leroy Township	6.3%	5.4%	-0.9%
Sheridan Township	21.1%	24.6%	3.5%
Tekonsha Township	16.2%	7.6%	-8.6%
NHBP	-	20.8%	-

Source: United States Census Bureau
-: Data unavailable

3.6 Schools Data

The following table presents 2022 enrollment information for public schools within Calhoun County:

Table 9: Calhoun County Public School Enrollment Information

School	District	Enrollment	Grades
Athens High School Campus	Athens Area Schools	267	6-12
East Leroy Elementary	Athens Area Schools	244	K-5
Ann J Kellogg Elementary	Battle Creek Public Schools	249	PK, 3-6
Battle Creek Area Math & Science Center	Battle Creek Public Schools	3,850	PK, K-12
Battle Creek Central High School	Battle Creek Public Schools	1,126	9-12
Dudley STEM Elementary	Battle Creek Public Schools	116	PK, K-2
Fremont Elementary	Battle Creek Public Schools	681	PK, K-2
LaMora Park Elementary	Battle Creek Public Schools	178	PK, K-2
Northwestern Middle	Battle Creek Public Schools	226	6-8
Post-Franklin Elementary	Battle Creek Public Schools	240	PK, K-2
Springfield Middle	Battle Creek Public Schools	403	6-8
Valley View Elementary	Battle Creek Public Schools	438	PK, K-5
Verona Elementary	Battle Creek Public Schools	234	PK, 3-5
Calhoun Area Career Center	Calhoun Intermediate School District	896	10-12
Doris Klaussen Development Center	Calhoun Intermediate School District	256	PK, K-12
Beadle Lake Elementary	Harper Creek Community Schools	320	PK, K-4
Harper Creek Middle	Harper Creek Community Schools	832	5-8
Harper Creek High School	Harper Creek Community Schools	891	9-12
Sonoma Elementary	Harper Creek Community Schools	369	K-4
Wattles Park Elementary	Harper Creek Community Schools	344	K-4
Lillian Fletcher Elementary	Homer Community Schools	362	K-4
Homer Middle School	Homer Community Schools	281	5-8
Homer Community High School	Homer Community Schools	303	9-12
Lakeview Middle School	Lakeview School District	1,179	5-8
Minges Brook Elementary	Lakeview School District	336	PK, K-4
Praireview Elementary	Lakeview School District	261	PK, K-4
Riverside Elementary	Lakeview School District	354	PK, K-4
Westlake Elementary	Lakeview School District	390	PK, K-4
Mar Lee School	Mar Lee School District	305	K-8

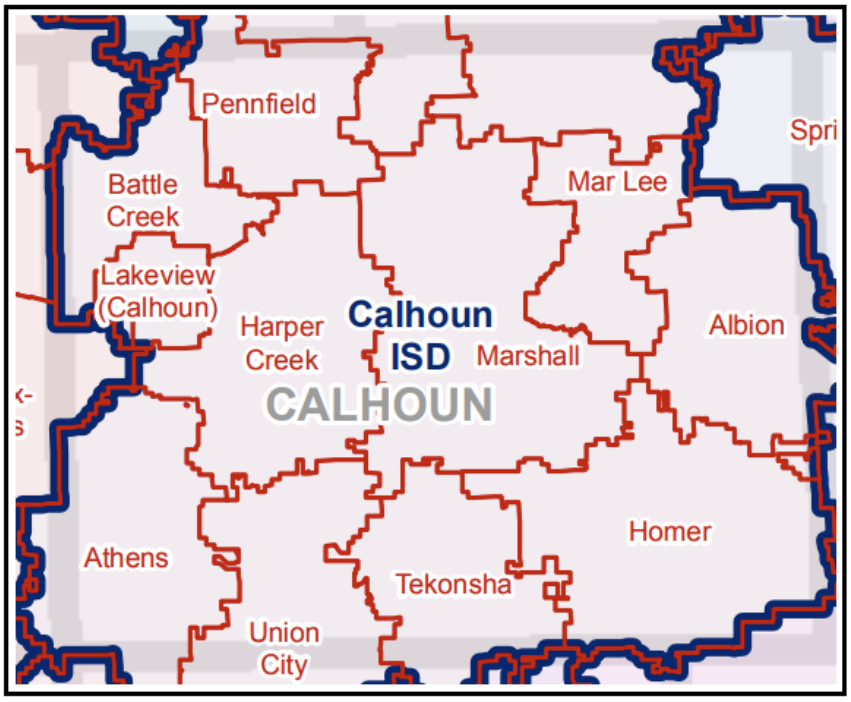
Table 9: Calhoun County Public School Enrollment Information

School	District	Enrollment	Grades
Cromwell Early Childhood	Marshall Public Schools	-	Early Childhood
Gordon Elementary	Marshall Public Schools	259	K-5
Harrington Elementary	Marshall Public Schools	262	K-5
Hughes Elementary	Marshall Public Schools	270	K-5
Marshall High School	Marshall Public Schools	733	6 - 8
Marshall Middle School	Marshall Public Schools	547	9-12
Marshall Opportunity High School	Marshall Public Schools	142	9-12
Walters Elementary	Marshall Public Schools	316	K-5
Tekonsha Elementary School	Tekonsha Community Schools	180	K-5
Tekonsha Middle/High School	Tekonsha Community Schools	222	6-12

Source: Calhoun County
-: Not Reported

The following map details the location of Calhoun County School Districts:

Map 8: Calhoun County School Districts



Source: Michigan Center for Geographic Information Department of Information Technology

3.7 Critical Facilities

Certain facilities have a net positive value on the community as they contribute to the public good by facilitating the basic functions of society. These facilities maintain order, public health, education, and help the economy function. Additionally, there are infrastructure and facilities integral to disaster response and recovery operations. Conversely, some infrastructure and facilities are of extreme importance due to the negative externalities created when they are impacted by a disaster. What fits these definitions will vary slightly from community to community, but the definitions remain as a guideline for identifying critical facilities and infrastructure. Critical facility locations and mapping for participating jurisdictions are presented in Appendix D and are discussed in the hazard sections of this plan.

3.8 Tribal Sacred Sites and Critical Facilities

NHBP does have sacred and cultural sites within its Tribally owned lands, however NHBP elected not to detail the location of these sites to the open public. NHBP has 11 self-identified critical facilities on their tribal lands. Each critical

facility is deemed necessary for the continual supply of goods and services to the community or are critical in the response and recovery operations following a disaster. Critical facility locations and mapping for NHBP are presented in Appendix D. Additionally, the NHBP Pine Creek Reservation is listed on the National Register of Historic Places.

3.9 Agricultural Data

Agriculture forms a very important part of both the economic and social fabric of Calhoun County. The United States Department of Agriculture (USDA) National Agricultural Statistics Service data was used to develop agricultural information for Calhoun County. The following table details information from the USDA Census of Agriculture for 2007, 2012, and 2017 (the latest available data) for Calhoun County:

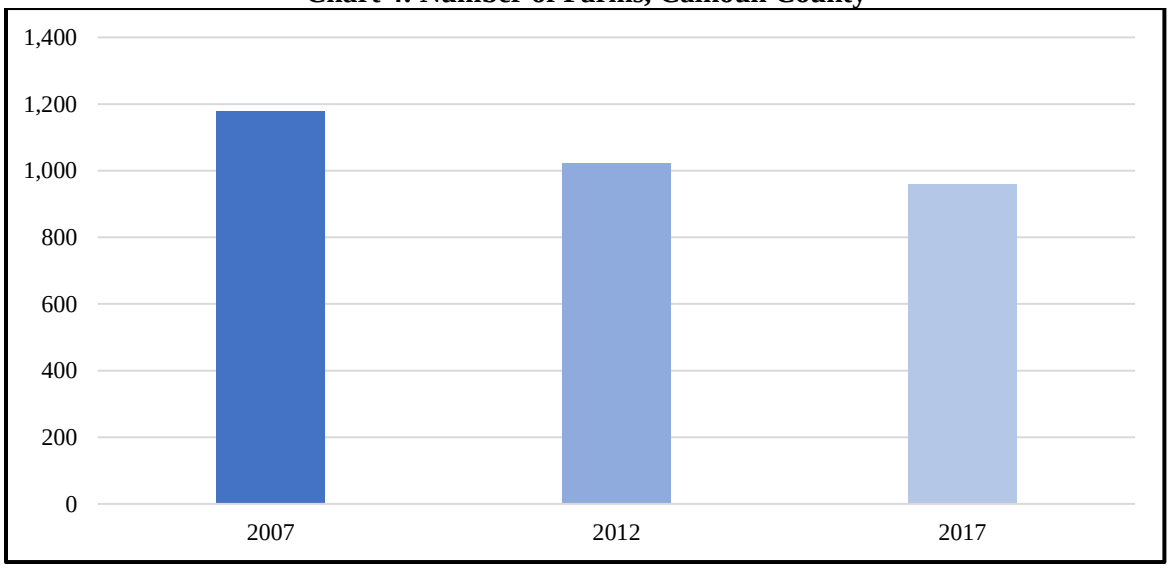
Table 10: Calhoun County Agricultural Data

Agricultural Census Year	Number of Farms	Farm Acreage	Cropland Acreage	Market Value of Agricultural Products Sold
2007	1,178	227,994	175,143	$89,816,000
2012	1,023	224,877	175,599	$133,035,000
2017	958	213,946	174,533	$113,869,000
Percentage Change, 2007 - 2017	-18.7%	-6.2%	-0.3%	26.8%

Source: United States Department of Agriculture National Agricultural Statistics Service

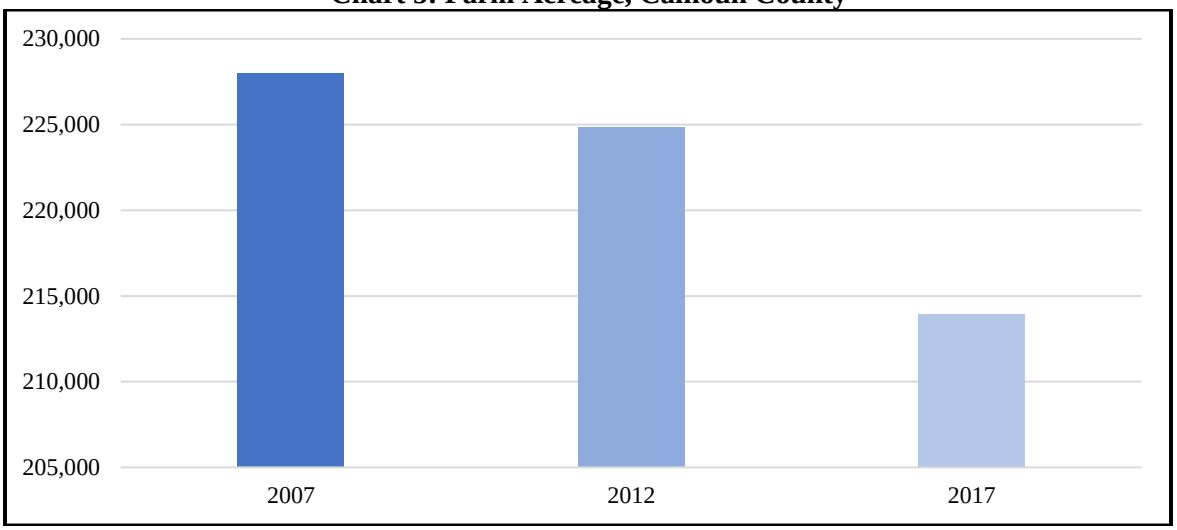
The continued increase in the market value of agricultural products sold in the county could represent an increase in vulnerability for the agricultural sector over the life of this plan. The following charts illustrate the above data.

Chart 4: Number of Farms, Calhoun County



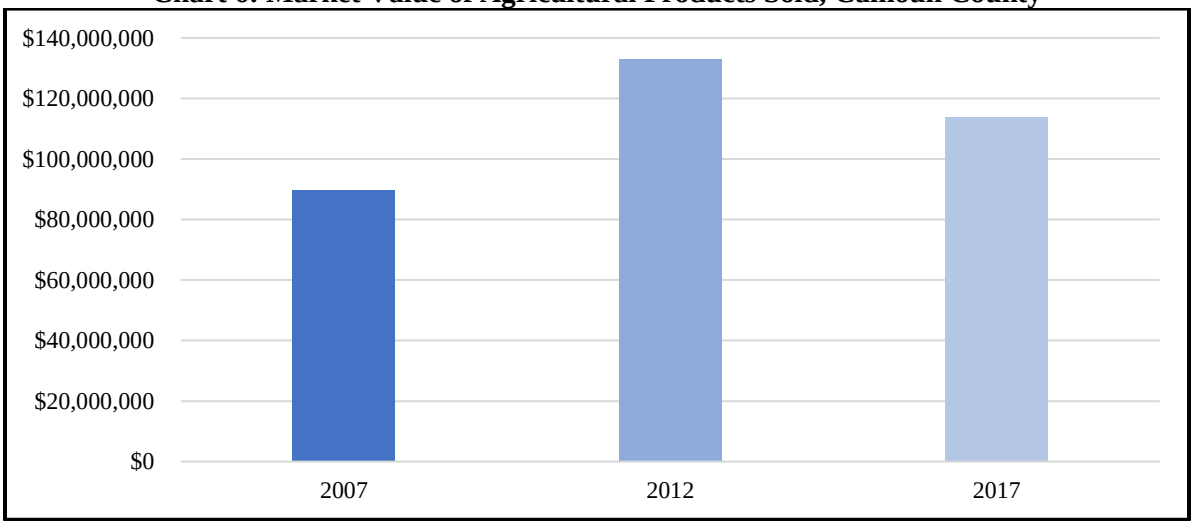
Source: USDA

Chart 5: Farm Acreage, Calhoun County



Source: USDA

Chart 6: Market Value of Agricultural Products Sold, Calhoun County



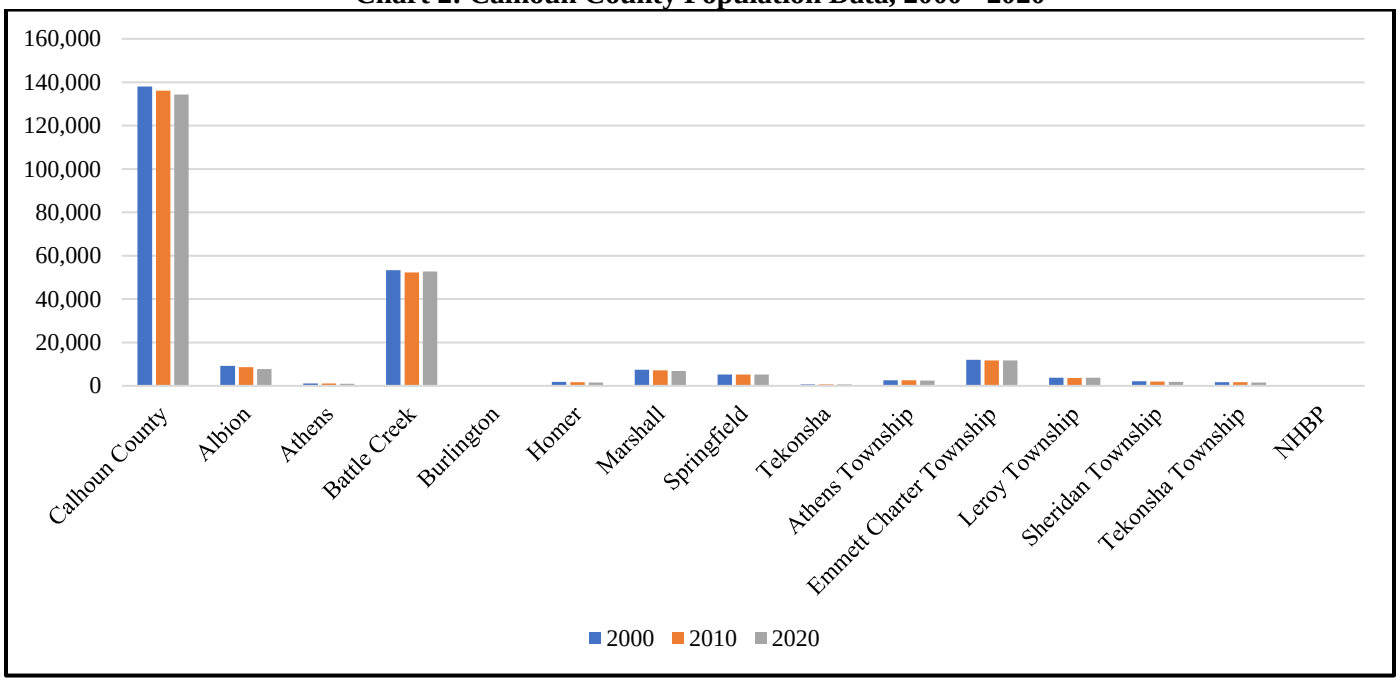
Source: USDA

3.10 Development Trends

A summary assessment for development trends and growth (as they apply to changes in a jurisdiction's vulnerability and risk) can be broken down into two categories, area-wide hazards and point hazards. Area-wide hazards indiscriminately impact the entire planning area. Since it is beyond scientific measurement where an area-wide hazard, such as winter storms, will impact, and likely it will impact everywhere, it is reasonable to assume any significant growth and development will increase vulnerability and risk. Additionally, if a jurisdiction develops or populates a known hazard area (point hazard) that jurisdiction's vulnerability and risk increase by an amount equal to the development or growth that now exists in that identified hazard area.

It is anticipated that Calhoun County and all participating jurisdictions will see lower population levels over the life of this plan. This declining nature will likely equate to decreasing vulnerability to identified hazards for all participating jurisdictions. The following chart details population trends for all Calhoun County and its participating jurisdictions from 2000 to 2020.

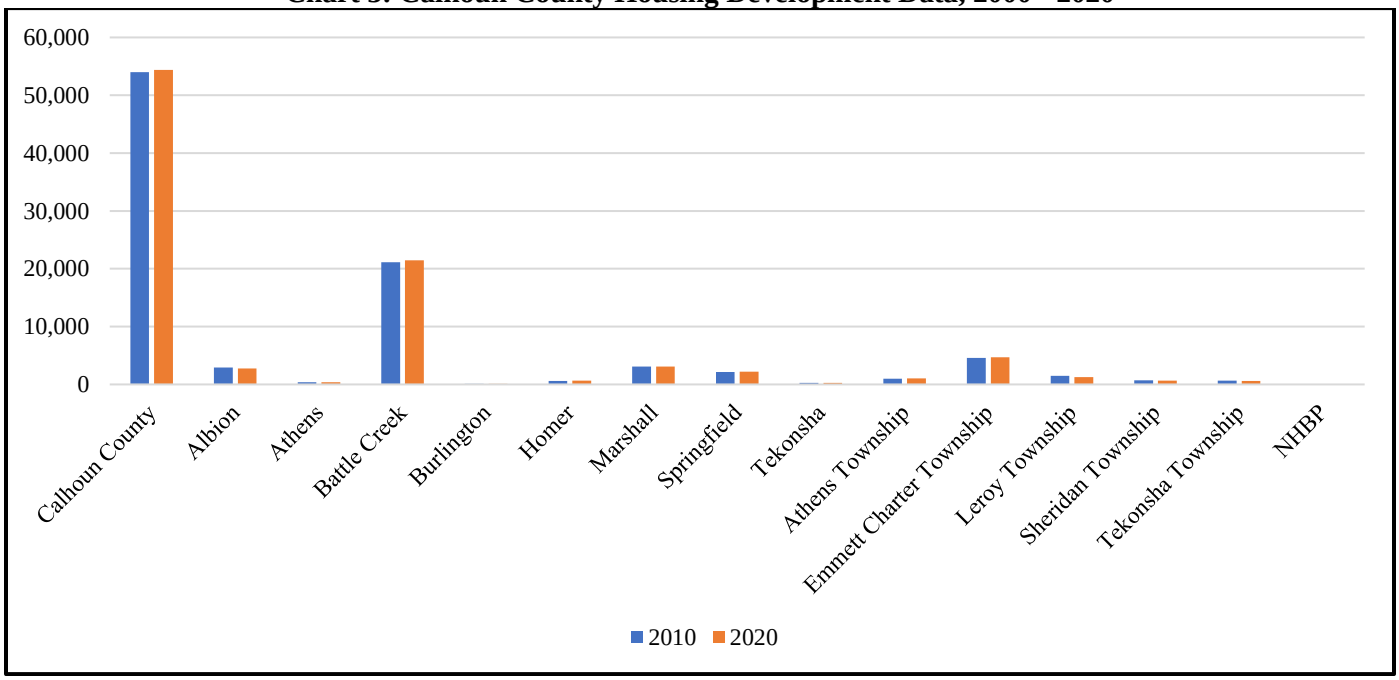
Chart 2: Calhoun County Population Data, 2000 - 2020



Source: United States Census Bureau

It is anticipated that Calhoun County and all participating jurisdictions will see static housing levels over the life of this plan. This static nature will likely equate to static vulnerability to identified hazards for all participating jurisdictions. The following chart details housing development trends for Calhoun County and its participating jurisdictions from 2000 to 2020.

Chart 3: Calhoun County Housing Development Data, 2000 - 2020



Source: United States Census Bureau

Infrastructure repair can have a significant impact on regional development, both positive and negative. The specific effects depend on the scale of the repair projects, the quality of the infrastructure, and the overall economic and social context of the region, and may include:

- Improved Connectivity: Repairing and upgrading infrastructure, such as roads, bridges, and ports, can enhance connectivity within and between regions. This improved connectivity can reduce transportation costs, facilitate the movement of goods and people, and attract businesses and investments to the region.
- Economic Growth: Functional infrastructure supports economic activities. When infrastructure is repaired, it can create jobs directly in the construction and maintenance sectors. Additionally, it can indirectly stimulate economic growth by providing a reliable foundation for businesses to operate and expand, leading to increased production and trade.
- Enhanced Productivity: Well-maintained infrastructure can increase productivity by reducing downtime and transportation delays. This, in turn, can make regional industries more competitive and efficient.
- Attracting Investment: Regions with modern and well-maintained infrastructure are often more attractive to investors. Businesses are more likely to invest in regions with reliable transportation, utilities, and communication networks, as it reduces operational risks and costs.
- Quality of Life: Infrastructure repair can enhance the quality of life for residents by providing access to essential services such as clean water, sanitation, healthcare, and education. This can contribute to improved human development indicators and overall well-being.
- Resilience and Disaster Mitigation: Infrastructure repair can include upgrades to make infrastructure more resilient to natural disasters and climate change impacts. This can help protect communities and assets and reduce the long-term costs of recovery and reconstruction.
- Social Equity: Infrastructure repair can address disparities in access to essential services. It can benefit marginalized communities by providing them with equal access to transportation, utilities, and public facilities.

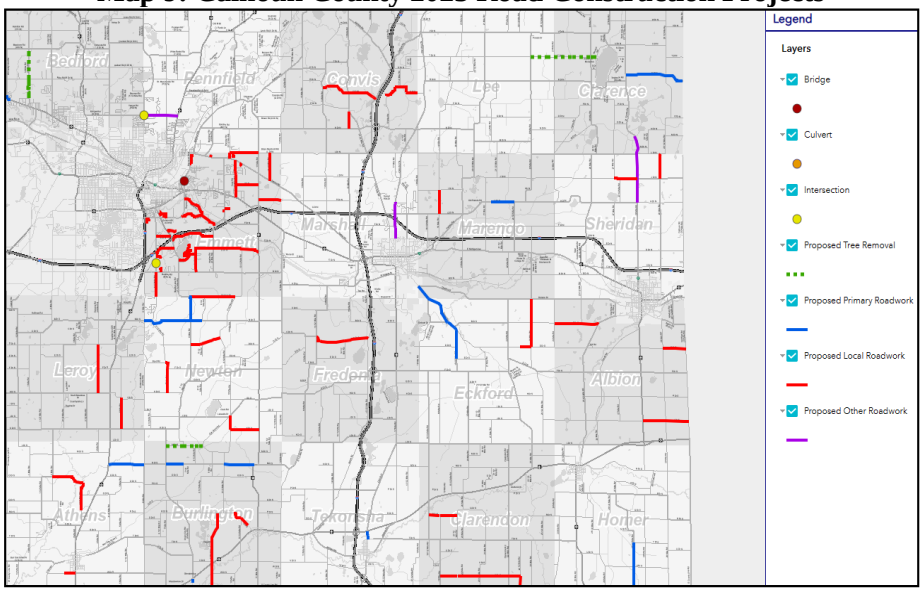
However, it is important to note that there can be negative impacts as well, including:

- Disruption During Construction: Repair projects can disrupt communities and businesses during the construction phase, leading to short-term challenges.
- Costs and Budget Constraints: Large-scale infrastructure repair projects can be costly, and they may strain regional budgets or lead to increased taxes or debt.
- Environmental Concerns: If not done carefully, infrastructure repair projects can have adverse environmental impacts, such as habitat disruption or water pollution.

As of this plan, one large infrastructure project is underway in Calhoun County. The Michigan Department of Transportation is investing $160,000,000 to repair ten miles of I-94 and replace or repair 17 bridges. The work will be between Helmer Road (Exit 95) in Battle Creek and 17 1/2 Mile Road in Marshall Township.

Calhoun County Road Department directs all road infrastructure projects within the county. The following map details the locations of scheduled road infrastructure projects slated to begin construction in 2023:

Map 9: Calhoun County 2023 Road Construction Projects

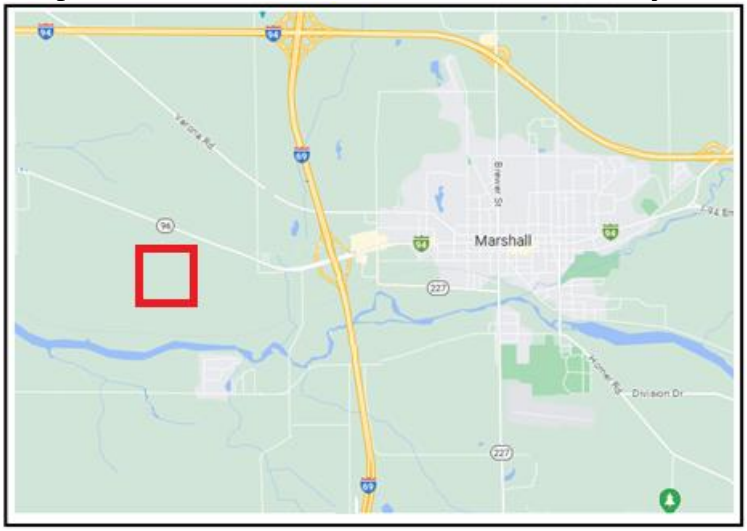


Source: Calhoun County

As of this plan, Albion has approved a 250-space mobile home development. This will substantially increase the number of mobile homes within the community which may increase Albion's vulnerability to many of the hazards identified in this plan.

As of this plan, a new 2,500,000-square-foot electric vehicle battery is in the process of being permitted in City of Marshall. The BlueOval Battery Park Michigan, in the City of Marshall, is anticipated to add millions of dollars into local small businesses and add approximately 2,500 jobs in the county. This increase in jobs may result in an increase in the population of City of Marshall, potentially increasing vulnerability to the hazards identified in this plan.

Map 10: Future Location of Ford Blue Oval Battery Park



3.11 Climate Change

For hazards related to weather patterns, climate change may cause significant changes in patterns and event frequency. There is a scientific consensus that climate change is occurring, and recent climate modeling results indicate that extreme weather events may become more common. Rising average temperatures produce a more variable climate system which may result in an increase in the frequency and severity of some extreme weather events, including:

- Longer and more intense heat waves
- An increased risk of wildfires
- Higher wind speeds
- Greater rainfall intensity
- Increased tornado activity

Specifically, according to the United State Environmental Protection Agency's "What Climate Change Means for Michigan:"

- Changing the climate is likely to increase the frequency of floods in Michigan. Over the last half century, average annual precipitation in most of the Midwest has increased by 5 to 10 percent. But rainfall during the four wettest days of the year has increased about 35 percent, and the amount of water flowing in most streams during the worst flood of the year has increased by more than 20 percent. During the next century, spring rainfall and average precipitation are likely to increase, and severe rainstorms are likely to intensify. Each of these factors will tend to further increase the risk of flooding.
- Changing the climate will have both beneficial and harmful effects on farming. Longer frost-free growing seasons and higher concentrations of atmospheric carbon dioxide would increase yields for some crops during an average year. But increasingly hot summers are likely to reduce yields of corn and possibly soybeans. Seventy years from now, much of Michigan's Lower Peninsula is likely to have 5 to 15 more days per year with temperatures above 95°F than it has today. More severe droughts or floods would also hurt crop yields.
- Rising temperatures can harm air quality and amplify existing threats to human health. Warmer weather can increase the production of ground-level ozone, a pollutant that causes lung and heart problems. High air temperatures can cause heat stroke and dehydration and affect people's cardiovascular and nervous systems. Midwestern cities are vulnerable to heat waves because many houses and apartments lack air conditioning. Heat stress is expected to increase as climate change brings hotter summer temperatures and more humidity. Certain people are especially vulnerable, including children, the elderly, the sick, and the poor.

Data from the NOAA NCEI Michigan 2022 State Climate Summary indicates the following concerning the climate change in the state:

- Temperatures have risen approximately 3° Fahrenheit since the beginning of the 20th century.
- Warming has been concentrated in winter and spring.
- The winter warming trend is reflected in a below average number of very cold nights since 1990.
- The frequency of extreme precipitation events has increased.
- Increases in precipitation are projected for Michigan, most likely during the winter and spring.
- The intensity of future droughts is projected to increase even if precipitation increases.

Section 4 – Hazard Profiles

4.1 Introduction

The goal of this hazard mitigation plan is to reduce the future impacts of hazards, including deaths and injuries, property damage, and disruption to local and county economies, and to further reduce the amount of public and private funds spent to assist recovery. To complete this goal, hazard mitigation decision-making in this plan has been based on a robust risk assessment, completed to identify natural, human caused, and technological hazards that represent a risk to Calhoun County and its participating jurisdictions. The following provide a definition of the risk assessment terms used during this assessment:

- **Hazard:** An act or phenomenon that has the potential to produce harm or other undesirable consequences to a person or thing.
- **Exposure:** The people, property, systems, or functions that could be lost to a hazard. Generally, exposure includes what lies in the area the hazard could affect.
- **Vulnerability:** Vulnerability is susceptibility to physical injury, harm, damage, or economic loss. It depends on an asset's construction, contents, and economic value of its functions.
- **Risk:** A function of hazard, vulnerability, and exposure. It refers to the likelihood of an event resulting in an adverse condition that causes injury or damage.

In order to accomplish this assessment, all relevant natural, human caused, and technological hazards, potential vulnerabilities, and exposures were identified. As potential hazards, vulnerabilities, and exposure are identified Calhoun County can continue to develop a strategy to identify and prioritize mitigation action to defend against these potential risks.

4.2 Declared Federal Disasters

The Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. §§ 5121-5206) provides for the Federal support of State and local governments and their citizens when impacted by an overwhelming disaster. The Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, establishes the process for requesting a Presidential disaster declaration and defines the type of assistance available.

If it is apparent that a Presidential disaster declaration may be necessary to assist in the recovery of an impacted area, Calhoun County and FEMA Region V will conduct a Preliminary Damage Assessment (PDA). This assessment is used to determine:

- The extent of the event.
- The impact of the event on individuals and public facilities.
- The types of federal assistance that may be needed.

Once the PDA is complete, and if a determination is made that the damages exceed available resources, the Governor may submit through FEMA Region V a declaration request to the President.

A major disaster declaration provides a wide range of federal assistance programs for individuals and public infrastructure, including funds for both emergency and permanent work. Not all programs, however, are activated for every disaster. The determination of which programs are authorized is based on the types of assistance specified in the Governor's request and the needs identified during the initial and subsequent PDAs. FEMA disaster assistance programs may include:

- Individual Assistance
- Public Assistance
- Hazard Mitigation

To recognize and encourage mitigation, FEMA considers the extent to which mitigation measures contributed to the reduction of disaster damages. This could be especially significant in those disasters where, because of mitigation, the estimated public assistance damages fell below the per capita indicator.

Historical events of significant magnitude or impact can result in a Presidential Disaster Declaration. The MPC reviewed the historical federal disaster declarations to assist in hazard identification. In the 74-year period from 1950 to 2023, Calhoun County has experienced one Presidential Disaster Declaration related to natural disasters, DR-631-MI, declared on September 8, 1980, for severe storms and flooding.

The President can declare an emergency for any occasion or instance when the President determines federal assistance is needed. Emergency Declarations supplement State and local or Indian tribal government efforts in providing emergency services, such as the protection of lives, property, public health, and safety, or to lessen or avert the threat of a catastrophe. The total amount of assistance provided for in a single emergency may not exceed $5,000,000. The following types of assistance are available under an Emergency Declaration:

- Public Assistance, Categories A (debris removal) and B (emergency protective measures)
- Individual Assistance, the Individuals and Households Program

For the 20-year period from 2003 to 2022, Calhoun County has experienced no Emergency Declarations related to natural disasters.

The Governor, or the Governor's Authorized Representative, may submit a request for a fire management assistance declaration as required. FEMA will approve declarations for fire management assistance when it is determined that a fire or fire complex on public or private forest land or grassland threatens such destruction as would constitute a major disaster.

The MPC reviewed the historical fire management declarations to assist in hazard identification. No fire management declarations were found for Calhoun County.

On the state level, two State of Emergency Declarations have been declared for Calhoun County, one in 1985 related to ice storms, and one in 2016 related to thunderstorms.

4.3 Identified Potential Hazards

One of the first steps in developing a hazard assessment is to identify the hazards that have a reasonable risk of occurring. Proper identification allows for appropriate and well-planned action in order to mitigate the extent and cascading impacts of an incident. Furthermore, while not all disaster contingencies can be planned for, applying an all-hazards approach to the mitigation process does yield greater awareness and better preparedness for unforeseen hazard incidents overall.

The MPC met to discuss previously identified hazards and deliberate on any changes or additions to the regional hazard profile. A thorough and comprehensive revision of data for each hazard was completed as part of this plan update. Additionally, this plan has worked, as per FEMA recommendations, to merge similar hazards together with the aim of both simplifying the usage of the plan and reducing duplication of effort.

The MPC confirmed the following natural hazards that may impact the Calhoun County and all participating jurisdictions:

Table 11: Calhoun County Identified Natural Hazards

Natural Hazard	Included in State of Michigan HMP	Included in Calhoun County HMP
Celestial Events	Yes	No
Dam Failure	Yes	No
Drought	Yes	Yes
Earthquake	Yes	No
Extreme Temperatures	Yes	Yes
Flood	Yes	Yes
Fog	Yes	No
Invasive Species	Yes	No
Land Subsidence	Yes	No
Shoreline Hazards	Yes	No
Severe Thunderstorms (Lightning, Wind, and Hail)	Yes	Yes
Tornado	Yes	Yes
Wildfire	Yes	No
Winter Storms	Yes	Yes

Based on discussion with the MPC, a lack of identified risk or history, and geographic improbability, numerous FEMA identified hazards such as coastal erosion, hurricane, tsunami, and volcanoes were not included in the scope of this plan. Additionally, four natural hazards included in the State of Michigan HMP, detailed below, were not included for the enumerated reasons:

- **Celestial Events:** There have been no recorded celestial events causing any damage or loss of life in Calhoun County. Due to the lack of documented and predicted impacts on both structures and population the MPC opted to not allocate potential resources or funding to mitigate against this hazard in favor of prioritizing other hazards.
- **Dam Failure:** There are no identified high hazard dams within Calhoun County. Due to the lack of potential impacts from a dam failure categorized below high hazard the MPC has elected not to include this hazard.
- **Earthquake:** There have been no recorded damaging earthquakes in Calhoun County. Additionally, mapping generated by the USGS indicates that Calhoun County and all participating jurisdictions would expect very light damage from all modeled earthquakes. Due to the lack of documented and predicted impacts on both structures and population the MPC opted to not allocate potential resources or funding to mitigate against this hazard in favor of prioritizing other hazards.
- **Fog:** Calhoun County has had no significant or recorded fog events for the past 15 years. As such, the MPC opted to not allocate potential resources or funding to mitigate against this hazard in favor of prioritizing other hazards.
- **Invasive Species:** The Michigan Department of Environmental Quality has indicated that known and listed invasive species for Calhoun County do not pose an immediate critical threat which would warrant inclusion in this plan. While there exists a persistent threat from invasive species for the county mitigation efforts are being managed through a combined effort of the Michigan Departments of Environmental Quality, Natural Resources, and Agriculture and Rural Development via the collaborative Michigan Invasive Species Program.
- **Land Subsidence:** There have been no recorded incidences of subsidence events in Calhoun County. Additionally, a study performed by Michigan State University on subsidence risk does not place Calhoun County within any identified risk zones.
- **Shoreline Hazards:** Calhoun County has no exposure to shoreline hazards as no part of the county borders the Great Lakes. As such, the MPC opted to not allocate potential resources or funding to mitigate against this hazard in favor of prioritizing other hazards.
- **Wildfires:** There have been no recently reported damaging wildfires within Calhoun County. Additionally, FEMA NRI data indicates that the potential risk to Calhoun County from wildfire is very low. Finally, wildland fires tend to thrive in forested environments. The agricultural nature of Calhoun County has limited forested areas to provide wildfire fuel. Due to the lack of documented and predicted impacts on both structures and

population the MPC opted to not allocate potential resources or funding to mitigate this hazard in favor of prioritizing other hazards.

4.4 Hazard Planning Significance

For the purposes of this plan, hazard planning significance refers to the relevance of the identified hazard to the jurisdictions of Calhoun County when calculating risk and vulnerability. In order to help quantify the planning significance for a hazard, data was reviewed on two levels, federal (National Risk Index data) and local (researched plan data relevant to occurrence and vulnerability on a county and local level). This allowed for a comparison between data sets for each hazard type and allowed for a summation at the county level. It is recognized that inconsistencies in methodologies and data make it difficult to make a direct comparison across all data levels. However, as possible, collected data was translated into a unified model that accounted for any variability in data and methodologies.

The result of this assessment provides a larger scale snapshot of how Calhoun County jurisdictions view risk and allowed for integration of hazard data into the HMP.

For natural hazards, data from this plan was vetted by MPC members and participating jurisdictions to ensure it matched local conditions. Additionally, the Calhoun County utilized FEMA's National Risk Index (NRI) which provides a method of understanding high and local level jurisdictional vulnerability. FEMA's NRI dataset and online tool was used to help determine local community risk for identified natural hazards in this HMP.

The risk equation behind the Risk Index includes three components, Expected Annual Loss (EAL), social vulnerability (previously discussed), and community resilience (previously discussed). The dataset supporting EAL provides estimates measured in 2022 U.S. dollars. The datasets supporting the social vulnerability and community resilience components have been standardized using a minimum-maximum normalization approach prior to being incorporated into the NRI risk calculation.

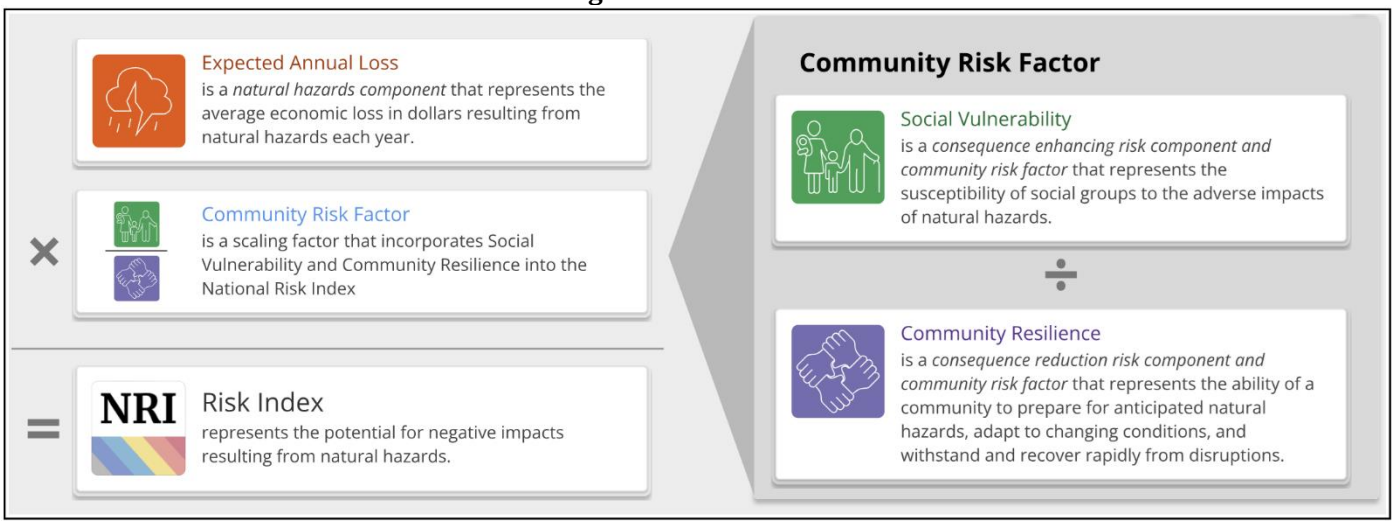
As part of the NRI, EAL represents the average economic loss in dollars resulting from a hazard each year. It quantifies loss for relevant consequence types, buildings, people, and agriculture. An EAL score and rating represent a community's relative level of expected losses each year when compared to all other communities at the same level. EAL is calculated using an equation that includes exposure, annualized frequency, and historic loss ratio risk factors. Exposure is a factor that measures the building value, population, and agriculture value potentially exposed to a natural hazard occurrence. Annualized frequency is a factor that measures the expected frequency or probability of a hazard occurrence per year. Historic loss ratio is a factor that measures the percentage of the exposed consequence type value (building, population, or agriculture) expected to be lost due to an occurrence. EAL represents the average economic loss in dollars resulting from natural hazards each year and is proportional to a community's risk.

To calculate Risk Index values, the NRI generates a Community Risk Adjustment to scale EAL values up or down, depending on their community risk factors, increasing with social vulnerability and decreases with community resilience. For a jurisdiction, a higher social vulnerability results in a higher Risk Index value while higher community resilience results in a lower Risk Index value.

Using these three components, Risk Index values are calculated for each jurisdiction (county and Census tract). The calculated Risk Index values form an absolute basis for measuring Risk within the NRI, and they are used to generate Risk Index percentiles and ratings across communities.

The risk equation behind the NRI is as follows:

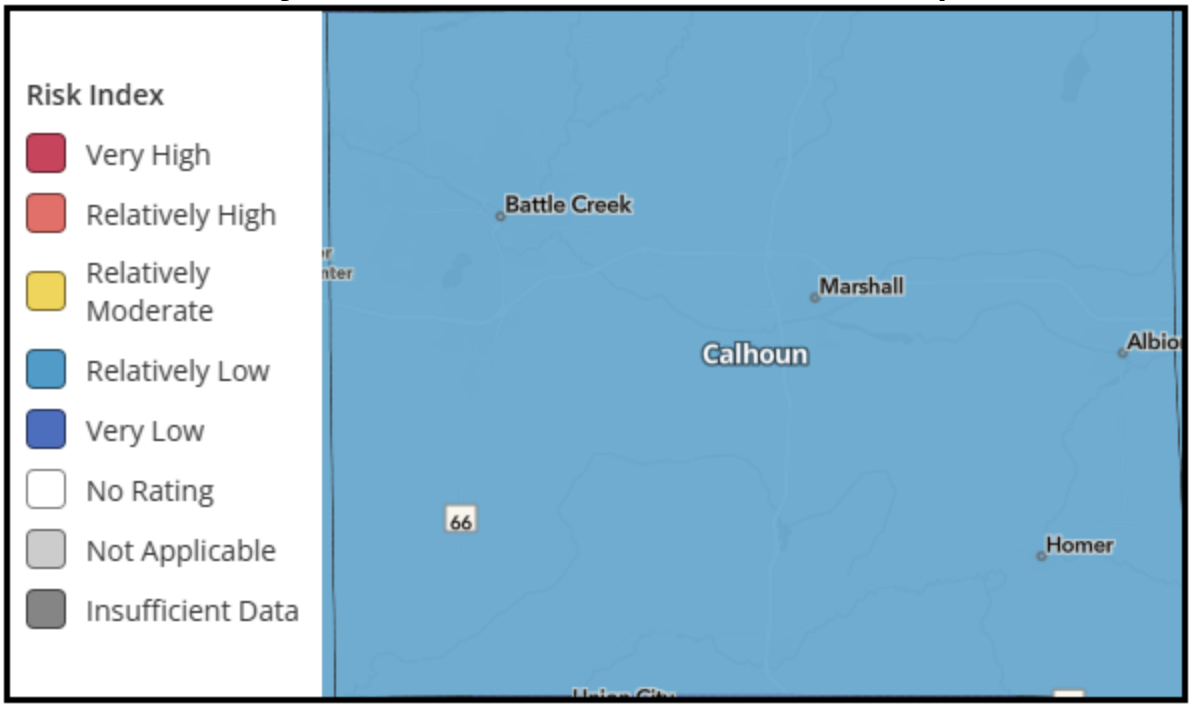
Figure 1: FEMA NRI



For both the Risk Index and EAL there is a qualitative rating that describes the nature of a community's score in comparison to all other communities at the same level, ranging from "Very Low" to "Very High." Because all ratings are relative, there are no specific numeric values that determine the rating.

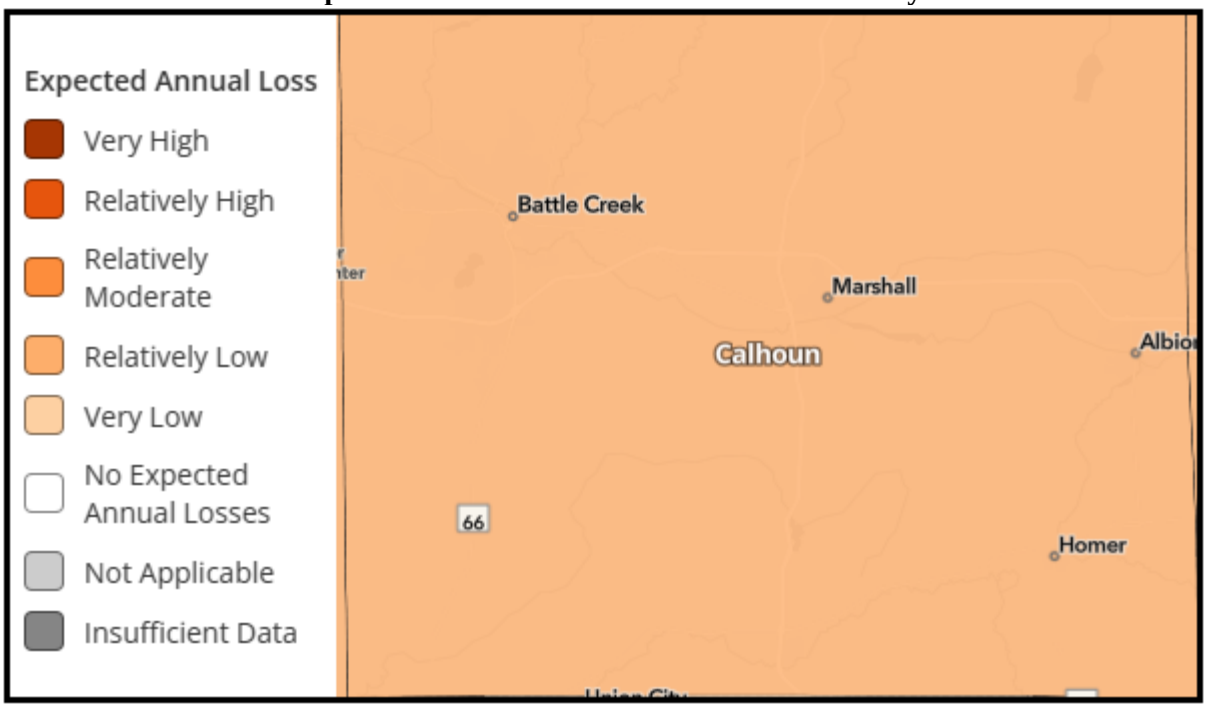
The following maps indicate the natural hazard composite NRI (relatively low) and EAL (relatively low) for Calhoun County:

Map 11: Natural Hazard Risk Index for Calhoun County



Source: FEMA NRI

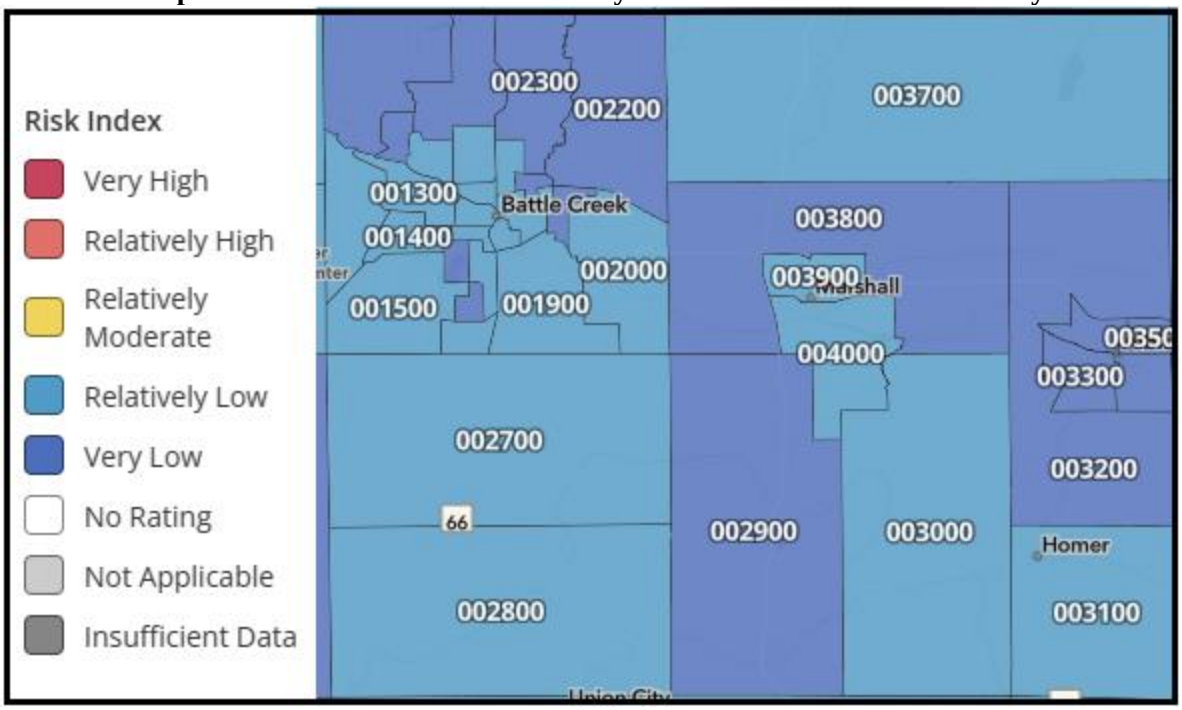
Map 12: Natural Hazard EAL for Calhoun County



Source: FEMA NRI

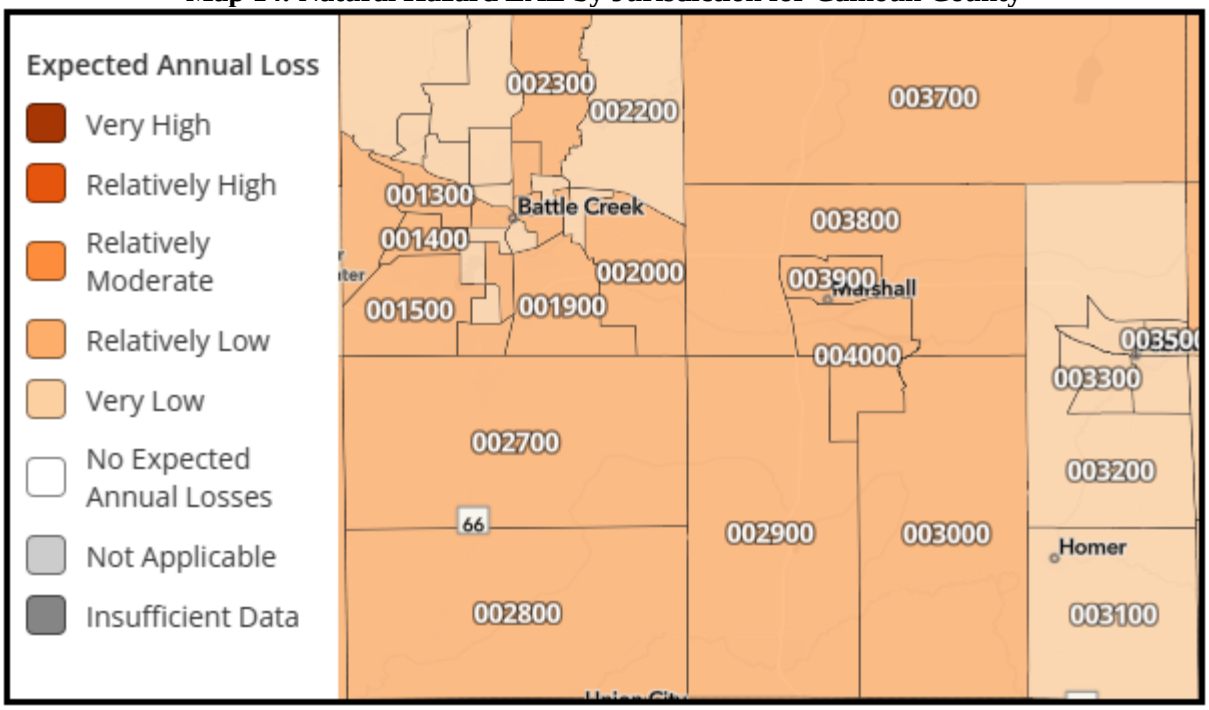
To help understand the risk and vulnerability to the identified hazards in this HMP for participating jurisdictions, risk index and EAL mapping from the FEMA NRI was run on a census tract level. As the NRI does not generate mapping for individual jurisdictions, census tract analysis is the closest analogue available to understand individual jurisdiction conditions.

Map 13: Natural Hazard Risk Index by Jurisdiction for Calhoun County



Source: FEMA NRI

Map 14: Natural Hazard EAL by Jurisdiction for Calhoun County



Source: FEMA NRI

The following table indicates the FEMA NRI and EAL analysis for each participating Calhoun County jurisdiction:

Table 12: Calhoun County FEMA NRI and EAL for All Natural Hazards

Jurisdiction	Risk Index	EAL
Calhoun County	Relatively Low	Relatively Low
City of Albion	Very Low	Very Low
City of Battle Creek	Relatively Low	Relatively Low
City of Marshall	Relatively Low	Relatively Low
City of Springfield	Relatively Low	Relatively Low
Village of Athens	Relatively Low	Relatively Low
Village of Burlington	Relatively Low	Relatively Low
Village of Homer	Relatively Low	Very Low
Village of Tekonsha	Very Low	Relatively Low
Athens Township	Relatively Low	Relatively Low
Emmett Charter Township	Relatively Low	Relatively Low
Leroy Township	Relatively Low	Relatively Low
Sheridan Township	Very Low	Very Low
Tekonsha Township	Relatively Low	Relatively Low
NHBP	Relatively Low	Relatively Low

Source: FEMA NRI

Please note that participating school districts mirror the risk rating of their respective jurisdictions.

To further help determine risk and vulnerability, social vulnerability, community resilience, risk index, and EAL data is presented in the following sections for each identified hazard by both county and jurisdiction. Additionally, FEMA NRI data tables, by census tract, are included in Appendix E. These data tables also contain the total building valuation and agricultural valuation of each census tract, allowing for an understanding of potential structural and agricultural

vulnerability. Where appropriate, differences in vulnerability to identified hazards are noted in each individual hazard section.

4.5 Hazard Occurrence and Assessment Data

NOAA's NCEI Storm Events Database was used as the primary source of information for previous occurrences of storm events. Where data sets were unavailable for a hazard, local reporting from participating jurisdictions was relied upon. It is worth noting that damage estimates indicated by the NCEI are often artificially low. This underreporting is a result of the way the events are reported to the NCEI, often by the local and/or National Weather Service (NWS) office. When reporting an event oftentimes the NWS office does not have access to the actual damage assessment resulting from that event. As such, the report often details a very low amount or zero-dollar amount for damages. Most of the events from NCEI are not associated with a federal emergency or disaster. If the event occurred at the same time as an event that was later determined to be a federal emergency or disaster, it is included with the NCEI data even if it occurred in a county not included in the federal declaration. Additionally, as FEMA's NRI relies on NCEI reporting data, these data deficiencies can impact hazard analysis, particularly for drought and flood.

Data was also obtained and utilized using Hazus-MH, Version 2.2 SP1, a program administered by the FEMA used to model losses. Modelling for hazards uses Hazus analysis to estimate losses and projected impacts from historical and annualized hazard events. Hazus default data was used in the analysis, including the 2020 Census and other State and Federal government facility databases.

4.6 Hazard Profiles

Each identified hazard is profiled in the subsequent sections, with the level of detail varying based on available information. Sources of information are cited in the detailed hazard profiles below.

Each hazard section provides a discussion on potentially vulnerable community lifelines. Community lifelines enable the continuous operation of critical government and business functions and are essential to human health and safety or economic security, and include safety, health, energy, communication, transportation, and water systems.

For hazards that have a higher chance of occurrence for specific jurisdictions throughout Calhoun County a discussion is provided as to the differing levels of potential vulnerability. All other hazards have been determined to have an equal chance of occurrence for all participating jurisdictions.

Please note that our tribal partners wanted their sacred sites to remain private. As such, no information concerning the potential impact of a hazard related to a sacred site was completed. However, a review of sacred site locations indicated that none were in identified floodplains. It can be generally assumed that none of the sites are at greater or lesser risk than any other area of the Tribal Reservation.

With each update of this plan, new information will be incorporated to provide for better evaluation and prioritization of the hazards.

The following hazards are presented in alphabetical order, and not by planning significance, for ease of reference.

4.7 Drought

4.7.1 Hazard Description

Drought is defined as an abnormally dry period lasting months or years when an area has a deficiency of water and precipitation in its surface and or underground water supply. It is, however, a normal, seasonal, and recurrent feature of climate that occurs in virtually all climate zones—typically in late spring through early fall. The duration of drought varies widely. There are cases when drought develops relatively quickly and lasts a very short period of time, exacerbated by extreme heat and/or wind, and there are other cases when drought spans multiple years, or even decades. The hydrological imbalance can be grouped into the following non-exclusive categories:

- Agricultural: When the amount of moisture in the soil no longer meets the needs of previously grown crops
- Hydrological: When surface and subsurface water levels are significantly below their normal levels
- Meteorological: When there is a significant departure from the normal levels of precipitation
- Socio-Economic: When the water deficiency begins to significantly affect the population

When below average, little or no rain falls, soil can dry out, and plants can die. If unusually dry weather persists and water supply problems develop, the period is defined as a drought. Human activity such as over-farming, excessive irrigation, deforestation, and poor erosion controls can exacerbate a drought's effects. It can take weeks or months before the effects of below average precipitation on bodies of water are observed. Depending upon the region, droughts can happen more quickly, be noticed sooner, or have their effects naturally mitigated. The more humid and wet an area is, the faster the effects will be realized. A naturally dry region, which typically relies more on subsurface water will take more time to actualize its effects.

Periods of drought can have significant environmental, agricultural, health, economic, and social consequences. The effects vary depending upon vulnerability and regional characteristics. Droughts can also reduce water quality through a decreased ability for natural rivers and streams to dilute pollutants and increase contamination. The most common effects are diminished crop yield, increased erosion, dust storms, ecosystem damage, reduced electricity production due to reduced flow through hydroelectric dams, shortage of water for industrial production, and increased risk of wildland fires.

4.7.2 Location & Extent

Droughts are regularly monitored by multiple federal agencies using a number of different indices. Among them are the U.S. Drought Monitor, the Palmer Drought Index, and the Standardized Precipitation Index, as next described.

The U.S. Drought Monitor provides a summary of drought conditions across the U.S. and Puerto Rico. Often described as a blend of art and science, the map is updated weekly by combining a variety of data-based drought indices and indicators, along with local expert input, into a single composite drought indicator.

The Palmer Drought Index (PDI), devised in 1965, was the first drought indicator to assess moisture status comprehensively. It uses temperature and precipitation data to circulate water supply and demand; incorporates soil moisture; and is considered most effective for non-irrigated cropland. It primarily reflects long-term drought and has been used extensively to initiate drought relief.

Table 13: Palmer Drought Severity Index

Category	Range (Per Year)
Extremely Wet	4.0 or more
Very Wet	3.0 to 3.99

Table 13: Palmer Drought Severity Index

Category	Range (Per Year)
Moderately Wet	2.0 to 2.99
Slightly Wet	1.0 to 1.99
Incipient Wet Spell	0.5 to 0.99
Near Normal	0.49 to -0.49
Incipient Dry Spell	-0.5 to -0.99
Mild Drought	-1.0 to -1.99
Moderate Drought	-2.0 to -2.99
Severe Drought	-3.0 to -3.99
Extreme Drought	-4.0 or less

Source: U.S. Drought Monitor

The Standardized Precipitation Index (SPI) is a way of measuring drought that is different from the PDI. Like the PDI, this index is negative for drought, and positive for wet conditions. However, the SPI is a probability index that considers only precipitation, while PDI indices are water balance indices that consider water supply (precipitation), demand (evapotranspiration) and loss (runoff).

Table 14: Standard Precipitation Index

Category	Range (Per Year)
Extremely Wet	2.0+
Very Wet	1.5 to 1.99
Moderately Wet	1.0 to 1.49
Near Normal	-.99 to .99
Moderately Dry	-1.0 to -1.49
Severely Dry	-1.5 to -1.99
Extremely Dry	-2 and less

Source: U.S. Drought Monitor

One of the best indicators of historic drought periods is provided by the U.S. Drought Monitor, which lists weekly drought conditions for the State of Michigan. The following table details the U.S. Drought Monitor categories.

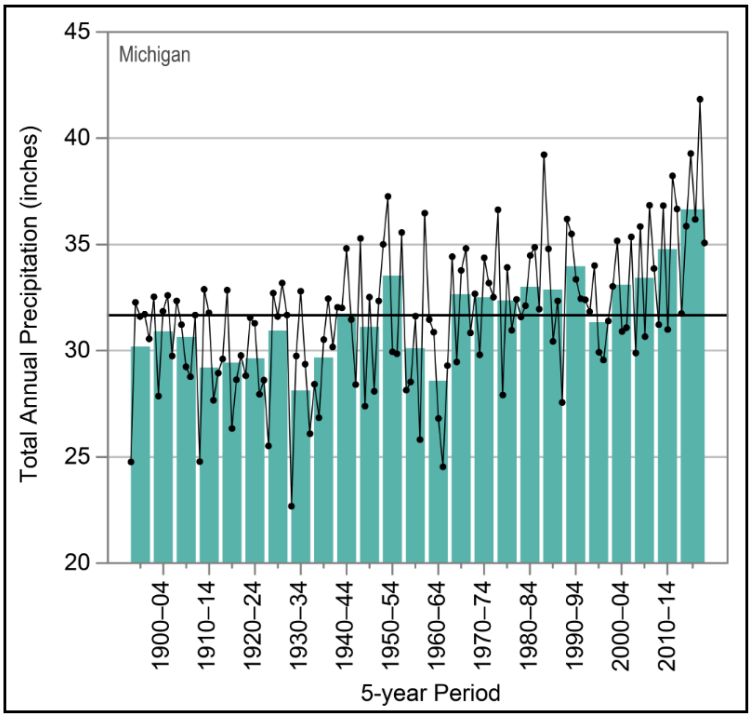
Table 15: U.S. Drought Monitor Categories

Rating	Described Condition
None	No drought conditions
D0	Abnormally Dry
D1	Moderate Drought
D2	Severe Drought
D3	Extreme Drought
D4	Exceptional Drought

Source: U.S. Drought Monitor

Precipitation data is collected by the NWS throughout the State of Michigan. Additional rainfall data is also collected by the NWS through citizen weather rainfall sites. The following chart indicates annual precipitation averages from 1895 to 2020:

Chart 7: Michigan Observed Annual Precipitation



Source: NOAA NCEI State Climate Summary 2022 for Michigan

All of Calhoun County is at risk for drought conditions. Current drought conditions, along with information on the current PDI and SPI may be found on the US Drought Monitor webpage.

4.7.3 Previous Occurrences

Drought is a normal climate pattern that has occurred in varying degrees of length, severity, and size. One of the best indicators of historic drought periods is provided by the U.S. Drought Monitor, which lists weekly drought conditions for Calhoun County. Historical data was gathered from the U.S. Drought Monitor weekly reports for the 10-year period between 2013 and 2022 (with the years 2013 and 2022 being full dataset years). This data was compiled and aggregated to provide a yearly estimate of the percentage of Calhoun County in each Drought Monitor category.

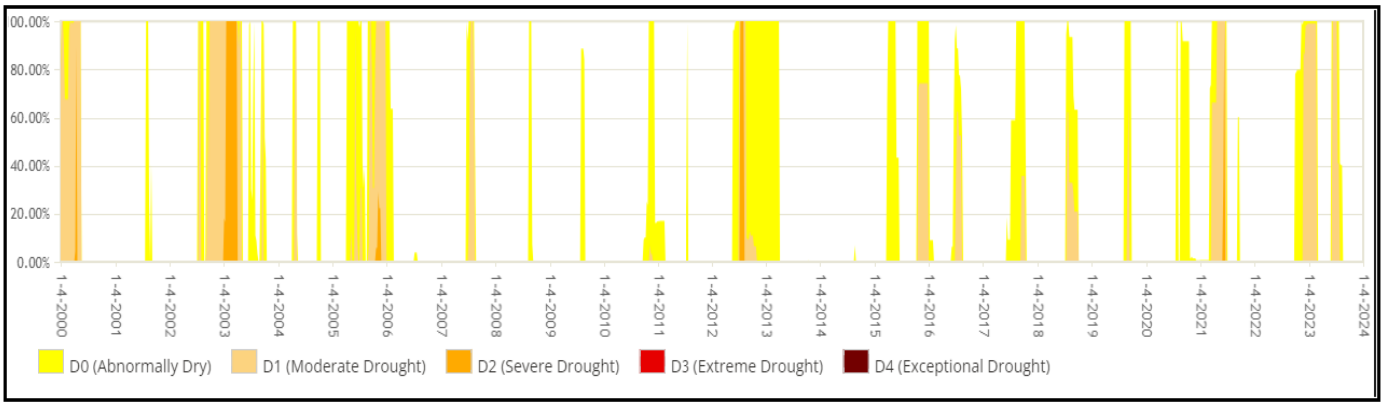
Table 16: Percentage Time in U.S. Drought Monitor Category

Year	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
2022	77.4%	22.6%	9.0%	0.0%	0.0%	0.0%
2021	65.9%	34.2%	23.7%	2.6%	0.0%	0.0%
2020	79.7%	20.3%	0.0%	0.0%	0.0%	0.0%
2019	86.8%	13.2%	2.1%	0.0%	0.0%	0.0%
2018	80.9%	19.1%	7.1%	0.0%	0.0%	0.0%
2017	75.2%	24.8%	2.7%	0.0%	0.0%	0.0%
2016	83.5%	16.5%	6.1%	0.0%	0.0%	0.0%
2015	59.7%	40.3%	14.2%	0.0%	0.0%	0.0%
2014	99.9%	0.1%	0.0%	0.0%	0.0%	0.0%
2013	73.6%	26.4%	0.0%	0.0%	0.0%	0.0%

Source: U.S. Drought Monitor

The following graph represents the historical percentage of Calhoun County in a Drought Monitor Category:

Chart 8: Percent Area in Drought Monitor Category



Source: U.S. Drought Monitor

As a result of drought conditions, Calhoun County has observed the following impacts for each of the identified drought monitor categories that have impacted the county over the last 10 years:

Table 17: Calhoun County Drought Impacts

Category	Historically Observed Impacts
D0	Low soil moisture
	Fire danger increase
D1	Livestock need supplemental feed and water
	Crops need supplemental water
	Fire danger increases
D2	Wildfire occurrence increase
	Well water decreases

As of this plan, no county or jurisdictional facilities have been impacted by drought conditions, with no dollar losses reported.

4.7.4 Probability of Future Events

Historically, drought has affected the Calhoun County region on a reoccurring basis. In reviewing historical data from the U.S. Drought Monitor weekly reports from January 2013 through December 2022 a yearly average can be created indicating the percentage time in each Drought Monitor category. This average can be used to extrapolate the potential likelihood of future drought conditions.

Table 18: Estimated Probability of Calhoun County Being in U.S. Drought Monitor Category, Calendar Year

None	D0-D4	D1-D4	D2-D4	D3-D4	D4
73.3%	21.8%	6.5%	2.6%	0.0%	0.0%

Data: U.S. Drought Monitor

4.7.5 Projected Changes in Hazard Location, Intensity, Frequency, and Duration

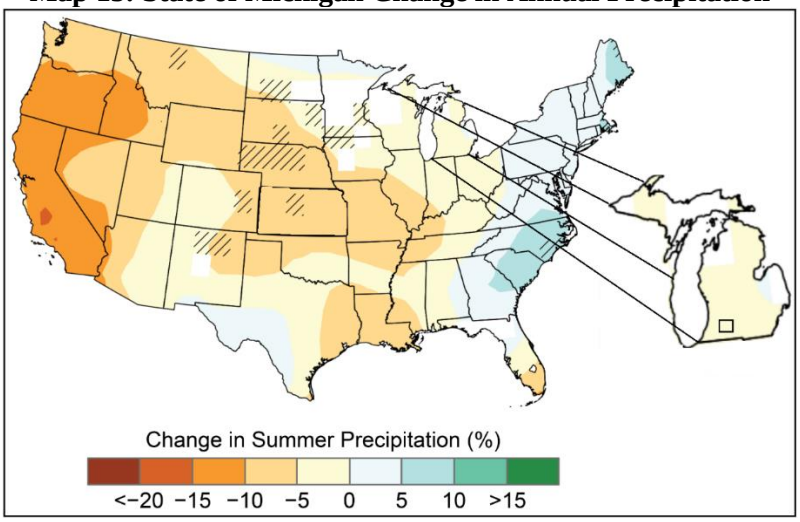
According to the National Institutes of Health National Center for Biotechnology Information publication Global Drought Trends and Future Projections "Drought is one of the most difficult natural hazards to quantify and is divided into categories (meteorological, agricultural, ecological and hydrological), which makes assessing recent changes and future scenarios extremely difficult." However, using long term data estimates of future drought conditions can be determined through a combination of climate modeling, historical data analysis, and scientific assessments. This modelling takes into account factors such as temperature, precipitation, soil moisture, and other relevant variables.

Current modelling from the NOAA State Climate Summary 2022 for Michigan suggests that projections of overall annual precipitation are uncertain, but generally believed to slightly decrease. However, summer precipitation is

projected to decrease across the state, while winter precipitation is projected to increase. Winter precipitation increases could benefit agricultural production during the spring, but summer drying would have negative impacts on rain-fed summer crops and rangeland. Although increased precipitation is projected, naturally occurring droughts are projected to be more intense because higher temperatures will increase evaporation rates.

The following map indicates the expected change in precipitation for Calhoun County:

Map 15: State of Michigan Change in Annual Precipitation



Source: NOAA NCEI State Climate Summary 2022 for Michigan

The NOAA NCEI State Climate Summary 2022 for Michigan indicates that the intensity of future droughts is projected to increase. Although projections of overall precipitation are uncertain, higher temperatures will increase the rate of soil moisture loss during dry spells, leading to more serious conditions during future naturally occurring droughts, including an increase in the occurrence and severity of wildfires.

Additionally, the -2.7% decrease in population in Calhoun County over the past 20 years, and the projected continued decrease during the life of this plan, may serve to mitigate this hazard due to a potential drop in water demands.

The agriculture base of Calhoun County is vulnerable to the short- and long-term effects of drought. Continued development in the agricultural sector will likely increase both the exposure to, and damages from, a drought event. As indicated in the data above, Calhoun County is seeing a continuing projected increase in the market value of agricultural products sold and thus potential greater future vulnerability to drought events. However, as also indicated in the data above, Calhoun County and all participating jurisdictions have been seeing generally declining populations. These potential declines could decrease the impact to their populations from a drought event from decreased water demands.

4.7.6 Vulnerability and Impact

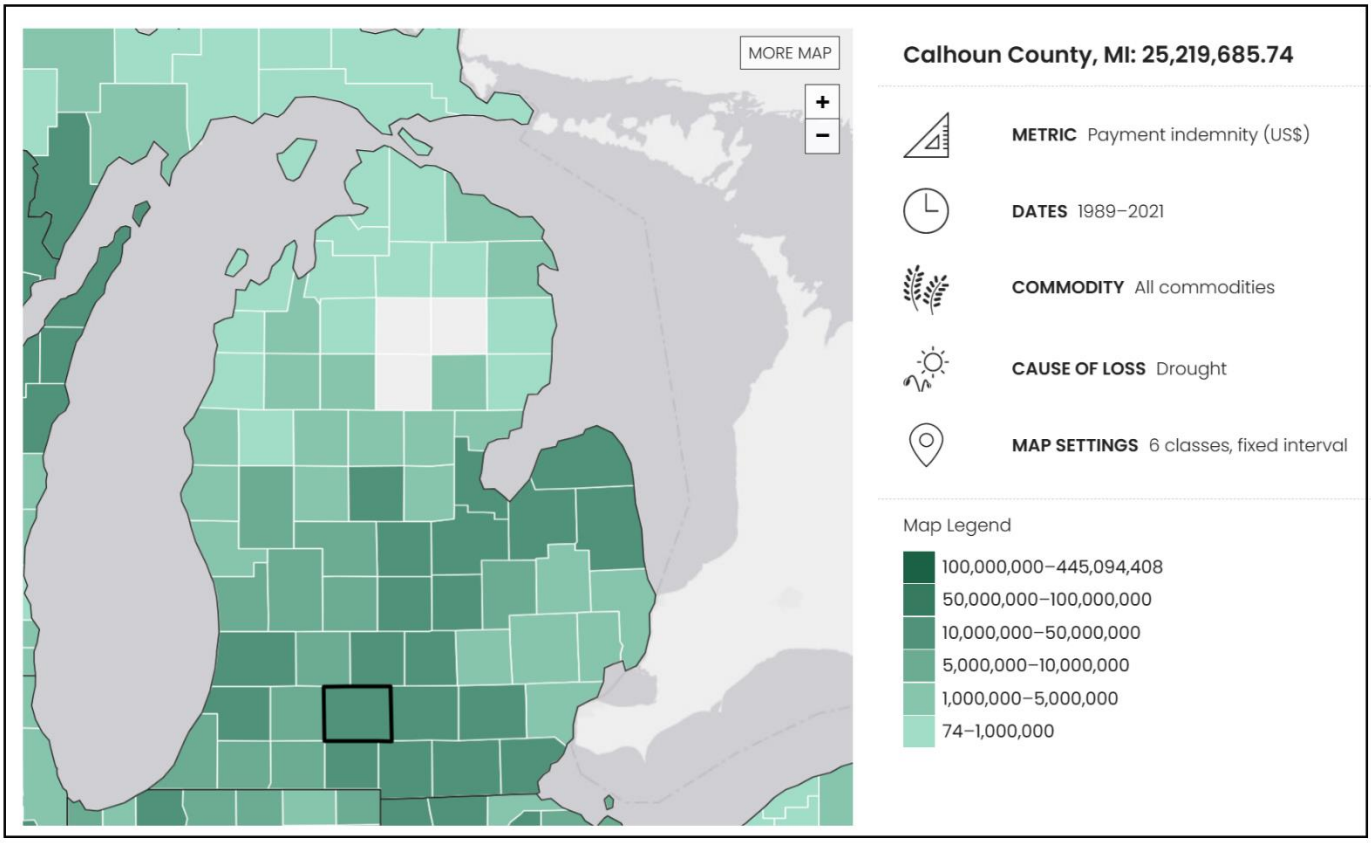
Droughts are rarely a direct cause of death, though the associated heat, dust, and stress can all contribute to increased mortality. However, drought can severely challenge a public water supplier through depletion of the raw water supply and greatly increased customer water demand. Even if the raw water supply remains adequate, problems due to limited treatment capacity or limited distribution system capacity may be encountered. Water supply planning is the key to minimizing the effects of drought on the population. Public water suppliers should continue to work to identify vulnerabilities and develop infrastructure, conservation plans, and partnerships to reduce the likelihood of running out of water during a drought.

In general, critical facilities and infrastructure are not directly vulnerable to losses as a result of drought. However, there is a potential that operations could be impacted by power failures caused by either increased utility demand or damaged

power delivery infrastructure. In addition, drinking water infrastructure may be specifically vulnerable to the impacts of drought. Any decrease in groundwater supplies would stress this infrastructure and may cause shortages or rationing.

Drought conditions can cause significant agricultural impacts. In addition to obvious losses in yields in both crop and livestock production, drought is associated with increases in insect infestations, plant disease, and wind erosion. Droughts also bring increased problems with insects and disease to forests and reduce growth. The incidence of wildfires increases substantially during extended droughts, which in turn places both human and wildlife populations at higher levels of risk. The following map from the United States Department of Agriculture details total agricultural losses, by county, due to drought conditions from 1989 to 2021:

Map 16: Agricultural Losses Due to Drought Conditions, 1989 to 2021



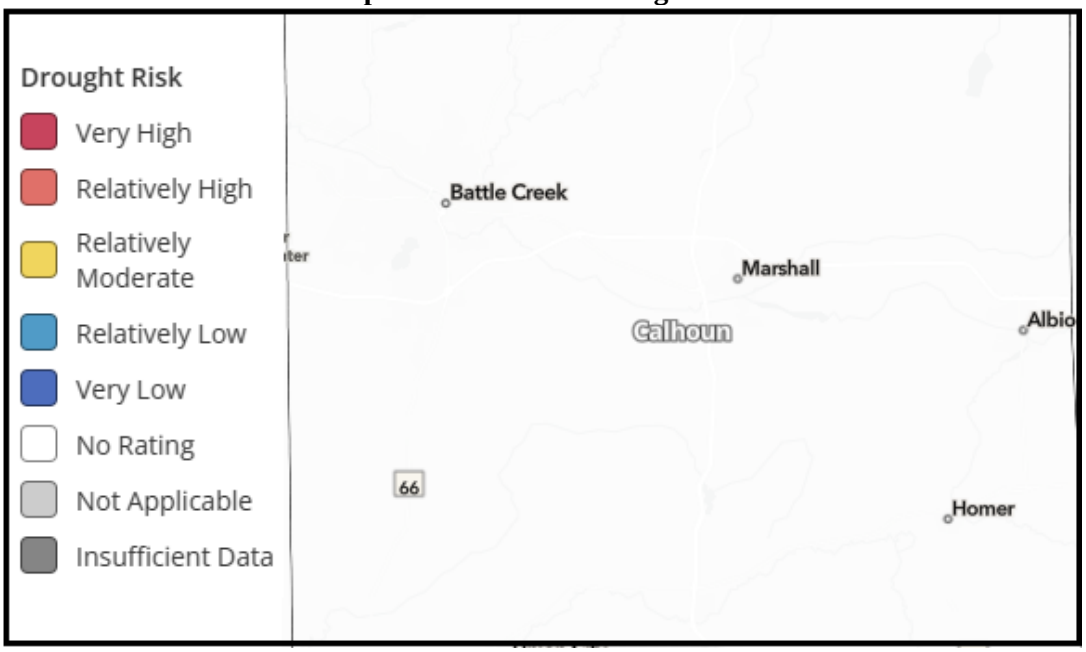
Source: USDA

Although environmental losses are difficult to quantify, increasing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects. Environmental losses are the result of damage to plant and animal species, wildlife habitat, and air and water quality, wildfires, degradation of landscape quality, loss of biodiversity, and soil erosion. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation. However, many species will eventually recover from it if it is a temporary aberration. However, the degradation of landscape quality, with increased soil erosion, may lead to a more permanent loss of biological productivity of the landscape.

County governmental facilities and assets will likely experience minimal impacts from drought conditions, unless there are substantial power, communications, or water outages. However, reduced water availability would likely have an immediate impact on firefighting efforts in urban and suburban areas as fire suppression equipment requires a minimum level of water pressure to activate. No asset dollar losses have been reported due to drought conditions.

Using the FEMA NRI, and consisting of three input components (expected annual loss, social vulnerability, and community resilience), the following map was created indicating the potential risk to Calhoun County from drought (no rating):

Map 17: FEMA NRI Drought Risk

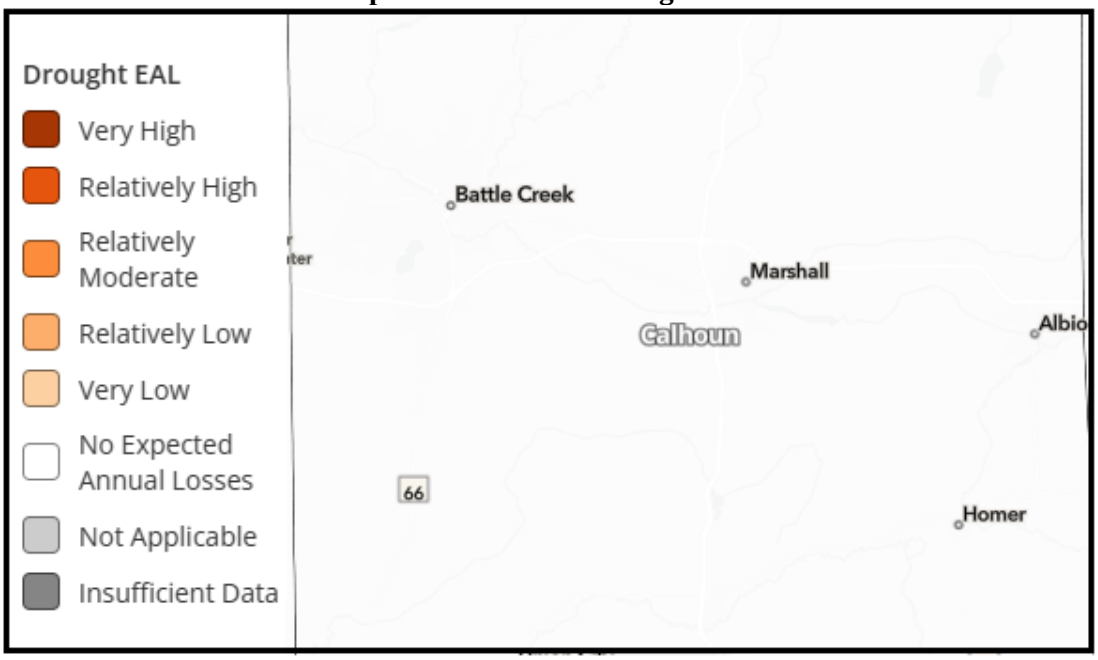


Source: FEMA NRI

No Rating indicates there is an NRI component with a score of 0, and the Risk Index score cannot be calculated for that hazard or community.

As part of the NRI, EAL represents the average economic loss in dollars resulting from natural hazards each year and is proportional to a community's risk. The following map indicates the EAL for Calhoun County for drought:

Map 18: FEMA NRI Drought EAL



Source: FEMA NRI

No expected annual loss indicates there is an NRI component with a score of 0, and the loss score cannot be calculated for that hazard or community.

Potentially Vulnerable Community Lifelines

Water utilities are particularly vulnerable to drought conditions due to the direct impact on water availability and supply. Water utilities can be affected by drought through:

- Reduced Water Availability: The reduction in water availability directly impacts the amount of water that water utilities can draw from local sources.
- Lower Reservoir Levels: Lower reservoir levels can affect the ability to meet water demand during periods of high usage.
- Declining Groundwater Levels: Lower groundwater levels make it more challenging for utilities to extract water.
- Water Quality Challenges: Lower water levels can lead to higher concentrations of contaminants, minerals, and sediments in the available water sources, requiring more extensive and costly treatment processes.
- Increased Treatment Costs: Treating water from depleted or lower-quality sources during drought conditions may require additional treatment steps, technologies, or chemicals, leading to increased operational costs for water utilities.
- Competition for Water Resources: During droughts, there is increased competition for limited water resources among various users, including agriculture, industry, and households. Water utilities may face challenges in securing sufficient water supplies amid this heightened competition.
- Impact on Water Infrastructure: Reduced water flow in rivers and streams can expose water infrastructure, such as pipelines, to the risk of corrosion.
- Water Use Restrictions: To conserve water during droughts, authorities may implement water use restrictions and conservation measures. These restrictions can impact water utilities' revenue and their ability to meet customer demand.

Calhoun County and participating jurisdictions are covered by the following domestic water suppliers:

Table 19: Calhoun County Community Water Supply Providers

Public Water Supply ID	Water Supply Name	Retail Population Served	Source	Owner
MI0000100	Albion	9,144	Groundwater	Local
MI0000260	Athens	1,024	Groundwater	Local
MI0000450	Battle Creek - Verona System	43,975	Groundwater	Local
MI0040081	Bellevue Mobile Home Park	190	Groundwater	Private
MI0040082	Birchwood Estates	178	Groundwater	Private
MI0040079	Creek Valley Mobile Home Park	245	Groundwater	Private
MI0040655	Creek Valley North	170	Groundwater	Private
MI0002125	Emmett Township	2,550	Groundwater	Local
MI0040084	Hickory Hills	708	Groundwater	Private
MI0003220	Homer	1,668	Groundwater	Local
MI0004150	Marshall	7,088	Groundwater	Local
MI0040091	My Place at Twin Valley	88	Groundwater	Private
MI0004760	Pennfield Township	3,916	Groundwater	Local
MI0040086	Phoenix Mobile Home Court	82	Groundwater	Private
MI0006240	Springfield	3,933	Groundwater	Local
MI0006562	Tekonsha	722	Groundwater	Local

Table 19: Calhoun County Community Water Supply Providers

Public Water Supply ID	Water Supply Name	Retail Population Served	Source	Owner
MI0040090	Twin Pines Mobile Home Park	182	Groundwater	Private

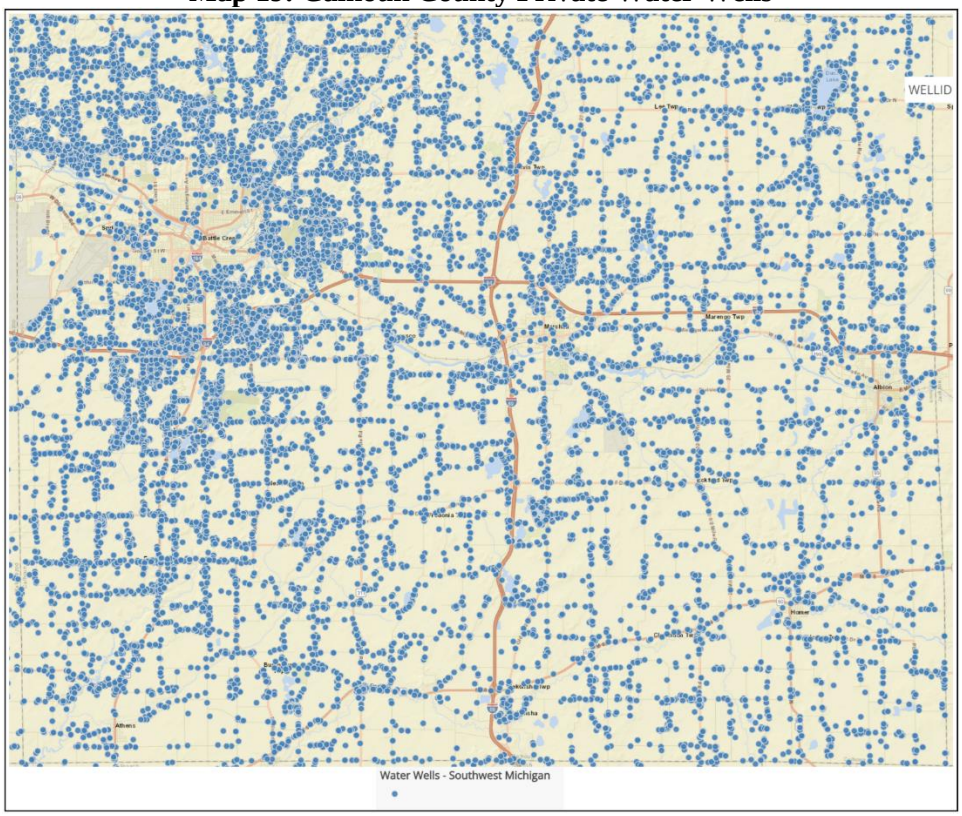
Source: State of Michigan

Communities and citizens served by private wells rather than water supply districts may be at higher risk to drought conditions, and may see the following impacts:

- Lowering of Water Table: Drought conditions can lead to a lowering of the water table, which is the level at which groundwater is located. Private wells that rely on groundwater may experience reduced yields or, in extreme cases, may run dry.
- Decreased Well Recharge: Drought reduces the amount of precipitation, leading to decreased recharge of groundwater. Private wells depend on a sustainable recharge rate to maintain a consistent and reliable water supply.
- Increased Competing Demands: During a drought, increased water demand for agricultural irrigation, municipal water supply, and other uses can create competition for the available groundwater. Private wells may face challenges due to this increased demand.
- Water Quality Concerns: Lower groundwater levels during droughts can lead to changes in water quality. Concentrations of minerals, contaminants, and pollutants may increase, affecting the suitability of water for drinking and other uses.

The following map, from the State of Michigan GIS Open Data, shows the locations of private wells throughout Calhoun County:

Map 19: Calhoun County Private Water Wells



Source: State of Michigan GIS Open Data

Should it be required to drill a private well deeper to accommodate for drought conditions impacting the level of the water table, on average, the cost to drill a private water well in the United States can range from $15 to $45 per foot. However, it's important to note that this is a general estimate, and actual costs can vary based on geological and hydrogeological conditions and well depth.

Consequence Analysis

This consequence analysis lists the potential impacts of a hazard on various elements of community and state infrastructure. The impact of each hazard is evaluated in terms of disruption of operations, recovery challenges, and overall wellbeing to all Calhoun County residents and first responder personnel. The consequence analysis supplements the hazard profile by analyzing specific impacts.

Table 20: Drought Consequence Analysis

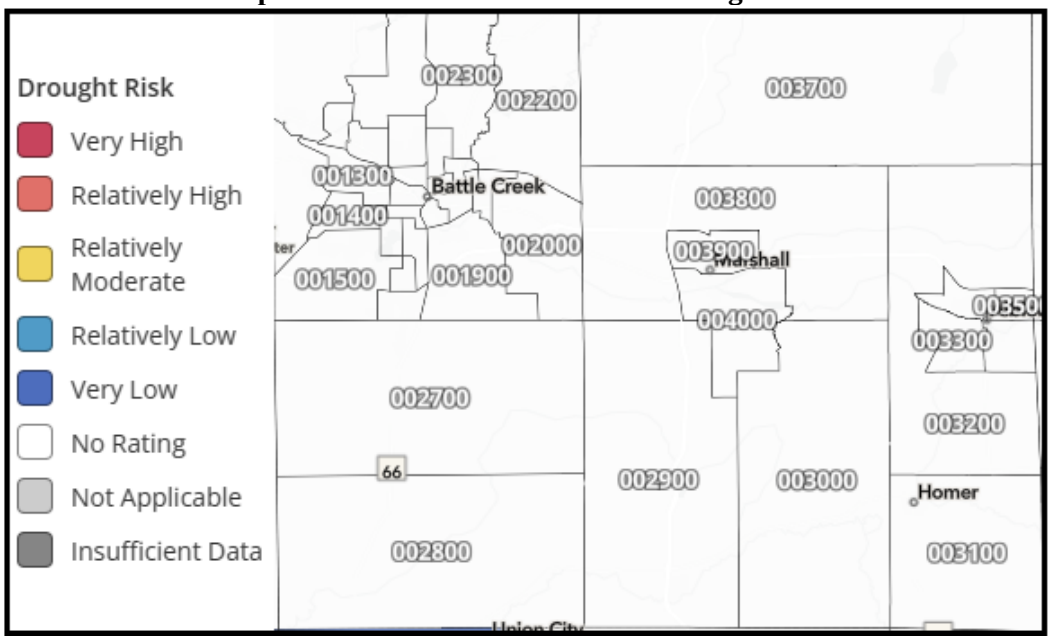
Subject	Potential Impacts
Impact on the Public	If the drought coincides with warmer months, vulnerable populations may face an increased risk of dehydration, death, heat-related illness, heat stroke. Lower quantities of water may also increase the likelihood of contamination due to higher concentrations of bacteria. During droughts, dry soils and wildfires increase the number of airborne particles, such as pollen and smoke, which can worsen chronic respiratory illnesses.
Impact on Responders	Reduced water availability would likely complicate firefighting efforts in urban and suburban areas where wildfire-fighting tactics such as chemical retardants and controlled burns are less suitable. Some fire suppression equipment requires a minimum level of water pressure to activate. If the drought coincides with warm months, first responders may face increased risk of heat-related injuries or death.
Continuity of Operations	Local jurisdictions maintain continuity plans which can be enacted as necessary based on the situation. While the expectation is minimal, this threat may impact an agency's ability to implement their continuity plan based on the hazard's potential to impact power, communications, or water outages. Critical life-saving activities and fire suppression will be directly impacted by these outages.
Delivery of Services	Droughts may impact the delivery of goods and services if there are shortages of raw materials.
Property, Facilities, and Infrastructure	Drought conditions may threaten levels or quality of municipal public water supplies or impact small communities and/or private potable water wells.
Impact on Environment	The potential of drought-related impacts could have significant impacts on supplies of animal feed, livestock, meat and dairy products, and processed grain products, and on crop production. Drought conditions may also increase the potential for fires. Drought is also associated with insect infestations, plant disease, wind erosion of soil, and decrease in levels of water produced by natural aquifers.
Economic Conditions	The economic impacts from a drought could be significant. Droughts have the potential to drain local resource, which will have a significant fiscal impact on government.
Public Confidence in Governance	Droughts can adversely affect the public, first responders, infrastructure, agriculture, economy, and overall operations. Direct, effective, and timely response by all levels of government is required for public confidence in the state's governance, especially in recognizing and mitigating economic impacts of the drought.

4.7.7 Jurisdictional Risk and Vulnerability

To help understand the risk and vulnerability to drought conditions of participating jurisdictions mapping from the FEMA NRI was run on a census tract level. As the NRI does not generate mapping for individual jurisdictions, census tract analysis is the closest analogue available to understand individual jurisdiction conditions.

Using the FEMA NRI, and consisting of three input components (expected annual loss, social vulnerability, and community resilience), the following map was created indicating the potential risk to participating jurisdictions from drought (no expected annual loss):

Map 20: FEMA NRI Jurisdictional Drought Risk

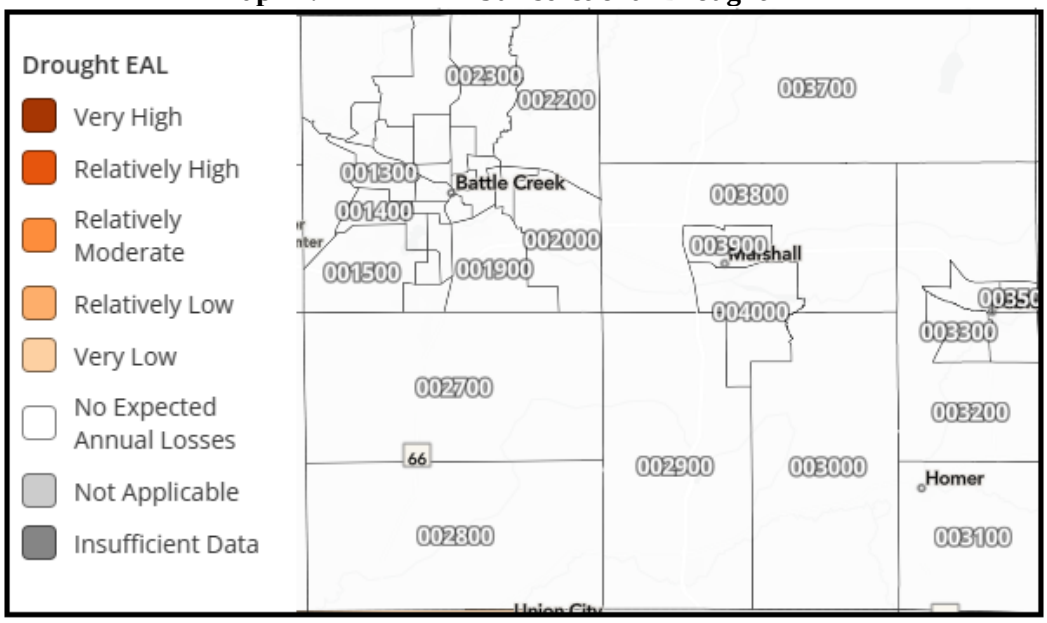


Source: FEMA NRI

No Rating indicates there is an NRI component with a score of 0, and the Risk Index score cannot be calculated for that hazard or community.

As part of the NRI, EAL represents the average economic loss in dollars resulting from natural hazards each year and is proportional to a community's risk. The following map indicates the EAL for drought for participating jurisdictions within Calhoun County:

Map 21: FEMA NRI Jurisdictional Drought EAL



Source: FEMA NRI

No Rating indicates there is an NRI component with a score of 0, and the Risk Index score cannot be calculated for that hazard or community.

The following table indicates the FEMA NRI and EAL analysis for drought for each participating Calhoun County jurisdiction:

Table 21: Calhoun County FEMA EAL and NRI for Drought

Jurisdiction	EAL	Risk Index
Calhoun County	No rating	No rating
City of Albion	No rating	No rating
City of Battle Creek	No rating	No rating
City of Marshall	No rating	No rating
City of Springfield	No rating	No rating
Village of Athens	No rating	No rating
Village of Burlington	No rating	No rating
Village of Homer	No rating	No rating
Village of Tekonsha	No rating	No rating
Athens Township	No rating	No rating
Emmett Charter Township	No rating	No rating
Leroy Township	No rating	No rating
Sheridan Township	No rating	No rating
NHBP	No rating	No rating

Source: FEMA NRI

NRI data tables concerning drought information, by census tract, may be found in Appendix E.

At greater risk may be the vulnerable populations, including the especially young, the elderly, and those below the poverty level. Hazard occurrences can exacerbate existing vulnerabilities and create new challenges. Vulnerable populations may have pre-existing health conditions that make them more susceptible to heat-related illnesses and dehydration, both of which can be exacerbated during droughts. Persons on fixed incomes and with limited resources may face difficulties in adapting their homes to withstand hazard conditions or may lack financial resources to cope with the increased costs of energy and water.

The following table details potentially vulnerable populations for participating jurisdictions within Calhoun County:

Table 22: Potential at Risk Population Data

Jurisdiction	Population 5 and Under (2021)	Population Over 65 (2021)	Estimated People in Poverty (2021)
Calhoun County	7,977 (5.9%)	23,659 (17.6%)	17,197 (12.8 %)
Albion	649 (8.4%)	978 (12.7%)	2,195 (28.5%)
Athens	77 (8.2%)	141 (15.1%)	100 (10.7%)
Battle Creek	3,659 (6.9 %)	8,131 (15.4 %)	11,599 (22.0 %)
Burlington	11 (3.9%)	57 (20.3%)	42 (14.9%)
Homer	120 (7.6%)	159 (10.1%)	250 (15.9 %)
Marshall	360 (5.3%)	1,521 (22.2%)	553 (8.1%)
Springfield	373 (7.0 %)	686 (13.0 %)	1,196 (22.4 %)
Tekonsha	22 (3.4%)	84 (12.8%)	158 (24.2%)
Athens Township	107 (4.4%)	554 (22.7%)	221 (9.0%)
Emmett Charter Township	352 (3.0%)	2,637 (22.4%)	966 (8.2%)
Leroy Township	345 (9.3%)	677 (18.2%)	257 (6.9%)
Sheridan Township	95 (5.2%)	310 (17.1%)	217 (12.0%)

Table 22: Potential at Risk Population Data

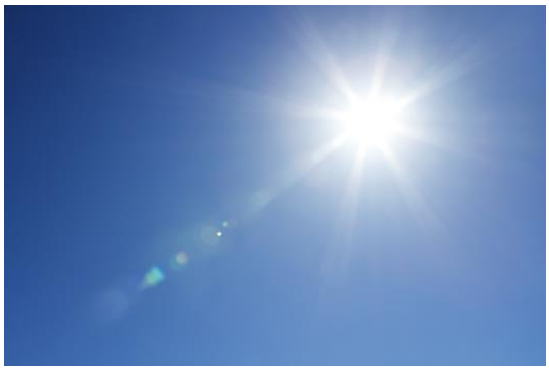
Jurisdiction	Population 5 and Under (2021)	Population Over 65 (2021)	Estimated People in Poverty (2021)
Tekonsha Township	60 (4.0%)	272 (17.9%)	178 (11.7%)
NHBP*	4 (4.8%)	11 (13.3%)	20 (25.3%)

Source: United States Census Bureau

*: Data indicates total tribal population living on Tribal Reservation. Information provided by NHBP Planning Department

Jurisdictional governmental facilities and assets will likely experience minimal impacts from drought conditions, unless there are substantial power, communications, or water outages. However, reduced water availability would likely have an immediate impact on firefighting efforts in urban and suburban areas as fire suppression equipment requires a minimum level of water pressure to activate.

4.8 Extreme Temperatures



4.8.1 Hazard Description

Extreme temperature events occur when climate conditions produce temperatures well outside of the predicted norm. These extremes can have severe impacts on human health and mortality, natural ecosystems, agriculture, and other economic sectors.

The Center for Disease Control identifies the following six groups as being especially vulnerable to extreme temperatures:

- Older Adults (aged 65)
- Infants and Children
- Individuals with Chronic Conditions
- Low-income Individuals
- Athletes
- Outdoor workers

4.8.2 Location & Extent

In general, Calhoun County has a humid continental climate that sees wet, warm summers, cold winters, and evenly distributed rainfall throughout the year. However, all of Calhoun County is at rick to extreme temperatures, defined as:

- 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. Humid or muggy conditions, which add to the discomfort of high temperatures, occur when an area of high atmospheric pressure traps moisture laden air near the ground.
- Although no specific definition exists for extreme cold, an extreme cold event can generally be defined as temperatures at or below freezing for an extended period of time. Extreme cold events are usually part of winter storm events but can occur during anytime of the year and can have devastating effects on agricultural production.

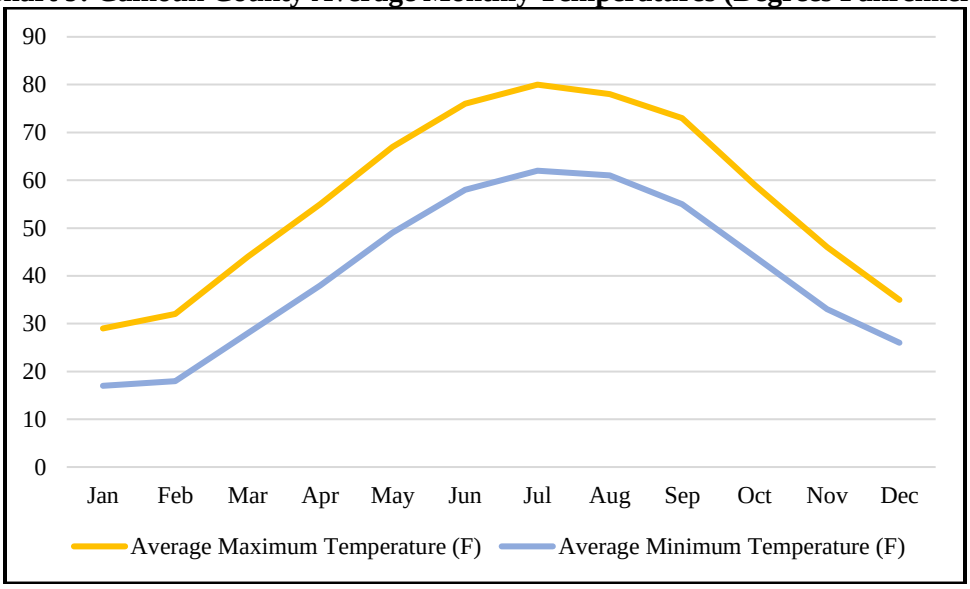
The following table and chart present average climate data for Calhoun County.

Table 23: Regional Average High Temperatures (Degrees Fahrenheit)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Maximum (F)	29	32	44	55	67	76	80	78	73	59	46	35
Average Minimum (F)	17	18	28	38	49	58	62	61	55	44	33	26

Source: https://www.weatherwx.com/climate-averages/mi/calhoun+county.html

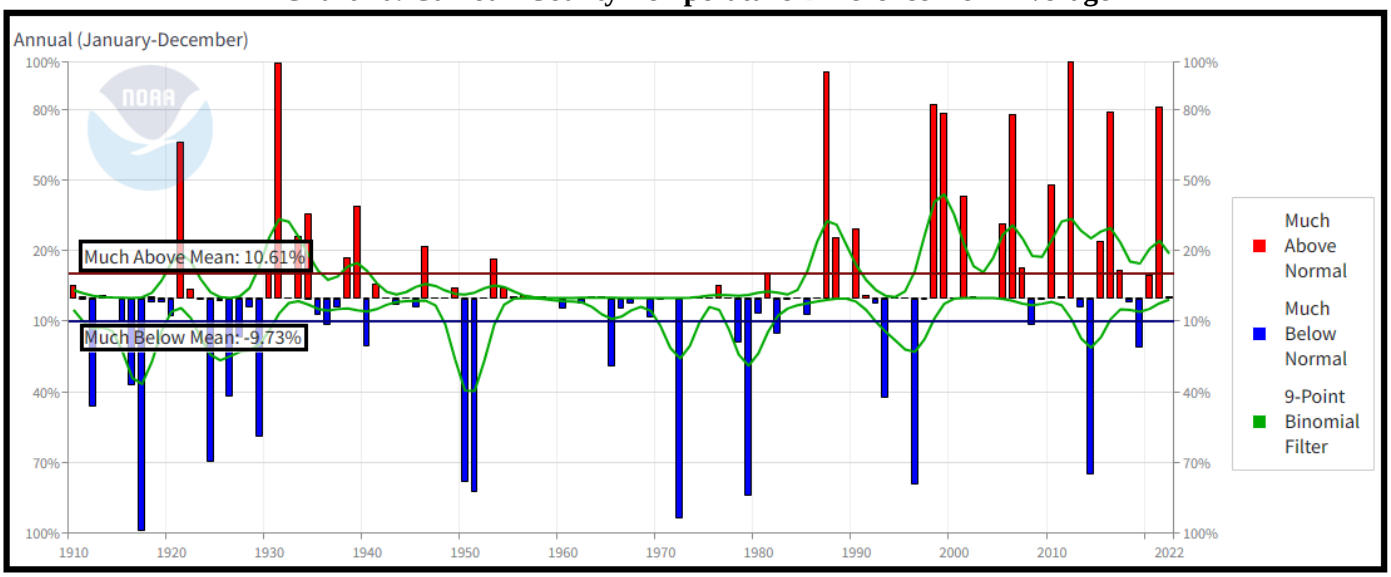
Chart 9: Calhoun County Average Monthly Temperatures (Degrees Fahrenheit)



Source: NOAA

Data from NOAA indicates that Calhoun County experienced a record high temperature of 102(F) in 1936, and a record low temperature of -20(F) in 1994. However, it is believed that both the average high temperatures and the record high temperature will likely increase over the coming years. As indicated by the below graph, using data generated from the NCEI, temperatures for Calhoun County are more frequently exceeding average temperatures, likely an impact of climate change.

Chart 10: Calhoun County Temperature Difference from Average



Source: NCEI

4.8.3 Previous Occurrences

The following table presents NCEI identified extreme temperature events and the resulting damage totals in Calhoun County from 1950 to 2023, with the years 1980 and 2023 being full dataset years, for the region. Data was reviewed regionally as the extreme temperature events covered large areas.

Table 24: Calhoun County NCEI Extreme Temperature Events, 1950 - 2023

Event Type	Number of Events	Property Damage	Deaths	Injuries
Excessive Heat	0	$0	0	0
Extreme Cold	0	$0	0	0

Source: NOAA NCEI

4.8.4 Probability of Future Events

Data from the NCEI indicates that Calhoun County can expect on a yearly basis, relevant to extreme temperature events:

Table 25: Calhoun County Extreme Temperature Probability Summary

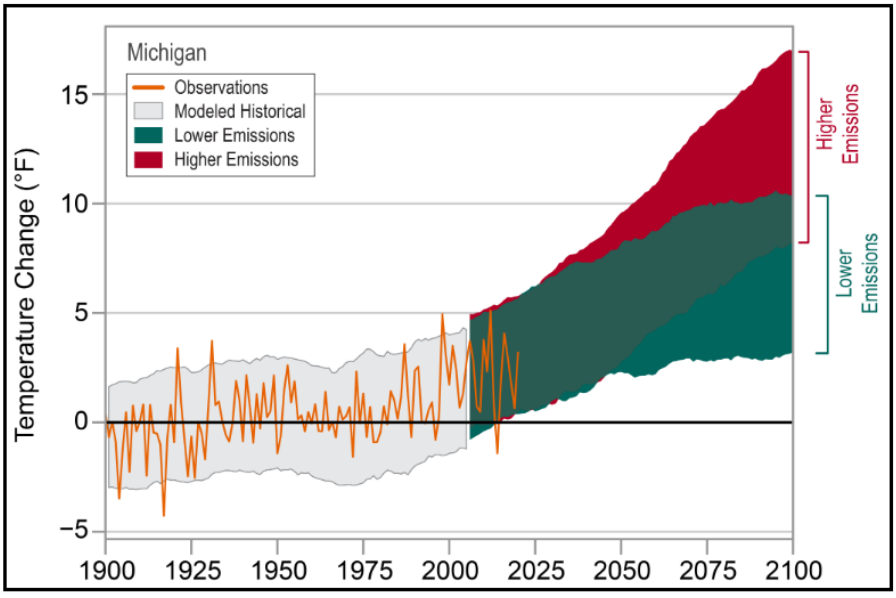
Data	Days
Number of Days with NCEI Reported Excessive Heat or Cold Event (1950 - 2023)	0
Average Events per Year	0
Number of Days with NCEI Reported Extreme Cold Event (1950 - 2023)	0
Average Extreme Temperature Events per Year	0

Source: NCEI

4.8.5 Projected Changes in Location, Intensity, Frequency, and Duration

When discussing extreme temperatures, climate change should be considered as it may markedly change future events. Recent climate modeling results indicate that extreme temperature events may become more common for Calhoun County, especially heat. The following chart indicates the projected temperature change for Michigan utilizing two global climate models. One model utilizes information in which greenhouse gas emissions continue to increase (higher emissions), with the other model utilizing information in which greenhouse gas emissions increase at a slower rate (lower emissions). Temperatures in Michigan, detailed by the orange line, have risen 3° F since the beginning of the early 1900s. Based on both the higher emission and lower emission models, continued warming is projected throughout this century.

Chart 11: Michigan Observed and Projected Temperature Change Based on Greenhouse Gas Emissions



Source: NOAA NCEI State Climate Summary 2022 for Michigan

Rising average temperatures produce a more variable climate system which may result in an increase in the frequency and severity of some extreme weather events including longer and hotter heat waves (and by correlation, an increased risk of wildfires, higher wind speeds, and tornado formation). Additionally, rising temperatures can harm air quality and amplify existing threats to human health. Warmer weather can increase the production of ground-level ozone, a

pollutant that causes lung and heart problems. Heat stress is expected to increase as climate change brings hotter summer temperatures and more humidity. Certain people are especially vulnerable, including children, the elderly, the sick, and those living below the poverty line.

The agriculture base of Calhoun County is increasingly vulnerable to the short- and long-term effects of extreme temperatures. Future development of agricultural resources would tend to increase the risk and impact of an extreme temperature event. As indicated in the data above, Calhoun County is seeing a continuing projected increase in the market value of agricultural products sold and thus a potential greater future vulnerability to extreme temperature events. However, as indicated in the data above, Calhoun County and all participating jurisdictions have been seeing generally declining populations. This declining population base could decrease the impact to citizens from an extreme temperature event through the reduction of demand on infrastructure systems.

4.8.6 Vulnerability and Impact

Data from the NCEI indicates that Calhoun County can expect on a yearly basis, relevant to extreme temperature events:

Table 26: Calhoun County Extreme Temperature Impact Summary

Data	Recorded Impact
Deaths or Injuries (1993-2022)	0
Average Number of Deaths or Injuries	0
Total Reported NCEI Property Damage (1993-2022)	$0
Average Property Damage per Year	$0

Source: NCEI

While difficult to quantify, the impacts of future extreme temperature may have far reaching impacts. The incidence of wildfires increases substantially during extended periods of extreme heat, which in turn places both human and wildlife populations at higher levels of risk. Although environmental impacts are difficult to quantify, losses to plant and animal species, wildlife habitat, and air and water quality, wildfires, degradation of landscape quality, loss of biodiversity, and soil erosion may result from extended periods of extreme temperatures.

A primary concern with this hazard is human health safety issues, as extreme temperatures can be a direct cause of death. Specific at-risk groups include outdoor workers, farmers, young children, and senior citizens. Compounding these concerns is the potential loss of electric power due to increased strain on power generation and distribution due to increased air conditioning or heating needs.

Extreme temperature impacts on humans can be measured for both heat and cold. The following table discusses potential impacts on human health related to excessive heat.

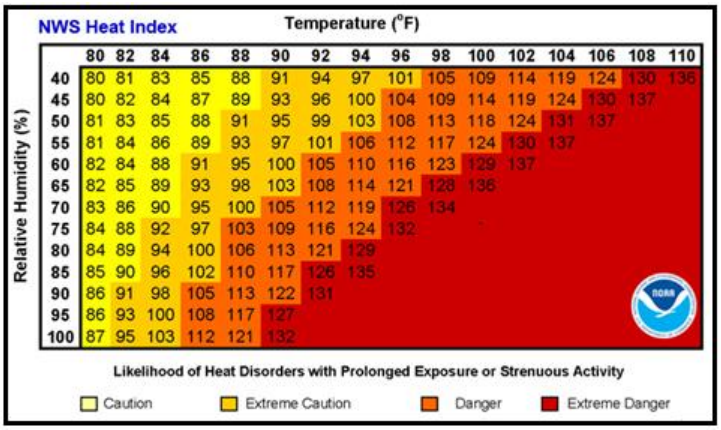
Table 27: Extreme Heat Impacts on Human Health

Heat Index Temperature	Potential Impact on Human Health
80-90° F	Fatigue possible with prolonged exposure and/or physical activity
90-105° F	Sunstroke, heat cramps, and heat exhaustion possible
105-130° F	Heatstroke/sunstroke highly likely with continued exposure

Source: National Weather Service Heat Index Program

Exposure to direct sun can increase Heat Index values by as much as 15°F. The zone above 105°F corresponds to a Heat Index that may cause increasingly severe heat disorders with continued exposure and/or physical activity. The following graph, from the NWS, indicates Heat Index values.

Chart 12: Heat Index



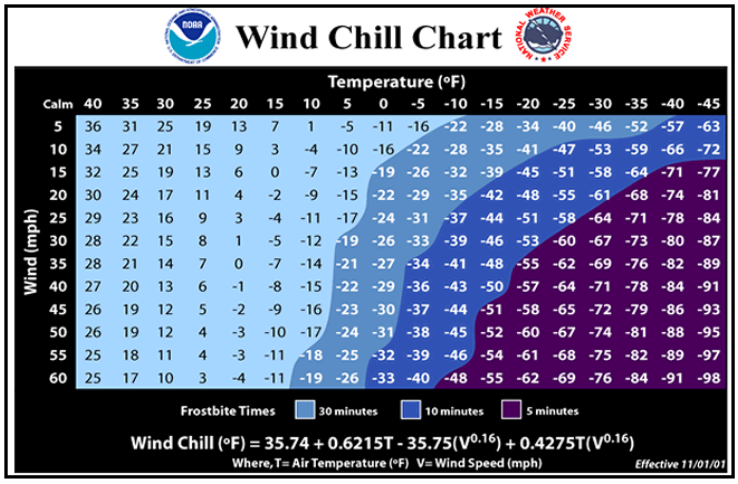
Source: NWS

Extreme cold temperatures can result in a variety of concerns, including:

- Frostbite: The freezing of skin and the body tissue just beneath it
- Hypothermia: Dangerously low body temperature (and the most common winter weather killer)

When extremely cold temperatures are accompanied by strong winds the result can be potentially lethal wind chills. Wind chill is the temperature your body feels when the air temperature is combined with the wind speed, and is based on the rate of heat loss from exposed skin caused by the effects of wind and cold. As the speed of the wind increases, it can carry heat away from your body much more quickly, causing skin temperature to drop. The wind chill chart shows the difference between the actual air temperature and the perceived temperature due to wind, and amount of time until frostbite occurs.

Chart 13: Wind Chill Chart

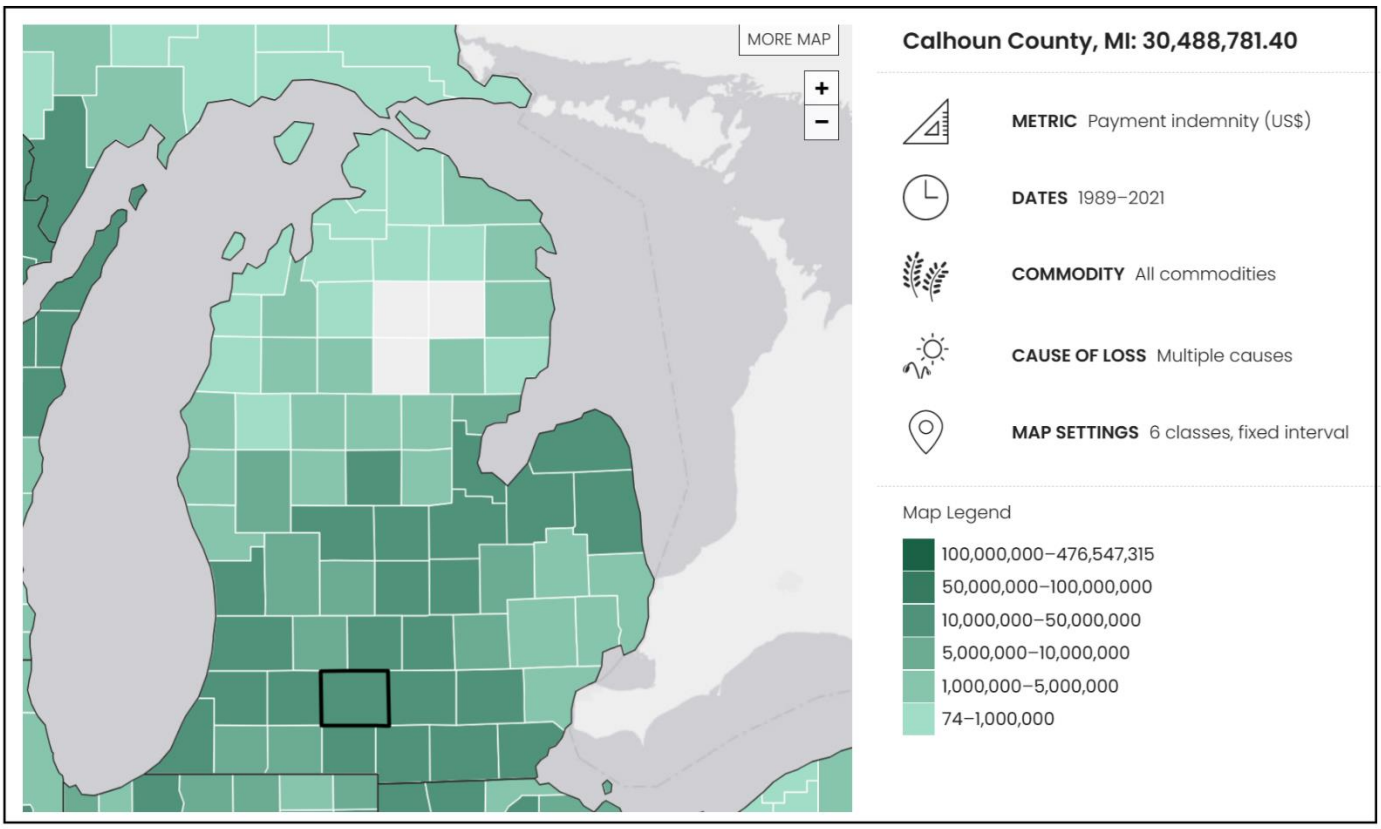


Source: NOAA

Extreme heat can cause significant damage to the local environment by dehydrating vegetation and wildlife, which may result in cascading effects to the surrounding environment, such as drought, wildfires, mudslides, or landslides. Extreme temperatures may severely decrease the yield of the agricultural sector. The yield of cash crops may be reduced, livestock may be adversely impacted by extreme heat, or grazing losses may be incurred by farmers or ranchers; potentially resulting in decreased food security. In the event of significant agricultural losses caused by extreme heat or drought, some assistance may be available to impacted farms or ranches.

Extreme heat conditions can cause significant agricultural impacts. The following map from the United States Department of Agriculture details total agricultural losses, by county, due to extreme conditions from 1989 to 2021:

Map 22: Agricultural Losses Due to Extreme Temperature Conditions, 1989 to 2021



Source: USDA

Extreme temperatures can pose various risks to local and county operations, and may include:

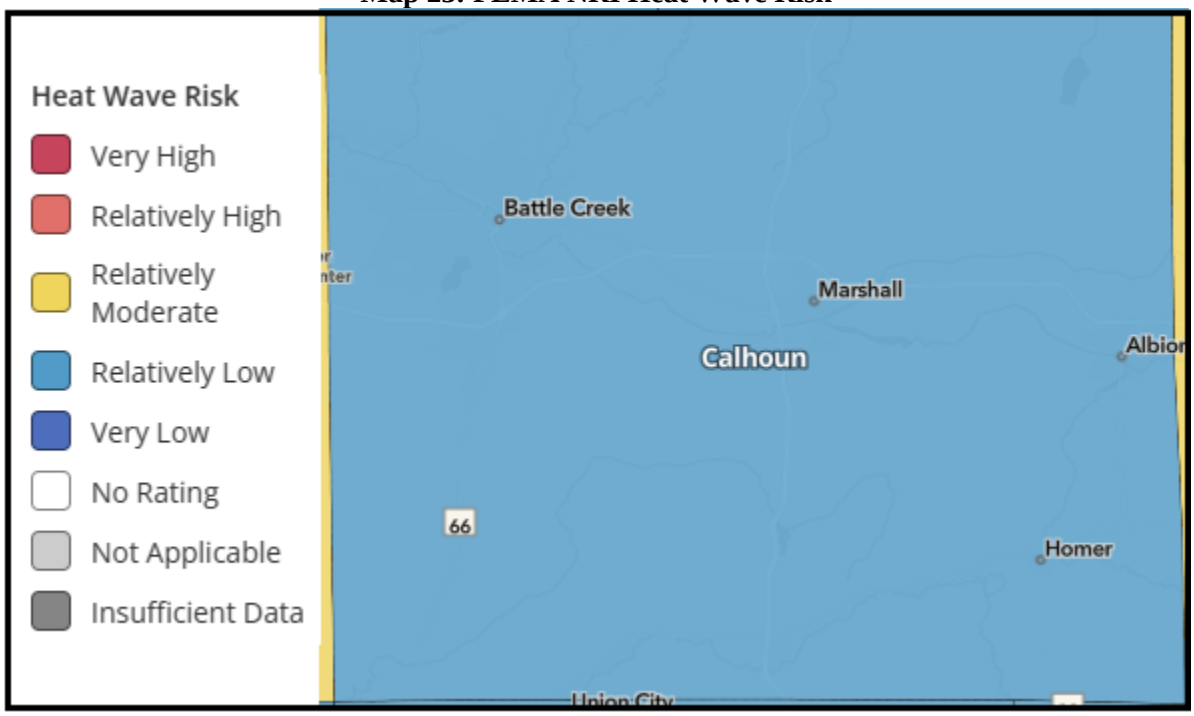
- Health and Safety Risks: High temperatures, especially during heatwaves, can pose significant health risks to government employees. Heat-related illnesses such as heat exhaustion and heatstroke can occur, potentially leading to hospitalizations or fatalities. Cold temperatures can also lead to cold-related illnesses and injuries, such as frostbite and hypothermia.
- Transportation Disruptions: Extreme heat can cause pavement to soften and buckle, leading to road closures and transportation disruptions. Extreme cold can result in icy road conditions and reduce visibility, making travel hazardous.
- Emergency Response: Government agencies may need to respond to extreme weather events, such as providing emergency shelter during heatwaves or responding to weather-related accidents and emergencies. These responses can strain resources and personnel.
- Budgetary Impact: The costs associated with responding to and mitigating the effects of extreme temperatures can strain state budgets. This includes expenses related to emergency response, infrastructure repairs, and healthcare.

While not directly vulnerable to extreme temperatures, all county assets may be vulnerable in the following ways:

- Power Grid Strain: Extreme temperatures, whether hot or cold, can lead to increased demand for electricity. This can strain the power grid, potentially causing power outages, which can disrupt government operations, including the functioning of critical infrastructure such as hospitals, emergency services, and data centers.
- Infrastructure Stress: Buildings and infrastructure can suffer damage due to extreme temperatures. For example, prolonged exposure to high temperatures can lead to structural damage, such as cracking and warping. Extreme cold can freeze and damage pipes, leading to water leaks and flooding when temperatures rise.

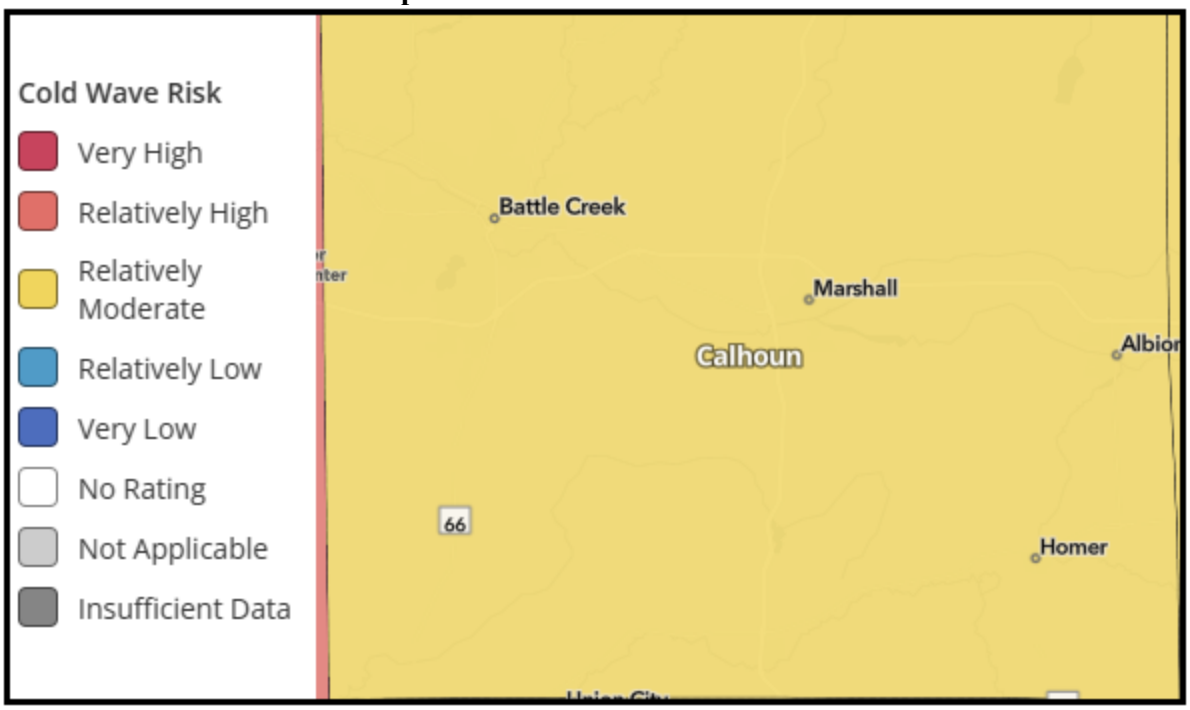
Using the FEMA NRI, and consisting of three input components (expected annual loss, social vulnerability, and community resilience), the following maps were created indicating the potential risk to Calhoun County from heat (relatively low) waves and cold waves (relatively moderate):

Map 23: FEMA NRI Heat Wave Risk



Source: FEMA NRI

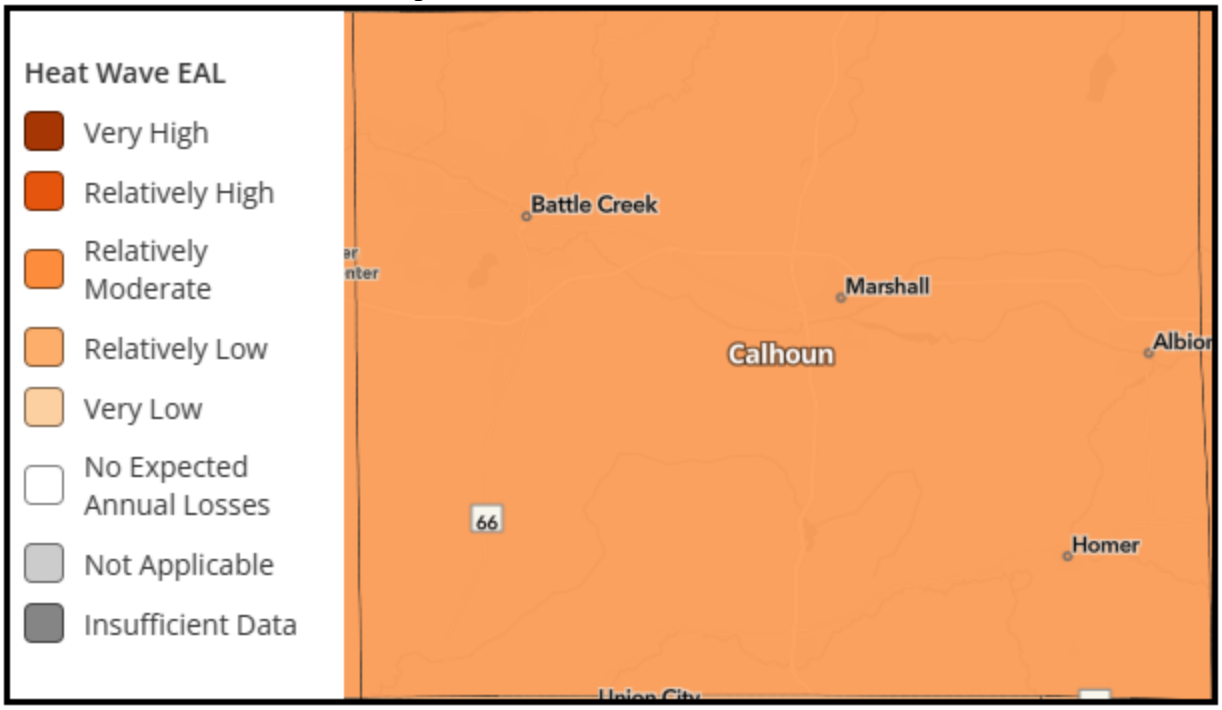
Map 24: FEMA NRI Cold Wave Risk



Source: FEMA NRI

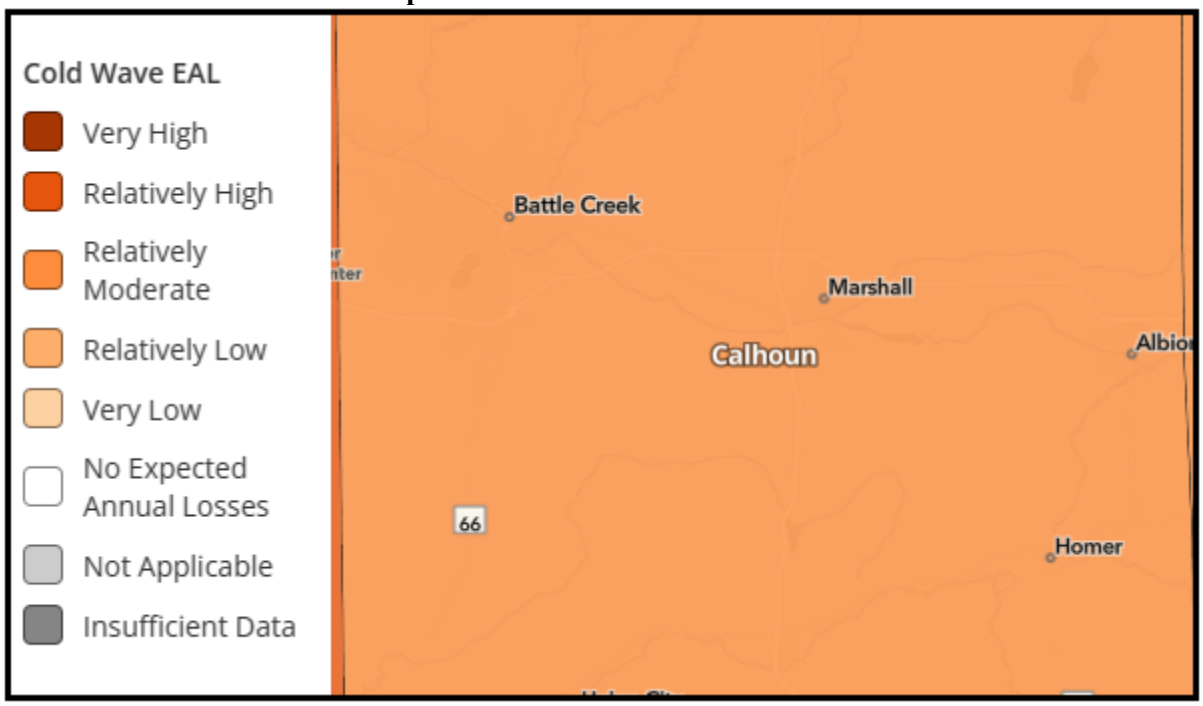
As part of the NRI, EAL represents the average economic loss in dollars resulting from natural hazards each year and is proportional to a community's risk. The following maps indicate the EAL for heat waves (relatively moderate) and cold waves (relatively moderate) for Calhoun County:

Map 25: FEMA NRI Heat Wave EAL



Source: FEMA NRI

Map 26: FEMA NRI Cold Wave EAL



Source: FEMA NRI

Potentially Vulnerable Community Lifelines

Extreme temperatures, whether excessively hot or cold, can impact various community lifelines, critical systems and services that communities rely on for their functioning. Vulnerabilities arise due to the stress that extreme temperatures place on infrastructure, resources, and operational processes.

Extreme heat and extreme cold can have significant impacts on roads, leading to various issues and challenges. The Calhoun County Road Department directly maintains and repairs 87 bridges and more than 1,300 miles of county roads. It also maintains more than 200 miles of state highways throughout Calhoun County on a contract basis.

Extreme temperatures can cause the following impacts:

- Softening of Asphalt: High temperatures can cause asphalt to soften and become more susceptible to deformation. This leads to the development of ruts and potholes as the road surface loses its stability.
- Rutting and Raveling: The combination of high temperatures and heavy traffic loads can result in rutting, where depressions or grooves form in the road surface. Raveling, the disintegration of the asphalt surface, may also occur.
- Expansion and Contraction: Materials like concrete and asphalt expand in high temperatures and contract in cooler temperatures. This expansion and contraction can lead to cracking and deterioration of the road surface over time.
- Freeze-Thaw Cycles: Fluctuations between freezing and thawing can lead to the formation of ice within the road structure. The expansion of water as it freezes can result in cracks and damage to the road surface.
- Frost Heaving: During freeze-thaw cycles, moisture in the soil beneath the road can freeze, causing the ground to heave upward. This can result in uneven surfaces and damage to the road structure.

The cost to replace a road can vary significantly based on several factors, including the type of road, local labor and material costs, the complexity of the project, and the specific requirements of the replacement. As a rough estimate, road construction costs can range from $1,000,000 to $10,000,000 million per mile.

Extreme heat and extreme cold can impact electrical utilities in various ways, potentially leading to disruptions in service. These impacts include:

- Power Outages: High temperatures can strain electrical systems, leading to increased demand for cooling systems like air conditioners. This heightened demand can overload power grids, resulting in power outages.
- Transformer Overheating: Transformers, which are crucial components in power distribution, can overheat in extreme temperatures. This can lead to malfunctions, reduced efficiency, or even failures, causing power disruptions.
- Equipment Failure: Electrical equipment, such as cables and switches, may experience higher resistance and increased stress during extreme heat, increasing the likelihood of equipment failures.
- Reduced Efficiency in Power Plants: Power generation facilities may experience reduced efficiency during heatwaves due to elevated ambient temperatures. This can affect the output of power plants and potentially lead to supply shortages.
- Icing on Power Lines: Ice accumulation on power lines can lead to increased weight, potentially causing lines to sag or break. This can result in power outages and safety hazards.
- Communication Disruptions: Both extreme heat and cold can impact communication infrastructure. For example, extreme cold can affect the performance of fiber optic cables, while extreme heat can lead to equipment failures in communication systems.

Calhoun County and participating jurisdictions use the following electrical utility providers:

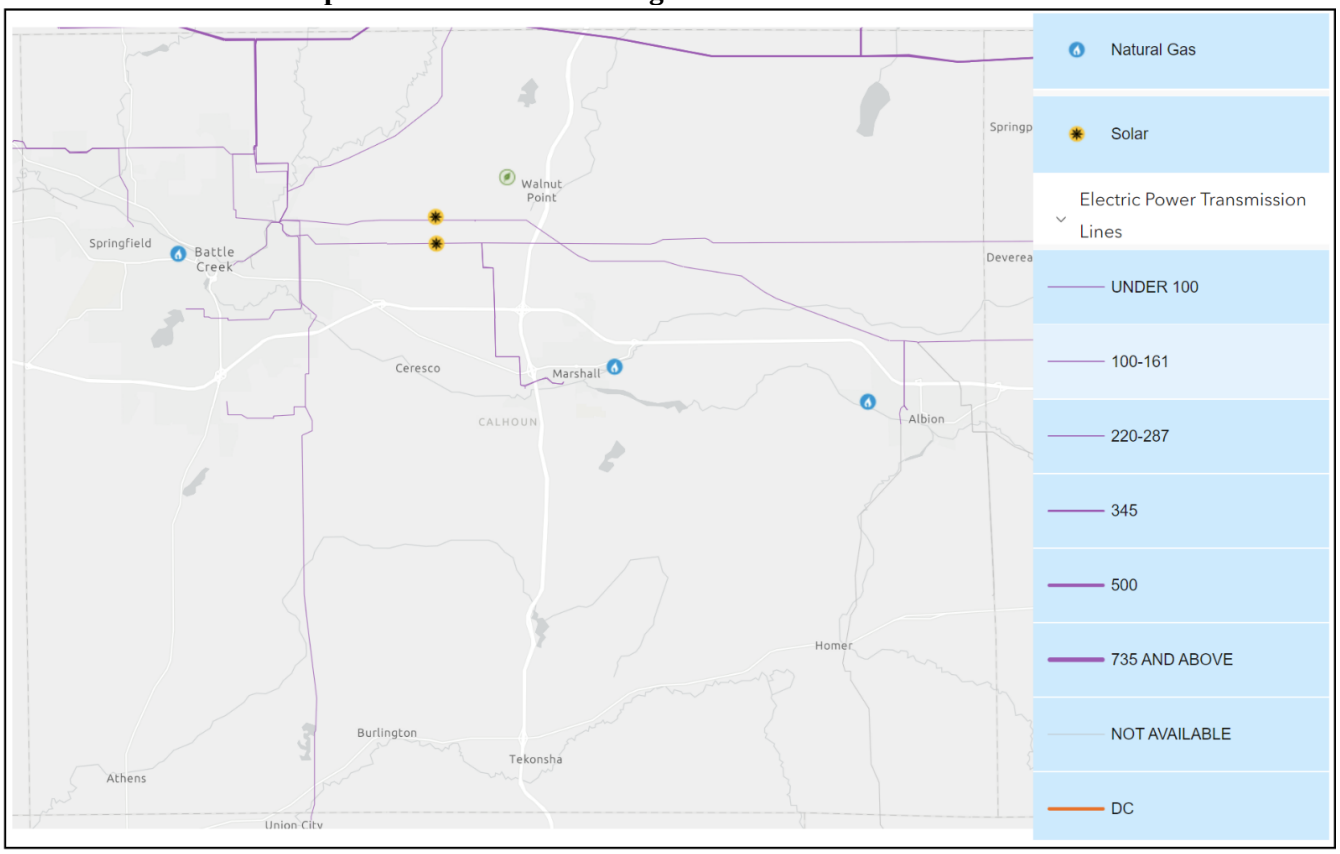
- Albion, Michigan:
  - Consumers Energy: 100.00%
- Athens, Michigan:
  - Consumers Energy: 100.00%
- Battle Creek, Michigan:
  - Consumers Energy: 100.00%
- Homer, Michigan:
  - Consumers Energy: 100.00%
- Marshall, Michigan:
  - Marshall MI Utilities: 50.00%
  - Consumers Energy: 50.00%
- Springfield, Michigan:
  - Consumers Energy: 50.00%
  - Great Lakes Energy: 50.00%
- Tekonsha, Michigan:
  - Consumers Energy: 100.00%

Electricity is generated in the county at six generation facilities, using the following methods:

- Solar: 78.22%
- Natural Gas: 16.37%
- Landfill Gas: 5.19%
- Conventional Hydroelectric: 0.23%

The following map, from the U.S. Energy Atlas, details the location of both electrical generating plants and high-capacity transmission lines within Calhoun County:

Map 27: Electrical Generating Plants and Transmission Lines



Source: U.S. Energy Atlas

The cost to replace electrical lines can vary widely based on several factors, including the type of electrical lines, the distance of the replacement, local labor and material costs, the complexity of the project, and any specific requirements or challenges involved. Additionally, costs can be significantly different for residential, commercial, or industrial projects. Additionally, urban and rural locations may have varying cost factors. As a rough estimate, the cost to replace electrical lines can range from a few thousand dollars to several thousand dollars per mile.

Major hospitals identified in Calhoun County include the Battle Creek VA Medical Center, Bronson Battle Creek Hospital, and Oaklawn Hospital. The total in-patient bed capacity of these facilities is approximately 700 beds. While these, and other smaller medical facilities, may see an increase in heat or cold related illness during an extreme temperature event, it is considered unlikely that this increase will impact or overload capacity. However, extreme temperatures can increase the demand for emergency shelters, particularly in cases of widespread power outages. Setting up and managing these shelters can strain resources.

Consequence Analysis

This consequence analysis lists the potential impacts of a hazard on various elements of community and state infrastructure. The impact of each hazard is evaluated in terms of disruption of operations, recovery challenges, and overall wellbeing to all Calhoun County residents and first responder personnel. The consequence analysis supplements the hazard profile by analyzing specific impacts.

Table 28: Extreme Temperature Consequence Analysis

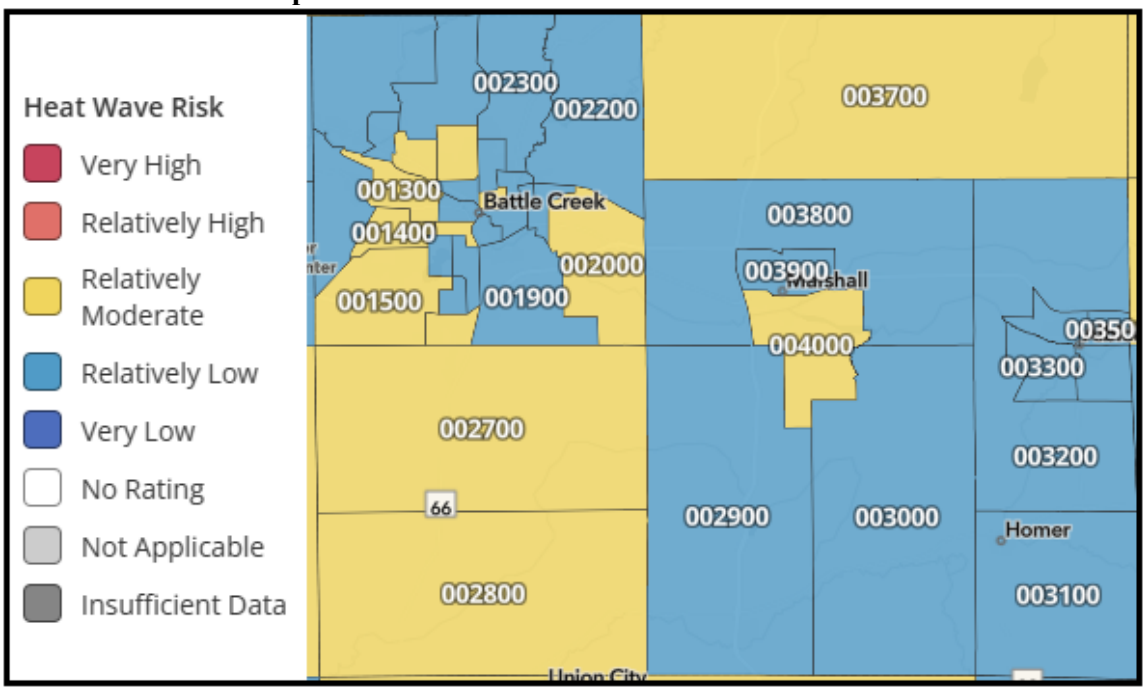
Subject	Potential Impacts
Impact on the Public	Extreme temperatures can have severe consequences for health, particularly for the elderly and young. Loss of electricity may impact heating or air conditioning leading to poorly tolerated indoor temperatures. Physical effects of extreme temperatures can cause major health problems and may lead to injury or death.
Impact on Responders	Without proper mitigation efforts, responders may be susceptible to temperature related illness. Extreme temperatures may also damage instruments or equipment necessary for response activities. First responders may face dangerous road conditions leading to accidents and prolonged response times.
Continuity of Operations	Local jurisdictions maintain continuity plans which can be enacted as necessary based on the situation. This hazard may impact an agency's ability to implement continuity operations due to power outages. If the activation of alternate facilities was required, continuity of operations may be difficult due to lack of computer/network access during power outages.
Delivery of Services	Extreme temperatures can impact efficient delivery or inability of goods or services due to potential health impacts on workers. Equipment and vehicles may be damaged, and the delivery of services may be delayed due to poor travel conditions
Property, Facilities, and Infrastructure	Facility integrity is at risk with regards to power cables and stations being overused and limiting operations. This could lead to limits on facility heating or cooling.
Impact on Environment	Extreme temperatures can cause significant damage to the local environment and result in habitat loss, invasive species, and changes in migration. Extreme temperatures may severely decrease the yield of cash crops. Livestock are adversely affected by extreme temperatures and may suffer medical problems or death.
Economic Conditions	Extreme temperatures may drain local resources. Under some conditions, some of the costs can be recouped through federal grant reimbursements.
Public Confidence in Governance	Governmental response, on all levels, requires direct actions that must be immediate and effective to maintain public confidence.

4.8.7 Jurisdictional Risk and Vulnerability

To help understand the risk and vulnerability to drought conditions of participating jurisdictions mapping from the FEMA NRI was run on a census tract level. As the NRI does not generate mapping for individual jurisdictions, census tract analysis is the closest analogue available to understand individual jurisdiction conditions.

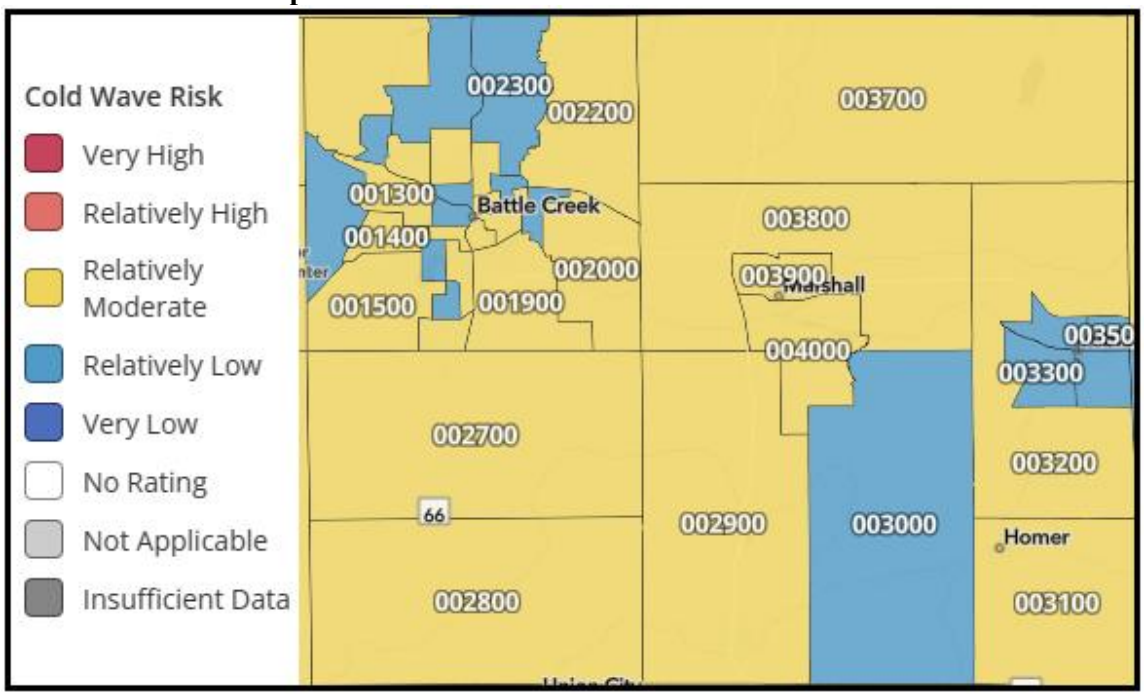
Using the FEMA NRI, and consisting of three input components (expected annual loss, social vulnerability, and community resilience), the following map was created indicating the potential risk to participating jurisdictions from extreme temperature:

Map 28: FEMA NRI Jurisdictional Heat Wave Risk



Source: FEMA NRI

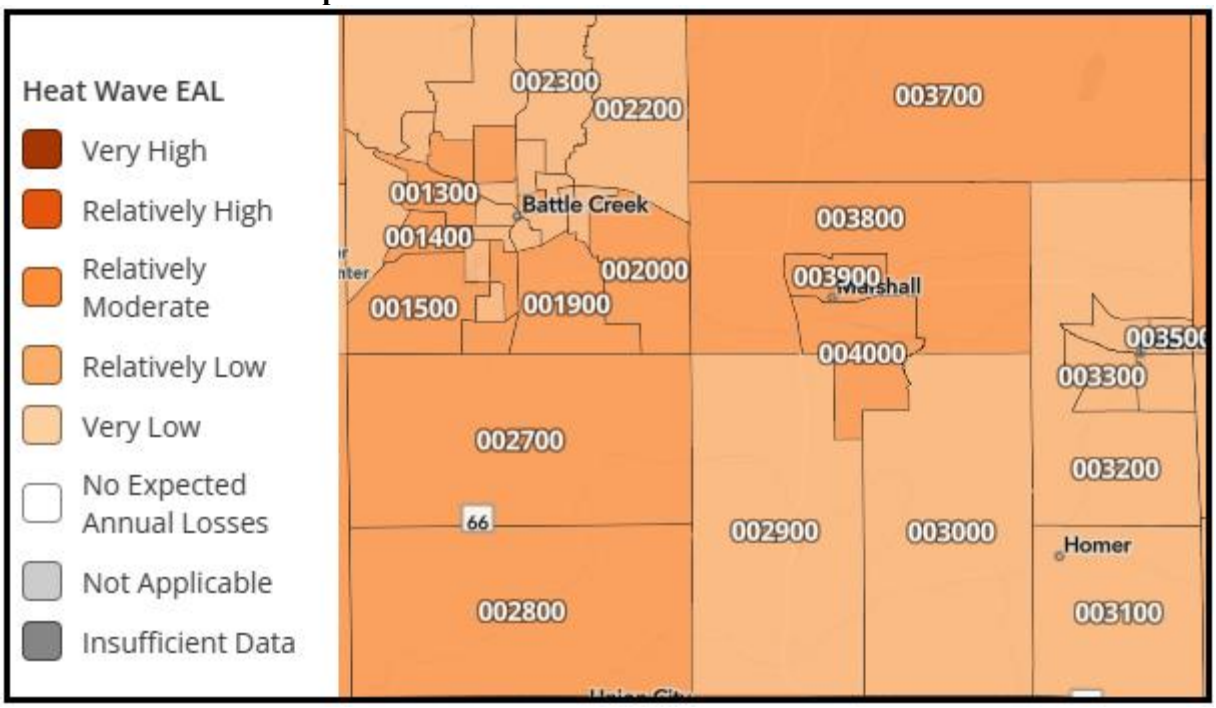
Map 29: FEMA NRI Jurisdictional Cold Wave Risk



Source: FEMA NRI

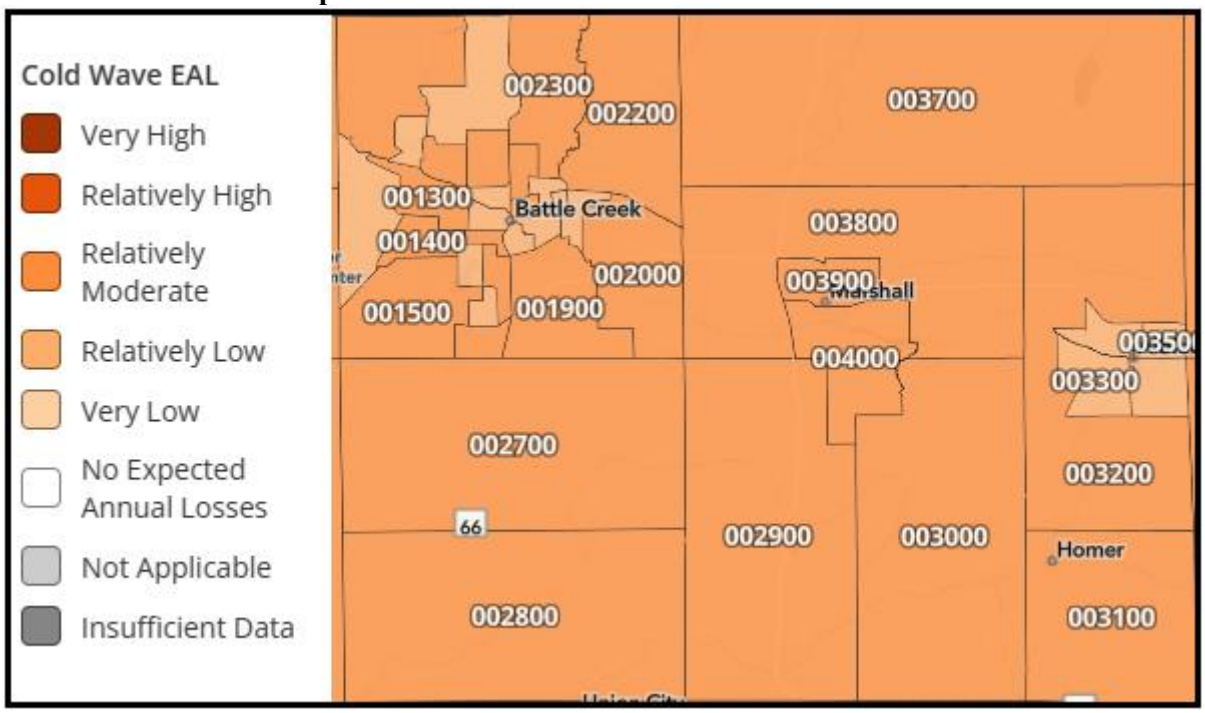
As part of the NRI, EAL represents the average economic loss in dollars resulting from natural hazards each year and is proportional to a community's risk. The following map indicates the EAL for extreme temperatures for participating jurisdictions within Calhoun County:

Map 30: FEMA NRI Jurisdictional Heat Wave EAL



Source: FEMA NRI

Map 31: FEMA NRI Jurisdictional Cold Wave EAL



Source: FEMA NRI

The following table indicates the FEMA NRI and EAL analysis for extreme temperature for each participating Calhoun County jurisdiction:

Table 29: Calhoun County EAL and NRI for Extreme Temperatures

Jurisdiction	Heat EAL	Heat Risk Index	Cold EAL	Cold Risk Index
Calhoun County	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate
City of Albion	Relatively Low	Relatively Low	Relatively Low	Relatively Low
City of Battle Creek	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate
City of Marshall	Relatively Moderate	Relatively Low	Relatively Moderate	Relatively Moderate
City of Springfield	Relatively Low	Relatively Low	Relatively Low	Relatively Low
Village of Athens	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate
Village of Burlington	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate
Village of Homer	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate
Village of Tekonsha	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate
Athens Township	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate
Emmett Charter Township	Relatively Moderate	Relatively Low	Relatively Moderate	Relatively Moderate
Leroy Township	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate
Sheridan Township	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate
Tekonsha Township	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate
NHBP	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate

Source: FEMA NRI

NRI data tables concerning extreme temperature information, by census tract, may be found in Appendix E.

Of particular concern, socially vulnerable and at-risk populations that may have difficulty with medical issues, poverty, extremes in age are often at increased susceptibility to the impacts of hazards. These populations suffer a disproportionate impact due to:

- Inadequate access to heating or cooling
- Constrained financial resources
- Limited access to healthcare

The following table details identified socially vulnerable and at-risk populations for participating Calhoun County jurisdictions:

Table 30: Potential at Risk Population Data

Jurisdiction	Population 5 and Under (2021)	Population Over 65 (2021)	Estimated People in Poverty (2021)
Calhoun County	7,977 (5.9%)	23,659 (17.6%)	17,197 (12.8 %)
Albion	649 (8.4%)	978 (12.7%)	2,195 (28.5%)
Athens	77 (8.2%)	141 (15.1%)	100 (10.7%)
Battle Creek	3,659 (6.9 %)	8,131 (15.4 %)	11,599 (22.0 %)
Burlington	11 (3.9%)	57 (20.3%)	42 (14.9%)
Homer	120 (7.6%)	159 (10.1%)	250 (15.9 %)
Marshall	360 (5.3%)	1,521 (22.2%)	553 (8.1%)
Springfield	373 (7.0 %)	686 (13.0 %)	1,196 (22.4 %)
Tekonsha	22 (3.4%)	84 (12.8%)	158 (24.2%)
Athens Township	107 (4.4%)	554 (22.7%)	221 (9.0%)
Emmett Charter Township	352 (3.0%)	2,637 (22.4%)	966 (8.2%)
Leroy Township	345 (9.3%)	677 (18.2%)	257 (6.9%)
Sheridan Township	95 (5.2%)	310 (17.1%)	217 (12.0%)
NHBP*	4 (4.8%)	11 (13.3%)	20 (25.3%)

Source: United States Census Bureau

*: Data indicates total tribal population living on Tribal Reservation. Information provided by NHBP Planning Department

All jurisdictional facilities are at potential risk to extreme temperature conditions, however this hazard is not expected to impact the structural integrity of a facility. Of particular concern are extremely low temperatures, which may result in frozen and broken pipes resulting in water damage to facilities. Additionally, all jurisdictional assets may be vulnerable in the following ways:

- Power Grid Strain: Extreme temperatures, whether hot or cold, can lead to increased demand for electricity. This can strain the power grid, potentially causing power outages, which can disrupt government operations, including the functioning of critical infrastructure such as hospitals, emergency services, and data centers.
- Infrastructure Stress: Buildings and infrastructure can suffer damage due to extreme temperatures. For example, prolonged exposure to high temperatures can lead to structural damage, such as cracking and warping. Extreme cold can freeze and damage pipes, leading to water leaks and flooding when temperatures rise.

4.9 Flood

4.9.1 Hazard Description

Flooding, as defined by the National Weather Service (NWS), is the rising and overflowing of a body of water onto normally dry land. It can result from any overflow of inland or tidal waters, or an unusual accumulation or runoff of surface waters from any source. Flooding is loosely classified as inland, riverine, or coastal.

Inland flooding, also known as "urban flooding" or "flash flooding," can be caused by intense, short-term rain or by moderate rainfall over several days, which can overwhelm existing drainage infrastructure. Other factors that affect the dynamics of this type of flood include slope, width, and vegetation in place along the watercourse banks. The slope that a flash flood traverses has a definite relationship to the overall speed in which the water will travel. The incline on which the water moves affects the width of the flooding area. Generally, the faster the water moves, the narrower the channel that will be created, since the water digs the channel deeper as it flows. When water flows over a shallower slope, it tends to spread out more, decreasing its potential to cause mass damage but still considered dangerous. Finally, the type of vegetation located along the flood's path can prevent further erosion of the channel banks. A structure that lies along a flood channel with no surrounding vegetation is at risk of having its foundation undercut, which can cause structural damage, or in some cases, a building's complete collapse. Riverine or alluvial, flooding occurs when excessive rainfall over an extended period of time causes a river to exceed its capacity. Typical causes of flooding, both inland and riverine, include tropical cyclonic systems, frontal systems, and isolated thunderstorms combined with other environmental variables such as changes to the physical environment, topography, ground saturation, soil types, basin size, drainage patterns, and vegetative cover. The rate of onset and duration of flooding events depends on the type of flooding (typical flood or flash flood). The spatial extent of a flooding event depends on the amount of water overflowing but can usually be mapped because of existing floodplains.

A floodplain is a flat or nearly flat land adjacent to a river or stream that experiences occasional or periodic flooding. Floodplains, or Special Flood Hazard Areas (SFHAs), are made when floodwaters exceed the capacity of the main channel or escape the channel by eroding its banks. Floodplains also include a floodway, which consists of the water channel and adjacent areas that carry flood flows and the flood fringe, which are areas covered by the flood but do not experience a strong current.

In its common usage, floodplains refer to areas inundated by the 100-year flood, i.e., the flood that has a 1% chance of being equaled or exceeded in any given year and the 500-year flood, i.e., the flood that has a 0.2% chance of being equaled or exceeded in any given year. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program (NFIP). Because these maps were often produced decades ago, the probabilities calculated when originally produced may understate the current probability of flooding, possibly by and order of magnitude. The NFIP aims to reduce the impact of flooding on private and public structures. It does so by providing affordable insurance to property owners, renters, and businesses and by encouraging communities to adopt and enforce floodplain management regulations. These efforts help mitigate the effects of flooding on new and improved structures. Overall, the program reduces the socio-economic impact of disasters by promoting the purchase and retention of general risk insurance and flood insurance.

The adverse impacts of flooding can include structural damage; agricultural crop loss; the death of livestock; loss of access to critical facilities due to roads being washed out or overtopped; unsanitary conditions resulting from materials such as dirt, oil, solvents, and chemicals being deposited during the recession; infestations of disease-carrying mosquitoes; mold and mildew, which pose a severe health risk to small children and the elderly; and temporary

backwater effects in sewers and drainage systems. Raw sewage is a breeding ground for bacteria, such as E. coli and other disease-causing agents. A boil order may need to be issued to protect people and animals from contaminated water.

Of equal concern is the long-term psychological effect that flooding has on the people impacted by it. They must contend with the loss of life, property, livelihood, etc., as they cope with the aftermath. The clean-up can take months. The cost to restore a home may be too much, especially for the unprepared or uninsured. Plus, there is the looming fear that it may flood again. The resulting stress on floodplain residents takes its toll in the form of aggravated physical and mental health problems.

Unfortunately, the risks from future floods are significant, given expanded development in coastal areas and floodplains, unabated urbanization, land-use changes, and climate change. Because of this, flooding may intensify in many regions across the country, even in areas where total precipitation is projected to decline.

According to the FEMA, water, and flooding account for about 40% of the Presidential declared disasters in the United States.

4.9.2 Location and Extent

A variety of factors affect the severity of flash and riverine flooding within the planning area. These include topography, weather characteristics, development, and geology. Intense flooding will create havoc in any jurisdiction affected. The predicative magnitude of flash and riverine floods varies greatly.

Flash Flooding

Flash flooding occurs during heavy or extended periods of rain, generally when the ground is unable to rapidly absorb the water. Most flash flooding in Calhoun County is caused by intense and stationary thunderstorms or rapid snow melting. Heavy sustained rain or rapidly melting snow can create rapid flooding very quickly, and flooding can occur miles away from where the rain fell. Factors that can contribute to the severity of flash flooding include rainfall intensity, duration, drainage condition, and ground conditions (paved or unpaved). Flash floods are particularly dangerous to people and property, as six inches of moving water can knock a person down and two feet can lift a vehicle. As there is often little warning of a flash flood event, they are the cause of most flood fatalities.

Riverine Flooding

Riverine flooding refers to the overflow of water from a river or a stream onto adjacent land areas. This type of flooding occurs when the water level in a river or stream rises significantly and exceeds its banks, inundating the surrounding areas. The severity of riverine flooding can be influenced by the amount and intensity of rainfall in the watershed, the size, shape, and slope of the river or stream channel, and the presence of dams on the river system.

Urban Flooding

FEMA defines urban flooding as ‘the inundation of property in a built environment, particularly in more densely populated areas, caused by rain falling on increased amounts of impervious surfaces and overwhelming the capacity of drainage systems.” In Calhoun County, urban flooding has consistently increased due to a number of factors, including the filling for development of natural wetlands and waterways, the reduction of permeable surfaces, and the aging and insufficient capacity of stormwater systems.

To establish floodplains, FEMA adopted the Base Flood Elevation (BFE), which is the computed elevation that floodwater is anticipated to rise during a flood that has a1% chance of occurring in any given year. The BFE establishes the regulatory requirement for the elevation or floodproofing of structures, and the relationship between the BFE and a given structure’s elevation determines the flood insurance premium through the National Flodd Insurance Program (NFIP).

FEMA, through the Risk Mapping, Assessment, and Planning (Risk MAP) program, FEMA works with partners to assess and map these flood risks (Flood Insurance Rate Maps (FIRMs). As an additional benefit, the FIRMs serve as the basis for National Flood Insurance Program (NFIP) regulations and flood insurance purchase requirements.
Special Flood Hazard Areas (SFHAs) are defined as the area that will be inundated by the flood event having a 1% chance of being equaled or exceeded in any given year. The 1% annual chance flood is also referred to as the base flood or 100-year flood. The FIRM depicts the SFHA, including the 1%-annual-chance flood. These areas are labeled on the map as zone, as explained in the following table:

The following table details FEMA's FIRM flood zone classifications.

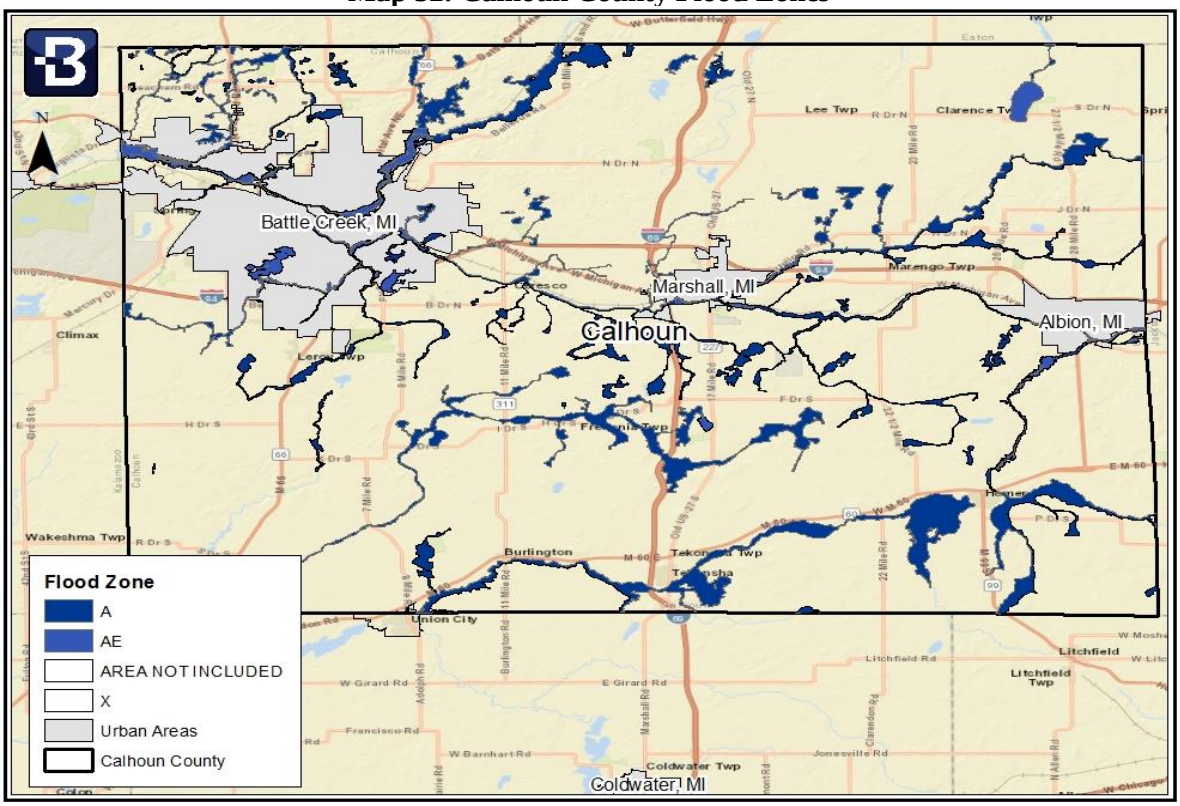
Table 31: Flood Zone Classifications

Zone	Description
A	The 1%-annual-chance or base floodplain. There are six (6) types of A Zones.
AE	The base floodplain where base flood elevations are provided.
AH	Shallow flooding base floodplain. BFEs are provided.
AO	The base floodplain with sheet flow, ponding, or shallow flooding. Base flood depths are provided.
AR	The base floodplain that results from the decertification of a previously accredited flood protection system that is in the process of being restored to provide a 1%-annual-chance or greater level of flood protection.
A99	Area to be protected from base flood by levees or Federal Flood Protection Systems under construction. BFEs are not determined.
B or Shaded X	Areas between the limits of the base flood and the 0.2% annual-chance (or 500-year) flood.
C or Unshaded X	Areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2% annual-chance flood

Source: FEMA

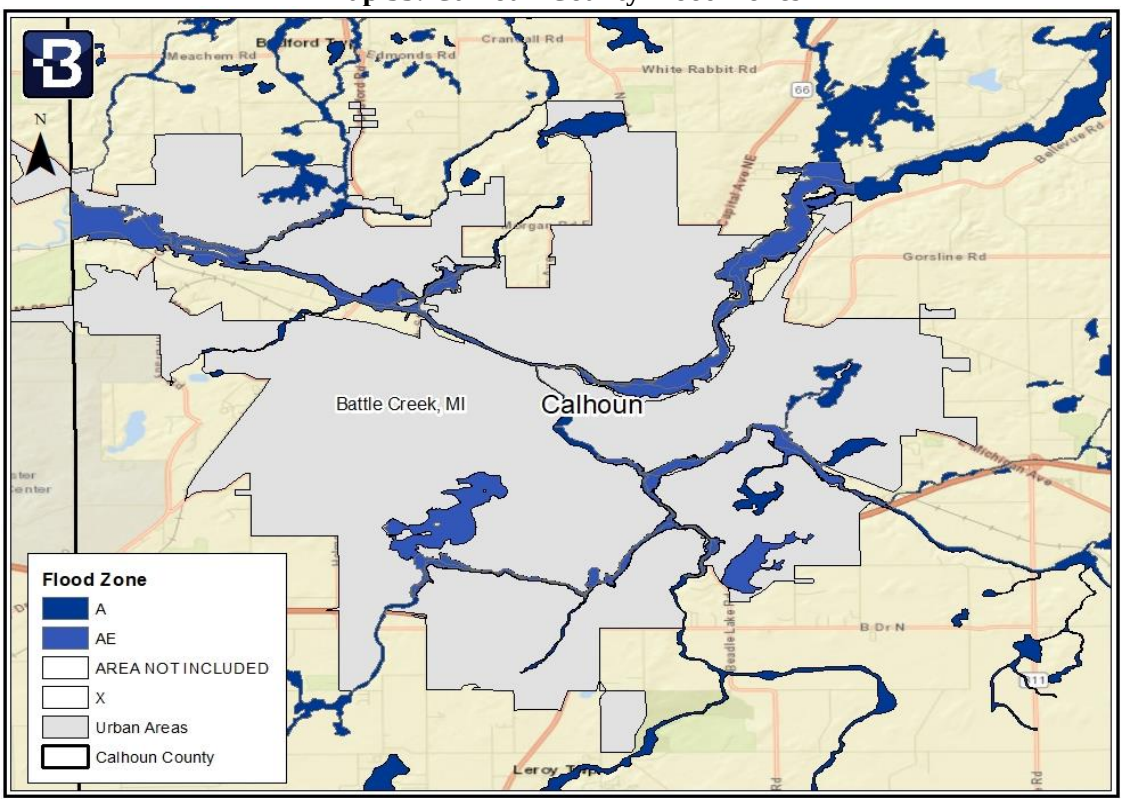
The following maps use FEMA FIRM data to depict the location of identified flood zones within Calhoun County.

Map 32: Calhoun County Flood Zones



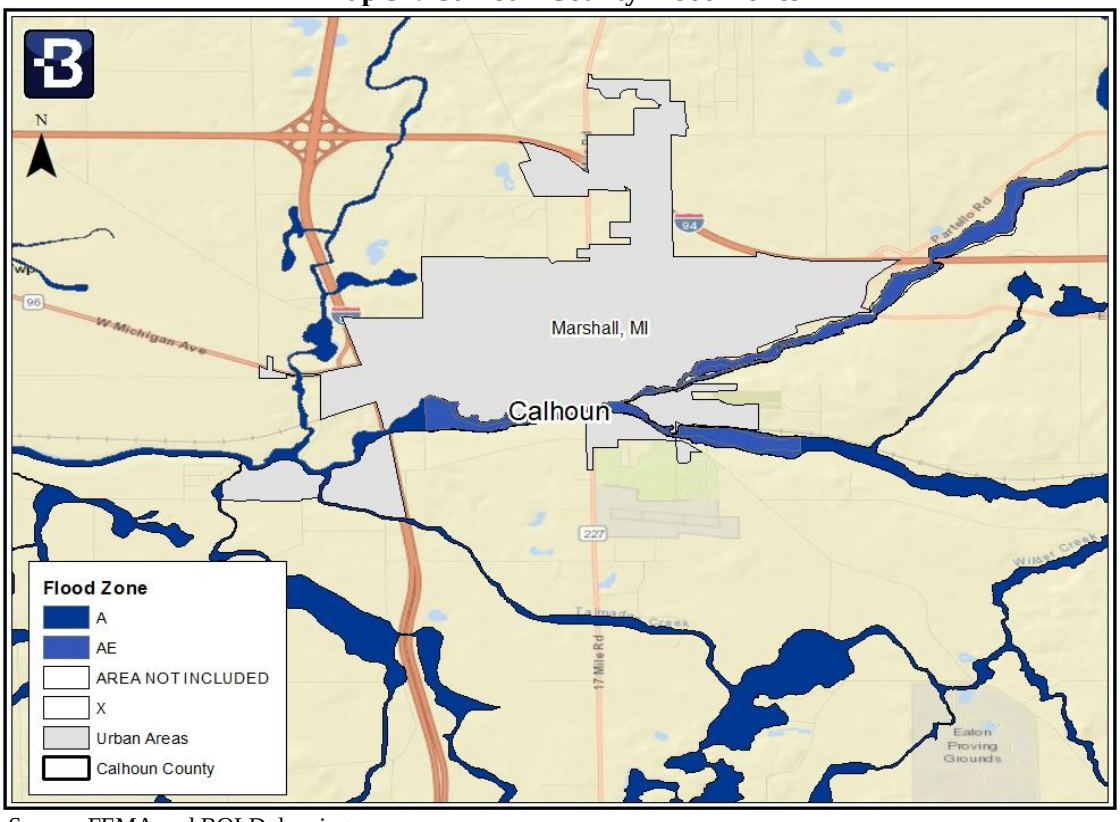
Source: FEMA and BOLDplanning

Map 33: Calhoun County Flood Zones



Source: FEMA and BOLDplanning

Map 34: Calhoun County Flood Zones



Source: FEMA and BOLDplanning

4.9.3 Previous Occurrences

The following table presents NCEI identified flood events and the resulting damage totals in Calhoun County from 2003 to 2022. with the years 2003 and 2022 being full dataset years.

Table 32: Calhoun County NCEI Flood and Flash Flood Events, 1950 - 2023

Jurisdiction	Event Type	Number of Days with Events	Property Damage	Deaths	Injuries
Calhoun County (total)	Flood	6	$6,210,000	0	0
	Flash Flood	6	$425,000	0	0

Source: NCEI

The following provides both local accounts and NCEI descriptions of notable recorded events:

- **April 17, 2013, Calhoun County**: Significant flooding occurred on rivers and streams across Calhoun County due to heavy rainfall and antecedent high river levels and saturated grounds. Damage estimates exceed $5,000,000, but Calhoun County specific damage totals were unavailable.
- **June 6, 2010, Battle Creek**: Calhoun County emergency management reported cars stalled in floodwaters in downtown Battle Creek. The road commission closed several roads due to washouts and flooding. Damages were estimated at $100,000.
- **May 21, 2004, Calhoun County**: Flooding in mid-May resulted in very high river levels and the ground was saturated on the 20th. Numerous thunderstorm complexes and areas of heavy rainfall developed repeatedly in the vicinity of a quasi-stationary frontal boundary draped across southern lower Michigan. Damages were estimated at $1,000,000.
- **May 26, 2000, Calhoun County**: Several severe thunderstorms produced flooding in several areas, and also caused a wall of a bowling alley to collapse (no injuries or fatalities). The road commission closed several roads due to washouts and flooding. Damages were estimated at $150,000.

4.9.4 Probability of Future Incidents

The definition of each flood zone's classification is used for the purpose of calculating the yearly probability of a riverine flood. Jurisdictions with property in a 100-year floodplain can expect a 1% annual chance of flooding within the designated areas. Jurisdictions with property in a 500-year floodplain can expect a 0.2% annual chance of flooding within the designated areas. Further, data from the NCEI indicates that Calhoun County can expect on a yearly basis, relevant to riverine flood events:

Table 33: Calhoun County Riverine Flood Probability Summary

Data	Days
Number of Days with NCEI Reported Event (1950-2023)	6
Average Events per Year	<1

Source: NCEI

Data from the NCEI indicates that Calhoun County can expect on a yearly basis, relevant to flash flood events:

Table 34: Calhoun County Flash Flood Probability Summary

Data	Days
Number of Days with NCEI Reported Event (1950-2023)	6
Average Events per Year	<1

Source: NCEI

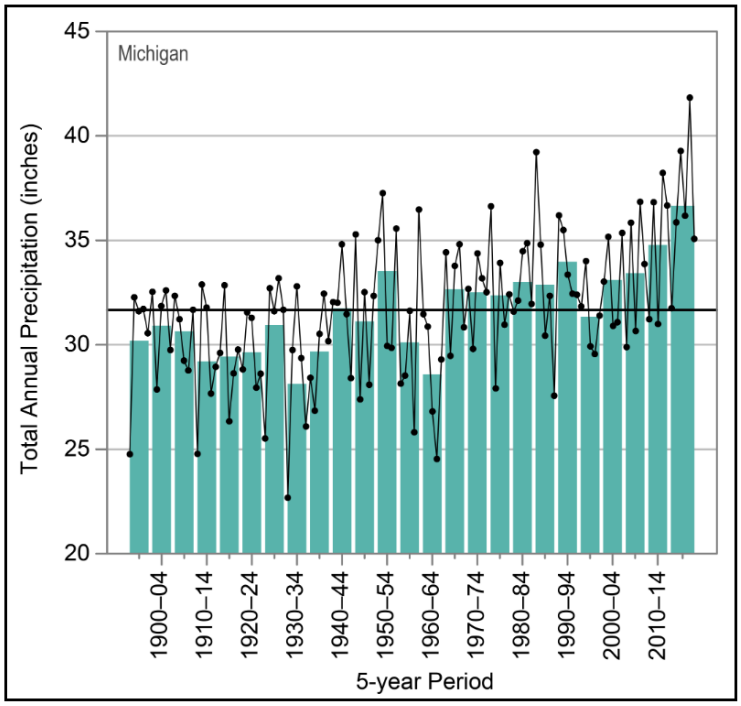
4.9.5 Projected Changes in Location, Intensity, Frequency, and Duration

Available data indicates that the impacts of climate change upon Calhoun County's built and natural environments are wide-ranging and, in many cases, growing in severity. Related to flooding, models suggest that the county and all participating jurisdictions will experience more extreme and intense precipitation events. The NOAA NCEI Summary

2022 for Michigan indicates that the frequency of extreme precipitation events has increased. Multiyear averages for two-inch extreme precipitation events for the 2010–2014 and 2015–2020 periods are the highest on record. The frequency and intensity of extreme precipitation are also projected to increase, potentially increasing the frequency and intensity of floods. Springtime flooding, in particular, could pose a threat to Michigan's important agricultural industry by delaying planting and threatening yield losses. Under a higher emissions pathway, it is expected that Calhoun County will see a continued increase in frequency and intensity of extreme precipitation events.

The NOAA NCEI State Climate Summary 2022 for Michigan indicates that the total annual precipitation has generally been above average in recent decades, as indicated by the following chart:

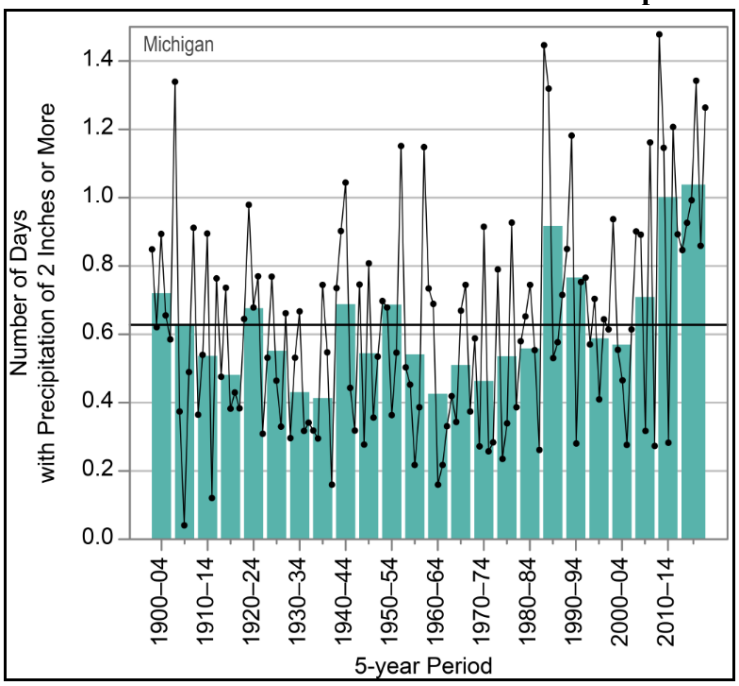
Chart 14: Michigan Total Annual Precipitation



Source: NOAA NCEI Summary 2022 for Michigan

Additionally, the NOAA NCEI State Climate Summary 2022 for Michigan indicates that the number of 2-inch extreme precipitation events has been increasing since 2000, as indicated by the following chart:

Chart 15: Observed Number of Two-Inch Extreme Precipitation Days



Source: NOAA NCEI Summary 2022 for Michigan

Calhoun County's current land-use regulations require the consideration of flood hazards during the development review process. Additionally, the generally static, or declining, nature of population growth during the past ten years in all participating jurisdictions indicates that both current and future development may decline. As such, the vulnerability to flood events may decrease.

4.9.6 Vulnerability and Impact

Data from the NCEI indicates that Calhoun County can expect on a yearly basis, relevant to riverine flood events:

Table 35: Calhoun County Riverine Flood Impact Summary

Data	Recorded Impact
Deaths or Injuries (1950-2023)	0
Average Number of Deaths or Injuries	0
Total Reported NCEI Property Damage (1950-2023)	$6,210,000
Average Property Damage per Year	$83,919

Source: NCEI

Data from the NCEI indicates that Calhoun County can expect on a yearly basis, relevant to flash flood events:

Table 36: Calhoun County Flash Flood Impact Summary

Data	Recorded Impact
Deaths or Injuries (1950-2023)	0
Average Number of Deaths or Injuries	0
Total Reported NCEI Property Damage (1950-2023)	$425,000
Average Property Damage per Year	$5,743

Source: NCEI

The results of the HAZUS analysis were utilized to estimate potential losses for riverine flooding. The intent of this analysis was to enable Calhoun County to estimate where flood losses could occur and the degree of severity using a consistent methodology. The HAZUS model helps quantify risk along known flood-hazard corridors as well as lesser streams and rivers that have a drainage area of 10 square miles or more. HAZUS®, version 5.0, was used to perform

the analysis for Calhoun County using essential facility data available through HAZUS databases and HIFLD data. The analysis was completed by BOLDplanning. For this hazard, the risk assessment data and maps involved were from an analysis of 1% annual chance flood event (100-Year Flood). The reported losses are based upon essential facility and census data as part of HAZUS. We are also mapping updated essential facilities provided by Calhoun County Emergency Management in relation to the flooded areas from HAZUS Level One modeling efforts.

HAZUS determines the displaced population based on the inundation area, not necessarily impacted buildings. As a result, there may be a population vulnerable to displacement even if the structure is not vulnerable to damage. Individuals and households will be displaced from their homes even when the home has suffered little or no damage either because they were evacuated or there was no physical access to the property because of flooded roadways.

Flood sheltering needs are based on the displaced population, not the damage level of the structure. HAZUS determines the number of individuals likely to use government-provided short-term shelters through determining the number of displaced households as a result of the flooding. To determine how many of those households and the corresponding number of individuals will seek shelter in government-provided shelters, the number is modified by factors accounting for income and age. Displaced people using shelters will most likely be individuals with lower incomes and those who do not have family or friends within the immediate area. Since the income and age factors are taken into account, the proportion of displaced population and those seeking shelter will vary from county to county.

Additionally, HAZUS takes into account flood depth when modeling damage (based on FEMA's depth-damage functions). Generated reports capture damage by occupancy class (in terms of square footage impacted) by damage percent classes. Occupancy classes include agriculture, commercial, education, government, industrial, religion, and residential. Damage percent classes are grouped by 10 percent increments up to 50%. Buildings that sustain more than 50% damage are considered to be substantially damaged.

The following table provides the HAZUS results for vulnerable populations and the population estimated to seek short term shelter as well as the numbers of damaged and substantially damaged buildings for Calhoun County.

Table 37: Calhoun County HAZUS Flood Scenario Displaced Population Building Damages

Displaced Population	Persons Seeking Shelter	Damaged Buildings	Destroyed Buildings
538	3,675	407	**54**

Source: FEMA HAZUS

Especially critical is timely evacuation orders, and adherence to those orders. If evacuation is not heeded, or flood waters rise quickly enough, citizens could drown or become trapped for extended periods of time with no access to services or medical care. Of special concern are long term care and medical facilities where it can take longer to evacuate, or evacuation may be impossible. Additionally, lower income citizens may not have the means to relocate, whether it be lack of transportation or lack of resources to afford temporary shelter. Expected impacts of flooding on citizens may include:

- Loss of Life: Flooding is one of the leading causes of weather-related fatalities worldwide. Fast-rising floodwaters can lead to drowning and other water-related accidents, resulting in the tragic loss of lives.
- Injuries: Floods can cause injuries due to waterborne diseases, contaminated floodwaters, debris, and accidents during evacuation or rescue operations.
- Displacement: Many people may be forced to evacuate their homes during floods and will require emergency shelter or temporary housing. Prolonged displacement can be emotionally and economically challenging.
- Health Risks: Floodwaters often contain pollutants, sewage, and hazardous materials. Exposure to contaminated water can lead to waterborne diseases, infections, and other health risks.
- Mental Health Effects: Survivors of floods may experience a range of emotional and psychological challenges, including post-traumatic stress disorder, anxiety, depression, and grief.

- Food and Water Shortages: Floods can contaminate water supplies and disrupt the distribution of food. This can lead to shortages of clean drinking water and essential food items.
- Impact on Vulnerable Populations: Vulnerable populations, including the elderly, children, people with disabilities, and those living in poverty, are often disproportionately affected by floods due to limited resources and mobility challenges.
- Long-Term Consequences: Some flood impacts, such as mold growth, structural damage, and land degradation, can have long-term consequences that persist even after the floodwaters recede.

Floods can have significant and often costly impacts on facilities and critical infrastructure. These impacts can disrupt essential services, damage infrastructure, and pose safety risks. The extent of the impact depends on factors such as the severity of the flood, the preparedness of the infrastructure, and the effectiveness of flood management measures. Here are some of the common impacts of floods on facilities and critical infrastructure:

- Structural Damage: Floodwaters can cause extensive damage to buildings, including critical infrastructure such as power plants, water treatment facilities, hospitals, and transportation hubs. The force of moving water can weaken foundations, erode structural elements, and compromise the integrity of buildings.
- Electrical and Mechanical Systems: Floodwaters can damage electrical systems, including transformers, switchgear, and electrical panels, leading to power outages and the disruption of critical services. Mechanical systems, such as heating, ventilation, and air conditioning, may also be affected.
- Water and Wastewater Infrastructure: Floods can overwhelm water supply and wastewater treatment systems. Contamination of drinking water sources can lead to water shortages and health risks, while damage to wastewater treatment plants can result in the discharge of untreated sewage into water bodies.
- Transportation Networks: Floods can damage roads, bridges, railways, and airports, making transportation difficult or impossible.
- Communication Infrastructure: Floods can disrupt telecommunications and internet services, hindering communication among emergency responders and the public. Loss of communication can impede coordination and response efforts.
- Healthcare Facilities: Damage to healthcare infrastructure can limit the capacity to provide medical care during a crisis.
- Energy Infrastructure: Floods can damage power generation facilities, including hydroelectric dams and power plants, leading to power outages and potential safety hazards.

HAZUS analysis also provides an estimate of the repair costs for impacted buildings as well as the associated loss of building contents and business inventory. Building damage can also cause additional losses to a community by restricting a building's ability to function properly. Income loss data accounts for losses such as business interruption and rental income losses as well as the resources associated with damage repair and job and housing losses. These losses are calculated by HAZUS using a methodology based on the building damage estimates.

The damaged building counts generated by HAZUS are susceptible to rounding errors and are likely the weakest output of the model due to the use of census blocks for analysis. Generated reports include this disclaimer: "Unlike the earthquake and hurricane models, the flood model performs its analysis at the census block level. This means that the analysis starts with a small number of buildings within each census block and applies a series of distributions necessary for analyzing the potential damage. The application of these distributions and the small number of buildings make the flood model more sensitive to rounding errors that introduces uncertainty into the building count results." Additionally, losses are not calculated for individual buildings, but instead are based on the performances of entire classes of buildings obtained from the general building stock data. In the flood model, the number of grid cells (pixels) at each flood depth value is divided by the total number of grid cells in the census block. The result is used to weight the flood depths applied to each specific occupancy type in the general building stock. First floor heights are then applied to determine the damage depths to analyze damages and losses.

The following table provides the HAZUS results for building damages and business interruption loss due to these damages.

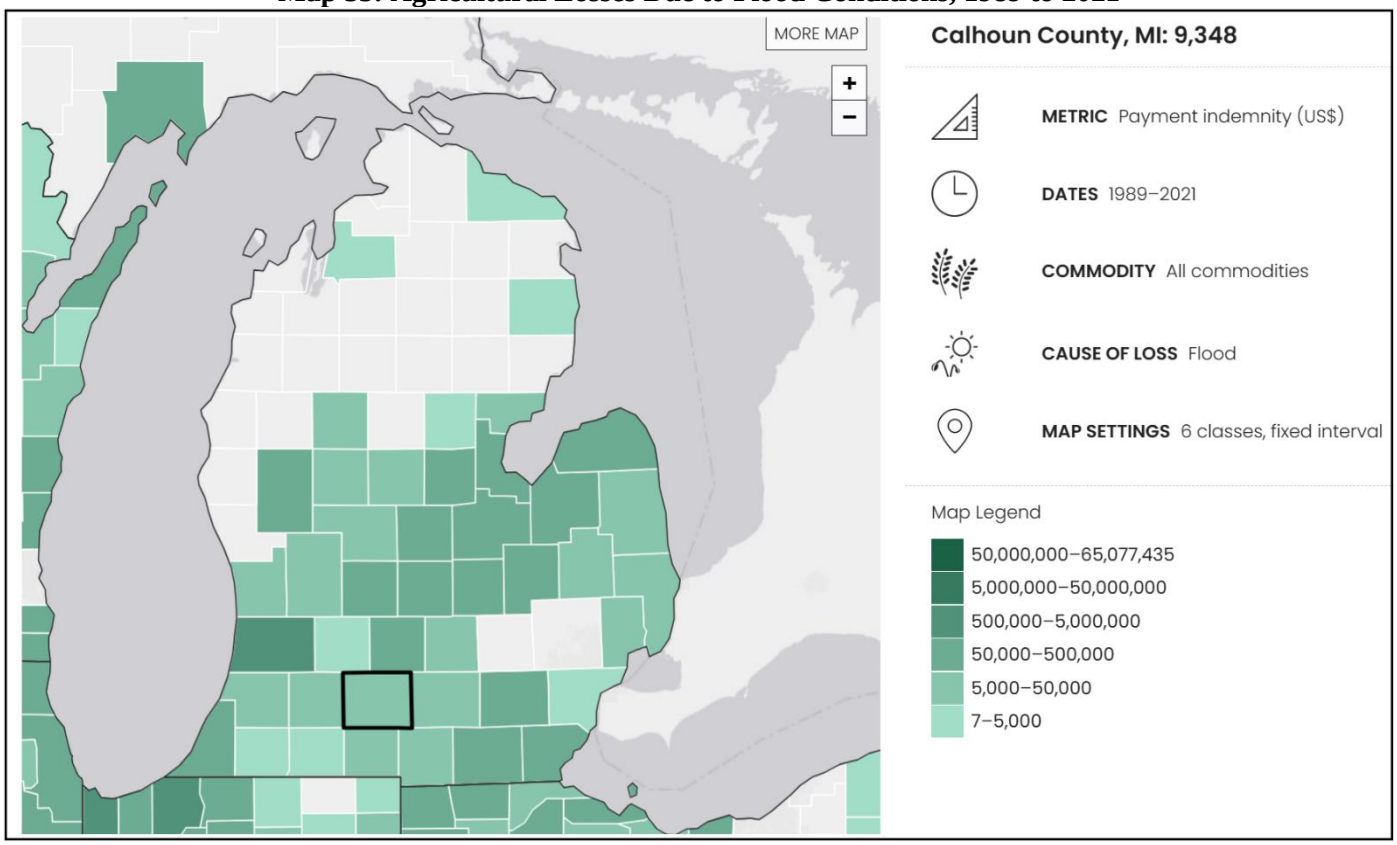
Table 38: Calhoun County HAZUS Flood Scenario Structural Damage and Income Loss

Structural Damage	Contents Damage	Inventory Loss	Total Direct Loss	Total Business Interruption Loss	Total Loss
$203,900,000	$522,300,000	$52,120,000	$54,880,000	$1,250450,000	$2,028,760,000

Source: FEMA HAZUS

Flood conditions can cause significant agricultural impacts. The following map from the United States Department of Agriculture details total agricultural losses, by county, due to extreme conditions from 1989 to 2021:

Map 35: Agricultural Losses Due to Flood Conditions, 1989 to 2021



Source: USDA

Of particular concern related to flooding is the safety of citizens. Especially critical is timely evacuation orders, and adherence to those orders. If evacuation is not heeded, or flood waters rise quickly enough, citizens could drown or become trapped for extended periods of time with no access to services or medical care. Of special concern are long term care and medical facilities where it can take longer to evacuate, or evacuation may be impossible. Additionally, lower income citizens may not have the means to relocate, whether it be lack of transportation or lack of resources to afford temporary shelter.

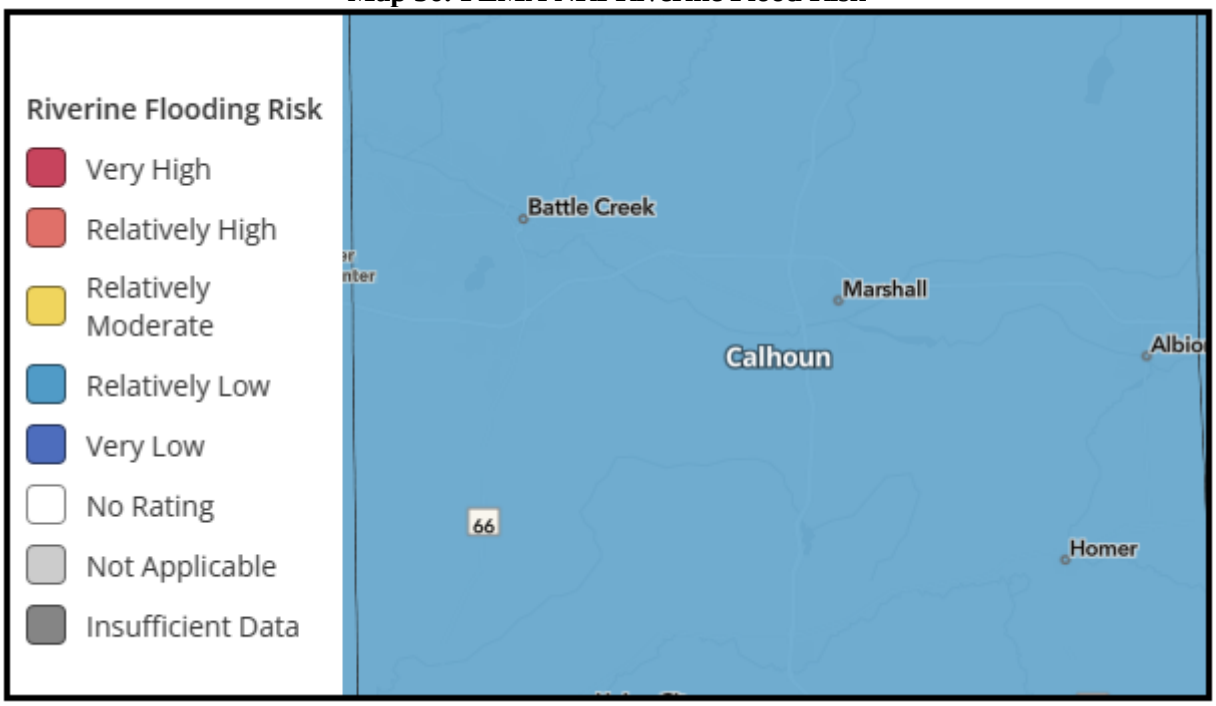
Environmental impacts from flooding can be far reaching. Of particular concern is flood related runoff, potentially carrying sewage, pesticides, or hazardous chemicals, which can cause long lasting environmental harm. Expected negative outcomes could include changes in habitat, a decrease of available food, and an increase in the spread of vector-associated disease due to standing water.

Floods can pose significant risks to county operations and buildings, as they can result in a wide range of immediate and long-term consequences. Some of the potential risks to county operations and facilities associated with floods include:

- Loss of Life and Injury: Flooding can lead to loss of life and injuries, particularly if people are unable to evacuate in time or if they underestimate the dangers of floodwater. This is a primary concern during flooding events.
- Infrastructure Damage: Floodwaters can cause extensive damage to critical infrastructure, including roads, bridges, public buildings, and utilities such as water treatment plants and power substations. This can disrupt government operations and essential services.
- Evacuation and Displacement: Flooding often necessitates the evacuation of residents and businesses from affected areas. Government agencies may need to establish emergency shelters and provide support to displaced populations.
- Economic Impact: Flooding events can have a severe economic impact. This includes costs associated with infrastructure repairs, property damage, crop loss, business interruption, and the strain on local economies.
- Emergency Response: State and local government agencies must respond swiftly to manage flood-related crises, coordinate evacuations, provide emergency services, and ensure public safety. This can strain resources and personnel.

Using the FEMA NRI, and consisting of three input components (expected annual loss, social vulnerability, and community resilience), the following map weas created indicating the potential risk to Calhoun County from riverine flooding (relatively low):

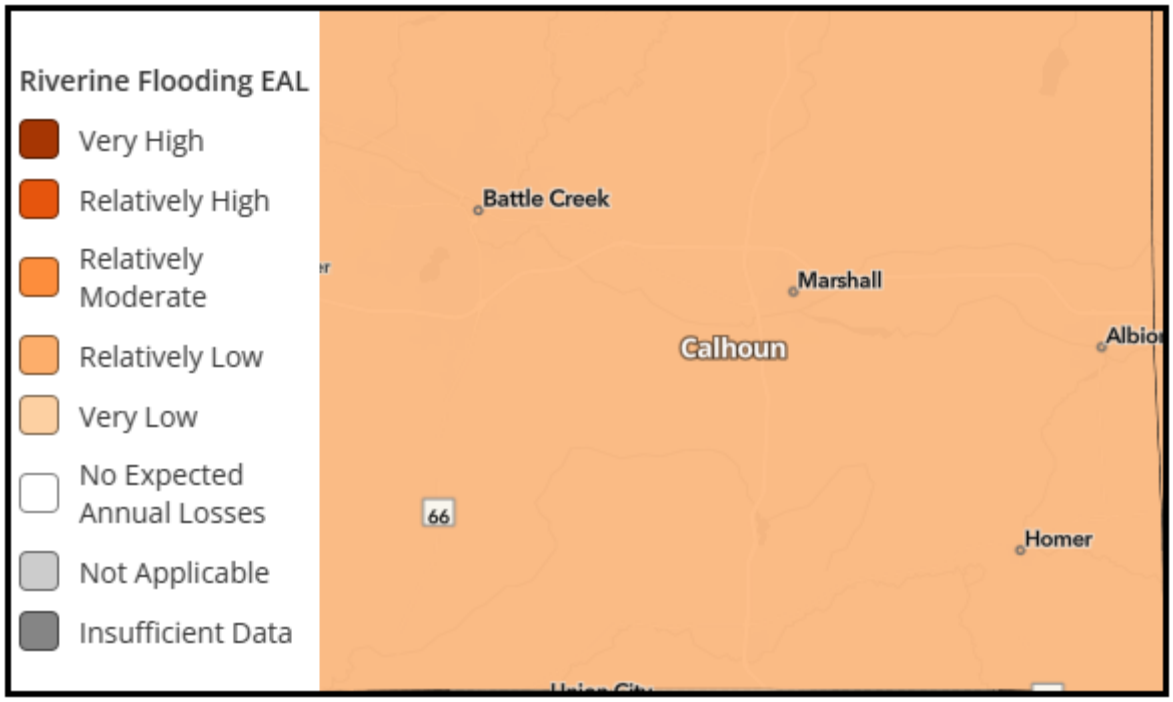
Map 36: FEMA NRI Riverine Flood Risk



Source: FEMA NRI

As part of the NRI, EAL represents the average economic loss in dollars resulting from natural hazards each year and is proportional to a community's risk. The following maps indicate the EAL for riverine flooding for Calhoun County (relatively low):

Map 37: FEMA NRI Riverine Flood EAL



Source: FEMA NRI

Potentially Vulnerable Community Lifelines

Flooding can impact various community lifelines, critical systems and services that communities rely on for their functioning. Vulnerabilities arise due to the stress that flooding can place on infrastructure, resources, and operational processes.

The HAZUS model indicated that no Calhoun County or jurisdictional critical facilities are estimated to be damaged or suffer loss of use from the flood scenario.

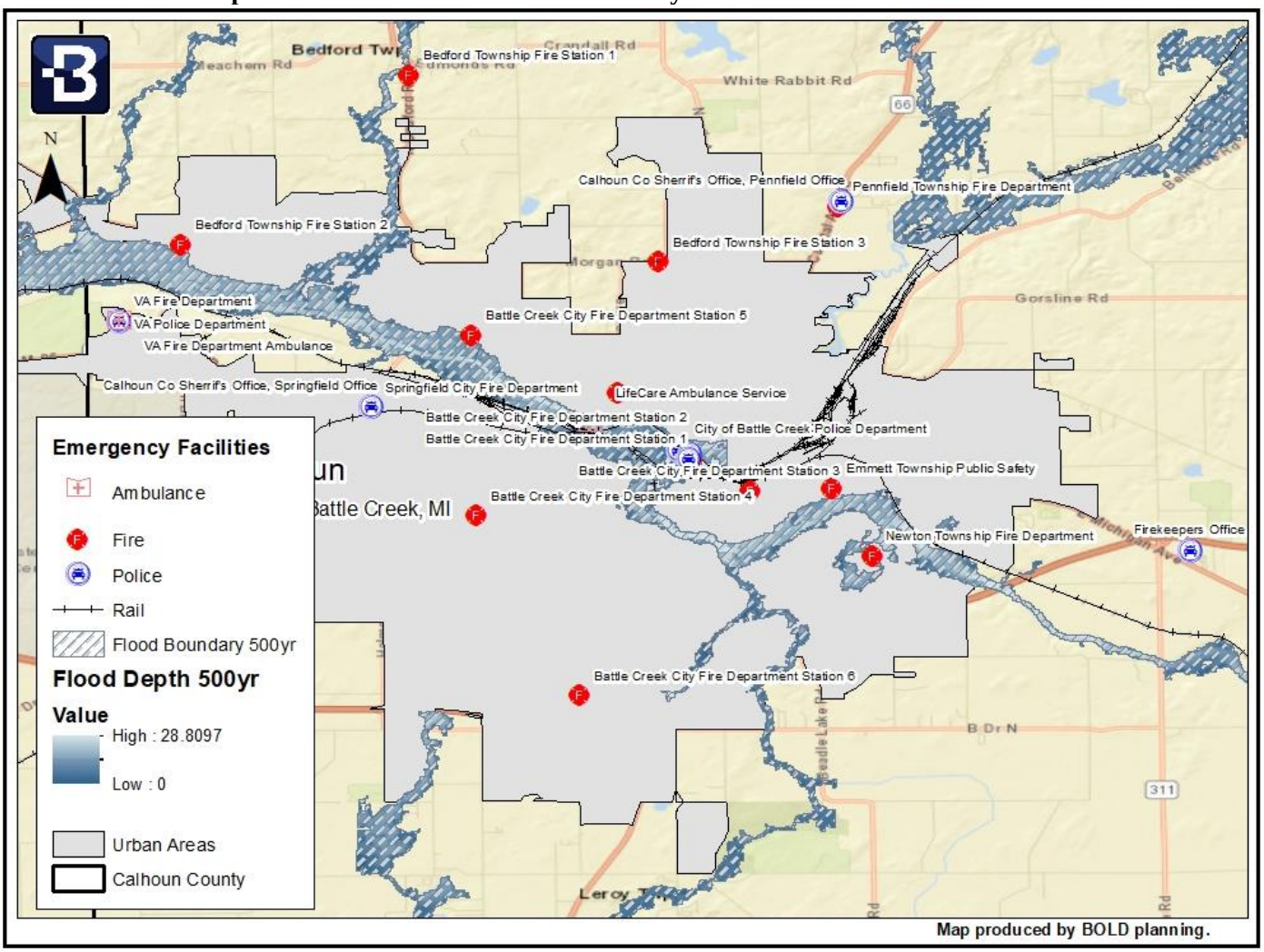
Table 39: HAZUS Flood Scenario Number of Critical Facilities Damaged or Impacted

Jurisdiction	Emergency Operations Centers	Fire Stations	Hospitals	Police Stations	Schools
Calhoun County	0	0	0	0	0

Source: FEMA HAZUS

A HAZUS analysis was performed to determine critical facility locations relative to the potential flood areas. Using GIS, flood zones were overlaid on the critical facility location data:

Map 38: Critical Facilities and Community Lifelines in Potential Flood Areas



Source: FEMA and BOLDplanning

As per HAZUS, before the flood analyzed in this scenario, the region had 291 hospital beds available for use. On the day of the scenario flood event, the model estimates that 291 hospital beds are available in the region.

Flooding can have significant and widespread impacts on road infrastructure. The extent of the damage depends on factors such as the severity and duration of the flood, the type of flooding (river overflow, flash flooding), and the design and resilience of the road infrastructure. Impacts may include:

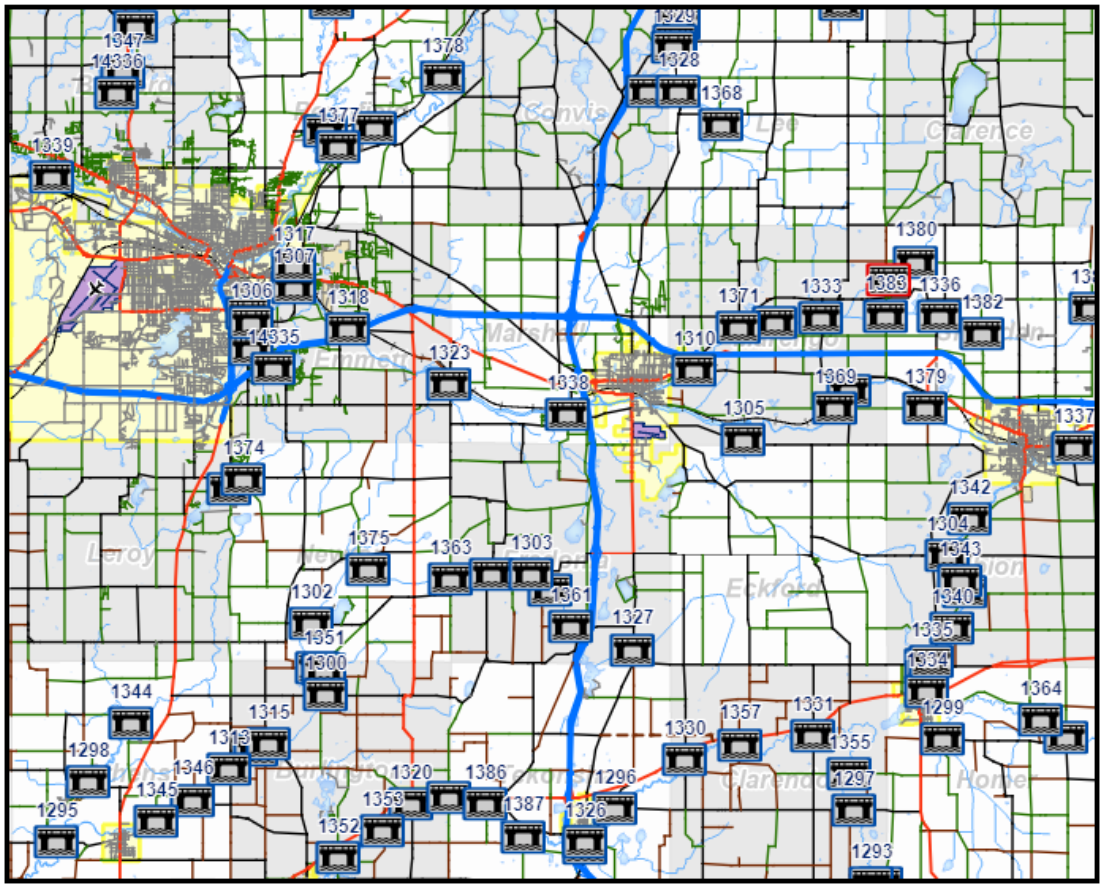
- Structural Damage: Floodwaters can erode road surfaces, weaken foundations, and damage bridges and culverts. The force of flowing water can undermine the structural integrity of roads and cause washouts.
- Road Surface Erosion: The erosion caused by floodwaters can remove the top layer of road surfaces, leading to potholes, cracks, and a general deterioration of the road condition.
- Subsidence and Sinkholes: The infiltration of water into road foundations can cause subsidence or create sinkholes.
- Debris Accumulation: Floodwaters often carry debris such as logs, branches, and sediment. The accumulation of debris on roads can impede drainage systems, block culverts, and hinder the flow of water.
- Road Closures: Flooding can result in the closure of roads due to safety concerns. High water levels, washouts, or structural damage may make roads impassable, leading to disruptions in transportation.

- Loss of Road Markings and Signs: Floodwaters can wash away road markings and signs, reducing visibility and creating safety hazards for motorists.
- Long-Term Damage: Even after floodwaters recede, long-term damage to road infrastructure may persist. Subsurface waterlogging, soil destabilization, and residual structural weaknesses can contribute to ongoing deterioration.

The cost to replace a road can vary significantly based on several factors, including the type of road, local labor and material costs, the complexity of the project, and the specific requirements of the replacement. As a rough estimate, road construction costs can range from $1,000,000 to $10,000,000 million per mile.

Bridges crossing rivers can pose significant concerns during flooding events due to the increased risk of structural failure. Floodwaters can exert powerful hydraulic forces on bridge structures, with the flow of water, debris, and floating objects impacting the bridge's substructure and foundation. Scouring, the removal of soil or sediment around bridge foundations can increase during a flood event increasing the risk of failure. Floodwater can also cause the deformation and misalignment of bridge components. As water levels rise and fall, the structural elements may undergo stress and strain, potentially leading to long-term damage and misalignment. The following map details the location of all bridges within Calhoun County:

Map 39: Bridge Locations



Source: Calhoun County

Of additional concern are bridges identified as structurally deficient crossing rivers or streams. A structurally deficient bridge is a bridge that has one or more components showing signs of deterioration or damage, affecting its overall structural integrity. A structurally deficient bridge is not necessarily in immediate danger of collapse, but rather contains

elements that require attention and may need repair, rehabilitation, or replacement. The following table details structurally deficient bridges crossing over rivers in the Calhoun County:

Table 40: Structurally Deficient Bridges Crossing Rivers

Jurisdiction	Location	Year Constructed	Average Daily Crossings
Bedford	M-89 over Wabascon Creek	1947	14,726

Source: Federal Highway Administration National Bridge Inventory

Flooding can have substantial and often severe impacts on electrical utilities, disrupting power generation, transmission, and distribution systems. The consequences of flooding on electrical utilities can vary depending on factors such as the depth and duration of the flooding and the type of infrastructure affected, and may include:

- Substation and Power Plant Damage: Floodwaters can inundate electrical substations and power plants, damaging critical equipment such as transformers, switchgear, and control systems. Substantial damage to these facilities can lead to prolonged outages.
- Electrical Equipment Short-Circuits: Water infiltration into electrical equipment can cause short-circuits, leading to equipment failure and potentially causing fires. This can result in widespread power outages and safety hazards.
- Transmission Line Disruptions: Floodwaters can impact the stability of transmission towers and lines. Structural damage or collapse of transmission infrastructure can disrupt the flow of electricity over long distances.
- Distribution Network Damage: Localized flooding can damage distribution infrastructure, including power lines, poles, and transformers. This can lead to outages in specific neighborhoods or communities.
- Transformer Submersion: Floodwaters can submerge transformers, which are critical components in power distribution. Submersion can cause these transformers to malfunction or fail, leading to service interruptions.
- Underground Cable Damage: Underground power cables can be damaged by flooding, especially in areas with subterranean infrastructure. Water infiltration can compromise cable insulation, leading to electrical faults and outages.
- Loss of Fuel Supply: Natural gas power plants may face challenges in maintaining a stable fuel supply if transportation routes are disrupted due to flooding.

Calhoun County and participating jurisdictions use the following electrical utility providers:

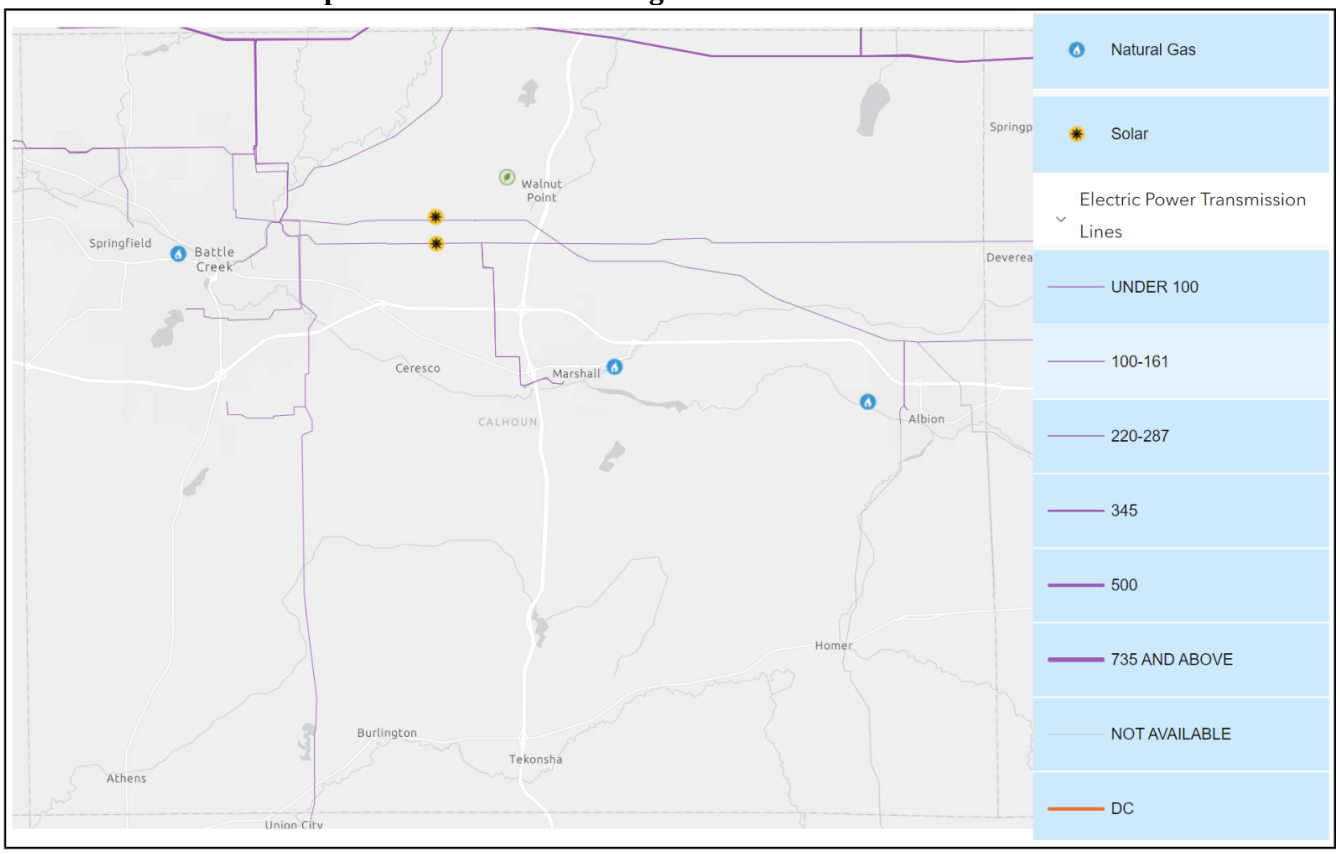
- Albion, Michigan:
  - Consumers Energy: 100.00%
- Athens, Michigan:
  - Consumers Energy: 100.00%
- Battle Creek, Michigan:
  - Consumers Energy: 100.00%
- Homer, Michigan:
  - Consumers Energy: 100.00%
- Marshall, Michigan:
  - Marshall MI Utilities: 50.00%
  - Consumers Energy: 50.00%
- Springfield, Michigan:
  - Consumers Energy: 50.00%
  - Great Lakes Energy: 50.00%
- Tekonsha, Michigan:
  - Consumers Energy: 100.00%

Electricity is generated in the county at six generation facilities, using the following methods:

- Solar: 78.22%
- Natural Gas: 16.37%
- Landfill Gas: 5.19%
- Conventional Hydroelectric: 0.23%

The following map, from the U.S. Energy Atlas, details the location of both electrical generating plants and high-capacity transmission lines within Calhoun County:

Map 40: Electrical Generating Plants and Transmission Lines



Source: U.S. Energy Atlas

The cost to replace electrical lines can vary widely based on several factors, including the type of electrical lines, the distance of the replacement, local labor and material costs, the complexity of the project, and any specific requirements or challenges involved. Additionally, costs can be significantly different for residential, commercial, or industrial projects. Additionally, urban and rural locations may have varying cost factors. As a rough estimate, the cost to replace electrical lines can range from a few thousand dollars to several thousand dollars per mile.

Major hospitals identified in Calhoun County include the Battle Creek VA Medical Center, Bronson Battle Creek Hospital, and Oaklawn Hospital. The total in-patient bed capacity of these facilities is approximately 700 beds. While these, and other smaller medical facilities, may see an increase in flood related injuries during an event, it is considered unlikely that this increase will impact or overload capacity.

Consequence Analysis

This consequence analysis lists the potential impacts of a hazard on various elements of community and state infrastructure. The impact of each hazard is evaluated in terms of disruption of operations, recovery challenges, and

overall wellbeing to all Calhoun County residents and first responder personnel. The consequence analysis supplements the hazard profile by analyzing specific impacts.

Table 41: Flood Consequence Analysis

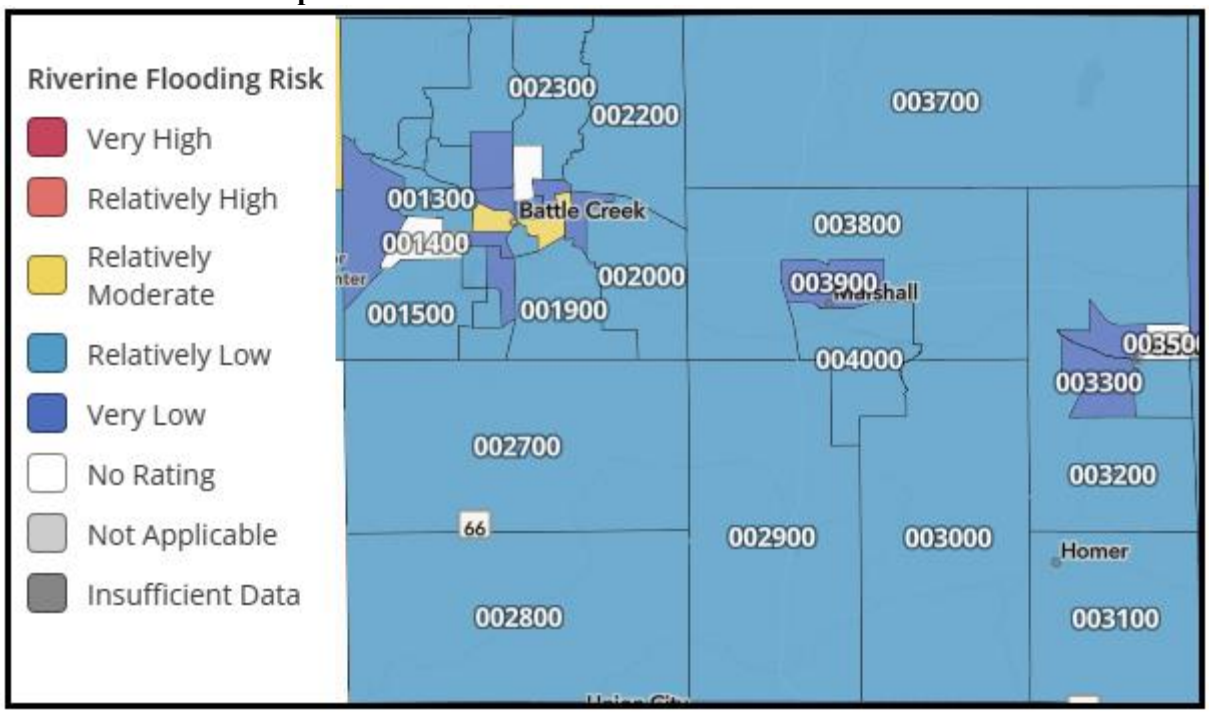
Subject	Potential Impacts
Impact on the Public	Significant flooding events can lead to the damage and loss of homes, property, and businesses. Flash flooding and excessive rainfall may lead to dangerous conditions on roadways. Closures of medical facilities is a major public health concern if flooding damages those facilities. Water sources may become contaminated, and water or sewer systems may be disrupted. Vector-associated disease may increase.
Impact on Responders	Responders may be called on to evacuate people from impacted areas, close roads, and attend to the injured. Responders may face challenges with transportation. Flash floods can also injure responders, as well as delay response operations.
Continuity of Operations	Local jurisdictions maintain continuity plans which can be enacted as necessary based on the situation. Floods which create power outages, debris damage, and road closures are not uncommon. This threat may impact an agency's ability to maintain operations.
Delivery of Services	Flooding can cause road and bridge closures, as well as disrupt transit services, impacting the ability to deliver goods and services. Exposure to flood waters may also damage or destroy physical goods such as food, clothing, and hygiene products.
Property, Facilities, and Infrastructure	Flooding can cause significant property destruction. Floods can disrupt normal daily activities due to the potential impact on schools, hospitals, and other public infrastructure. Transportation infrastructure can be damaged which could impact the freedom of movement or provision of utilities. Water sources can become contaminated. Water and sewer systems may be disrupted. Solid-waste collection and disposal may also be impacted, causing dangerous public health risks.
Impact on Environment	Rising waters from flooding impact the environment by spreading pollution, inundating water and wastewater treatment plants, and disrupting wildlife. Standing water following a flood event can facilitate the spread of vector-associated diseases.
Economic Conditions	Significant and repeated flooding can lower property value throughout the state, which can have a deleterious effect on the tax base. Furthermore, flooding drains response resources, which can be costly during a large flooding event for disaster reimbursement
Public Confidence in Governance	Ineffective flooding response can decrease the public's confidence in the ability to respond and govern. Multi-level government response requires direct actions that must be immediate and effective to maintain public confidence. Efficiency in response and recovery operations is critical in keeping public confidence high.

4.9.7 Jurisdictional Risk and Vulnerability

To help understand the risk and vulnerability to drought conditions of participating jurisdictions mapping from the FEMA NRI was run on a census tract level. As the NRI does not generate mapping for individual jurisdictions, census tract analysis is the closest analogue available to understand individual jurisdiction conditions.

Using the FEMA NRI, and consisting of three input components (expected annual loss, social vulnerability, and community resilience), the following map was created indicating the potential risk to participating jurisdictions from flooding:

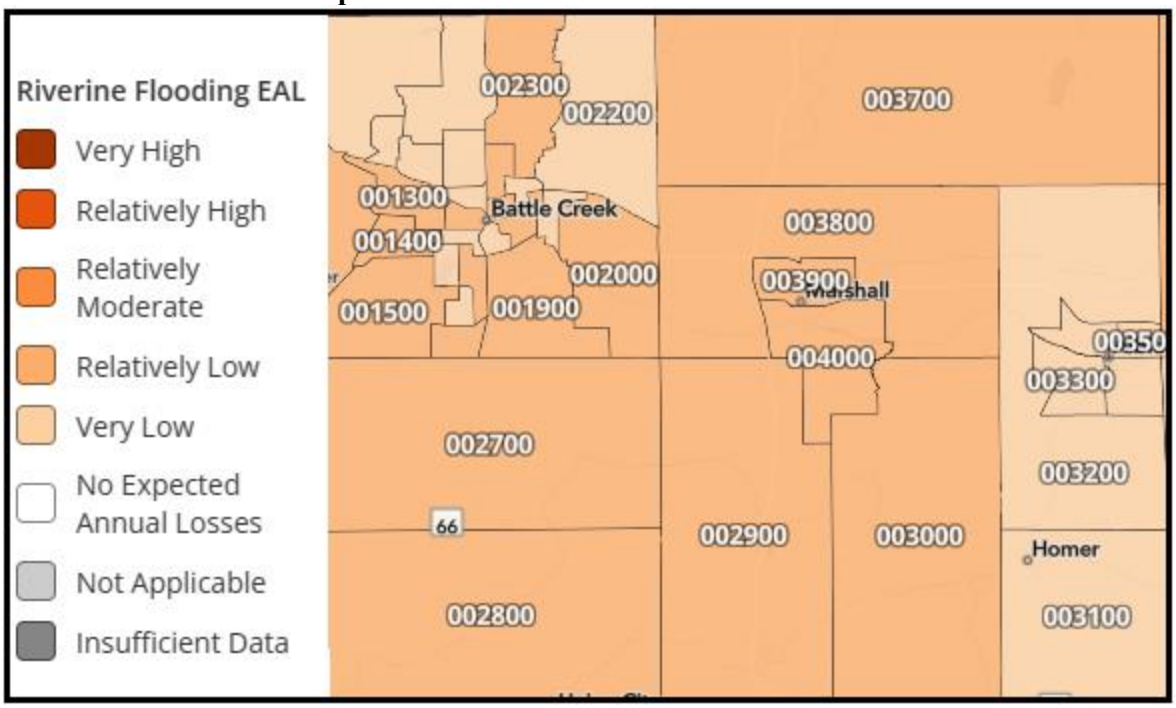
Map 41: FEMA NRI Jurisdictional Riverine Flood Risk



Source: FEMA NRI

As part of the NRI, EAL represents the average economic loss in dollars resulting from natural hazards each year and is proportional to a community's risk. The following map indicates the EAL for flooding for participating jurisdictions within Calhoun County:

Map 42: FEMA NRI Jurisdictional Flood EAL



Source: FEMA NRI

The following table indicates the FEMA NRI and EAL analysis for flood for each participating Calhoun County jurisdiction:

Table 42: Calhoun County FEMA EAL and NRI for Flood

Jurisdiction	EAL	Risk Index
Calhoun County	Relatively Low	Relatively Low
City of Albion	Very Low	Very Low
City of Battle Creek	Relatively Low	Relatively Low
City of Marshall	Very Low	Very Low
City of Springfield	Relatively Moderate	Relatively Moderate
Village of Athens	Relatively Low	Relatively Low
Village of Burlington	Relatively Low	Relatively Low
Village of Homer	Relatively Low	Relatively Low
Village of Tekonsha	Relatively Low	Relatively Low
Athens Township	Relatively Low	Relatively Low
Emmett Charter Township	Relatively Low	Relatively Low
Leroy Township	Relatively Low	Relatively Low
Sheridan Township	Relatively Low	Relatively Low
Tekonsha Township	Relatively Low	Relatively Low

Source: FEMA NRI

NRI data tables concerning flood information, by census tract, may be found in Appendix E.

Calhoun County and participating jurisdiction structures are valued at $25,481,727,000. Since flash flooding threatens the entire planning area, all structures are considered exposed and vulnerable.

A GIS analysis of FEMA's identified SFHAs allowed for an understanding of the valuation of potentially at-risk structures. Please note that no school facilities were identified in SFHAs.

Table 43: Calhoun County Riverine Flood Vulnerable Structures

Jurisdiction	Commercial	Governmental	Industrial	Residential
Calhoun County	$731,500	$0	$94,250	$11,983,720
City of Albion	$5,000	$0	$0	$1,946,000
City of Battle Creek	$78,420,420	$4,167,400	$7,085,840	$17,745,320
City of Marshall	$13,000	$0	$0	$10,000
City of Springfield	$0	$0	$0	$0
Village of Athens	$0	$0	$120,000	$131,000
Village of Burlington	$0	$0	$22,000	$0
Village of Homer	$0	$0	$379,000	$531,000
Village of Tekonsha	$325,000	$0	$0	$145,000
NHBP	$0	$0	$0	$0

Note: Calculations completed based on 2017-dollar valuations

Mapping for jurisdictional facilities in identified flood plains is included above.

4.9.8 National Flood Insurance Program Communities

The NFIP is a federal program, managed by FEMA, that exists to provide flood insurance for property owners in participating communities, to improve floodplain management practices, and to develop maps of flood hazard areas. The following table presents NFIP participating communities.

Table 44: Calhoun County NFIP Communities

Community	Initial Flood Hazard Boundary Map Identified	Initial Flood Insurance Rate Map Identified	Current Effective Map Date
Albion Township	12/23/1977	10/15/1982	4/4/2011
Athens Township	-	4/4/2011	4/4/2011(M)
Bedford Township	8/16/1974	2/2/1983	4/4/2011
Burlington Township	7/15/1977	7/2/1987	4/4/2011(M)
Clarence Township	9/26/1975	2/18/1983	4/4/2011
Convis Township	15/05/75	2/11/1983	4/4/2011(M)
Eckford Township	7/22/1977	8/19/1986	4/4/2011(M)
Emmett Township	9/26/1975	6/1/1983	4/4/2011
Fredonia Township	8/19/1987	8/19/1987	4/4/2011
Homer Township	4/1/1977	9/28/1979	4/4/2011(M)
Lee Township	7/15/1977	4/4/2011	4/4/2011(M)
Leroy Township	7/15/1977	3/1/1987	4/4/2011(M)
Marengo Township	9/19/1975	5/17/1982	4/4/2011
Marshall Township	-	2/11/1983	4/4/2011
Newton Township	5/26/1978	9/1/1986	4/4/2011(M)
Pennfield Township	9/26/1975	10/15/1982	4/4/2011
Sheridan Township	7/15/1977	3/11/1983	4/4/2011
Tekonsha Township	6/30/1978	6/4/1987	4/4/2011(M)
Albion	6/28/1974	6/15/1982	4/4/2011
Athens	9/19/1975	4/4/2011	4/4/2011(M)
Battle Creek	7/19/1974	4/4/1983	4/4/2011
Burlington	10/10/1975	7/2/1987	4/4/2011(M)
Homer	4/28/1978	5/3/1982	4/4/2011
Marshall	6/14/1974	4/1/1982	4/4/2011
Springfield	6/28/1974	9/28/1979	4/4/2011
Tekonsha	10/24/1975	5/1/1987	4/4/2011(M)

Note: (M): No Elevation Determined - All Zone A, C and X

Additionally, the NFIP's Community Rating System (CRS) incentive rewards communities for the work they do managing their floodplains. Eligible communities that qualify for this voluntary program go above the minimum NFIP requirements and can offer their citizens discounted flood insurance in both SFHAs areas and non-SFHA areas. Bedford Township currently participates in the CRS, as of May 1, 2002, and is rated as a class 9 participant receiving a 5% discount on flood insurance premiums.

4.9.9 FEMA Flood Policy Data

Calhoun County flood policy information was sourced from FEMA's Flood Insurance Data and Analytic, Calhoun County, and the State of Michigan. The number of flood insurance policies in effect may not include all structures at risk to flooding, and some properties are under-insured. The flood insurance purchase requirement is for flood insurance in the amount of federally backed mortgages, not the entire value of the structure. Additionally, contents coverage is not required. The following table shows the details of NFIP policy statistics for Calhoun County.

Table 45: Calhoun Policy and Loss Statistics

Jurisdiction	Number of Policies in Force	Total Coverage
Albion	9	$854,000
Athens	1	$280,000
Battle Creek	47	$14,517,300

Table 45: Calhoun Policy and Loss Statistics

Jurisdiction	Number of Policies in Force	Total Coverage
Bedford Township	11	$2,245,900
Burlington	2	$420,000
Burlington Township	3	$513,900
Clarence Township	11	$3,118,000
Eckford Township	1	$74,900
Emmett Township	10	$2,944,500
Fredonia Township	2	$348,000
Homer Township	1	$74,000
Homer	2	$220,000
Leroy Township	3	$840,000
Marengo Township	3	$556,700
Marshall Township	1	$350,000
Pennfield Township	13	$1,936,100
Sheridan Township	1	$350,000
Springfield	2	$360,000

Source: FEMA Flood Insurance Data and Analytic, Calhoun County, State of Michigan

Data concerning policies and total coverage for Calhoun County was not presented in the last version of this HMP, and historic data concerning coverage was unavailable through FEMA. As such direct trends in coverage could not be calculated. However, data concerning NFIP polices and coverage for the State of Michigan for the latest 12-month rolling period indicates that coverage has been declining throughout the state.

4.9.10 Repetitive Loss Structures

A high priority for Calhoun County is the reduction of losses to Repetitive Loss (RL) and Severe Repetitive Loss (SRL) structures. The NFIP defines a RL property as:

- Any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978. At least two of the claims must be more than 10 days apart.

The definition of severe repetitive loss as applied to this program was established in section 1361A of the National Flood Insurance Act, as amended, 42 U.S.C. 4102a. An SRL property is defined as a residential property that is covered under an NFIP flood insurance policy and:

- That has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or
- For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

For both of the above, at least two of the referenced claims must have occurred within any ten-year period and must be greater than ten days apart.

Calhoun County has three identified as RL properties and no SRL properties. All three RL properties are located in the City of Battle Creek and are of a single-family residential type (newer data unavailable from FEMA but requested during this process). The following table details information concerning RL identified properties in Calhoun County.

Table 46: Calhoun County RL and SRL Properties

Jurisdiction	Number of Repetitive Loss Properties	Number of Claims
Battle Creek	3	9

Source: Calhoun County and FEMA

4.10 Severe Thunderstorms

4.10.1 Hazard Description

Severe thunderstorms comprise the hazardous and damaging weather effects often found in violent storm fronts. They can occur together or separate, they are common and usually not hazardous, but on occasion they can pose a threat to life and property.

This plan defines severe thunderstorms as a combination of the following severe weather effects as defined by NOAA and the National Weather Service (NWS).

- **Hail:** Precipitation in the form of irregular pellets or balls of ice more than 5 mm in diameter, falling from a cumulonimbus cloud.
- **Lightning:** A visible electrical discharge produced by a thunderstorm. The discharge may occur within or between clouds, between the cloud and air, between a cloud and the ground or between the ground and a cloud.
- **Thunderstorm Winds:** The same classification as high or strong winds but accompanies a thunderstorm. It is also referred to as a straight-line wind to differentiate from rotating or tornado associated wind. Additionally, these winds can rapidly create dust storms that severely impact visibility.

Severe thunderstorms have been so consistent throughout modern history that much of the vulnerability is mitigated. However, this section is not concerned with everyday wind, lightning in the sky, or mild precipitation. This section is concerned with common storm elements when they behave such that they pose a threat to property and life.

4.10.2 – Location and Extent

Severe thunderstorms can rapidly descend on an area, but in many cases are predictable. Most weather forecasts focus on more than just temperature but on quickly changing conditions that may lead to the onset of severe storms. All of Calhoun County is susceptible to severe thunderstorms.

The NWS classifies thunderstorms, often the generator of hail, lightning and high winds, using the following categories.

- **Marginal:** Isolated severe thunderstorms, limited in duration and/or coverage and/or intensity
- **Slight:** Scattered severe storms possible, short-lived and/or not widespread, isolated intense storms possible
- **Enhanced:** Numerous severe storms possible, more persistent and/or widespread, a few intense
- **Moderate:** Widespread severe storms likely, long-lived, widespread and intense
- **High:** Widespread severe storms expected, long-lived, very widespread and particularly intense

Additionally, the combination of hot and humid weather conditions can cause a specific type of severe thunderstorm known as a derecho. A derecho is a widespread, long-lived windstorm associated with rapidly moving thunderstorms. Derechos are generally defined by the following parameters:

- Wind gusts of at least 58 mph or greater along most of its length
- Wind damage extends in a line greater than 240 miles

Derechos can produce destruction similar to tornadoes.

In the United States, hail causes billions of dollars in damage to property, crops and livestock each year. Because of the large agricultural industry in Calhoun County, crop damage and livestock losses due to hail are a concern. Vehicles, roofs of buildings and homes, and landscaping are the other things most commonly damaged by hail. Hail has been known to cause injury and the occasional fatality to humans, often associated with traffic accidents.

Based on information provided by the National Weather Service concerning size, the following table describes potential damage impacts of the various sizes of hail.

Table 47: Hail Size Comparison and Damage Descriptions

Diameter (inches)	Size Description	Potential Damage Impacts
1/4	Pea Size	No damage
1/2	Mothball, peanut, USB Plug	Slight damage to vegetation
3/4	Penny Size	Increased damage to crops and vegetation
7/8	Nickel Size	Severe damage to crops and vegetation, damage begins to glass and plastic
1	Quarter Size	Increased glass damage, damage begins to bodies of vehicles
1 1/4	Half Dollar Size	Large scale glass damage, begin roof damage, risk of injury to exposed persons
1 1/2	Ping Pong Ball Size	Large scale glass damage, begin roof damage, increased risk of injury to exposed persons
1 3/4	Golf Ball Size	Severe roof damage, risk of serious injuries to exposed persons
2	Lime or medium sized Hen Egg	Potential structural damage, risk of very severe injuries to exposed persons
2 1/2	Tennis Ball Size	Extensive structural damage, risk of very severe injuries or death to exposed persons

Source: National Weather Service

A recent report by the Insurance Information Institute says lightning strikes caused $1,300,000,000 in damage across the United States in 2021. There is currently no scale to indicate the severity of a lightning strike, but data from NOAA indicates that there approximately 25 million cloud-to-ground lightning strikes per year in the United States.

To measure wind speed and its correlating potential for damage, experts use the Beaufort scale as shown below.

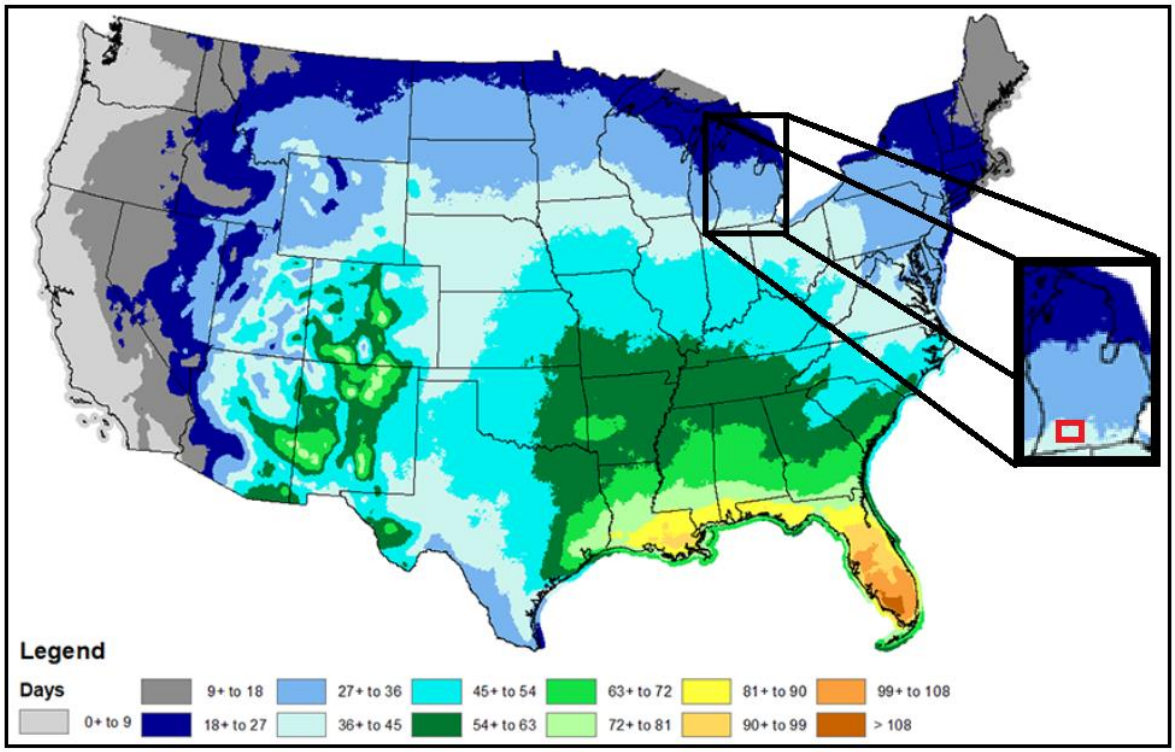
Table 48: Beaufort Scale

Beaufort Number	Wind Speed (mph)	Effects on Land
0	Under 1	Calm, smoke rises vertically
1	1-3	Smoke drift indicates wind direction, vanes do not move
2	4-7	Wind felt on face, leaves rustle, vanes begin to move
3	8-12	Leaves, small twigs in constant motion. Light flags extended.
4	13-18	Dust, leaves and loose paper raised up; small branches move
5	19-24	Small trees begin to sway
6	25-31	Large branches of trees in motion, whistling heard in wires
7	32-38	While trees in motion, resistance felt in walking against the wind
8	39-46	Twigs and small branches broken off trees
9	47-54	Slight structural damage occurs, slate blown from roofs
10	55-63	Seldom experienced on land, trees broken, structural damage occurs
11	64-72	Very rarely experienced on land, usually with widespread damage
12	73 or higher	Violence and destruction

Source: NOAA

The widespread and frequent nature of thunderstorms makes hail, lightning, and high wind a relatively common occurrence for Calhoun County. The following map, from NOAA, indicates annual mean thunderstorm days from 1993 to 2018.

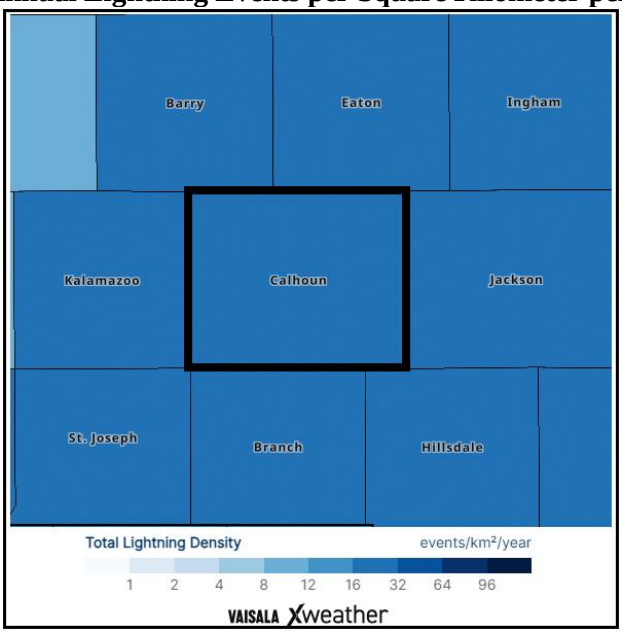
Map 43: Annual Mean Thunderstorm Days, 1993-2018



Source: NOAA

The following map, from Vaisala, indicates the average annual light events per square kilometer per year for Calhoun County.

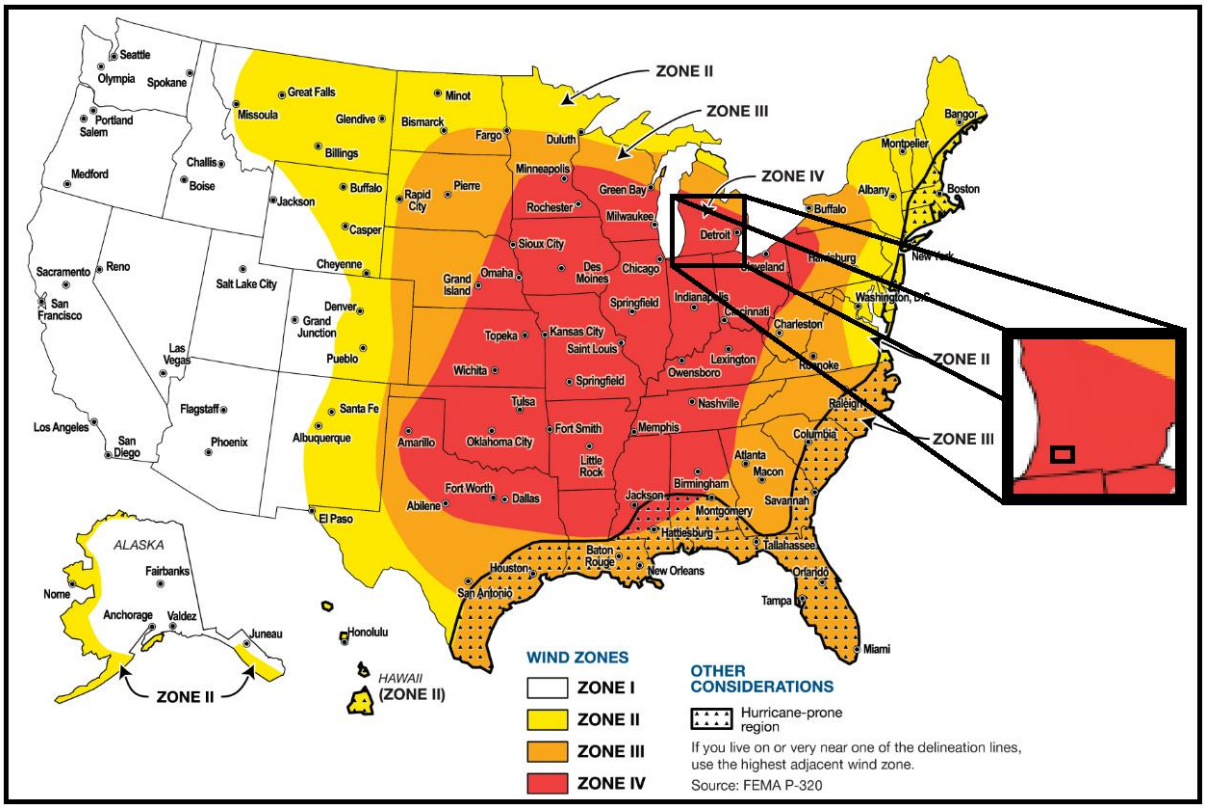
Map 44: Average Annual Lightning Events per Square Kilometer per Year, 2016 - 2022



Source: Vaisala

The following map illustrates wind zones for the United States. As indicated on the map, Calhoun County is in zone IV, the highest category, with up to 250 miles per hour possible.

Map 45: Wind Zones



Source: National Institute of Standards and Technology

4.10.3 Previous Occurrences

The following table presents NCEI identified severe thunderstorm events and the resulting damage totals in Calhoun County from 1950 to 2023, with the years 1950 and 2023 being full dataset years. Please note that as severe thunderstorm events tend to cover larger areas occurrence data is being presented as representative of all participating jurisdictions.

Table 49: Calhoun County NCEI Severe Thunderstorm Events, 1950-2023

Event Type	Number of Events	Property Damage	Deaths	Injuries
Hail	60	$1,025,000	0	0
Lightning	1	$11,000	0	0
Thunderstorm Winds	193	$36,880,000	1	10

Source: NCEI

The following provides both local accounts and NCEI descriptions of notable recorded events:

- **August 24, 2023 – Albion:** Severe storms developed during the evening hours in an extremely unstable environment. There were multiple reports of downed trees and limbs and power lines. Damages were estimated at $5,000,000.
- **August 29, 2022 – Springfield:** A peak wind gust to 58 mph was measured at Battle Creek airport and numerous trees and power lines were blown down. Damages were estimated at $200,000.
- **June 26, 2021 –Leroy Township:** An NWS storm survey determined that there was an 8.5-mile-long path of tree damage. Thunderstorm winds likely originated from a surging rear-flank downdraft associated with a mesocyclone embedded within a multicell storm line. Tree damage in the form of uproots and a mix of healthy and unhealthy snaps were common along the path. Most of the path length had EF-0 type of damage. In small

sections of the path, damage was more in line with EF-1 estimated wind speeds in the form of several dozen trees snapped or uprooted. The worst damage was along M Drive S and K Drive S, near 10 Mile Road. Damage to property was relatively minor and ground surveys and tours of homes and farms with the property owners revealed no sign of debris deposited down the path into fields. Damages were estimated at $200,000.

- **June 1, 2019 – Battle Creek:** Hail up to almost three inches in diameter was reported. Damages were recorded at $100,000.
- **October 7, 2014 – Albion:** An NWS storm survey indicated that winds reached up to 80 to 90 mph near to northeast of Albion in Calhoun County, where numerous trees and power lines were blown down with extensive power outages. One roof was also blown off a home. A 74-mph wind gust was measured at Brooks field. Damages were estimated at $2,000,000.
- **May 29, 2011 –Leroy Township:** The bowing segment of a line echo wave pattern caused extensive damage to homes, businesses, and utilities on the south side of Battle Creek along E Columbia Ave. Approximately 600 homes were damaged with 76 of those homes having been destroyed. Also, 21 businesses were damaged of which 4 were destroyed. To the north and east of the Battle Creek area, two dozen rural properties also sustained damage. Throughout the county, over 40,000 customers were without power, and thousands of trees were either uprooted or snapped. The damage path was 33 miles long and ranged from 0.5 mile up to 2 miles in width. Two people were reported injured and damage in the area was estimated at $25,000,000.
- **October 24, 2001 – Tekonsha:** A major severe weather episode occurred across southern lower Michigan, highlighted by three supercell thunderstorms that caused extensive damage. Damages were estimated at $1,000,000.

4.10.4 Probability of Future Events

Predicting the probability of severe thunderstorm occurrences is tremendously challenging due to the large number of factors involved and the random nature of formation. Data from the NCEI indicates that Calhoun County, can expect on a yearly basis, relevant to severe thunderstorm events:

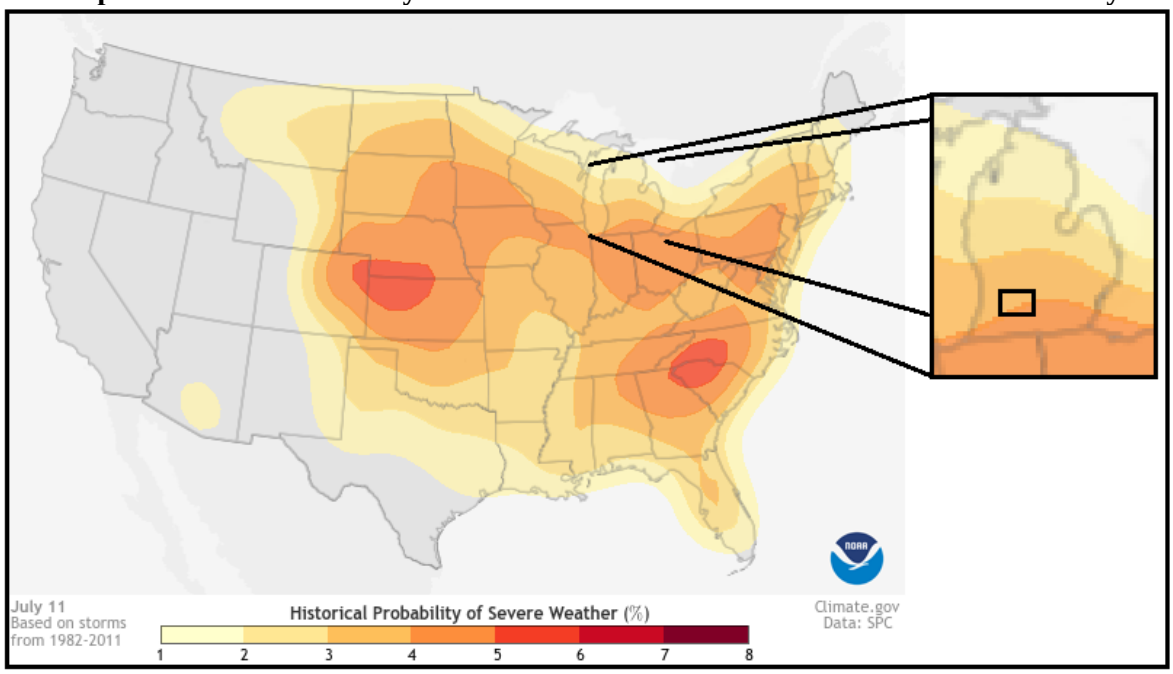
Table 50: Calhoun County and Participating Jurisdictions Severe Thunderstorm Probability Summary

Data	Days
Number of Days with NCEI Reported Event (1950-2023)	154
Average Events per Year	2

Source: NCEI

Data from NOAA indicates that Calhoun County can expect between 36 to 45 thunderstorms per year. Additionally, the following map from NOAA provides a probability snapshot for the probability of a severe weather event on a summer day.

Map 46: Historic Probability of a Severe Weather Summer Event in Calhoun County



Source: NOAA

4.10.5 Projected Changes in Location, Intensity, Frequency, and Duration

Climate change can have several impacts on severe thunderstorms, although the precise details can vary depending on regional climate patterns and other factors. In general, it is believed that climate change can alter the timing and seasonality of severe thunderstorms. In some cases, this may mean more thunderstorms occurring earlier or later in the year.

Climate change can lead to increased temperatures and moisture levels in the atmosphere, which can provide favorable conditions for the development of severe thunderstorms. This can result in a higher frequency of severe thunderstorm events and an increase in their intensity. As a result of increased temperatures, warmer air can hold more moisture, leading to increased rainfall during severe thunderstorms. This can elevate the risk of flash flooding, particularly in areas prone to heavy precipitation. Changes in atmospheric circulation patterns associated with climate change can lead to stronger winds within thunderstorms. This can result in more powerful wind gusts, increasing the risk of wind damage and downed trees and power lines.

Climate change can influence the conditions necessary for hail formation within thunderstorms. Warmer temperatures at the surface and greater instability in the atmosphere can contribute to larger and more damaging hailstones. Additionally, changes in atmospheric conditions can affect the frequency and distribution of lightning strikes associated with thunderstorms. More lightning can increase the risk of wildfires in dry regions.

It is important to note that while there is evidence linking climate change to changes in weather patterns that can influence severe thunderstorms, predicting specific thunderstorm events remains challenging. Climate models provide valuable insights into long-term trends, but individual thunderstorm events are influenced by a complex interplay of factors.

As indicated in the data above, Calhoun County and all participating jurisdictions have been seeing generally declining populations. A declining population could decrease population risks to severe storms by nature of their being fewer citizens to negatively impact.

Calhoun County's current land-use regulations require the consideration of building codes during the development review process. A building-by-building structural review, including roof profile, type and strength of windows, and

foundation systems would need to be considered to determine structural risk. However, enforced building codes can ensure that newly built and renovated structures can withstand all but the most extreme weather incidents.

The agriculture base of Calhoun County is increasingly vulnerable to the effects of severe storms. Future development of agricultural resources would tend to increase the risk and impact of an event. As indicated in the data above, Calhoun County is seeing an increase in the market value of agricultural goods sold, and thus a potential greater future vulnerability.

4.10.6 Vulnerability and Impact

Data from the NCEI indicates that Calhoun County can expect on a yearly basis, relevant to severe thunderstorm events. Please note that damages and injuries, as represented above, are not broken down into participating jurisdictions due to the random and widespread nature of occurrence.

Table 51: Calhoun County Severe Thunderstorm Impact Summary

Data	Recorded Impact
Deaths or Injuries (1950-2023)	11
Average Number of Deaths or Injuries	<1
Total Reported NCEI Property Damage (1950-2023)	$37,916,000
Average Property Damage per Year	$512,378

Source: NCEI

Data from HAZUS was used to provide a county building stock valuation. This data was then compared to NCEI structural damage figures to determine the percentage of impacted building within the county for the period of 2003-2022 for each severe storm component. Data was only available at a county level.

Table 52: Calhoun County Severe Storm Percentage Loss Data

Hazard	HAZUS Valuation	NCEI Structure Damage, 1950-2023	Percentage of Building Valuation Damaged
Hail	$25,591,571,000	$1,025,000	0.04%
Lightning	$25,591,571,000	$11,000	0.0%
Wind	$25,591,571,000	$36,880,000	1.4%

Source: NCEI and Calhoun County

Severe thunderstorms can have a wide range of effects on people, often posing significant risks to life, property, and general well-being. In the absence of proper shelter, hail, lightning, and high winds can cause serious injury. In general, if potentially exposed persons take shelter in a solid, well-constructed structure protection from these severe thunderstorm components would be provided. However, old or poorly constructed facilities may be more prone to damage, potentially increasing the impact on economically disadvantaged populations. Some of the potential effects of severe thunderstorms on people may include:

- Death and Injury: Thunderstorms produce lightning and string winds driving debris. Both of these elements can cause injuries or fatalities.
- Power Outages: Lightning strikes, strong winds, and falling trees can lead to power outages, disrupting daily life, and potentially affecting essential services, such as medical equipment and refrigeration.
- Mental Health Impact: Severe thunderstorms can be frightening and stressful, leading to anxiety and post-traumatic stress disorder in some individuals. The emotional toll of property damage and loss can also be significant.
- Displacement: People may need to evacuate their homes or be temporarily displaced due to storm damage, requiring emergency shelter and support.
- Economic Costs: Severe thunderstorms result in economic costs, including repair and recovery expenses, insurance claims, and potential loss of income due to property damage or work disruptions.

- Public Safety Response: Severe thunderstorms can strain public safety resources, including emergency services, law enforcement, and medical facilities.

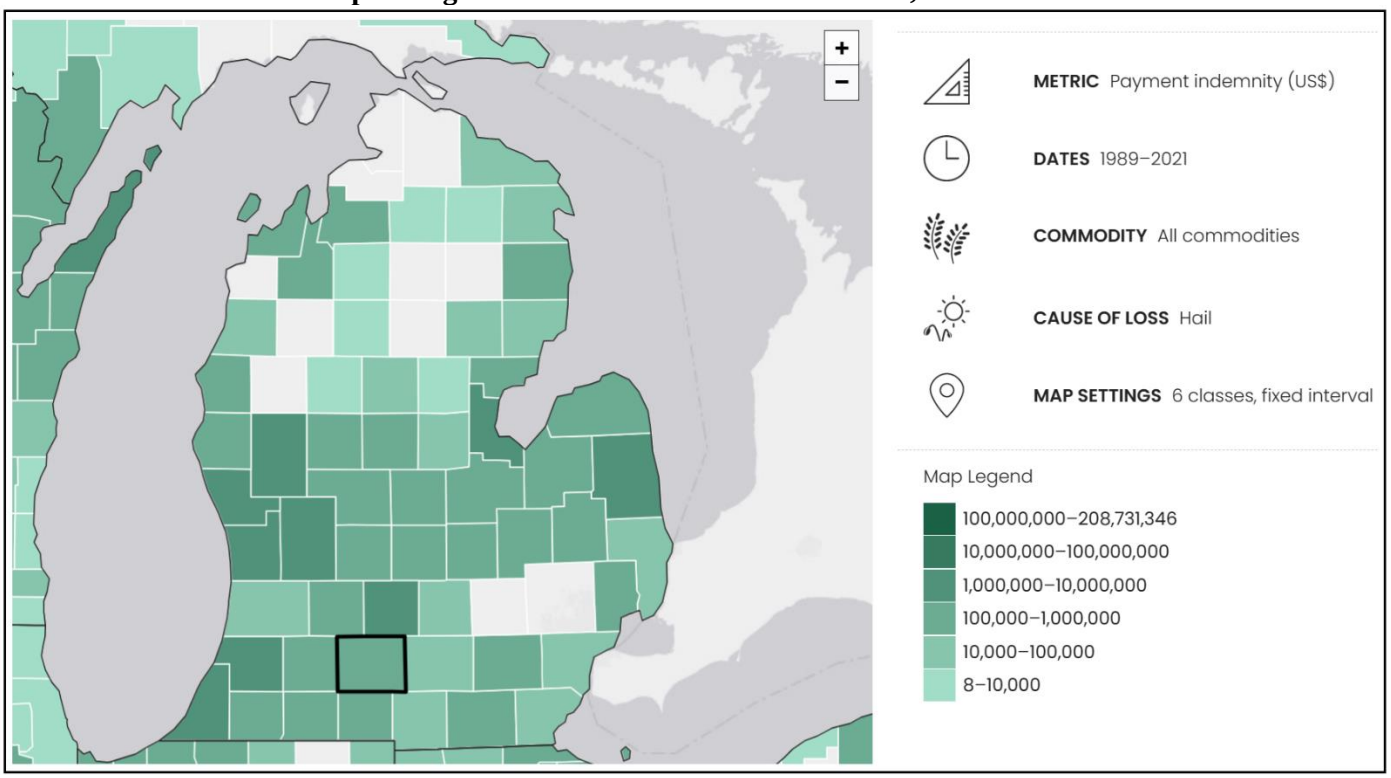
Data from the FEMA Hazus system indicates the total value of property within Calhoun County is $25,481,727,000, all of which is vulnerable to severe thunderstorms. All facilities within Calhoun County can be impacted by severe thunderstorms, including critical facilities. However, the location and construction of the facility will have a significant impact on the vulnerability. In general, older structures would be at higher risk of negative impacts. Some of the potential impacts include:

- Electrical Infrastructure Damage: Severe thunderstorms can damage electrical infrastructure, including power lines, transformers, and substations. This can result in widespread power outages, affecting homes, businesses, hospitals, and other critical facilities.
- Communication Disruptions: Thunderstorms can disrupt telecommunications infrastructure, including cell towers, data centers, and communication networks. This can impact emergency communication and coordination efforts.
- Transportation Disruptions: Heavy rain, strong winds, and flooding can damage roads, bridges, and transportation networks. This can lead to transportation disruptions, accidents, and delays, affecting the movement of goods and people.
- Airport Closures: Thunderstorms can force the closure of airports due to safety concerns, affecting air travel and cargo shipments.
- Water and Wastewater Systems: Severe storms can overwhelm water treatment plants and wastewater facilities, leading to contamination and water supply disruptions. Flooding can also damage water infrastructure.
- Critical Facilities: Hospitals, emergency response centers, and other critical facilities may be affected by power outages, flooding, and damage to infrastructure. This can impact the ability to provide essential services during and after the storm.
- Energy Generation: Thunderstorms can disrupt energy generation facilities, such as wind farms and solar installations, and damage conventional power plants. This can affect the availability of electricity.
- Safety Risks: Damage to infrastructure can pose safety risks to workers and the public. Fallen power lines, damaged buildings, and debris can be hazardous.

Severe thunderstorms can pose various risks to the environment. These risks can have both short-term and long-term impacts on natural ecosystems. Severe thunderstorms can produce heavy rainfall over a short period of time, leading to flash floods and riverine flooding. This can result in soil erosion, damage to aquatic habitats, and the displacement of aquatic organisms. Large hailstones can damage crops, vegetation, and natural habitats. Hail can strip leaves from trees and plants, reducing their ability to photosynthesize and grow. It can also damage wildlife habitats. Severe thunderstorms often produce strong straight-line winds. These winds can uproot trees, damage forests, and disrupt animal habitats. They can also scatter debris and cause structural damage to buildings, which can lead to further environmental issues if hazardous materials are released. Lightning is a common occurrence in thunderstorms and can spark wildfires. These wildfires can have significant ecological impacts, including habitat destruction, loss of wildlife, and changes in the local ecosystem.

Hail events can cause significant agricultural impacts. The following map from the United States Department of Agriculture details total agricultural losses, by county, due to hail events from 1989 to 2021:

Map 47: Agricultural Losses Due to Hail Events, 1989 to 2021



Source: USDA

Severe thunderstorms can pose various risks to government operations, facilities, and assets. These risks can have significant economic and operational consequences, and can include:

- Structural Damage: High winds, hail, and tornadoes associated with severe thunderstorms can cause significant damage to government buildings and infrastructure. This can result in costly repairs and disruptions to government operations.
- Power Outages: Severe thunderstorms can lead to power outages by damaging electrical infrastructure such as power lines and substations. Government buildings may lose power, affecting critical operations and services.
- Flooding: Heavy rainfall during severe thunderstorms can lead to flooding, which can damage government buildings and disrupt operations. Flood damage may require extensive repairs and cleanup.
- Communication Disruptions: Lightning strikes can damage communication equipment, including telephone lines and computer systems. This can hinder communication between government agencies and the public.
- Transportation Disruptions: Severe thunderstorms can make roads impassable due to flooding or fallen trees. This can impact the ability of government employees to commute to work and can disrupt the delivery of goods and services.
- Emergency Response: Severe thunderstorms may require the activation of emergency response plans. This can strain resources and personnel, especially if the storms lead to widespread damage or evacuations.
- Loss of Records and Data: Flooding or equipment damage can result in the loss of important records and data stored in government buildings. This can have legal and operational implications.
- Budgetary Impact: The costs associated with repairing and restoring government buildings and infrastructure after severe thunderstorms can strain budgets.

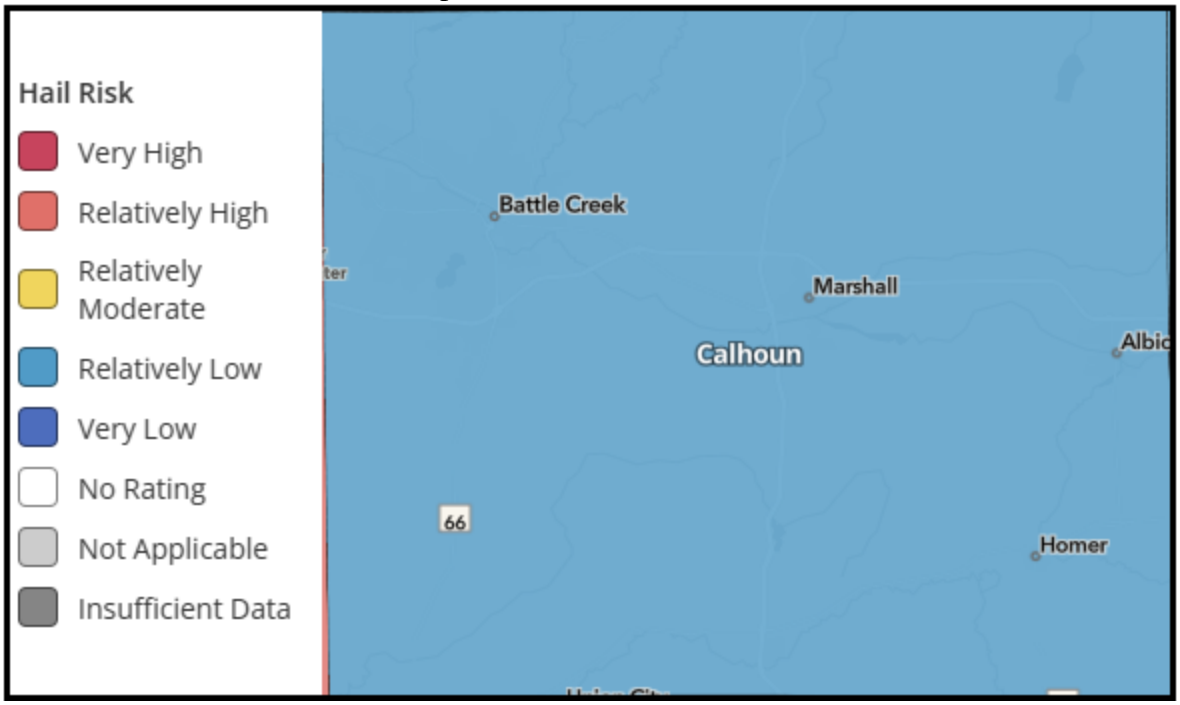
Structural vulnerability to hail is determined by construction and exposure. Metal siding and roofing is better able to stand up to the damage of a hailstorm than other materials, such as glass. Additionally, this damage can also impact personal vehicles, causing an economic impact. The vulnerability of infrastructural damage caused by wind is based

largely on building construction and standards. Other factors, such as location, condition, and maintenance of trees also play a significant role in determining vulnerability.

Data from the FEMA Hazus system indicates the total value of government property within Calhoun County is $258,661,000, all of which is vulnerable to severe thunderstorms.

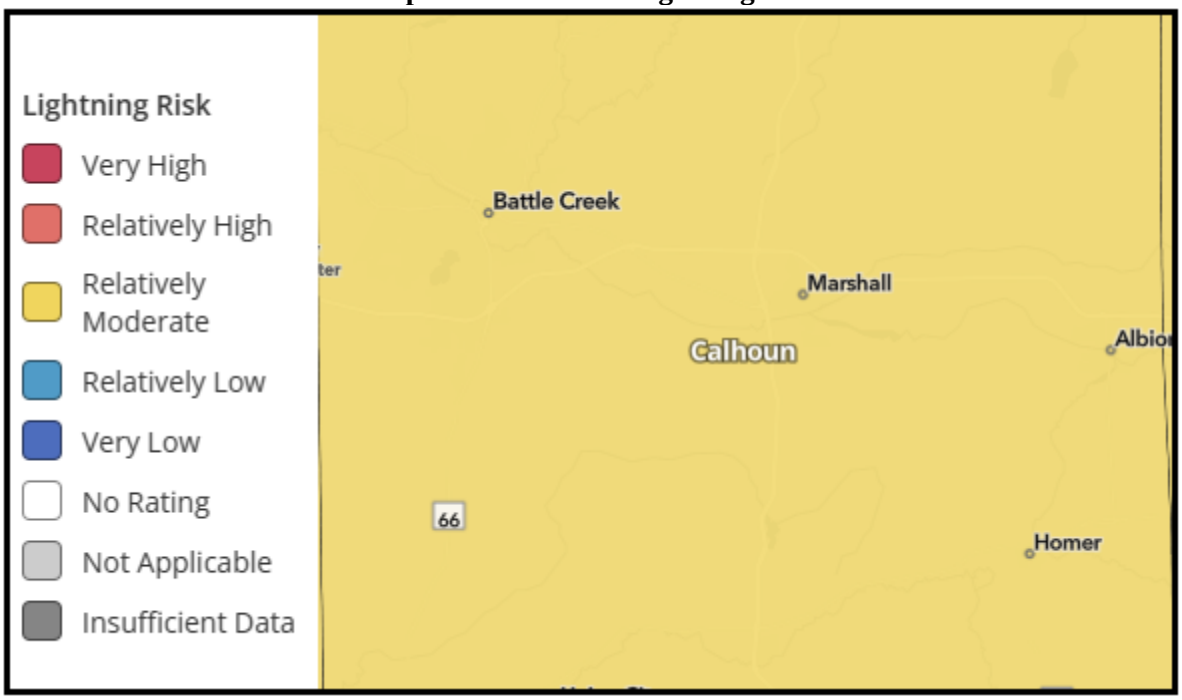
Using the FEMA NRI, and consisting of three input components (expected annual loss, social vulnerability, and community resilience), the following maps were created indicating the potential risk to Calhoun County from hail (relatively low), lighting (relatively moderate), and strong wind (relatively high), the components of severe thunderstorms:

Map 48: FEMA NRI Hail Risk



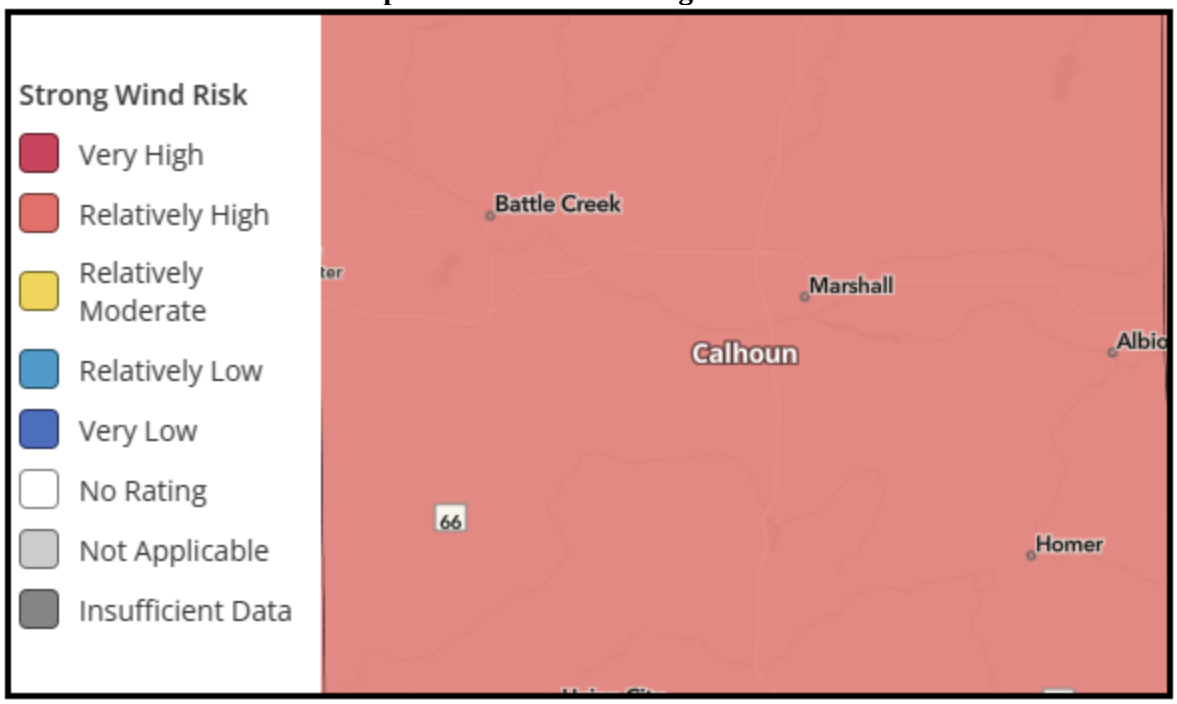
Source: FEMA NRI

Map 49: FEMA NRI Lightning Risk



Source: FEMA NRI

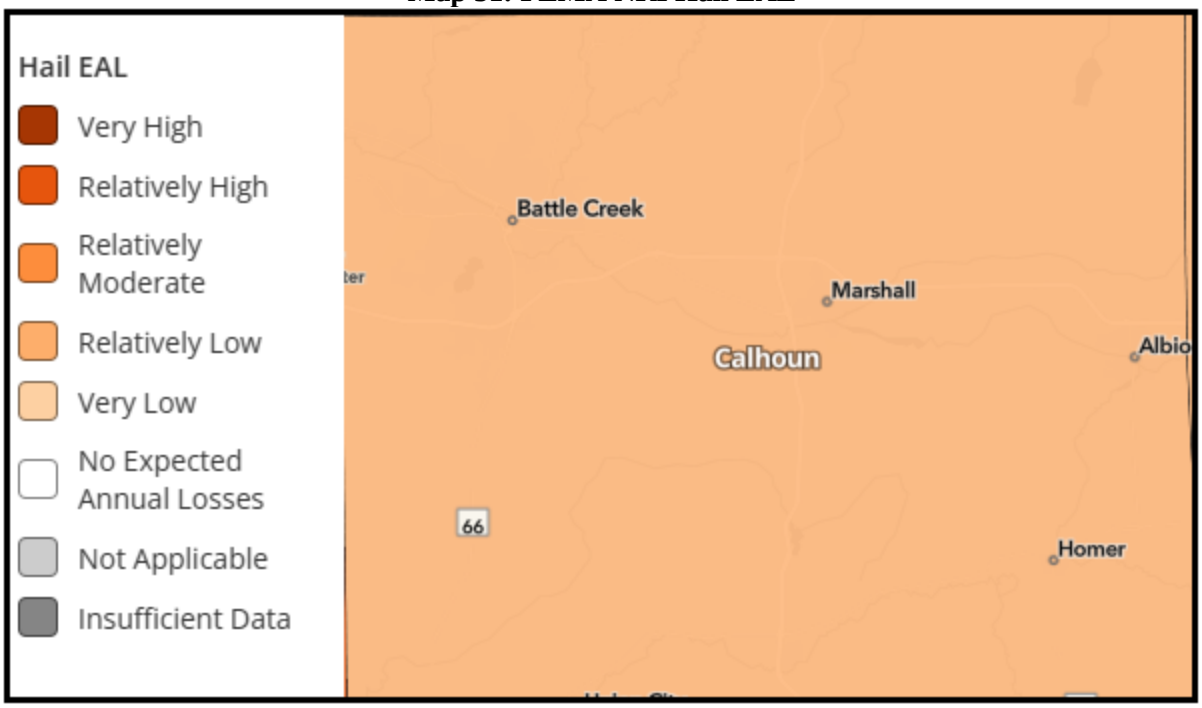
Map 50: FEMA NRI Strong Wind Risk



Source: FEMA NRI

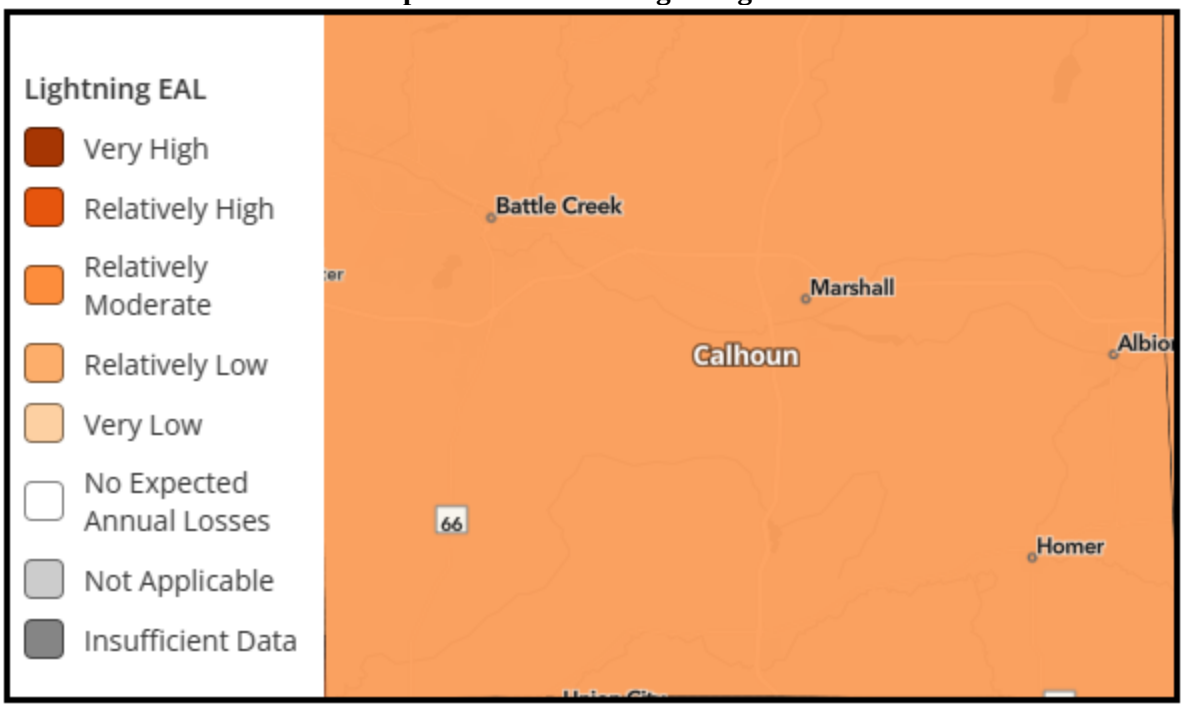
As part of the NRI, EAL represents the average economic loss in dollars resulting from natural hazards each year and is proportional to a community's risk. The following maps indicate the EAL for hail (relatively low), lightning (relatively moderate), and strong wind (relatively high) for Calhoun County:

Map 51: FEMA NRI Hail EAL



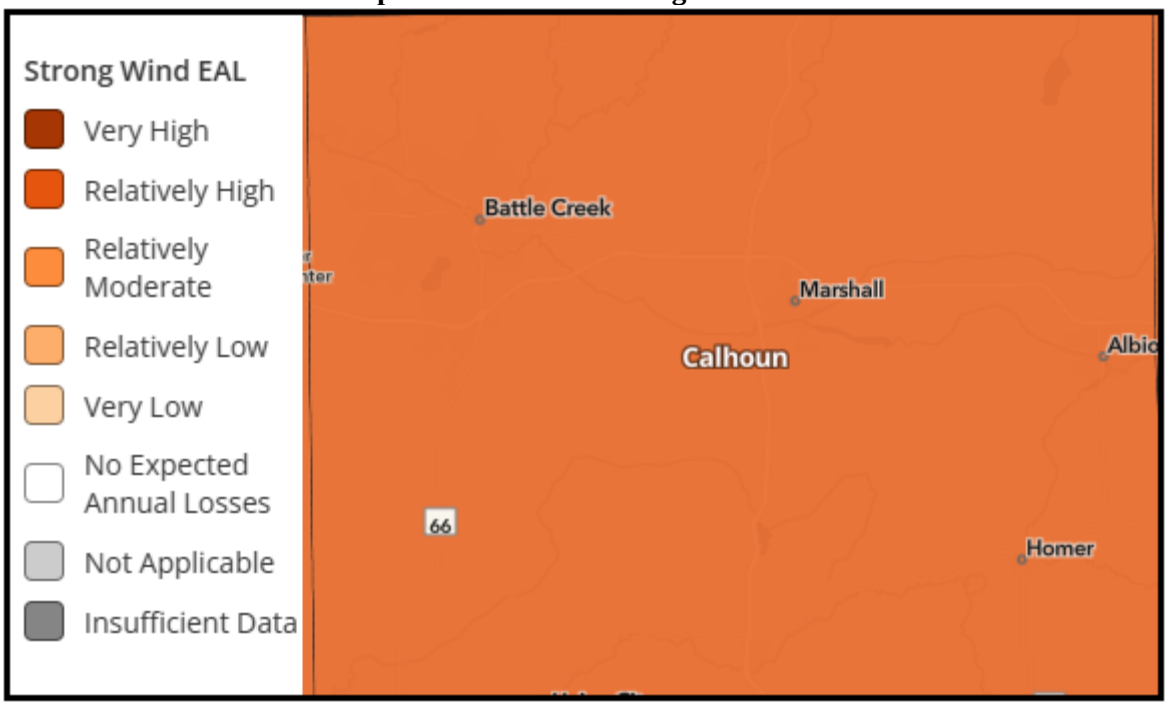
Source: FEMA NRI

Map 52: FEMA NRI Lightning EAL



Source: FEMA NRI

Map 53: FEMA NRI Strong Wind EAL



Source: FEMA NRI

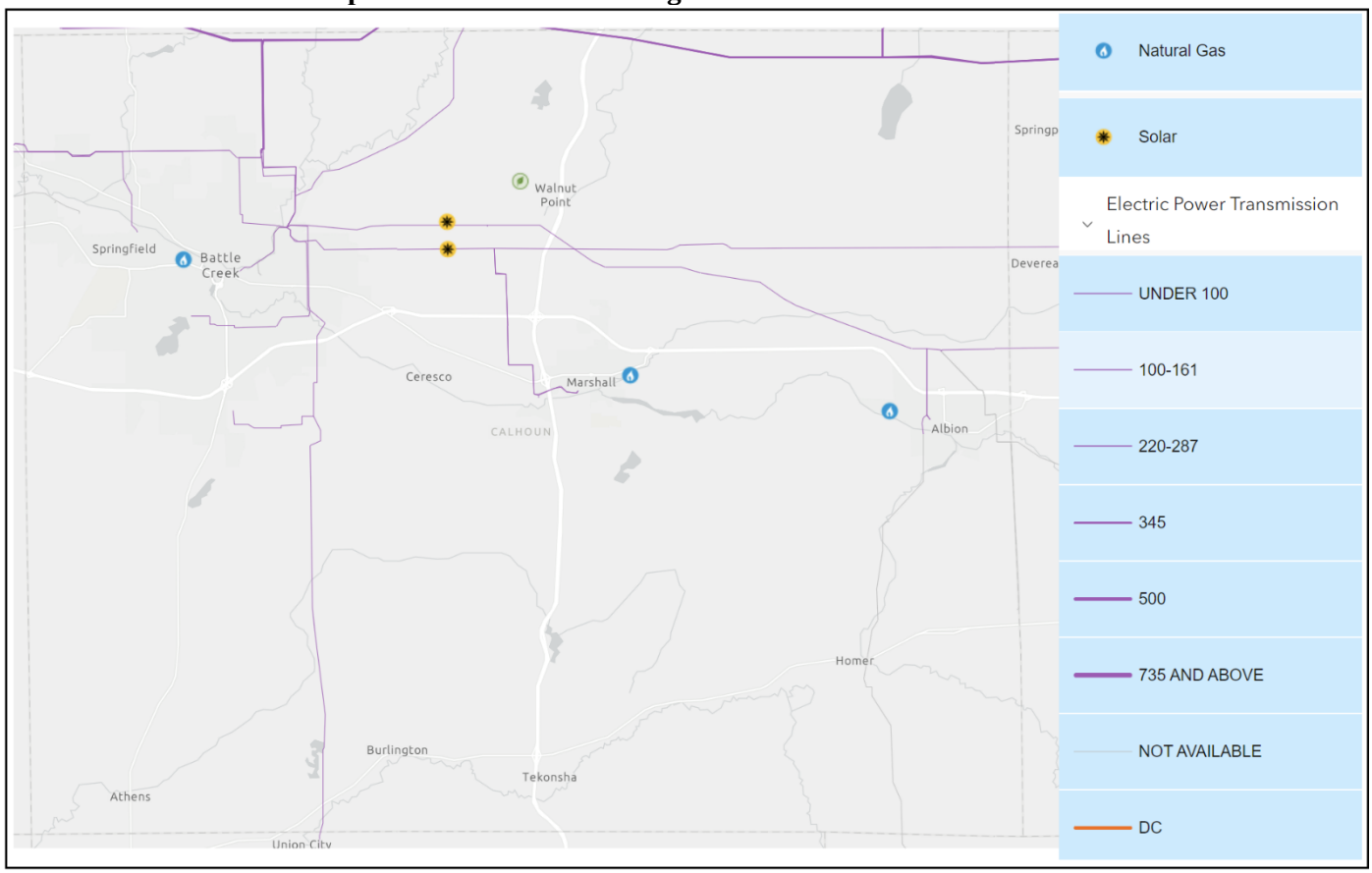
Potentially Vulnerable Community Lifelines

Severe thunderstorms can have significant impacts on electrical utilities, leading to disruptions in power supply and potential damage to infrastructure. Severe thunderstorms can affect electrical utilities in the following ways:

- Lightning Strikes: Lightning is a common occurrence in thunderstorms and poses a substantial risk to electrical infrastructure. Lightning strikes can damage power lines, transformers, substations, and other critical components, leading to power outages.
- Wind Damage: High winds associated with severe thunderstorms can cause trees, branches, and other debris to fall onto power lines. This can result in downed power lines, structural damage to utility poles, and disruptions in electrical service.
- Hailstorms: Severe thunderstorms may produce hail, which can damage power lines, transformers, and other equipment. Hailstones can also lead to short circuits and insulation damage on electrical components.
- Power Surges: Lightning strikes, strong winds, and other storm-related events can lead to power surges in the electrical grid. These surges can damage electronic devices, appliances, and utility equipment connected to the power supply.

The following map, from the U.S. Energy Atlas, details the location of both electrical generating plants and transmission lines within Calhoun County:

Map 52: Electrical Generating Plants and Transmission Lines



Source: U.S. Energy Atlas

The cost to replace electrical lines can vary widely based on several factors, including the type of electrical lines, the distance of the replacement, local labor and material costs, the complexity of the project, and any specific requirements or challenges involved. Additionally, costs can be significantly different for residential, commercial, or industrial projects. Additionally, urban and rural locations may have varying cost factors. As a rough estimate, the cost to replace electrical lines can range from a few thousand dollars to several thousand dollars per mile.

Communications systems within Calhoun County may have an increased vulnerability to severe thunderstorm events. Of particular concern is 911 and the dispatch system. Calhoun County and all jurisdictions are served by the Calhoun County Consolidated Dispatch Authority, a public authority formed under the Urban Cooperation Act of 1967. The Calhoun County Consolidated Dispatch Authority is the sole public safety answering point in Calhoun County, providing direct dispatching for:

- Law Enforcement
- Emergency Medical Services
- Fire

Severe storms can disrupt this vital communications system, affecting reliability and functionality. Some of the key vulnerabilities include:

- Physical Infrastructure Damage: High winds, heavy rainfall, and other severe weather conditions can cause physical damage to communication infrastructure such as cell towers, antennas, cables, and data centers. This damage can result in network outages and disruptions.

- Power Outages: Severe storms often lead to power outages, which can affect the operation of communication networks. Without a stable power supply, cell towers, data centers, and other critical components may become non-functional, leading to service interruptions.
- Lightning Strikes: Lightning poses a threat to communication infrastructure. Direct strikes or induced surges can damage electronic equipment, leading to the need for repairs or replacements and causing downtime.
- Signal Interference: Severe storms can create electromagnetic interference that disrupts radio signals used in wireless communication. This interference can lead to poor signal quality, dropped calls, and slower data speeds.
- Loss of Backhaul Connectivity: Severe weather events can damage the backhaul infrastructure that connects various communication nodes. This backbone infrastructure is crucial for transmitting data between local and regional networks, and any disruption can impact overall network performance.
- Communication Tower Instability: High winds and extreme weather conditions can compromise the stability of communication towers. If towers are not designed to withstand severe weather, they may collapse, leading to network outages.
- Network Congestion: In the event of a disaster, communication networks may experience a surge in usage as people attempt to contact emergency services, friends, and family. This increased demand can lead to network congestion, making it difficult for users to connect.

The cost to repair the Calhoun County communications network can vary widely depending on the extent of the damage, the size of the network, and the specific technologies involved. Repair costs may include expenses for labor, equipment replacement or repair, materials, and any additional resources required to restore the network to full functionality. The following data, from the U.S. Department of Homeland Security Cybersecurity and Infrastructure Security Agency, indicates cost ranges for communications system components:

Table 53: Summary of Communication System Component Costs

Components	Examples	Cost	Expected Lifespan
Infrastructure	Towers, shelters, commercial and backup power equipment,	$$$–$$$$$	20–25 years
Fixed Station Equipment	Antennas, repeaters, towers on wheels, consoles, mobile stations, servers, computers, physical and electronic security elements (e.g., fencing, cameras, monitors, environmental conditions)	$$-$$$	3-15 years
Devices	Handheld portable radios, cellular phones, satellite phones, mobile data devices	$-$$	2-10 years
Accessories	Holsters, chargers, speakers, lapel microphone extensions, Bluetooth, vehicle kits, aircards, intercoms	$	2-10 years
Features	Encryption to protect against security risks, ruggedization to ensure reliant services, Over-the-Air-Programming, automatic roaming	$-$$$	-
Software and Data Storage	Global information system, emergency notifications, monitoring, call answering, database access, Automatic Vehicle Locator	$-$$	-

Source: U.S. Department of Homeland Security Cybersecurity and Infrastructure Security Agency

Major hospitals identified in Calhoun County include the Battle Creek VA Medical Center, Bronson Battle Creek Hospital, and Oaklawn Hospital. The total in-patient bed capacity of these facilities is approximately 700 beds. While these, and other smaller medical facilities, may see an increase in severe thunderstorm related injuries during an event, it is considered unlikely that this increase will impact or overload capacity.

Consequence Analysis

This consequence analysis lists the potential impacts of a hazard on various elements of community and state infrastructure. The impact of each hazard is evaluated in terms of disruption of operations, recovery challenges, and overall wellbeing to all Calhoun County residents and first responder personnel. The consequence analysis supplements the hazard profile by analyzing specific impacts.

Table 54: Severe Thunderstorm Consequence Analysis

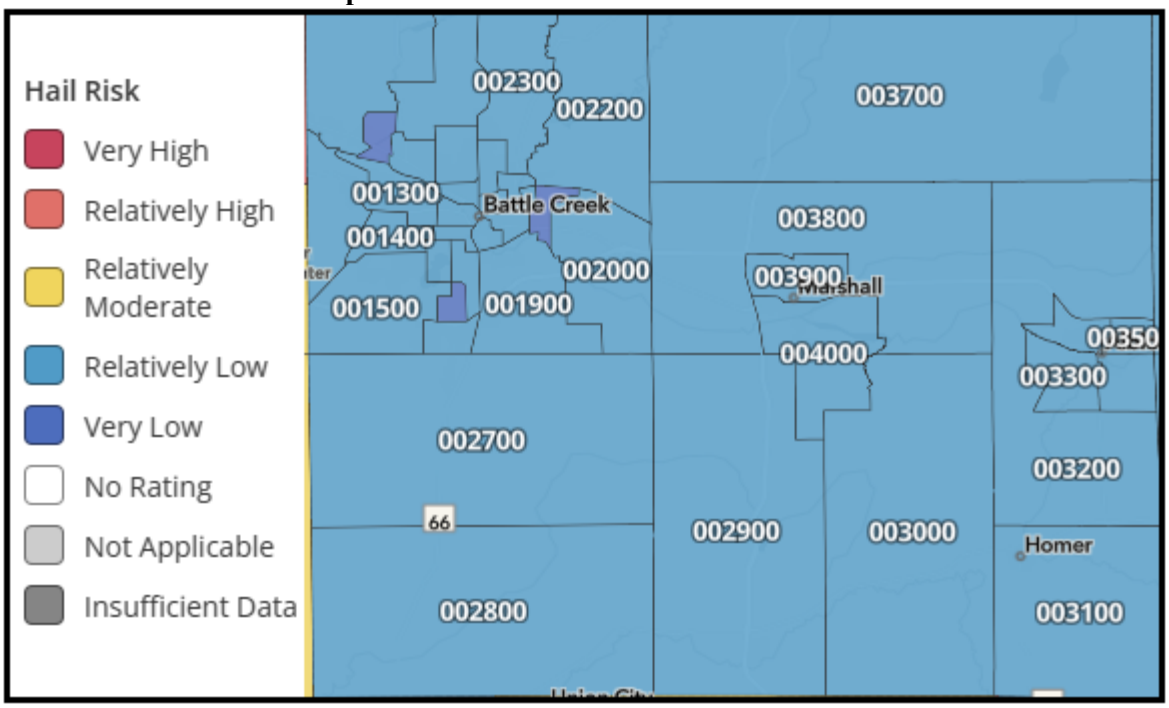
Subject	Potential Impacts
Impact on the Public	Thunderstorms can cause extensive property damage, loss of utility service, and injury to the public. Those most at-risk are low-income and homeless individuals without proper shelter.
Impact on Responders	First responders may be unable to access roadways due to flooding, trees, or debris. Exposure to lightning, flooding, and high winds may cause injuries to first responders. Vehicles and resources may be damaged, leading to impaired response activities. In addition, road conditions may become hazardous as a result of the by-products
Continuity of Operations	Local jurisdictions maintain continuity plans which can be enacted as necessary based on the situation. Severe thunderstorms may impact an agency's ability to maintain continuity of operations due to power outages, flooding, and wind damage. If the activation of alternate facilities was required, travel may be difficult as well as computer/network access due to long-term power outages caused by thunderstorms.
Delivery of Services	Delivery of services may be impaired by flooding, obstruction, and damage to roadways and resources. The ability to deliver goods and services will be impacted locally, regionally, or statewide depending on the magnitude of the event. Goods, equipment, and vehicles may become damaged during transport.
Property, Facilities, and Infrastructure	Power lines and power generators are most at risk from thunderstorms and impacts could result in isolated power outages or full-scale blackouts. Building and vehicle damage can occur from hail and other debris created by thunderstorms. Properties and critical facilities also may face foundational and physical damage due to flooding, lightning strike, or excessive winds, delaying response and recovery operations.
Impact on Environment	Waste and debris from damage treatment infrastructure or hazardous materials facilities could contaminate sources of water and food. Debris can impact and contaminate wildlife and natural areas. Lightning strikes may also ignite fires, leading to destruction of agricultural crops, critical ecosystems, and natural habitats.
Economic Conditions	Flooding, high winds, lightning, and hail can stress state and local resources. Even if some of the costs can be recouped through federal reimbursements (federal disaster declaration), there is a fiscal impact on the local government.
Public Confidence in Governance	Ineffective thunderstorm response can decrease the public's confidence in the ability to respond and govern. Governmental response across local, state, regional, and federal levels require direct actions that must be immediate and effective to maintain public confidence.

4.10.7 Jurisdictional Risk and Vulnerability

To help understand the risk and vulnerability to severe thunderstorms of participating jurisdictions mapping from the FEMA NRI was run on a census tract level. As the NRI does not generate mapping for individual jurisdictions, census tract analysis is the closest analogue available to understand individual jurisdiction conditions.

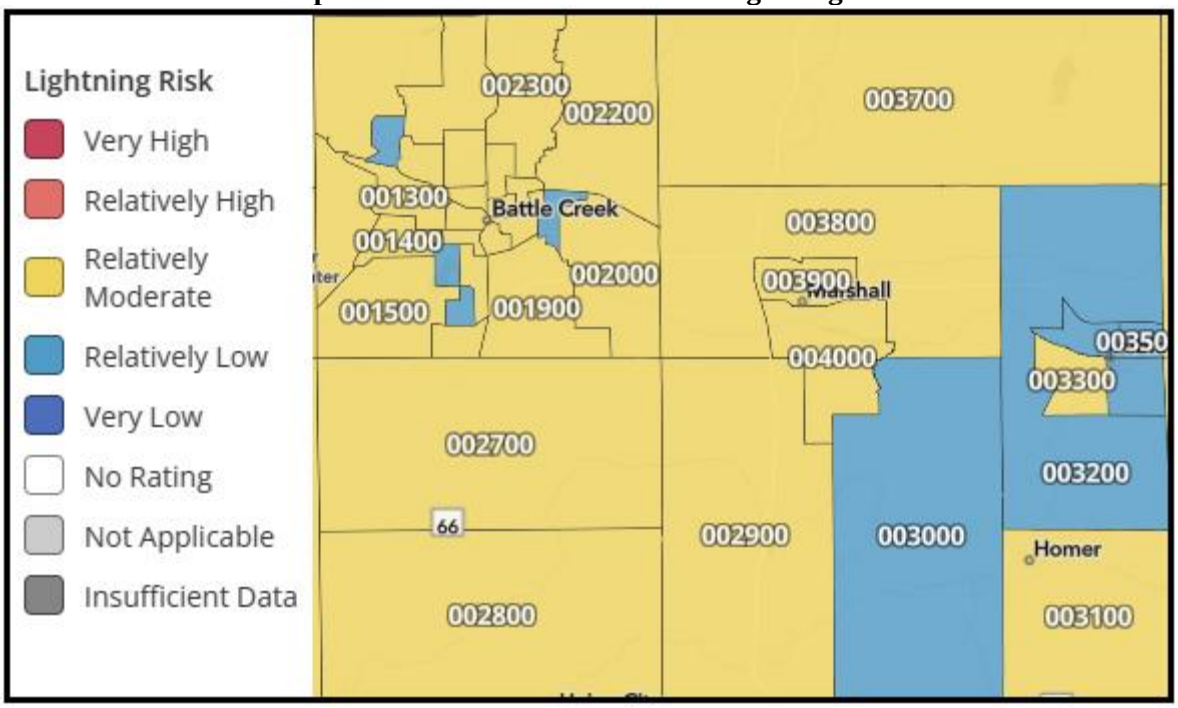
Using the FEMA NRI, and consisting of three input components (expected annual loss, social vulnerability, and community resilience), the following map was created indicating the potential risk to participating jurisdictions from hail, lightning, and strong wind, the components of strong thunderstorms:

Map 55: FEMA NRI Jurisdictional Hail Risk



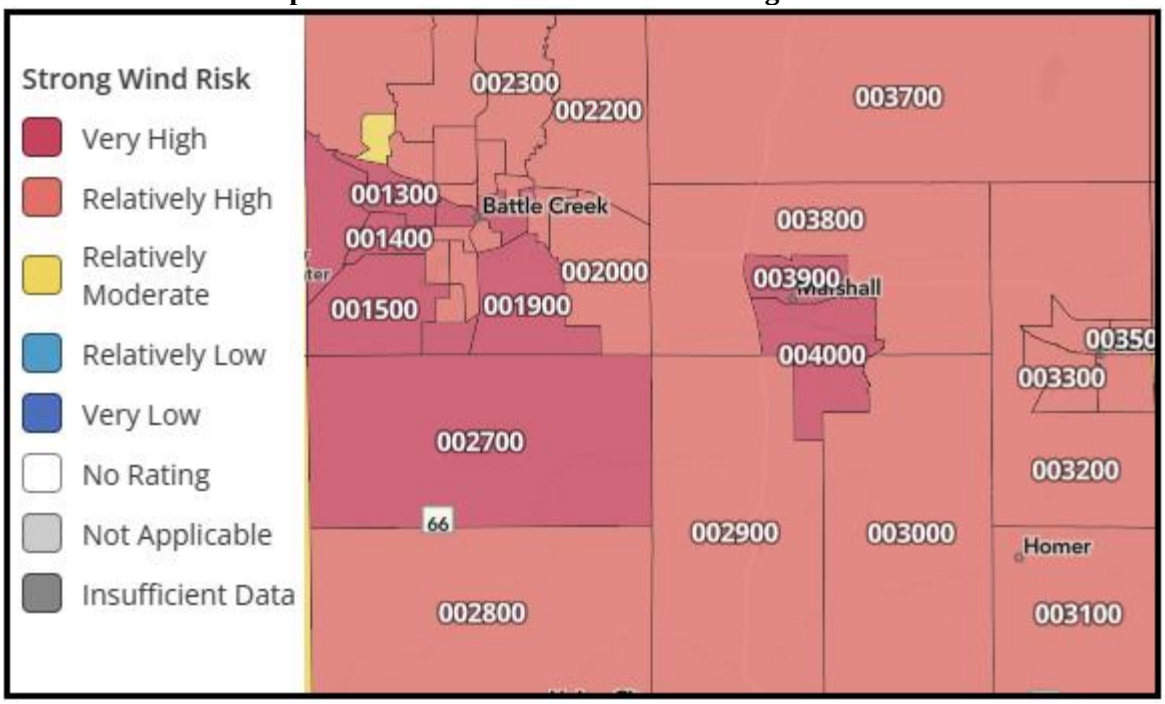
Source: FEMA NRI

Map 56: FEMA NRI Jurisdictional Lightning Risk



Source: FEMA NRI

Map 57: FEMA NRI Jurisdictional Strong Wind Risk

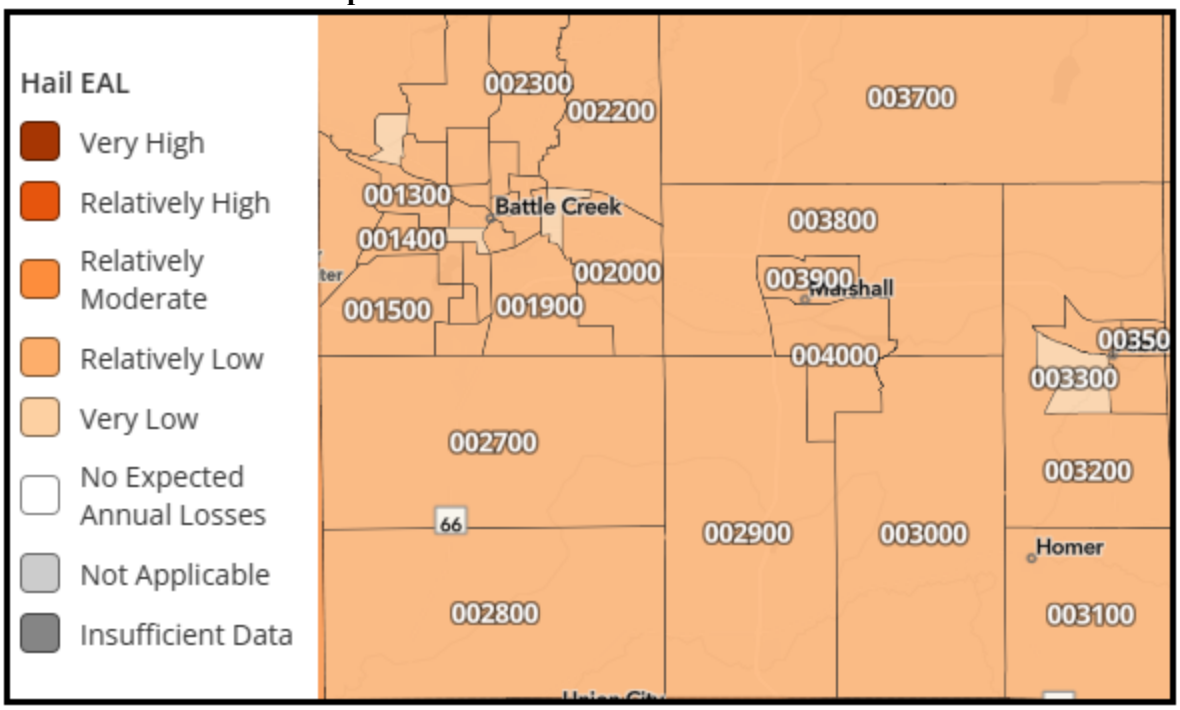


Source: FEMA NRI

NRI data tables concerning severe storm information, by census tract, may be found in Appendix E.

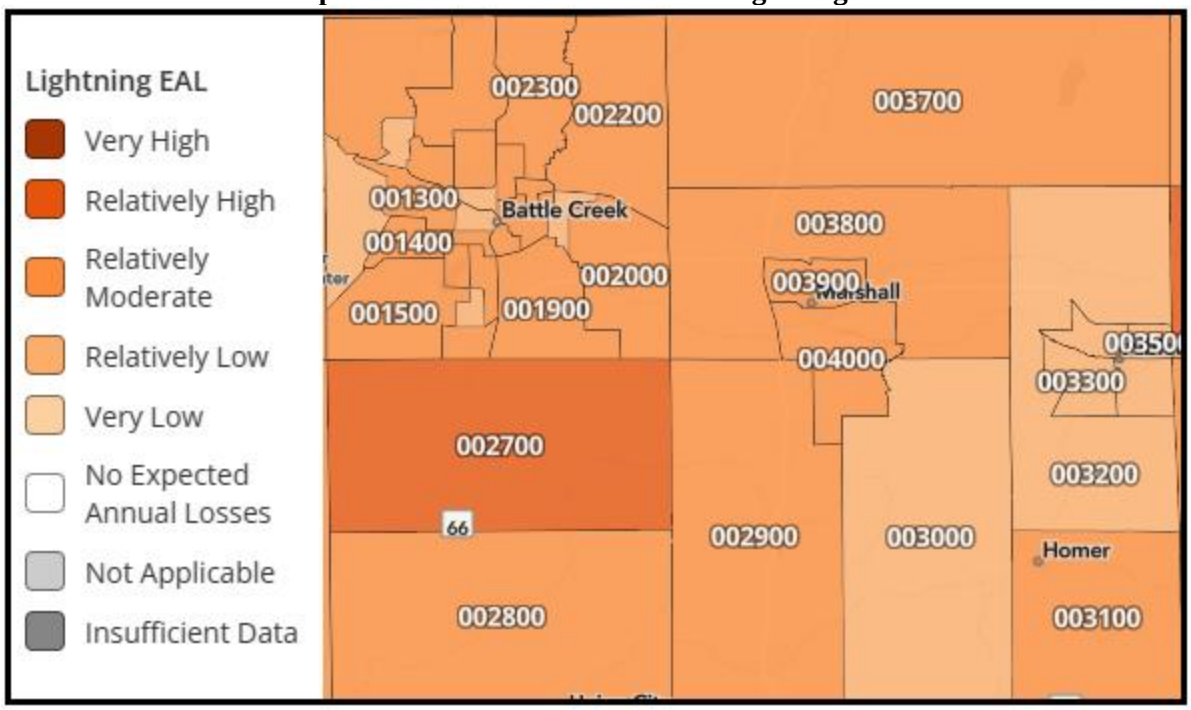
As part of the NRI, EAL represents the average economic loss in dollars resulting from natural hazards each year and is proportional to a community's risk. The following map indicates the EAL for hail, lightning, and strong wind, the components of severe thunderstorms, for participating jurisdictions within Calhoun County:

Map 58: FEMA NRI Jurisdictional Hail EAL



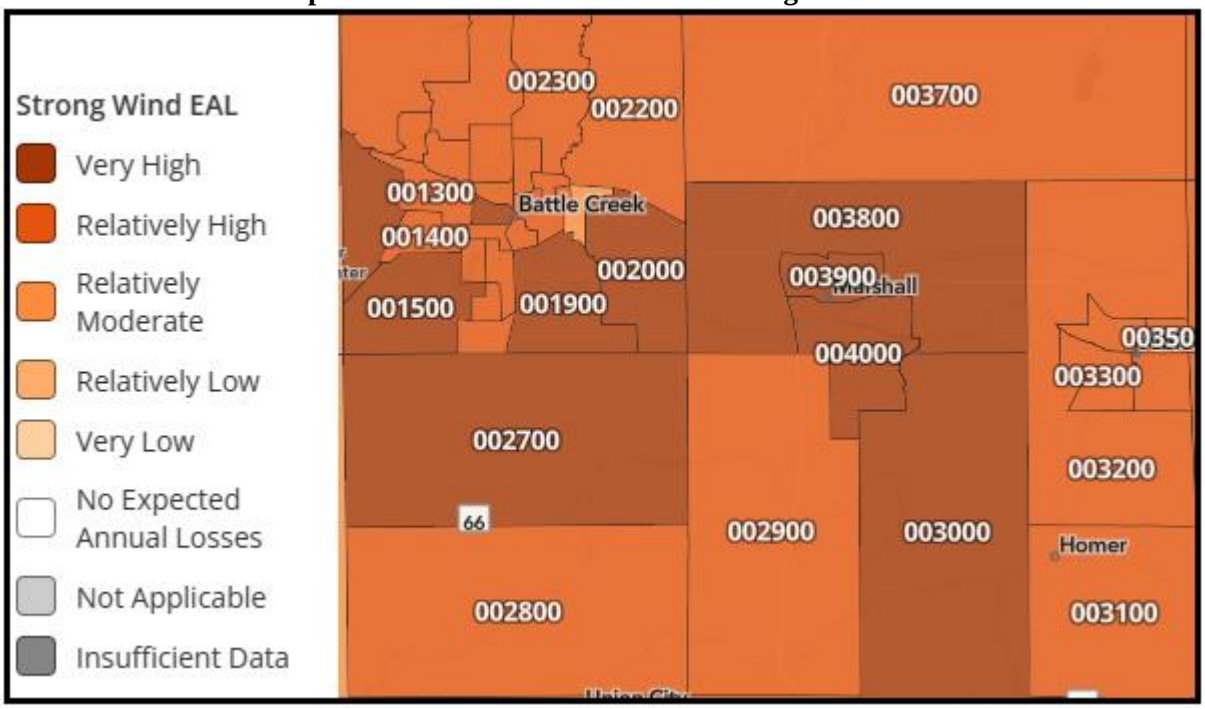
Source: FEMA NRI

Map 59: FEMA NRI Jurisdictional Lightning EAL



Source: FEMA NRI

Map 60: FEMA NRI Jurisdictional Strong Wind EAL



Source: FEMA NRI

The following table indicates the FEMA NRI and EAL analysis for the components of severe thunderstorms (hail, lightning, and strong winds) for each participating Calhoun County jurisdiction:

Table 55: Calhoun County FEMA EAL and NRI for Hail

Jurisdiction	EAL	Risk Index
Calhoun County	Relatively Low	Relatively Low
City of Albion	Very Low	Relatively Low
City of Battle Creek	Relatively Low	Relatively Low
City of Marshall	Relatively Low	Relatively Low
City of Springfield	Relatively Low	Relatively Low
Village of Athens	Relatively Low	Relatively Low
Village of Burlington	Relatively Low	Relatively Low
Village of Homer	Relatively Low	Relatively Low
Village of Tekonsha	Relatively Low	Relatively Low
Athens Township	Relatively Low	Relatively Low
Emmett Charter Township	Relatively Low	Relatively Low
Leroy Township	Relatively Low	Relatively Low
Sheridan Township	Relatively Low	Relatively Low
Tekonsha Township	Relatively Low	Relatively Low
NHBP	Relatively Low	Relatively Low

Source: FEMA NRI

The following table indicates the FEMA NRI and EAL analysis for drought for each participating Calhoun County jurisdiction:

Table 56: Calhoun County FEMA EAL and NRI for Lightning

Jurisdiction	EAL	Risk Index
Calhoun County	Relatively Moderate	Relatively Moderate
City of Albion	Relatively Low	Relatively Moderate
City of Battle Creek	Relatively Moderate	Relatively Moderate
City of Marshall	Relatively Moderate	Relatively Moderate
City of Springfield	Relatively Low	Relatively Moderate
Village of Athens	Relatively Moderate	Relatively Moderate
Village of Burlington	Relatively Moderate	Relatively Moderate
Village of Homer	Relatively Moderate	Relatively Moderate
Village of Tekonsha	Relatively Moderate	Relatively Moderate
Athens Township	Relatively Moderate	Relatively Moderate
Emmett Charter Township	Relatively Moderate	Relatively Moderate
Leroy Township	Relatively High	Relatively Moderate
Sheridan Township	Relatively Low	Relatively Low
Tekonsha Township	Relatively Moderate	Relatively Moderate
NHBP	Relatively Moderate	Relatively Moderate

Source: FEMA NRI

Table 57: Calhoun County FEMA EAL and NRI for Strong Winds

Jurisdiction	EAL	Risk Index
Calhoun County	Relatively High	Relatively High
City of Albion	Relatively High	Relatively High
City of Battle Creek	Relatively High	Very High
City of Marshall	Very High	Very High
City of Springfield	Very High	Very High
Village of Athens	Relatively High	Relatively High
Village of Burlington	Relatively High	Relatively High

Table 57: Calhoun County FEMA EAL and NRI for Strong Winds

Jurisdiction	EAL	Risk Index
Village of Homer	Relatively High	Relatively High
Village of Tekonsha	Relatively High	Relatively High
Athens Township	Relatively High	Relatively High
Emmett Charter Township	Very High	Very High
Leroy Township	Very High	Very High
Sheridan Township	Relatively High	Relatively High
Tekonsha Township	Relatively High	Relatively High
NHBP	Relatively High	Relatively High

Source: FEMA NRI

Lower income communities, including communities with a large percentage of mobile homes, may suffer disproportionate impacts from severe storm events, especially strong winds. The following table indicates mobile home data for participating jurisdictions:

Table 58: Calhoun County Mobile Home Data

Jurisdiction	Occupied Housing Stock as Mobile Homes (2010)	Occupied Housing Stock as Mobile Homes (2020))	Percentage Change in Mobile Homes (2010-2020)
Calhoun County	5.5%	4.7%	-0.8%
Albion	0.3%	0.23%	-0.07%
Athens	3.2%	2.4%	-0.8%
Battle Creek	1.8%	2.4%	0.6%
Burlington	24.8%	19.1%	-5.7%
Homer	10.4%	17.0%	6.6%
Marshall	1.0%	1.1%	0.1%
Springfield	8.4%	12.3%	3.9%
Tekonsha	19.4%	7.5%	-11.9%
Athens Township	11.3%	8.2%	-3.1%
Emmett Charter Township	4.2%	3.0%	-1.2%
Leroy Township	6.3%	5.4%	-0.9%
Sheridan Township	21.1%	24.6%	3.5%
NHBP	-	20.8%	-

Source: United States Census Bureau
-: Data unavailable

Since severe storms threaten the entire planning area equally, all tribal, municipal, and school district structures are considered exposed and vulnerable to severe thunderstorms. Data from the FEMA Hazus system indicates the total value of property within Calhoun County is $25,481,727,000.

4.11 Tornadoes

4.11.1 Hazard Description

A tornado is a violent, dangerous, rotating column of air that is in contact with both the surface of the earth and a cumulonimbus cloud or, in rare cases, the base of a cumulus cloud. Tornadoes come in many shapes and sizes but are typically in the form of a visible condensation funnel, whose narrow end touches the earth and is often encircled by a cloud of debris and dust.

Tornadoes can cause several kinds of damage to buildings. Tornadoes have been known to lift and move objects weighing more than 3 tons, toss homes more than 300 feet from their foundations, and siphon millions of tons of water. However, less spectacular damage is much more common. Houses and other obstructions in the path of the wind cause the wind to change direction. This change in wind direction increases pressure on parts of the building. The combination of increased pressures and fluctuating wind speeds creates stress on the building that frequently causes connections between building components, roofing, siding, windows, etc., to fail. Tornadoes can also generate a tremendous amount of flying debris. If wind speeds are high enough, airborne debris can be thrown at buildings with enough force to penetrate windows, roofs, and walls.

4.11.2 – Location and Extent

Tornadoes can strike anywhere in Calhoun County or its participating jurisdictions placing the entire planning area at risk. A tornado may arrive with a squall line or cold front and touch down quickly. Smaller tornadoes can strike without warning. Other times tornado watches and sirens will alert communities of high potential tornado producing weather or an already formed tornado and its likely path.

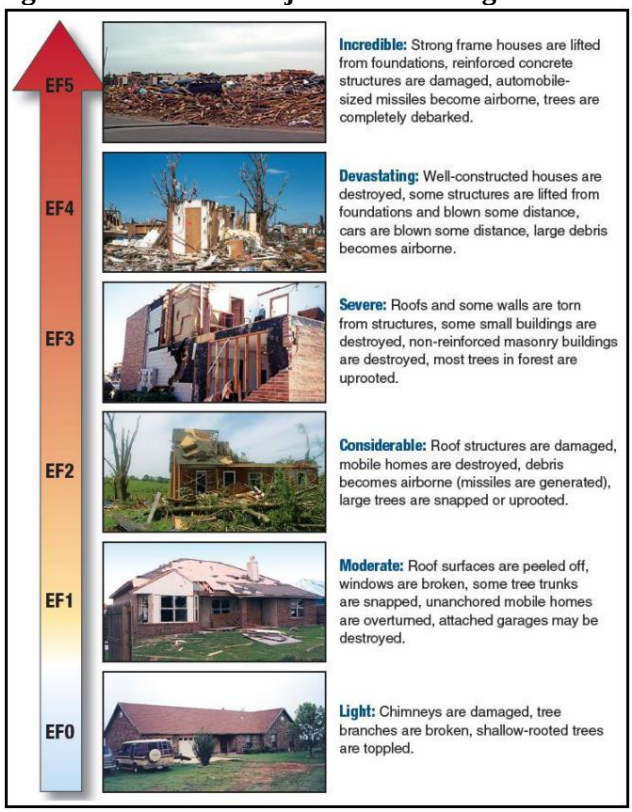
Since 2007, the United States uses the Enhanced Fujita (EF) Scale to categorize tornadoes. The scale correlates wind speed values per F level and provides a rubric for estimating damage.

Table 59: 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 leveled; cars thrown, and small missiles generated.
EF5	>200	<0.1%	Explosive. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 300 ft.; steel reinforced concrete structure badly damaged; high rise buildings have significant structural deformation; incredible phenomena will occur.

Source: NOAA Storm Prediction Center

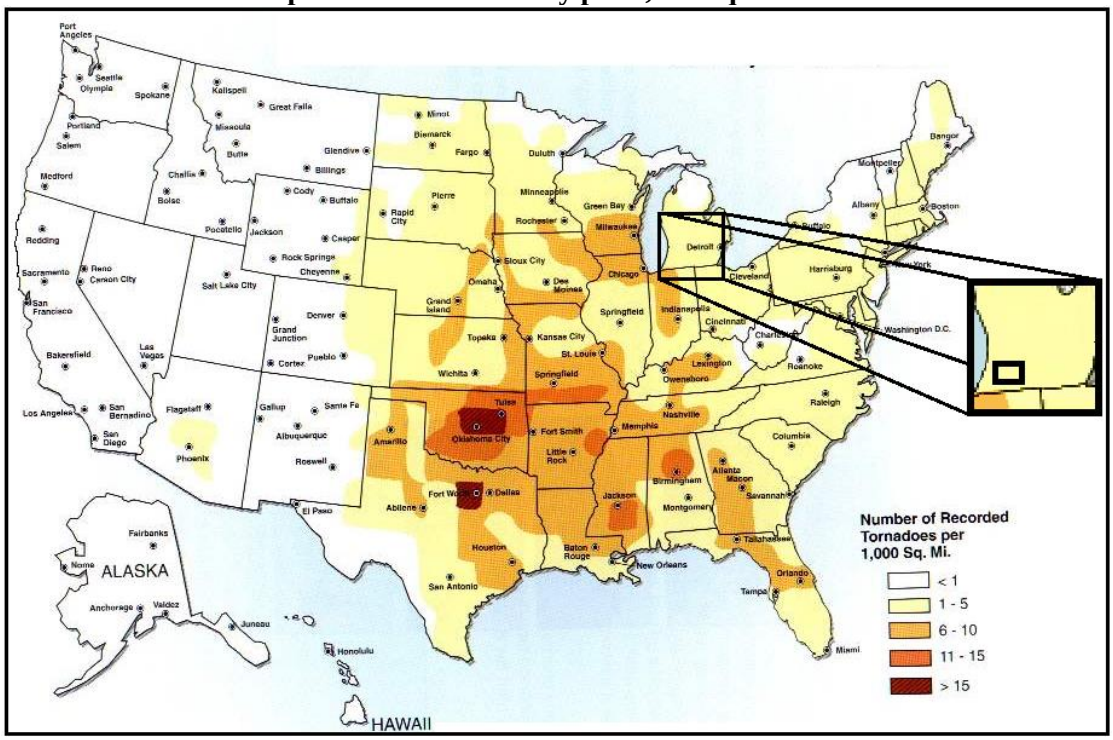
Figure 2: Enhanced Fujita Scale Damage Estimates



Source: FEMA

The following map, from FEMA, indicates that Calhoun County can expect, on average, one to five tornadoes per 1,000 square miles, a moderate category.

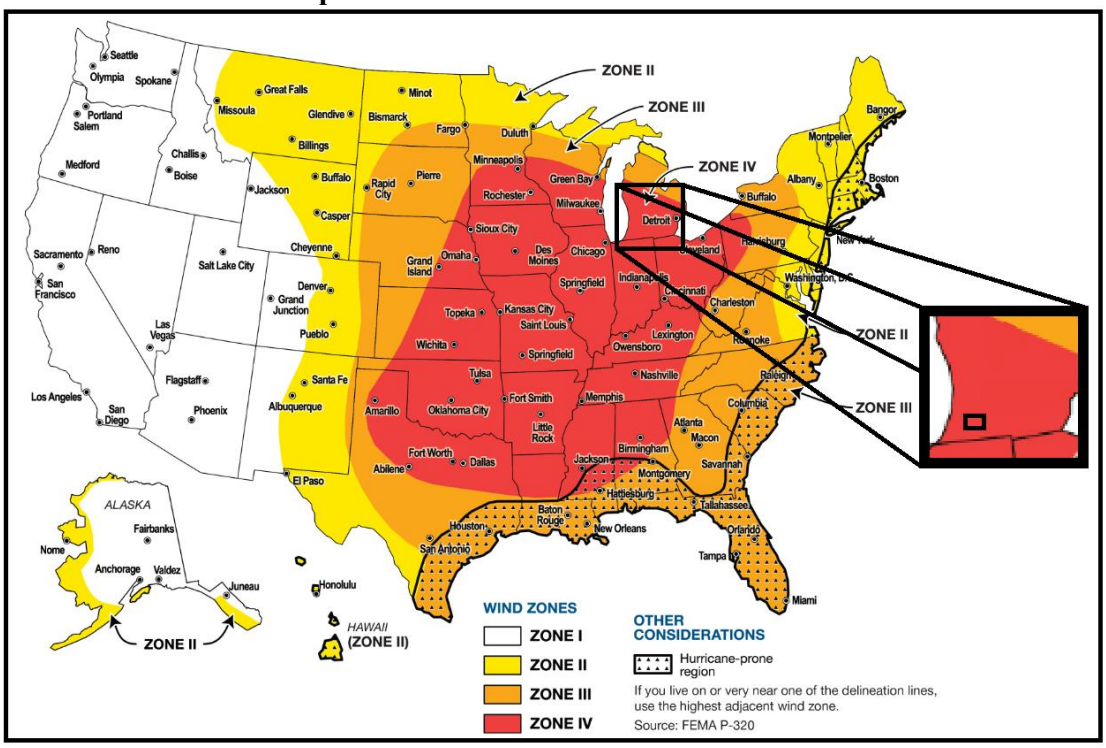
Map 61: Tornado Activity per 1,000 Square Miles



Source: FEMA

On the basis of 70 years of tornado history, FEMA and the NWS have divided the United States into four zones that geographically reflect the number and strength of recorded tornadoes. Calhoun County is in Zone IV, which has experienced the most and the strongest tornado activity.

Map 62: Tornado Zones of the United States



Source: FEMA

4.11.3 Previous Occurrences

The following table presents NCEI identified tornado events and the resulting damage totals in Calhoun County from 1950 to 2023. with the years 1950 and 2023 being full dataset years. Please note that as tornadoes events tend to cover larger areas occurrence data is being presented as representative of all participating jurisdictions.

Table 60: Calhoun County NCEI Tornado Events, 1950-2023

Event Type	Number of Events	Property Damage	Deaths	Injuries
Tornado	15	$4,305,000	0	21

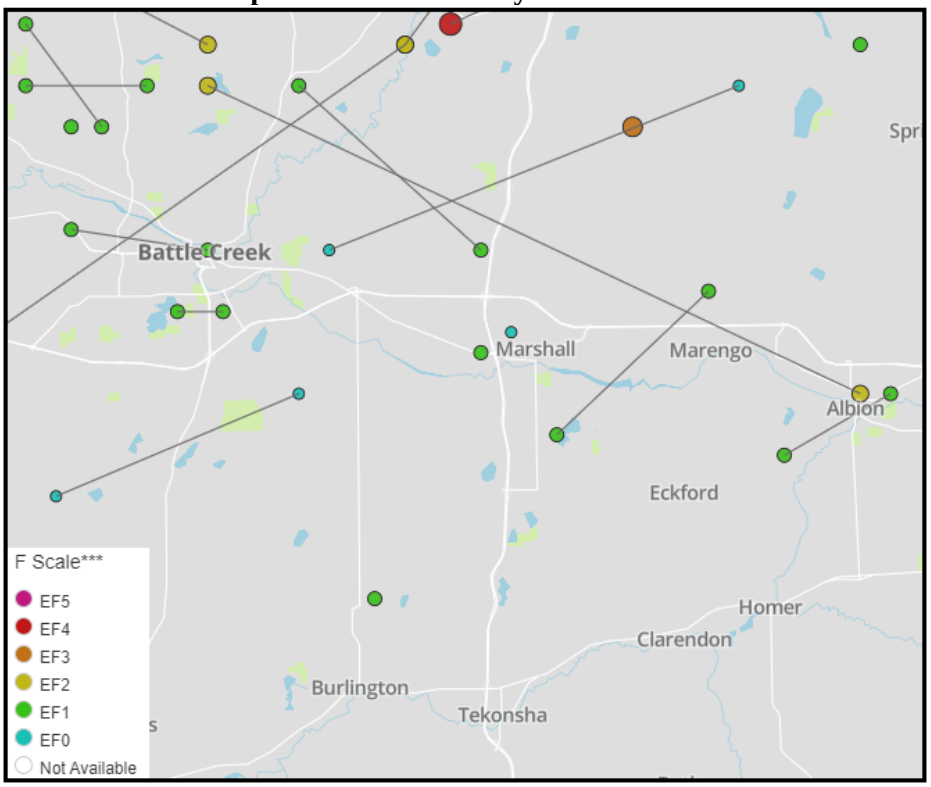
Source: NCEI

The following provides both local accounts and NCEI descriptions of notable recorded events:

- **June 5, 2010 – Battle Creek:** The tornado touched down near the intersection of Capitol Avenue and East Stafford Avenue just east of Goguac Lake and moved east just missing Riverside Elementary School and then moving along Chapel Hill Drive where it reached its peak intensity. The tornado then weakened as it moved across Interstate 194 before finally dissipating as it crossed 6 1/2-mile road. Three houses and Chapel Hill Methodist Church suffered partial loss of their roofs which along with approximately 100 snapped and uprooted trees resulted in a rating of EF1 along Chapel Hill Drive. The remainder of the track was rated EF0 where clusters of trees were uprooted or snapped with only minor damage occurring to houses in the path. Damages were reported at $2,000,000.
- **July 20, 2003 – Battle Creek:** A F1 tornado struck Calhoun County. The tornado path was eight miles long from where it first touched down to where it lifted for the last time. The tornado width was nearly one-half mile wide where the most severe damage occurred. Damage was recorded at $1,000,000.

NOAA has been tracking tornadoes in Calhoun County for decades. This following map, which contains data from 1950 to 2023, pinpoints where tornadoes have touched down and traces its path.

Map 63: Calhoun County Tornado Paths



Source: NOAA

4.11.4 Probability of Future Events

Predicting the probability of tornado occurrences is tremendously challenging due to the large number of factors involved and the random nature of formation. Data from the NCEI indicates that Calhoun County can expect on a yearly basis, relevant to tornado events:

Table 61: Calhoun County Tornado Probability Summary

Data	Events
Number of Days with NCEI Reported Event (1950-2023)	15
Average Events per Year	<1 (once every 5 years)
Strongest EF Rated Tornado	F2

Source: NCEI

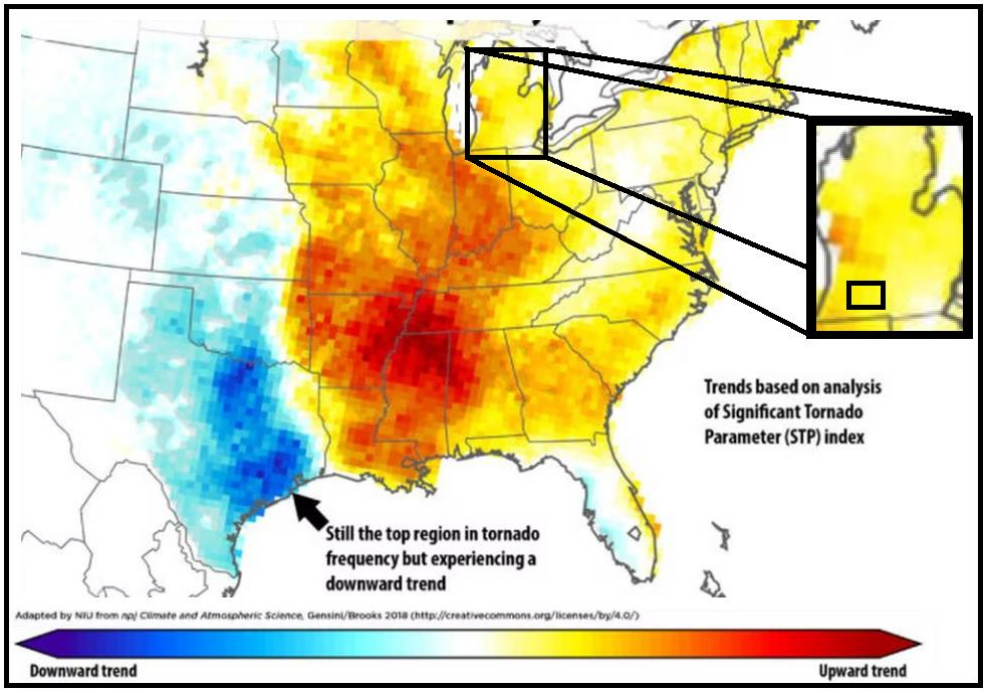
4.11.5 Projected Changes in Location, Intensity, Frequency, and Duration

The relationship between climate change and tornadoes is complex, and while there is ongoing research in this area, it is not fully understood. Tornadoes are small-scale, short-lived weather phenomena that can be influenced by a variety of atmospheric factors, including temperature, humidity, wind patterns, and atmospheric instability. Climate change can influence some of these factors, which may, in turn, affect tornado activity. Tornadoes typically form when warm, moist air near the surface clashes with cooler, drier air aloft, creating atmospheric instability. Climate change can alter temperature and humidity patterns, potentially affecting the conditions necessary for tornado formation. Additionally, climate change can lead to more extreme and variable weather patterns. While this may not necessarily increase the overall number of tornadoes, it could lead to more unpredictable and severe tornado events when they do occur. Some research suggests that climate change could lead to longer tornado seasons, with tornadoes occurring outside of their typical timeframes.

It's important to emphasize that while there may be some links between climate change and tornado activity, these links are not fully understood, and it is difficult to attribute specific tornado events to climate change. Tornadoes are influenced by a complex interplay of factors, and any changes in tornado patterns may vary by region.

Research conducted by the National Severe Storms Lab looked at to help determine future tornado probability. Significant Tornado Parameters are a measurement of the major parameters of tornado conditions, including wind speed and direction, wind at differing altitudes, unstable air patterns, and humidity. The following map, generated by Northern Illinois University and compiled from Significant Tornado Parameter data, indicates that Calhoun County may see an increasing number of tornadoes.

Map 64: Tornado Frequency Trends



Source: Northern Illinois University

As indicated in the data above, Calhoun County and all participating jurisdictions have been seeing generally static or declining populations. A static or declining population could decrease population risks to tornadoes by nature of their being fewer citizens to negatively impact.

Calhoun County's current land-use regulations require the consideration of building codes during the development review process. A building-by-building structural review, including roof profile, type and strength of windows, and foundation systems would need to be considered to determine structural risk. However, enforced building codes can ensure that newly built and renovated structures can better withstand tornado events.

The agriculture base of Calhoun County is increasingly vulnerable to the effects of tornadoes. Future development of agricultural resources would tend to increase the risk and impact of an event. As indicated in the data above, Calhoun County is seeing a continuing projected increase in agricultural activities and thus a potential greater future vulnerability.

4.11.6 Vulnerability and Impact

Data from the NCEI indicates that Calhoun County can expect on a yearly basis, relevant to tornado events:

Table 62: Calhoun County Tornado Impact Summary

Data	Recorded Impact
Deaths or Injuries (1950-2023)	21
Average Number of Deaths or Injuries	<1
Total Reported NCEI Property Damage (1950-2023)	$4,305,000
Average Property Damage per Year	$58,176

Source: NCEI

Data from HAZUS was used to provide a county building stock valuation. This data was then compared to NCEI structural damage figures to determine the percentage of impacted building within the county for the period of 2003-2022 for tornadoes. Data was only available at a county level.

Table 63: Calhoun County HAZUS and NCEI Tornado Percentage Loss Data

Hazard	HAZUS Building Valuation	NCEI Structure Damage, 2002-2022	Percentage of Building Valuation Damaged
Tornado	$25,591,571,000	$4,305,000	0.17%

Source: FEMA HAZUS

While difficult to quantify, as the impacts of future tornadoes will be determined by many factors, the impacts of a tornado may be widespread. An EF4 or EF5 tornado has the potential to level facilities. A lesser magnitude tornado can rip off roofs and walls while launching airborne missiles born from debris. In the absence of proper shelter tornadoes can cause serious injury. In general, if potentially exposed persons take shelter in a solid, well-constructed shelter protection from tornadoes would be provided. However, old or poorly constructed facilities may be more prone to damage, potentially increasing the impact on economically disadvantaged populations.

Tornadoes can have significant and often devastating impacts on people and communities. These impacts can vary depending on the tornado's intensity, size, path, and may include:

- Injuries and Fatalities: Tornadoes can cause a wide range of injuries, from minor cuts and bruises to severe trauma. Flying debris, structural damage, and the force of the wind can lead to injuries or fatalities among those directly affected by the tornado. Prompt medical care is essential to treat injuries effectively and save lives.
- Mental Health Effects: Tornadoes can be extremely traumatic events, causing psychological distress and emotional trauma for survivors. Individuals may experience post-traumatic stress disorder, anxiety, depression, and grief. Mental health support and counseling services are often needed to help survivors cope with these emotional challenges.
- Displacement: People may need to evacuate their homes or be temporarily displaced due to tornado damage, requiring emergency shelter and support.

After a tornado, health risks may arise due to contaminated water, debris, and unsafe conditions. Inadequate sanitation and exposure to harsh weather can exacerbate health issues. Children, the elderly, and individuals with disabilities or limited mobility may face additional challenges in evacuating to safety and accessing needed resources.

Tornadoes can have significant and wide-ranging impacts on facilities, critical facilities, and critical infrastructure. These risks can have significant economic and operational consequences, and can include:

- Critical Facility Damage: Hospitals and healthcare facilities may be damaged or rendered inoperable during tornadoes, affecting the ability to provide medical care during a disaster. Fire stations, police stations, and emergency operation centers may be damaged or destroyed, impacting the ability of first responders to coordinate disaster response efforts. Damage to emergency shelters and housing facilities can disrupt services which are critical for providing temporary shelter to displaced individuals and families.

- Infrastructure Damage: High winds and blowing debris can cause considerable damage to infrastructure. This can result in costly repairs and disruptions to daily lives for an extended period.
- Power Outages: Tornadoes can cause power outages by bringing down power lines and damaging electrical infrastructure. Critical facilities such as hospitals, emergency response centers, and data centers may rely on backup generators to maintain essential operations during outages.
- Communication Disruptions: Tornadoes can damage communication infrastructure, including cell towers, telephone lines, and data centers, leading to disruptions in phone and internet services. This can hinder emergency communication and coordination, affecting critical response efforts.
- Transportation Disruptions: Debris and fallen trees on roads, runways, and railways can disrupt transportation networks, leading to travel delays, accidents, and closures. Critical facilities may face challenges in receiving essential supplies and personnel during and after the storm.
- Healthcare System Strain: Hospitals and healthcare facilities may experience increased demand for medical services due to storm-related injuries and illnesses.
- Water and Wastewater System Interruptions: Tornadoes can damage water treatment plants, pumping stations, and water distribution systems. This can lead to a loss of clean drinking water and sanitation services, posing health risks to affected communities. Damage to wastewater treatment facilities and sewer systems can result in the release of untreated sewage, creating environmental hazards and public health concerns.
- Property Damage: Tornadoes can result in property damage, up to and including complete structural collapse.

Tornadoes can have significant impacts on the environment. These impacts are often destructive and can affect ecosystems, wildlife, natural resources, and even the local climate. Tornadoes can disrupt natural habitats by uprooting or damaging trees, destroying vegetation, and altering landscapes. This can affect the habitat suitability for wildlife and plant species. Tornadoes can harm or displace wildlife, resulting in injury or death. Nesting birds, burrowing mammals, and other species can be particularly vulnerable. As tornadoes can transport plant seeds, insects, and other organisms over long distances, in the aftermath it is possible for invasive species to take root in new areas, especially those impacted by wildfires caused by downed utility lines.

Tornadoes can have significant and wide-ranging impacts on local operations. Some of the key impacts of tornadoes on operations may include:

- Emergency Response and Public Safety: Tornadoes can lead to a surge in emergency calls for services related to accidents, injuries, and damaged structures. State agencies involved in emergency response must mobilize additional resources to handle these demands.
- Emergency Operations Centers: Tornadoes often require the activation of state Emergency Operations Centers to coordinate emergency response efforts. These centers serve as hubs for communication, resource allocation, and decision-making during disasters.
- Emergency Shelters and Services: Tornadoes may require the establishment of emergency shelters and services for displaced residents. State agencies must coordinate the setup and operation of these facilities.
- Education Disruption: Tornadoes can lead to school closures, affecting state-run education programs and services. State agencies may need to coordinate with school districts to ensure the safety of students.
- Budgetary Impact: The costs associated with emergency response efforts, disaster recovery, and infrastructure repair can strain state budgets.
- Resource Allocation: State governments must allocate resources, including personnel, equipment, and stockpiled supplies, to support emergency response and recovery efforts.
- Communication Challenges: Tornadoes can disrupt communication networks, hindering the ability of government agencies to communicate internally and with the public. This can impact emergency notifications and coordination efforts.

- Administrative and Governance Challenges: State government offices and facilities may experience closures or reduced staffing during tornadoes, affecting administrative functions, regulatory processes, and public services.
- Economic Impact: The destruction of infrastructure and businesses can have significant economic consequences for the state and local communities, including job losses and reduced economic activity.
- Public Services: Tornadoes can disrupt the delivery of public services, including transportation, utilities, and social services, affecting the well-being of residents.

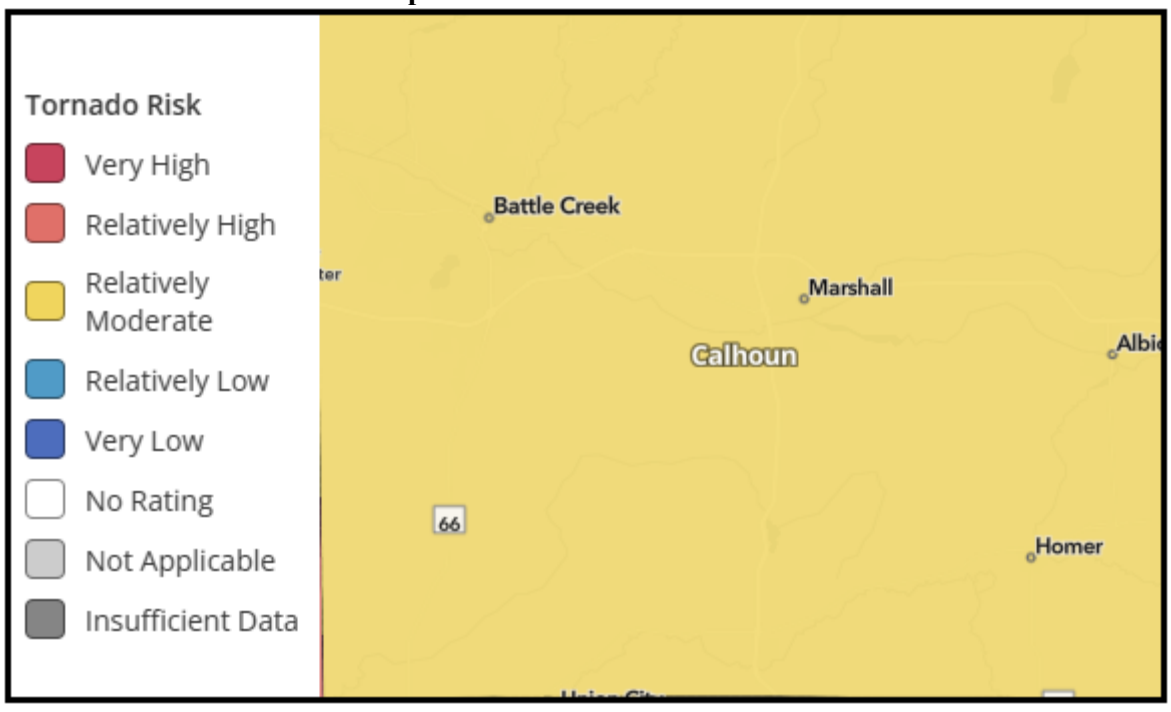
Tornadoes can have severe and destructive impacts on government facilities and assets, affecting operations, and potential impacts may include:

- Structural Damage: Tornadoes can cause significant structural damage to government buildings, including offices, administrative centers, and public facilities. Roofs may be torn off, walls may collapse, and windows may shatter.
- Communication Infrastructure Damage: Tornadoes can damage communication infrastructure, such as cell towers, antennas, and communication lines, affecting the ability of government agencies to coordinate emergency response efforts.
- Infrastructure Damage: Tornadoes can block roads, damage bridges, and disrupt transportation networks.

Data from the FEMA Hazus system indicates the total value of government property within Calhoun County is $258,661,000, all of which is vulnerable to tornadoes.

Using the FEMA NRI, and consisting of three input components (expected annual loss, social vulnerability, and community resilience), the following map was created indicating the potential risk to Calhoun County from tornadoes (relatively moderate):

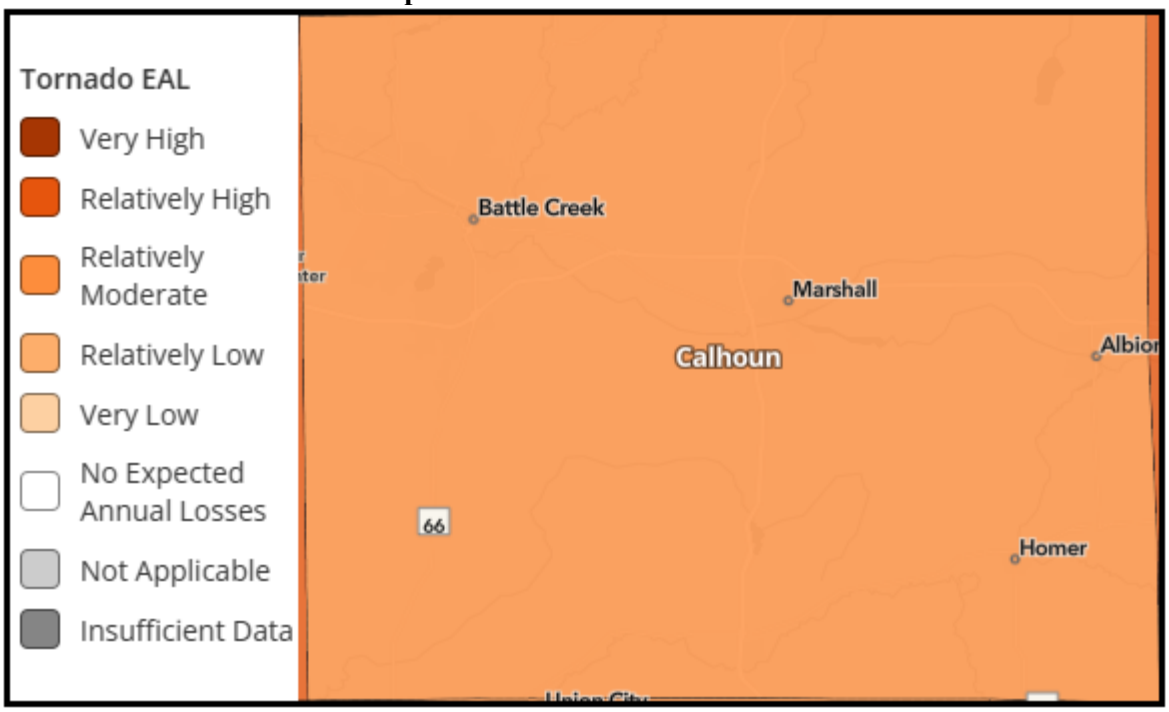
Map 65: FEMA NRI Tornado Risk



Source: FEMA NRI

EAL represents the average economic loss in dollars resulting from natural hazards each year and is proportional to a community's risk. The following map indicate the EAL for tornadoes for Calhoun County (relatively moderate):

Map 66: FEMA NRI Tornado EAL



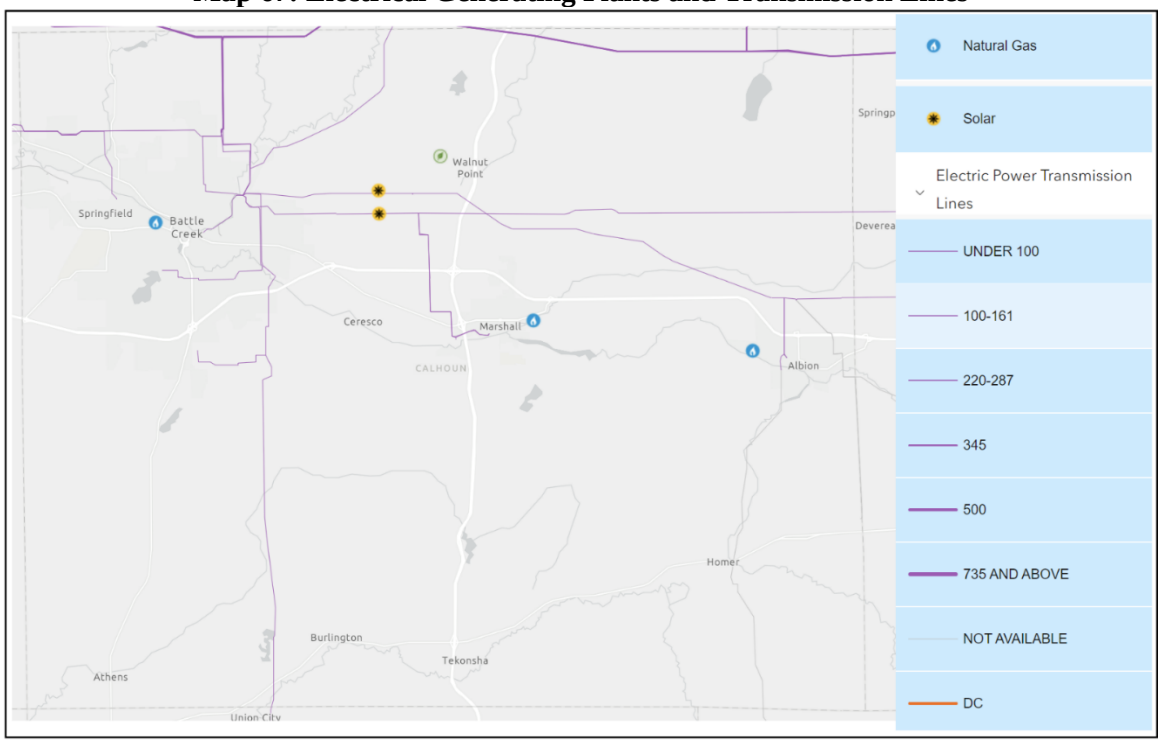
Source: FEMA NRI

Potentially Vulnerable Community Lifelines

Tornadoes can have significant impacts on electrical utilities, leading to disruptions in power supply and potential damage to infrastructure. The high winds associated with smaller tornadoes can cause trees, branches, and other debris to fall onto power lines. Higher intensity tornadoes can destroy transmission infrastructure. This can result in downed power lines, structural damage to utility poles, and disruptions in electrical service.

The following map, from the U.S. Energy Atlas, details the location of both electrical generating plants and transmission lines within Calhoun County:

Map 67: Electrical Generating Plants and Transmission Lines



Source: U.S. Energy Atlas

The cost to replace electrical lines can vary widely based on several factors, including the type of electrical lines, the distance of the replacement, local labor and material costs, the complexity of the project, and any specific requirements or challenges involved. Additionally, costs can be significantly different for residential, commercial, or industrial projects. Additionally, urban and rural locations may have varying cost factors. As a rough estimate, the cost to replace electrical lines can range from a few thousand dollars to several thousand dollars per mile.

Communications systems within Calhoun County may have an increased vulnerability to tornado events. Of particular concern is 911 and the dispatch system. Calhoun County and all jurisdictions are served by the Calhoun County Consolidated Dispatch Authority, a public authority formed under the Urban Cooperation Act of 1967. The Calhoun County Consolidated Dispatch Authority is the sole public safety answering point in Calhoun County, providing direct dispatching for:

- Law Enforcement
- Emergency Medical Services
- Fire

Tornadoes can disrupt this vital communications system, affecting reliability and functionality. Some of the key vulnerabilities include:

- Structural Damage to Communication Towers: Tornadoes can cause direct structural damage to communication towers, including cellular, television, radio, and microwave towers. Toppled or damaged towers can disrupt signal transmission and reception.
- Power Outages: Tornadoes often cause power outages by damaging electrical infrastructure. Communication facilities, including cell towers and data centers, rely on a stable power supply. Power failures can lead to service interruptions.

- Fiber Optic Cable Damage: Flying debris and tornado-related destruction can damage underground and aerial fiber optic cables. Severed cables can disrupt data transmission and internet connectivity.
- Microwave Link Disruptions: Tornadoes can interfere with microwave communication links, which are used for long-distance communication. High winds and debris can disrupt the line of sight needed for these links.
- Equipment Damage: Communication equipment located outdoors, such as antennas, dishes, and amplifiers, can be damaged by tornadoes, affecting the performance of communication systems.
- Loss of Communication Nodes: Tornadoes can damage communication nodes, exchanges, and network switching centers. Loss of these critical components can lead to widespread service disruptions.
- Cellular Network Congestion: In the aftermath of a tornado, there is often an increased demand for cellular communication as individuals seek information and contact loved ones. This surge in demand can lead to network congestion and reduced service quality.

The cost to repair the Calhoun County communications network can vary widely depending on the extent of the damage, the size of the network, and the specific technologies involved. Repair costs may include expenses for labor, equipment replacement or repair, materials, and any additional resources required to restore the network to full functionality. The following data, from the U.S. Department of Homeland Security Cybersecurity and Infrastructure Security Agency, indicates cost ranges for communications system components:

Table 64: Summary of Communication System Component Costs

Components	Examples	Cost	Expected Lifespan
Infrastructure	Towers, shelters, commercial and backup power equipment,	$$$–$$$$$	20–25 years
Fixed Station Equipment	Antennas, repeaters, towers on wheels, consoles, mobile stations, servers, computers, physical and electronic security elements (e.g., fencing, cameras, monitors, environmental conditions)	$$-$$$	3-15 years
Devices	Handheld portable radios, cellular phones, satellite phones, mobile data devices	$-$$	2-10 years
Accessories	Holsters, chargers, speakers, lapel microphone extensions, Bluetooth, vehicle kits, aircards, intercoms	$	2-10 years
Features	Encryption to protect against security risks, ruggedization to ensure reliant services, Over-the-Air-Programming, automatic roaming	$-$$$	-
Software and Data Storage	Global information system, emergency notifications, monitoring, call answering, database access, Automatic Vehicle Locator	$-$$	-

Source: U.S. Department of Homeland Security Cybersecurity and Infrastructure Security Agency

Tornadoes can significantly impact emergency response infrastructure, creating challenges for first responders and organizations involved in managing and mitigating the effects of severe weather events. Tornadoes can impact emergency response through:

- Transportation Disruptions: Debris on roads can hinder the ability of emergency vehicles to navigate and reach affected areas promptly. Hazardous road conditions may result in delays in response times.
- Road Closures: Tornadoes can lead to the closure of roads due to debris accumulation and hazardous conditions. This can limit access for emergency vehicles and impede the evacuation of residents.
- Communication Disruptions: Tornadoes can disrupt communication networks, affecting the ability of emergency responders to coordinate and communicate effectively. Downed power lines and damage to communication infrastructure contribute to these disruptions.

- Power Outages: Tornadoes downing power lines can lead to power outages. Emergency response facilities, such as command centers and fire stations, may lose power, affecting their operational capabilities.
- Resource Allocation Challenges: Tornadoes often require the allocation of additional resources, including personnel, equipment, and supplies, to address immediate needs. This can strain emergency response organizations and impact their ability to respond to other concurrent incidents.
- Logistical Challenges: Tornadoes may create logistical challenges for the transportation of supplies, equipment, and personnel to affected areas, hindering the overall effectiveness of emergency response efforts.
- Increased Demand for Services: Tornadoes can result in an increased demand for emergency services, including medical assistance, search and rescue operations, and responses to accidents. Emergency response organizations may need to manage a higher volume of incidents simultaneously.

Calhoun County currently has the following major law enforcements departments, all of which may be impacted by tornadoes:

- Marhsall County Sherriff's Office
- Albion Public Safety
- Battle Creek Police Department
- Emmett Township Department of Public Safety
- Homer Police Department
- Marshall Police Department
- Michigan State Police District 5 Post 57 - Battle Creek
- Springfield Department of Public Safety

Calhoun County currently has the following major fire departments, all of which may be impacted by tornadoes:

- Albion Township Fire Department
- Athens Township Fire Department
- Battle Creek Fire Department
- Bedford Township Fire Department
- Burlington Township Fire Department
- Charter Township of Bedford Fire Department
- Emmett Township Department of Public Safety
- Fredonia Township Fire Department
- Homer Fire Department
- Leroy Township Fire Department
- Marengo Township Fire Department
- Marshall Fire Department
- Marshall Township Fire Department
- Newton Township Fire Department
- Pennfield Township Fire Department
- Sheridan Township Fire Department
- Springfield Department of Public Safety
- Tekonsha Fire Department

Major hospitals identified in Calhoun County include the Battle Creek VA Medical Center, Bronson Battle Creek Hospital, and Oaklawn Hospital. The total in-patient bed capacity of these facilities is approximately 700 beds. While these, and other smaller medical facilities, may see an increase in tornado related injuries during an event, it is considered unlikely that this increase will impact or overload capacity.

Consequence Analysis

This consequence analysis lists the potential impacts of a hazard on various elements of community and state infrastructure. The impact of each hazard is evaluated in terms of disruption of operations, recovery challenges, and overall wellbeing to all Calhoun County residents and first responder personnel. The consequence analysis supplements the hazard profile by analyzing specific impacts.

Table 65: Tornado Consequence Analysis

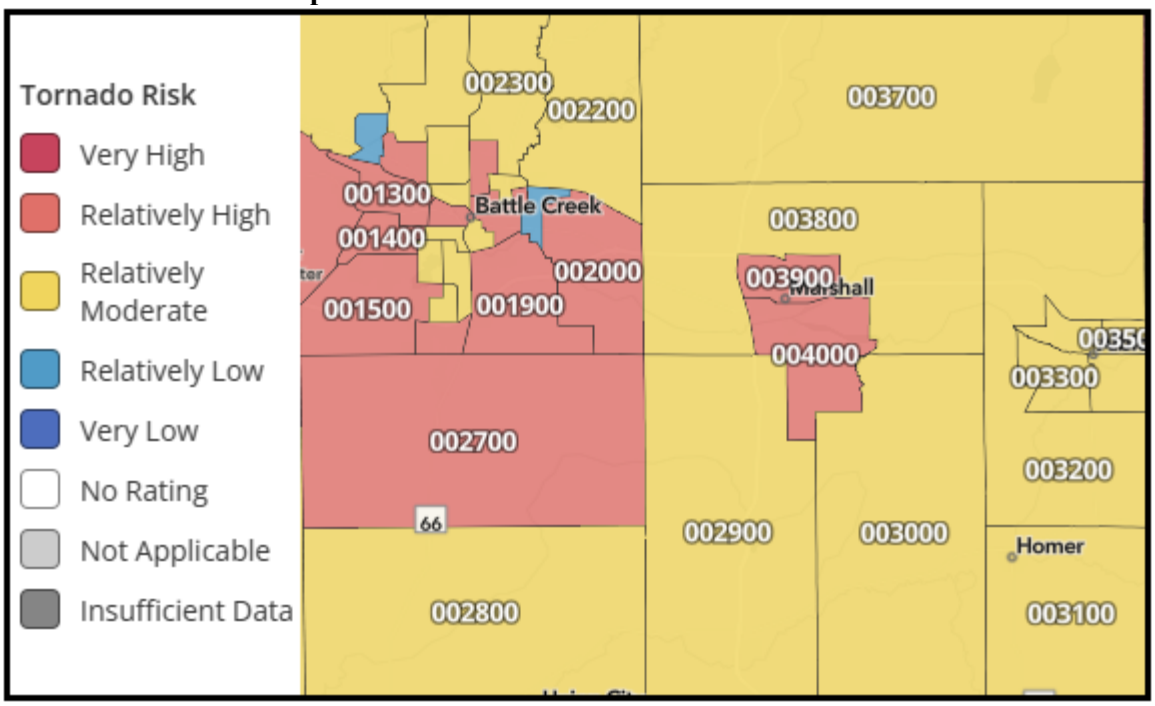
Subject	Potential Impacts
Impact on the Public	High wind speeds can destroy homes and turn debris into projectiles, causing injury or death. An increased demand for medical treatment for traumatic injuries would be anticipated. Significant portions of the population may be displaced by the destruction and those individuals may not have access to personal documents or medical records.
Impact on Responders	First responders may be injured as the tornado passes, resulting in employee absenteeism that impacts the overall capacity to respond to the event. The deposit of debris on major roadways, the location of the event, and/or damage to equipment or facilities may increase the response times. Exposed wires or hazardous materials may cause injury to first responders during search and rescue operations.
Continuity of Operations	Local jurisdictions maintain continuity plans which can be enacted as necessary based on the situation. Tornadoes may impact an agency's ability to maintain continuity of operations due to power or communications infrastructure impacts. If the activation of alternate facilities was required, travel may be difficult due to reduced transportation options, power outages, or damage to facilities.
Delivery of Services	Delivery of services may be impacted by dangerous conditions or disruption to transportation systems, causing food, water, and resource systems to be delayed or halted. Waterway infrastructure may be damaged or malfunction, stopping barge and ship traffic. Goods may be damaged, destroyed, or carried off by high winds.
Property, Facilities, and Infrastructure	Damages from lower intensity tornadoes can range from chimney damage to uprooted shallow trees. A significant tornado (EF-2) would cause damage to roofs on frame houses, complete destruction of mobile homes and large trees and utility lines snapping. A devastating tornado (EF-4) would result in well-constructed houses being leveled, weak foundations blown away, and cars thrown away. Communications or power infrastructure may be damaged or destroyed.
Impact on Environment	Tornadoes may cause significant damage to the environment by exposing hazardous materials, causing contamination of water or food sources, or uprooting vegetation. Animals may be injured by flying debris or being lifted by the tornado. Agricultural crops may be lost due to contamination or being uprooted.
Economic Conditions	Tornadoes pose a fiscal impact on the local governments, even if some of those costs can be recouped through federal grant reimbursements. Fiscal resources may be drained by the occurrence of a tornado.
Public Confidence in Governance	The public's confidence in governance is affected by immediate local and state response through direct and effective actions. Efficiency in response and recovery operations is critical in keeping public confidence high.

4.11.7 Jurisdictional Risk and Vulnerability

To help understand the risk and vulnerability to severe thunderstorms of participating jurisdictions mapping from the FEMA NRI was run on a census tract level. As the NRI does not generate mapping for individual jurisdictions, census tract analysis is the closest analogue available to understand individual jurisdiction conditions.

Using the FEMA NRI, and consisting of three input components (expected annual loss, social vulnerability, and community resilience), the following map was created indicating the potential risk to participating jurisdictions from tornadoes:

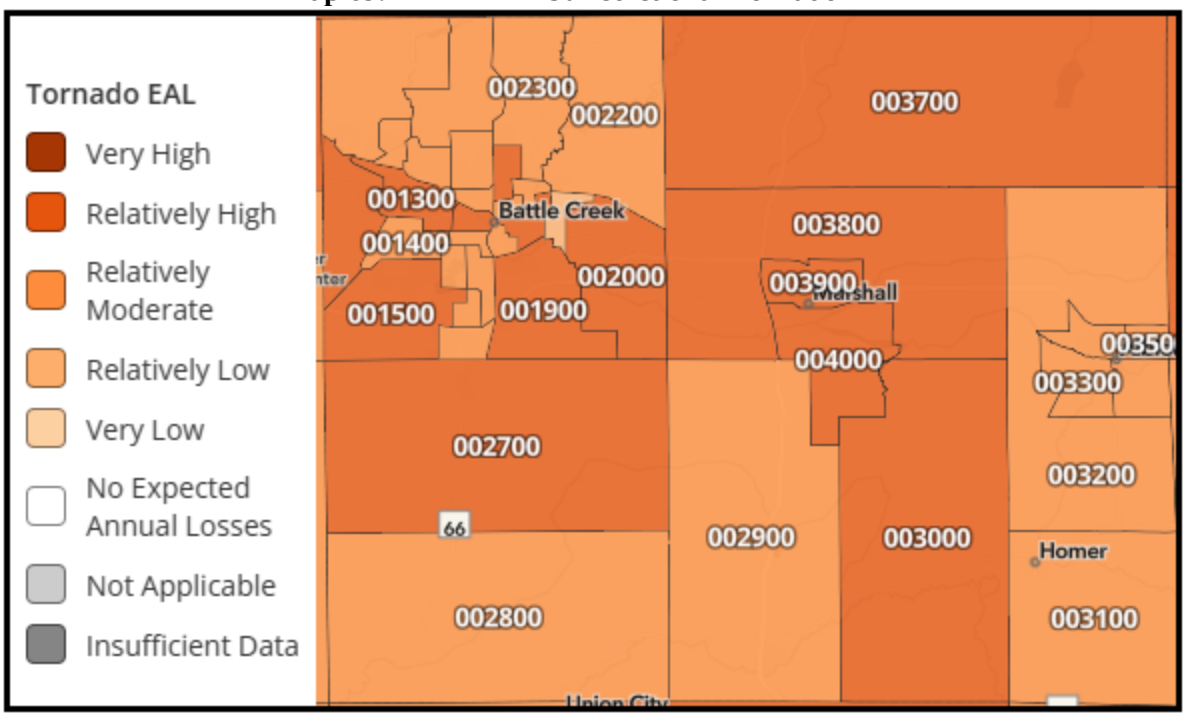
Map 68: FEMA NRI Jurisdictional Tornado Risk



Source: FEMA NRI

As part of the NRI, EAL represents the average economic loss in dollars resulting from natural hazards each year and is proportional to a community's risk. The following map indicates the EAL for tornadoes for participating jurisdictions within Calhoun County:

Map 69: FEMA NRI Jurisdictional Tornado EAL



Source: FEMA NRI

The following table indicates the FEMA NRI and EAL analysis for tornadoes for each participating Calhoun County jurisdiction:

Table 66: Calhoun County FEMA EAL and NRI for Tornadoes

Jurisdiction	EAL	Risk Index
Calhoun County	Relatively Moderate	Relatively Moderate
City of Albion	Relatively Moderate	Relatively Moderate
City of Battle Creek	Relatively Moderate	Relatively High
City of Marshall	Relatively High	Relatively High
City of Springfield	Relatively High	Relatively High
Village of Athens	Relatively Moderate	Relatively Moderate
Village of Burlington	Relatively Moderate	Relatively Moderate
Village of Homer	Relatively Moderate	Relatively Moderate
Village of Tekonsha	Relatively Moderate	Relatively Moderate
Athens Township	Relatively Moderate	Relatively Moderate
Emmett Charter Township	Relatively High	Relatively High
Leroy Township	Relatively High	Relatively High
Sheridan Township	Relatively Moderate	Relatively Moderate
Tekonsha Township	Relatively Moderate	Relatively Moderate
NHBP	Relatively Moderate	Relatively Moderate

Source: FEMA NRI

NRI data tables concerning tornado information, by census tract, may be found in Appendix E.

Lower income communities, including communities with a large percentage of mobile homes, may suffer disproportionate impacts from tornado events. The following table indicates mobile home data for participating jurisdictions:

Table 67: Calhoun County Mobile Home Data

Jurisdiction	Occupied Housing Stock as Mobile Homes (2010)	Occupied Housing Stock as Mobile Homes (2020))	Percentage Change in Mobile Homes (2010-2020)
Calhoun County	5.5%	4.7%	-0.8%
Albion	0.3%	0.23%	-0.07%
Athens	3.2%	2.4%	-0.8%
Battle Creek	1.8%	2.4%	0.6%
Burlington	24.8%	19.1%	-5.7%
Homer	10.4%	17.0%	6.6%
Marshall	1.0%	1.1%	0.1%
Springfield	8.4%	12.3%	3.9%
Tekonsha	19.4%	7.5%	-11.9%
Athens Township	11.3%	8.2%	-3.1%
Emmett Charter Township	4.2%	3.0%	-1.2%
Leroy Township	6.3%	5.4%	-0.9%
Sheridan Township	21.1%	24.6%	3.5%
NHBP	-	20.8%	-

Source: United States Census Bureau
-: Data unavailable

Since tornadoes threaten the entire planning area equally, all tribal, municipal, and school district structures are considered exposed and vulnerable. Data from the FEMA Hazus system indicates the total value of property within Calhoun County is $25,481,727,000.

4.12 Winter Storms

4.12.1 Hazard Description

A winter storm encompasses multiple effects caused by winter weather. Included are strong winds, ice storms, heavy or prolonged snow, sleet, and extreme temperatures. Winter storms can be increasingly hazardous in areas and regions that only see winter storms intermittently.

This plan defines winter storms as a combination of the following winter weather effects as defined by NOAA and the NWS.

- **Ice Storm:** An ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication. These accumulations of ice make walking and driving extremely dangerous. Significant ice accumulations are usually accumulations of ¼" or greater.
- **Heavy Snow:** This generally means snowfall accumulating to 4" or more in depth in 12 hours or less; or snowfall accumulating to 6" or more in depth in 24 hours or less.
- **Winter Storm:** Hazardous winter weather in the form of heavy snow, freezing rain, or heavy sleet. It may also include extremely low temperatures and increased wind.
- **Cold Wave/Extreme Cold:** As described by NWS, a cold wave is a rapid fall in temperature within a 24-hour period requiring substantially increased protection to agriculture, industry, commerce, and social activities. As evidenced by past incidents across the U.S., extreme cold can cause impact to human life and property.

4.12.2 – Location and Extent

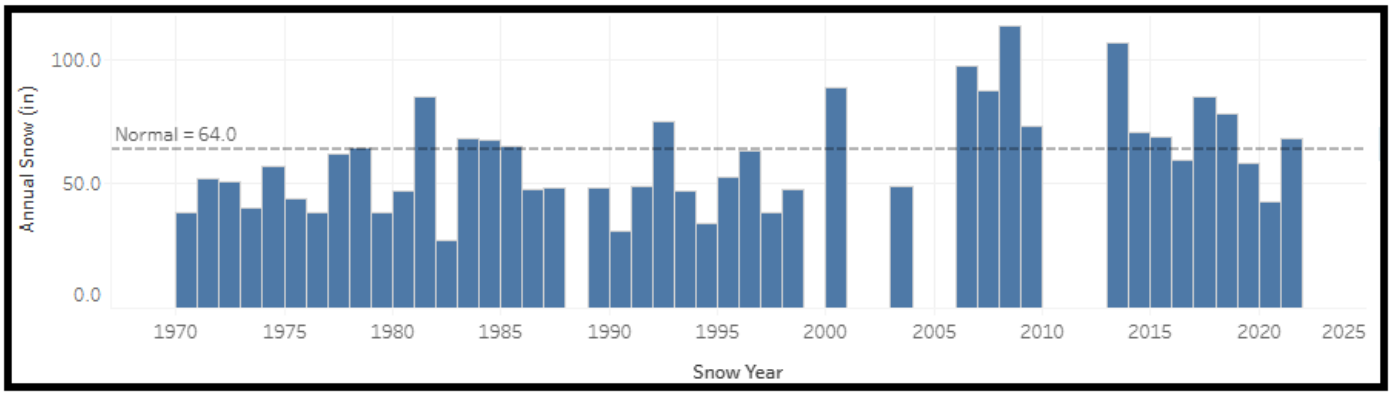
Winter storms occur regularly throughout Calhoun County and its participating jurisdictions, and often affect the entire planning area. These events occur on a large geographic scale, often affecting multiple counties, regions, and states.

Winter storms typically form with warning and are often anticipated. Like other large storm fronts, the severity of a storm is not as easily predicted and when it is, the window of notification is up to a few hours to under an hour. Although meteorologists estimate the amount of snowfall a winter storm will drop, it is not known exactly how many feet of snow will fall, whether or not it will form an ice storm, or how powerful the winds will be until the storm is already affecting a community.

Winter storms can range from moderate snow over a few hours to blizzard conditions with high winds, freezing rain or sleet, heavy snowfall with blinding wind-driven snow and extremely cold temperatures that last several days.

Th Midwest Region Climate Center maintains a snow collection point in Battle Creek, Calhoun County. Historically data from the station indicates that Calhoun County and its participating jurisdictions will typically see an average of 64 inches of snowfall each year.

Chart 16: Yearly Snowfall Totals for Calhoun County, 1970 - 2022



Source: Midwest Regional Climate Center

The Northeast Snowfall Impact Scale is a scale used to assess and rank the impact of snowfall events in the northeastern United States. It was developed by NOAA to provide a standardized way of measuring the societal and economic impacts of snowstorms in this region. The scale takes into account factors such as snowfall amount, population density, and the area affected by the storm to determine its impact. The NESIS scale has five categories, each with its own associated impacts:

Table 68: Northeast Snowfall Impact Scale

Category	Description	Impacts
1	Notable	Light to moderate snowfall. Limited impacts on transportation and daily life. Typically localized to small areas.
2	Significant	Moderate to heavy snowfall. Widespread impacts on transportation, including delays and disruptions. Some school and business closures. Widespread power outages are rare.
3	Major	Heavy snowfall, often exceeding one foot or more. Significant transportation disruptions, including major highway closures. Widespread school and business closures. Power outages may occur, especially in areas with wet, heavy snow.
4	Crippling	Extreme snowfall, often exceeding two feet or more. Severe and prolonged transportation disruptions, including highway closures. Widespread school and business closures for an extended period. Widespread and prolonged power outages, especially in areas with ice accumulation.
5	Extreme	Exceptional snowfall, often exceeding three feet or more. Complete paralysis of transportation systems, including major highways and airports. Extended school and business closures. Widespread and prolonged power outages with significant damage to the electrical infrastructure.

Source: NOAA

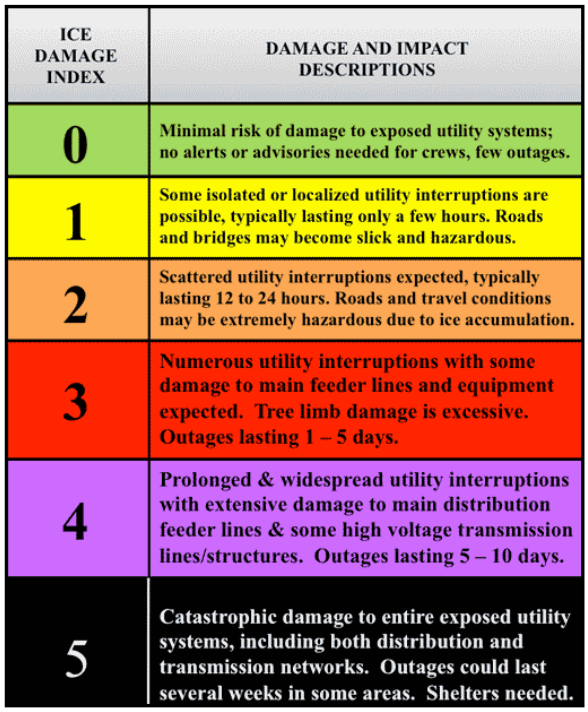
The scale provides valuable information for emergency management, public safety agencies, and the public to understand the potential impacts of a snowstorm and to prepare accordingly. It helps to quantify and communicate the severity of winter weather events, especially in regions where snowfall can have a major impact on daily life and the economy.

Ice storms are characterized by the accumulation of freezing rain or freezing drizzle, which coats surfaces with a layer of ice. These storms can have significant impacts on transportation, infrastructure, and the environment. Ice storms

occur when there's a layer of warm air above a layer of cold air near the surface. Precipitation falls as rain in the warm layer and then freezes upon contact with surfaces at or below freezing temperatures in the cold layer. The most common type of precipitation during an ice storm is freezing rain. This is rain that falls as a liquid but freezes upon contact with cold surfaces, forming a layer of ice.

The Sperry–Piltz Ice Accumulation Index is an ice accumulation and ice damage prediction index that, when combined with NWS data, predicts the projected footprint, total ice accumulation, and resulting potential damage from approaching ice storms.

Figure 3: Sperry–Piltz Ice Accumulation Index



Source: Sperry–Piltz Ice Accumulation Index

4.12.3 Previous Occurrence

The following table presents NCEI identified ice storm and winter storm events and the resulting damage totals in Calhoun County from 2003 to 2022, with the years 2003 and 2022 being full dataset years. Please note that as these storm events tend to cover larger areas occurrence data is being presented as representative of all participating jurisdictions.

Table 69: Calhoun County NCEI Winter Storm Events, 2003 - 2022

Event Type	Number of Events	Property Damage	Deaths	Injuries
Ice Storm	3	$1,030,000	0	0
Winter Storm	32	$1,150,000	0	0

Source: NCEI

It is worth noting that damage estimates indicated by the NCEI are often artificially low. This underreporting is a result of the way the events are reported to the NCEI, often by the local and/or NWS office. When reporting an event oftentimes the NWS office does not have access to the actual damage assessment resulting from that event. As such, the report often details a very low amount or zero-dollar amount for damages. Additionally, deaths and injuries may be underreported as they may be a result of a concurrent event, such as a person driving unsafely during heavy rain and passing away.

The following provides both local accounts and NCEI descriptions of notable recorded events:

- **April 14, 2018 – Calhoun County:** A quarter to four tenths of an inch of freezing rain was reported. The combination of freezing rain and strong winds caused power outages. Damages were reported at $100,000.
- **December 21, 2013 – Calhoun County:** An ice storm brought a half to three quarters of an inch of ice accumulation to the northern half of Calhoun County, causing numerous power outages and downed tree limbs and lines. Damages were reported at $1,000,000.
- **November 29, 2011 – Calhoun County:** Battle Creek emergency management reported the combination of wind and heavy wet snow brought down numerous trees and power lines in and near Battle Creek. A trained spotter reported 6.5 inches of snow in Albion. Damages were reported at $1,000,000.

4.12.4 Probability of Future Events

Predicting the probability of winter storm occurrences is tremendously challenging due to the large number of factors involved and the random nature of formation. Data from the NCEI indicates that Calhoun County can expect on a yearly basis, relevant to winter storm events:

Table 70: Calhoun County Winter Storm Probability Summary

Data	Events
Number of Days with NCEI Reported Event (1950-2023)	35
Average Events per Year	1

Source: NCEI

Additional data from NOAA and the NWS indicate that Calhoun County can expect an average annual snowfall of between 64 inches per year.

4.15.5 Projected Changes in Location, Intensity, Frequency, and Duration

Climate change can lead to greater variability in precipitation patterns. In Calhoun County, this may result in more erratic and intense winter storms with periods of heavy snowfall followed by rain or freezing rain. These mixed precipitation events can make winter storms more challenging to predict and can lead to a greater risk of ice accumulation. Additionally, Calhoun County may experience milder winters as average temperatures rise due to climate change. While this could lead to a decrease in the frequency of traditional snowstorms, it may also increase the likelihood of winter storms that produce mixed precipitation, including freezing rain and sleet. Warmer temperatures can lead to a higher snowfall threshold, meaning that storms that would have produced snow in the past may now bring more rain or a mix of precipitation types. This can affect the accumulation of snow in the state. Changes in atmospheric circulation patterns associated with climate change can influence the tracks of winter storms. This could lead to a shift in the amounts of heavy snowfall, ice, and other winter weather hazards.

As indicated in the data above, Calhoun County and all participating jurisdictions have been seeing generally static or declining populations. A static or declining population could decrease population risks to winter storms by nature of their being fewer citizens to negatively impact.

Calhoun County's current land-use regulations require the consideration of building codes during the development review process. A building-by-building structural review, including roof profile and strength would need to be to determine structural risk to snow and ice loads. However, enforced building codes can ensure that newly built and renovated structures can better withstand the loads.

The agriculture base of Calhoun County is increasingly vulnerable to the effects of winter storms. Future development of agricultural resources would tend to increase the risk and impact of an event. As indicated in the data above, Calhoun County is seeing a continuing projected increase in agricultural activities and thus a potential greater future vulnerability.

4.12.6 Vulnerability and Impact

Data from the NCEI indicates that Calhoun County can expect on a yearly basis, relevant to Winter Storm events:

Table 71: Calhoun County Winter Storm Impact Summary

Data	Recorded Impact
Deaths or Injuries (1950-2023)	0
Average Number of Deaths or Injuries	0
Total Reported NCEI Property Damage (1950-2023)	$2,180,000
Average Property Damage per Year	$29,460

Source: NCEI

All of Calhoun County is vulnerable to winter and ice storms. Based on the non-geographic specific aspect of this hazard, i.e., no one area is at a greater risk, all of the planning area's structural inventory and population is vulnerable.

Extremely cold temperatures are a threat to anyone exposed to them. Extreme cold can cause frostbite and hypothermia. Bitterly cold temperatures can also burst water and create an excessive demand on providers to deliver energy for household heating. There are also fire dangers associated with home heating. Heavy snow and/or ice can paralyze communities. Roads can become hazardous which may cause accidents, disrupted flow of supplies, and challenges in the delivery of emergency and medical services. Additional impacts on people and the community may include:

- Injuries and Fatalities: Slippery sidewalks, roads, and driveways can lead to slip and fall accidents, vehicle crashes, and pedestrian injuries. Exposure to extreme cold temperatures can cause frostbite, hypothermia, and cold-related illnesses, which can be life-threatening.
- Power Outages: Heavy snow, ice, and freezing rain can bring down power lines and disrupt electricity supply. Power outages can lead to heating and lighting challenges, particularly in extreme cold conditions.
- Transportation Disruptions: Winter storms can make roads and highways treacherous, leading to travel delays, accidents, and stranded motorists. Public transportation services may be disrupted, affecting commuters and essential travel.
- Stranded or Isolated Communities: Severe winter weather can leave communities isolated and cut off from emergency services and supplies. Residents may need to shelter in place or rely on local resources until conditions improve.
- Health Risks: Exposure to extreme cold can lead to a range of health risks, including frostbite, hypothermia, and cold-related illnesses. Individuals with pre-existing health conditions may face exacerbated risks.
- Increased Heating Costs: Cold weather can result in higher heating costs, which can be a financial burden for many households. Low-income individuals and families may struggle to afford adequate heating.
- Disruption of Essential Services: Severe winter weather can disrupt essential services such as healthcare, emergency response, and utilities. Hospitals may face increased patient volumes due to weather-related injuries and illnesses.

Severe winter storms can have significant and wide-ranging impacts on critical facilities and infrastructure. The extent of the impact depends on the severity of the storm, the preparedness of the facilities and infrastructure, and the effectiveness of response and recovery efforts, and may include:

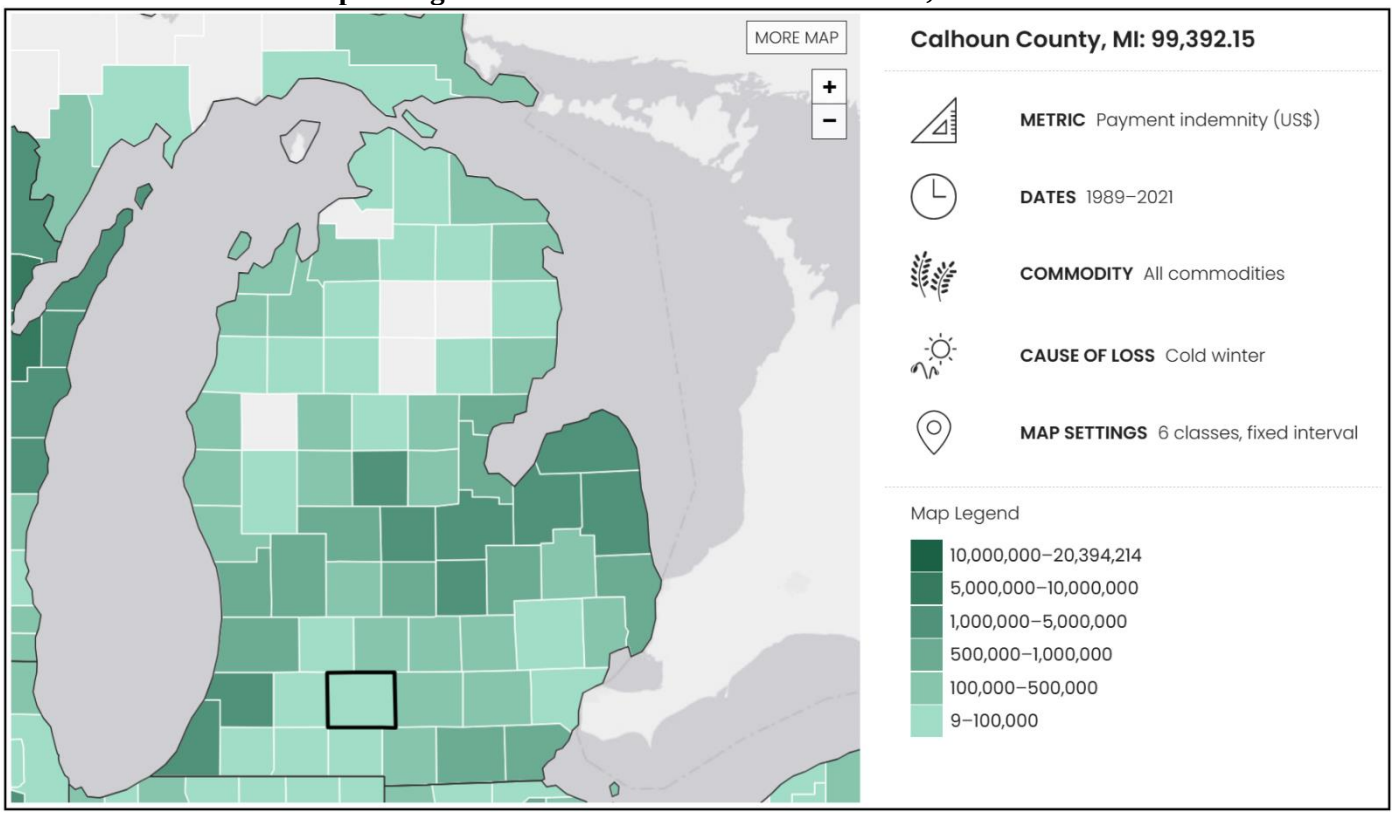
- Power Outages: Severe winter storms can cause power outages by bringing down power lines, causing ice accumulation on electrical infrastructure, or overloading the electrical grid due to increased demand for heating. Critical facilities such as hospitals, emergency response centers, and data centers may rely on backup generators to maintain essential operations during outages.

- Communication Disruptions: Ice and freezing rain can damage communication infrastructure, including cell towers, telephone lines, and data centers, leading to disruptions in phone and internet services. This can hinder emergency communication and coordination, affecting critical response efforts.
- Transportation Disruptions: Snow and ice accumulation on roads, runways, and railways can disrupt transportation networks, leading to travel delays, accidents, and closures. Critical facilities may face challenges in receiving essential supplies and personnel during and after the storm.
- Healthcare System Strain: Hospitals and healthcare facilities may experience increased demand for medical services due to storm-related injuries and illnesses, including those related to slips and falls, traffic accidents, and cold exposure.
- Water Supply Interruptions: Freezing temperatures can cause water pipes to burst, leading to water supply interruptions and damage to water infrastructure. Critical facilities such as hospitals and emergency response centers rely on a continuous supply of clean water for various purposes, including patient care and firefighting.
- Wastewater Systems: Cold temperatures can affect wastewater treatment plants, leading to potential operational disruptions and contamination risks.
- Fuel Supply Disruptions: Snow and ice can disrupt fuel supply chains, leading to shortages of gasoline, diesel, and heating oil. Critical facilities may rely on fuel for backup power generators and heating systems.
- Property Damage: Severe winter storms can result in property damage, including roof collapses due to heavy snow accumulation, ice damming, and frozen pipes.

Winter storms can have various impacts on the environment, particularly in regions prone to cold and snowy winters. These impacts can affect ecosystems, wildlife, and natural resources and can include habitat disruption, reduction of food sources, changes in migration patterns, and damage to foliage (especially if a spring storm). Additionally, the use of salt and de-icing chemicals on roads and sidewalks can have negative environmental impacts. These chemicals can find their way into nearby water bodies, leading to water pollution and harm to aquatic ecosystems. Snowmelt can also introduce pollutants from roadways and urban areas into rivers and streams, leading to reduced water quality. Elevated sediment levels and changes in water temperature can also affect aquatic life.

Severe winter weather conditions can cause significant agricultural impacts. The following map from the United States Department of Agriculture details total agricultural losses, by county, due to freeze events from 1989 to 2021:

Map 70: Agricultural Losses Due to Freeze Events, 1989 to 2021



Source: USDA

Severe winter weather can pose risks to local operations and can disrupt government functions and strain resources. Some of the risks to operations and facilities include:

- Transportation Disruptions: Snow and ice accumulation on roads and highways can hinder transportation, making it difficult for state agencies and personnel to travel and respond to emergencies. RIDOT must allocate resources to plow and salt roads, clear snow and ice, and repair potholes caused by freezing and thawing. These efforts are costly and resource intensive.
- School Closures: Winter storms often lead to school closures, which can affect state-run education programs and services. State agencies may need to coordinate with school districts to ensure the safety of students.
- Emergency Response and Public Safety: Winter storms can result in increased demands for emergency services, including responses to traffic accidents, medical emergencies, and stranded motorists. State and local agencies must allocate additional resources to address these needs.
- Economic Impact: Winter storms can result in economic losses due to reduced economic activity, transportation disruptions, property damage, and increased spending on emergency response and recovery efforts.
- Emergency Shelter Operations: Local jurisdictions may need to operate or coordinate emergency shelters during winter storms to provide shelter and resources to vulnerable populations, including those experiencing homelessness.
- Resource Allocation: State agencies must allocate resources, including personnel, equipment, and stockpiled supplies, to support emergency response efforts and maintain public services.
- Communication Challenges: Winter storms can disrupt communication networks, hindering the ability of state agencies to communicate internally and with the public. This can impact emergency notifications and coordination efforts.

- Budgetary Impact: The costs associated with snow removal, road maintenance, emergency response efforts, and infrastructure repair can strain state budgets.
- Governance and Administrative Challenges: State government offices and facilities may experience closures or reduced staffing during severe winter weather, affecting administrative functions, regulatory processes, and public services.

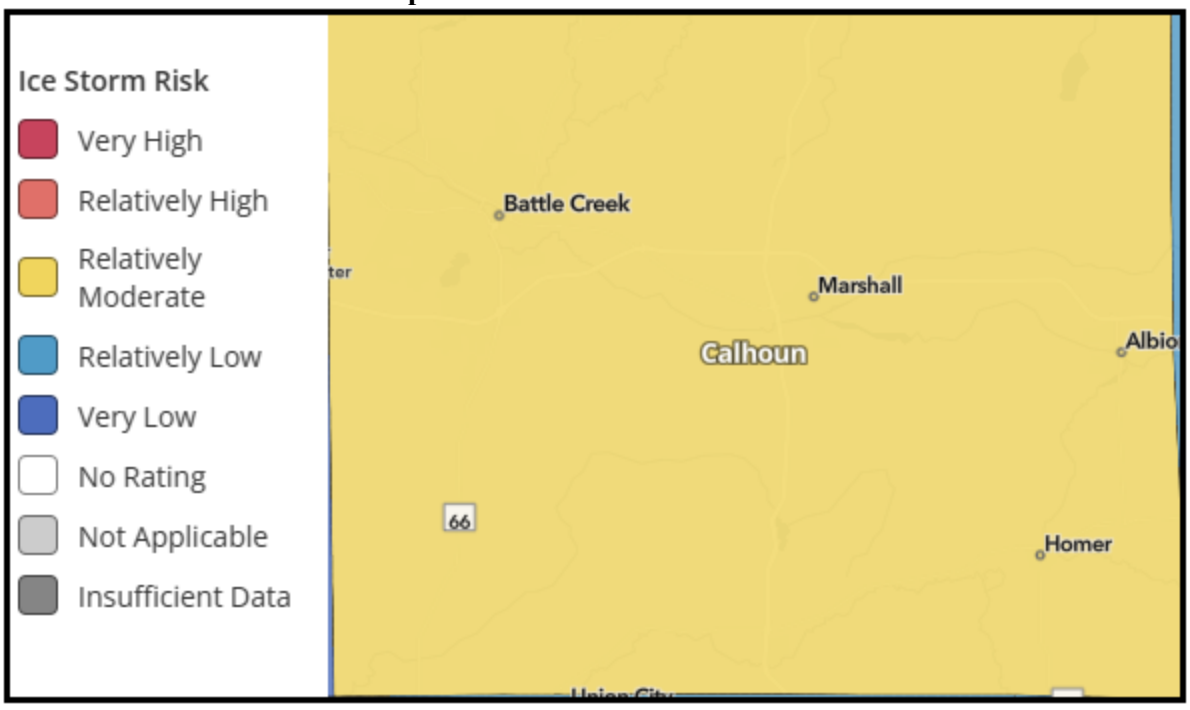
Winter and ice storms can have significant impacts on government facilities and assets. These impacts may include:

- Property Damage: Ice accumulation on buildings and structures can lead to structural damage, including roof collapses and damage to exterior elements. Frozen pipes and water mains can cause interior damage.
- Communication Challenges: Ice accumulation on communication infrastructure, such as antennas and transmission towers, can disrupt communication services, affecting the ability of government agencies to convey critical information.
- Infrastructure Maintenance Challenges: The need for snow and ice removal, as well as the maintenance of roads and public spaces, can be challenging during severe winter weather. This requires additional resources and coordination.

Data from the FEMA Hazus system indicates the total value of government property within Calhoun County is $258,661,000, all of which is vulnerable to tornadoes.

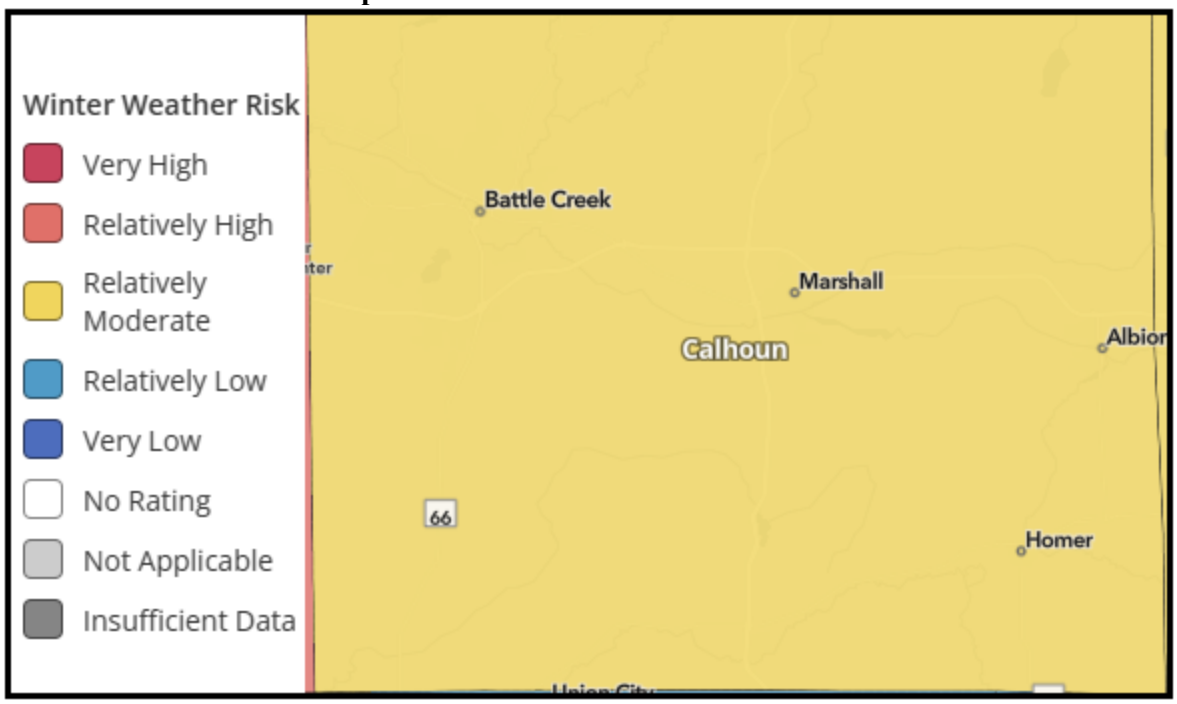
Using the FEMA NRI, and consisting of three input components (expected annual loss, social vulnerability, and community resilience), the following maps were created indicating the potential risk to Calhoun County from ice storms (relatively moderate) and winter weather (relatively moderate) for Calhoun County:

Map 71: FEMA NRI Ice Storm Risk



Source: FEMA NRI

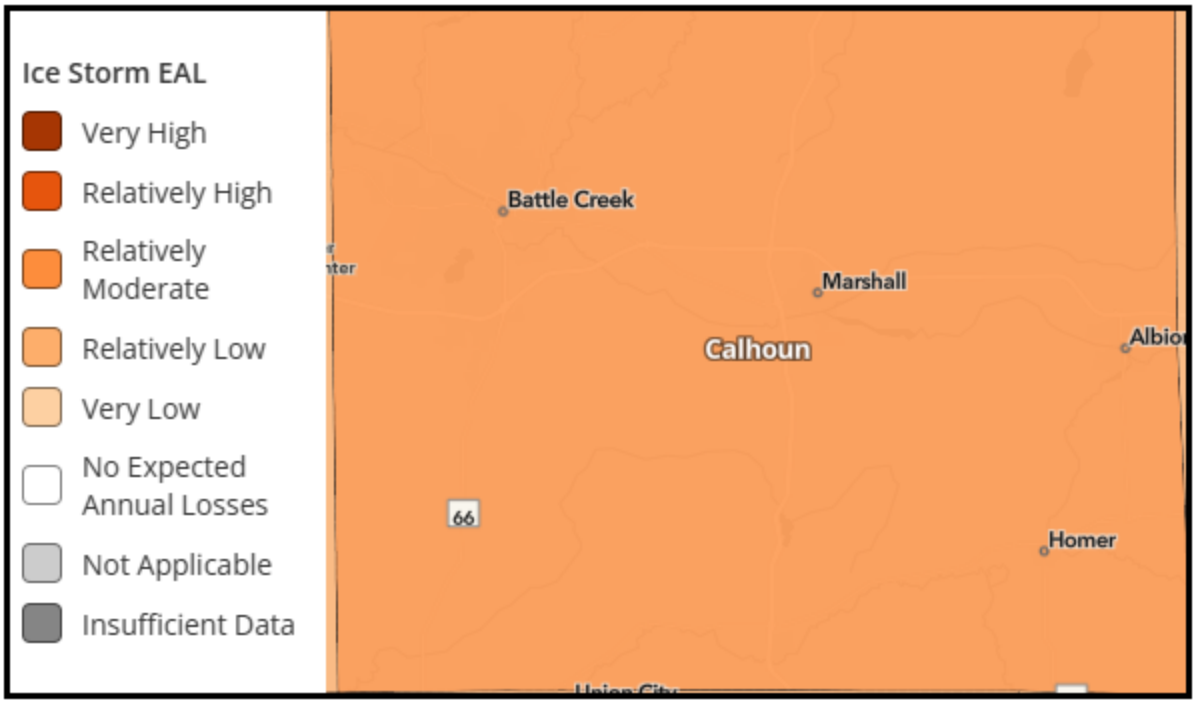
Map 72: FEMA NRI Winter Weather Risk



Source: FEMA NRI

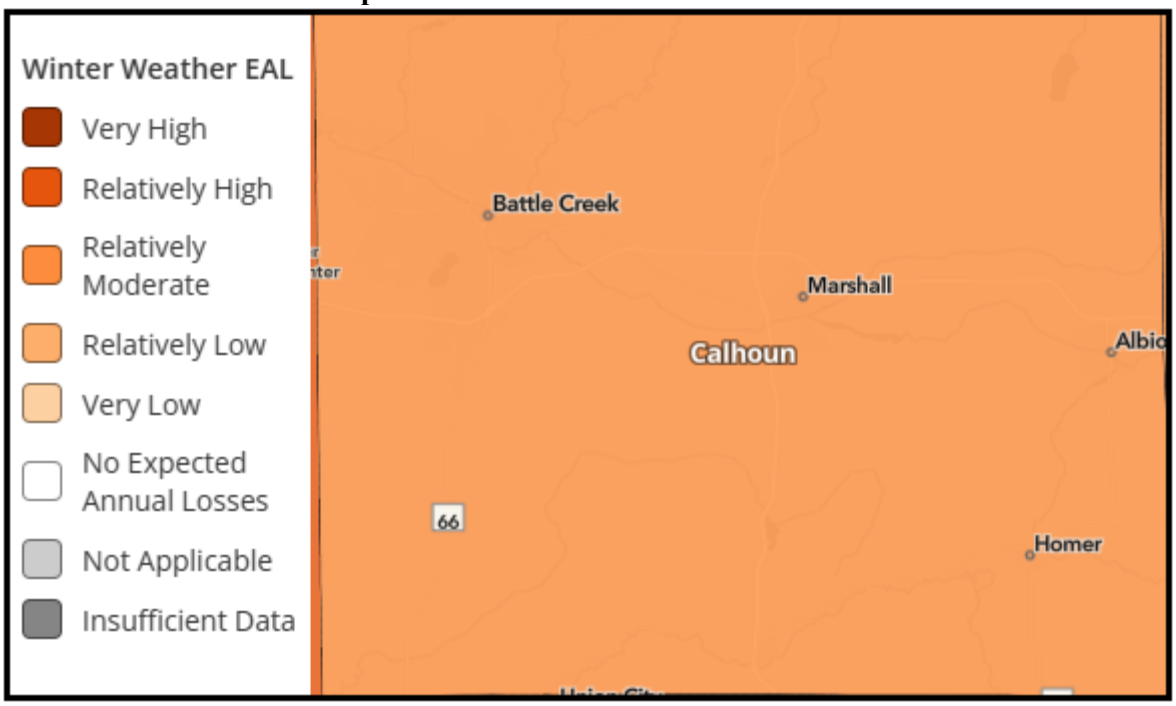
EAL represents the average economic loss in dollars resulting from natural hazards each year and is proportional to a community's risk. The following maps indicate the EAL for ice storms (relatively moderate) and winter weather(relatively moderate) for Calhoun County:

Map 73: FEMA NRI Ice Storm EAL



Source: FEMA NRI

Map 74: FEMA NRI Winter Weather EAL



Source: FEMA NRI

Potentially Vulnerable Community Lifelines

Extreme cold temperatures often associated with winter weather can impact various community lifelines, critical systems and services that communities rely on for their functioning. Vulnerabilities arise due to the stress that winter weather places on infrastructure, resources, and operational processes.

Winter storms can have significant impacts on road infrastructure, creating challenging conditions for transportation and necessitating proactive measures for maintenance and safety. Winter storms can impact road infrastructure:

- Snow Accumulation: Snowfall can accumulate on road surfaces, creating slippery and hazardous conditions for drivers. Accumulated snow can reduce road visibility and make travel difficult.
- Ice Formation: Freezing temperatures can lead to the formation of ice on roadways, increasing the risk of accidents and making roads slippery. Black ice, which is nearly invisible, poses a particular hazard.
- Snowdrifts: Strong winds during winter storms can lead to the formation of snowdrifts on roads, especially in open areas. These drifts can obstruct visibility and impede traffic flow.
- Road Surface Damage: The freeze-thaw cycle, where melted snow refreezes, can lead to the formation of ice patches and potholes on road surfaces. This cycle can contribute to the deterioration of road infrastructure over time.
- Freeze-Thaw Cycling: Alternating freezing and thawing can cause the expansion and contraction of water within pavement cracks, leading to the formation and enlargement of potholes.
- Snowplow and Deicing Operations: Snowplows and deicing operations are necessary to clear roads and improve driving conditions. However, the use of salt and chemicals for deicing can contribute to corrosion and deterioration of road surfaces and infrastructure.
- Infrastructure Stress: Bridges and overpasses are particularly susceptible to ice formation due to the lack of ground contact. Winter storms can stress these structures, potentially leading to structural issues over time.

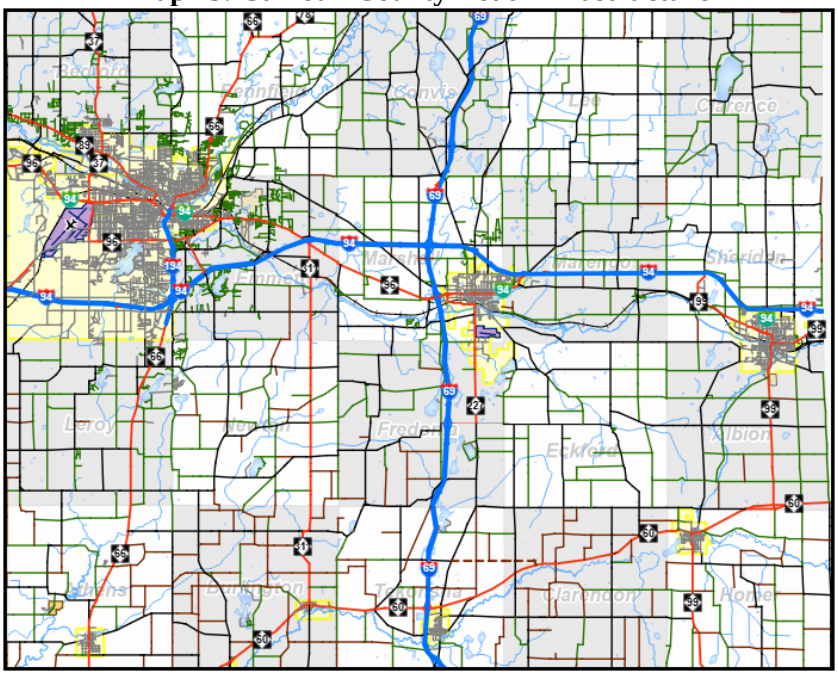
In Calhoun County, 490 miles of primary roads and 826 miles of local roads are maintained during winter weather by the Calhoun County Road Department, including 458 lane miles of state highways in contract with the State of Michigan. The roads are maintained by two regional units for winter operations, Battle Creek and Marshall. Each unit has an assigned number of lane miles to maintain. Crews remove accumulated snow and ice from the roadway by plowing and/or applying salt depending on weather conditions.

Calhoun County Road Department's policy for prioritizing snow removal is based on traffic volume, speed limits and road surface types. Preference is given in the following order:

- State trunklines
- Primary roads
- Major local roads
- Residential / subdivision streets

The following map details all roads within Calhoun County that may be impacted by severe winter storms:

Map 75: Calhoun County Road Infrastructure



Source: Calhoun County

Winter storms can impact electrical utilities in various ways, potentially leading to disruptions in service. These impacts include:

- Power Outages: High temperatures can strain electrical systems, leading to increased demand for cooling systems like air conditioners. This heightened demand can overload power grids, resulting in power outages.
- Equipment Failure: Electrical equipment, such as cables and switches, may experience higher resistance and increased stress during extreme heat, increasing the likelihood of equipment failures.
- Reduced Efficiency in Power Plants: Power generation facilities may experience reduced efficiency during heatwaves due to elevated ambient temperatures. This can affect the output of power plants and potentially lead to supply shortages.
- Icing on Power Lines: Ice accumulation on power lines can lead to increased weight, potentially causing lines to sag or break. This can result in power outages and safety hazards.

Calhoun County and participating jurisdictions use the following electrical utility providers:

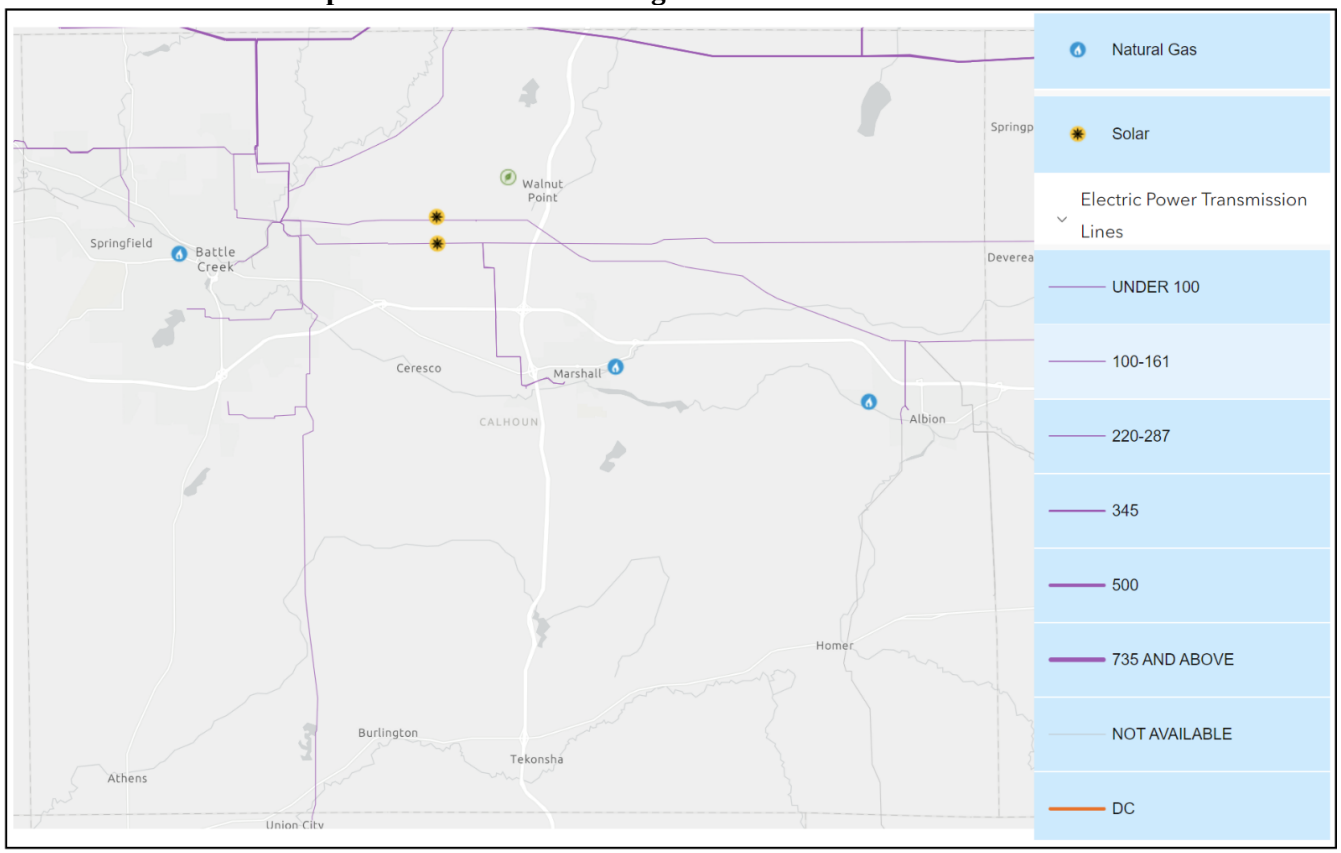
- Albion, Michigan:
  - Consumers Energy: 100.00%
- Athens, Michigan:
  - Consumers Energy: 100.00%
- Battle Creek, Michigan:
  - Consumers Energy: 100.00%
- Homer, Michigan:
  - Consumers Energy: 100.00%
- Marshall, Michigan:
  - Marshall MI Utilities: 50.00%
  - Consumers Energy: 50.00%
- Springfield, Michigan:
  - Consumers Energy: 50.00%
  - Great Lakes Energy: 50.00%
- Tekonsha, Michigan:
  - Consumers Energy: 100.00%

Electricity is generated in the county at six generation facilities, using the following methods:

- Solar: 78.22%
- Natural Gas: 16.37%
- Landfill Gas: 5.19%
- Conventional Hydroelectric: 0.23%

The following map, from the U.S. Energy Atlas, details the location of both electrical generating plants and high-capacity transmission lines within Calhoun County:

Map 76: Electrical Generating Plants and Transmission Lines



Source: U.S. Energy Atlas

The cost to replace electrical lines can vary widely based on several factors, including the type of electrical lines, the distance of the replacement, local labor and material costs, the complexity of the project, and any specific requirements or challenges involved. Additionally, costs can be significantly different for residential, commercial, or industrial projects. Additionally, urban and rural locations may have varying cost factors. As a rough estimate, the cost to replace electrical lines can range from a few thousand dollars to several thousand dollars per mile.

Winter storms can significantly impact emergency response infrastructure, creating challenges for first responders and organizations involved in managing and mitigating the effects of severe weather events. Winter storms can impact emergency response through:

- Transportation Disruptions: Snow and ice accumulation on roads can hinder the ability of emergency vehicles to navigate and reach affected areas promptly. Hazardous road conditions may result in delays in response times.
- Road Closures: Winter storms can lead to the closure of roads due to snow accumulation, ice, and hazardous conditions. This can limit access for emergency vehicles and impede the evacuation of residents.
- Communication Disruptions: Snow and ice can disrupt communication networks, affecting the ability of emergency responders to coordinate and communicate effectively. Downed power lines and damage to communication infrastructure contribute to these disruptions.
- Power Outages: Severe winter weather, including ice storms, can lead to power outages. Emergency response facilities, such as command centers and fire stations, may lose power, affecting their operational capabilities.
- Exposure: Emergency responders face increased health and safety risks in winter conditions. Exposure to extreme cold, snow, and ice can impact the well-being of responders and affect their ability to provide effective assistance.

- Resource Allocation Challenges: Winter storms often require the allocation of additional resources, including personnel, equipment, and supplies, to address immediate needs. This can strain emergency response organizations and impact their ability to respond to other concurrent incidents.
- Logistical Challenges: Snow accumulation and icy conditions may create logistical challenges for the transportation of supplies, equipment, and personnel to affected areas, hindering the overall effectiveness of emergency response efforts.
- Increased Demand for Services: Winter storms can result in an increased demand for emergency services, including medical assistance, search and rescue operations, and responses to accidents. Emergency response organizations may need to manage a higher volume of incidents simultaneously.

Calhoun County currently has the following major law enforcements departments, all of which may be impacted by winter storms:

- Marhsall County Sherriff's Office
- Albion Public Safety
- Battle Creek Police Department
- Emmett Township Department of Public Safety
- Homer Police Department
- Marshall Police Department
- Michigan State Police District 5 Post 57 - Battle Creek
- Springfield Department of Public Safety

Calhoun County currently has the following major fire departments, all of which may be impacted by winter storms:

- Albion Township Fire Department
- Athens Township Fire Department
- Battle Creek Fire Department
- Bedford Township Fire Department
- Burlington Township Fire Department
- Charter Township of Bedford Fire Department
- Emmett Township Department of Public Safety
- Fredonia Township Fire Department
- Homer Fire Department
- Leroy Township Fire Department
- Marengo Township Fire Department
- Marshall Fire Department
- Marshall Township Fire Department
- Newton Township Fire Department
- Pennfield Township Fire Department
- Sheridan Township Fire Department
- Springfield Department of Public Safety
- Tekonsha Fire Department

Major hospitals identified in Calhoun County include the Battle Creek VA Medical Center, Bronson Battle Creek Hospital, and Oaklawn Hospital. The total in-patient bed capacity of these facilities is approximately 700 beds. While these, and other smaller medical facilities, may see an increase in cold related illness during winter storm, it is considered unlikely that this increase will impact or overload capacity. However, winter storms can increase the demand for

emergency shelters, particularly in cases of widespread power outages or extreme cold temperatures. Setting up and managing these shelters can strain resources.

Consequence Analysis

This consequence analysis lists the potential impacts of a hazard on various elements of community and state infrastructure. The impact of each hazard is evaluated in terms of disruption of operations, recovery challenges, and overall wellbeing to all Calhoun County residents and first responder personnel. The consequence analysis supplements the hazard profile by analyzing specific impacts.

Table 72: Severe Winter Weather Consequence Analysis

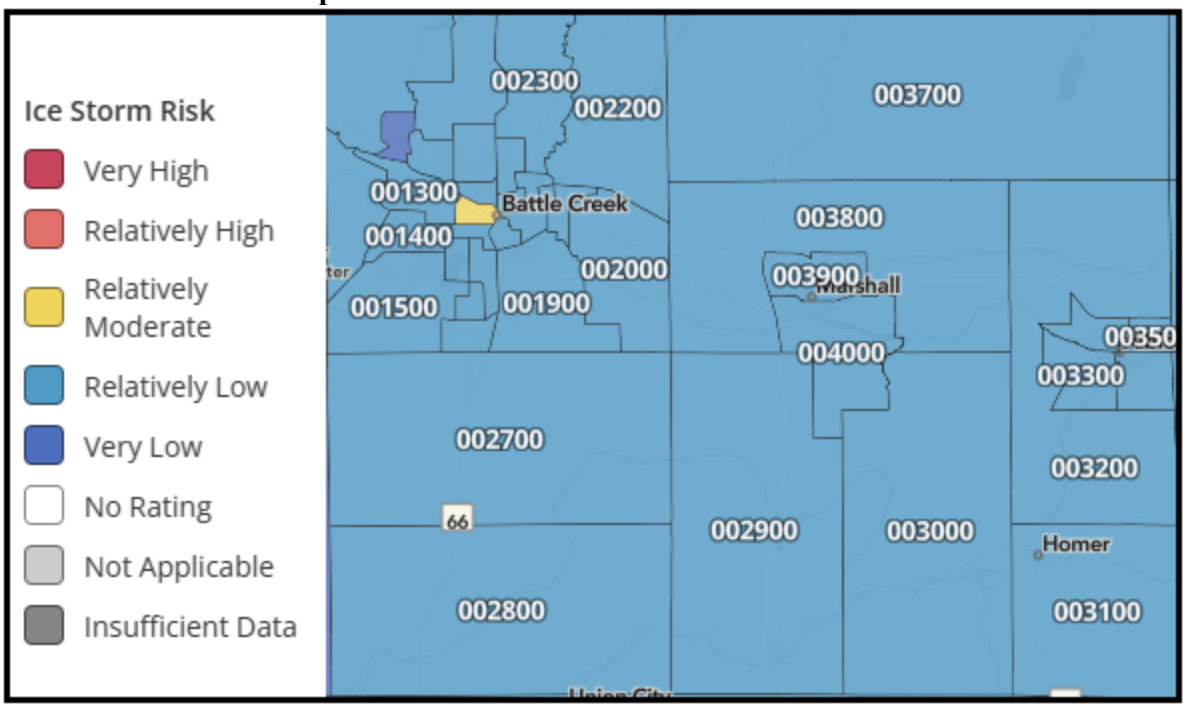
Subject	Potential Impacts
Impact on the Public	Freezing temperatures coupled with heavy snow accumulation can cause dangerous travel conditions, leading to accidents and road closures. Downed power lines can lead to a loss of electricity and heat, with the young and the elderly especially vulnerable. Extremely cold temperatures may lead to hypothermia and death.
Impact on Responders	Dangerous road conditions create a transportation challenge for first responders. First responders will need to control their own exposure to the elements for prolonged periods of time and will need to continuously seek heat and shelter to stay warm. Equipment may also be damaged or destroyed due to cold temperatures, heavy wind, ice, and heavy snow fall, which may lead to a decrease in response capabilities.
Continuity of Operations	Local jurisdictions maintain continuity plans which can be enacted as necessary. Severe winter weather may impact an agency's ability to maintain operations due to power outages and transportation difficulties. If the activation of alternate facilities was required, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.
Delivery of Services	The ability to deliver services can be impacted locally, regionally, or statewide depending on the severity of the severe winter weather event. Dangerous road conditions may lead to roadway and bridge closures, as well as transit service disruptions. Businesses and places of commerce may completely shut down, which leads to the disruption of goods and services.
Property, Facilities, and Infrastructure	Transportation, governmental operations, and communications may be heavily disrupted. Roads and bridges may be heavily impacted by severe winter weather, and may be completely obstructed by downed trees, powerlines, and snow accumulation. Snow and ice can impact access to homes and critical facilities such as hospitals, schools, and supermarkets. Power loss can lead to disruption of critical infrastructure and technology.
Impact on Environment	Heavy snow and ice accumulation can weigh down and damage vegetation, tree limbs, and power lines. Flooding may also occur after the rapid melting of a heavy snowfall, causing bodies of water to flood, damaging the surrounding areas. Exposure to extreme winter weather may result in animal death. Chemicals used to treat roadways may contaminate natural environments and water reservoirs if used in large quantities.
Economic Conditions	Severe winter weather poses a fiscal impact on the governments, even if some of those costs can be recouped through federal grant reimbursements. Local, county, and state resources may be drained by a severe winter weather event.
Public Confidence in Governance	The public's confidence in governance is affected by immediate local and state response through direct and effective actions. Efficiency in response and recovery operations is critical in keeping public confidence high.

4.12.7 Jurisdictional Risk and Vulnerability

To help understand the risk and vulnerability to severe thunderstorms of participating jurisdictions mapping from the FEMA NRI was run on a census tract level. As the NRI does not generate mapping for individual jurisdictions, census tract analysis is the closest analogue available to understand individual jurisdiction conditions.

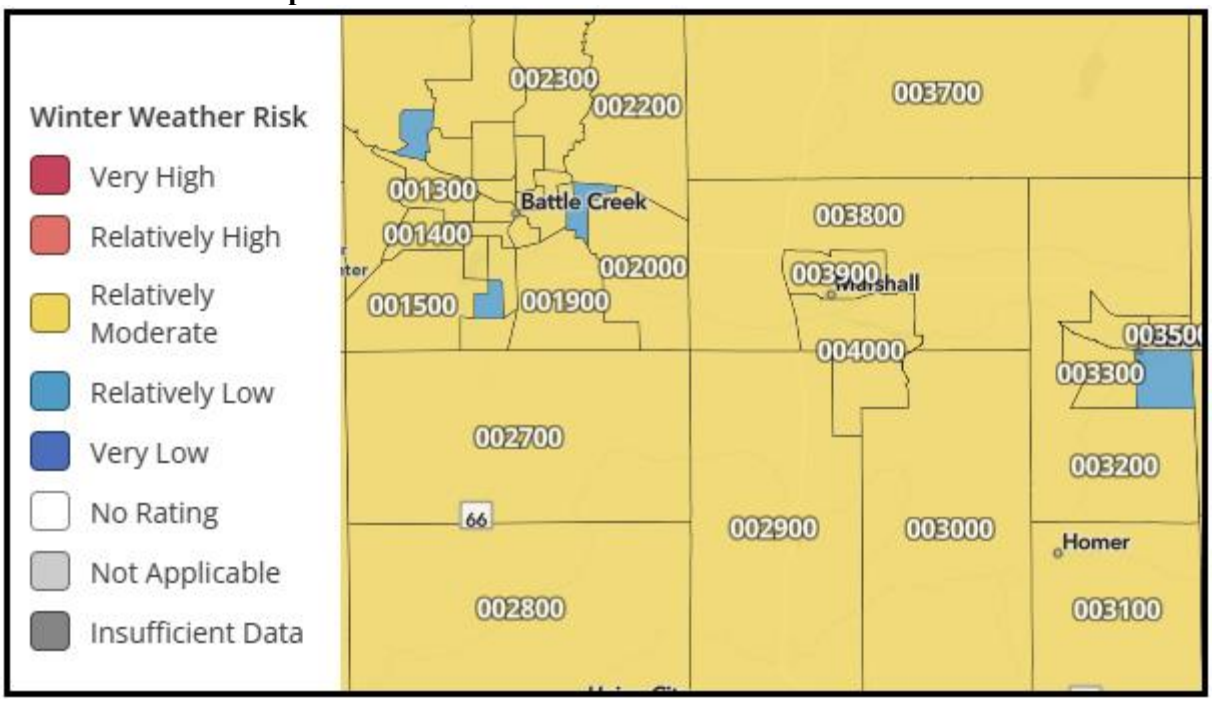
Using the FEMA NRI, and consisting of three input components (expected annual loss, social vulnerability, and community resilience), the following map was created indicating the potential risk to participating jurisdictions from ice storms and winter weather:

Map 77: FEMA NRI Jurisdictional Ice Storm Risk



Source: FEMA NRI

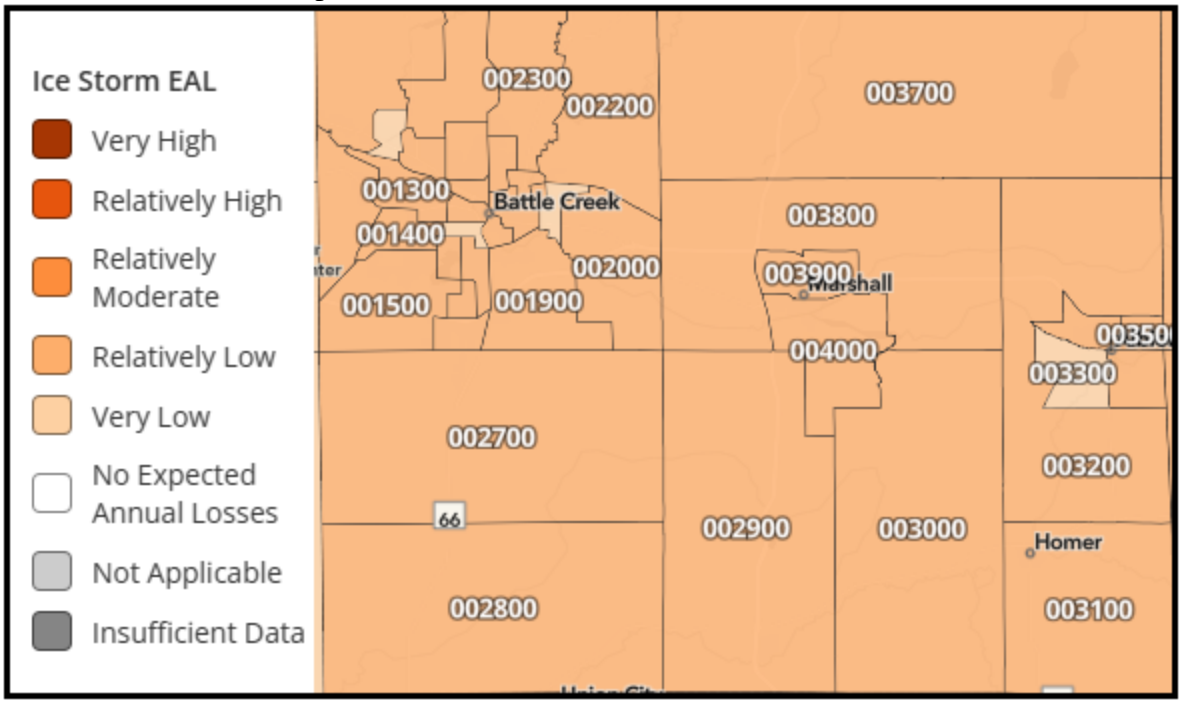
Map 78: FEMA NRI Jurisdictional Winter Weather Risk



Source: FEMA NRI

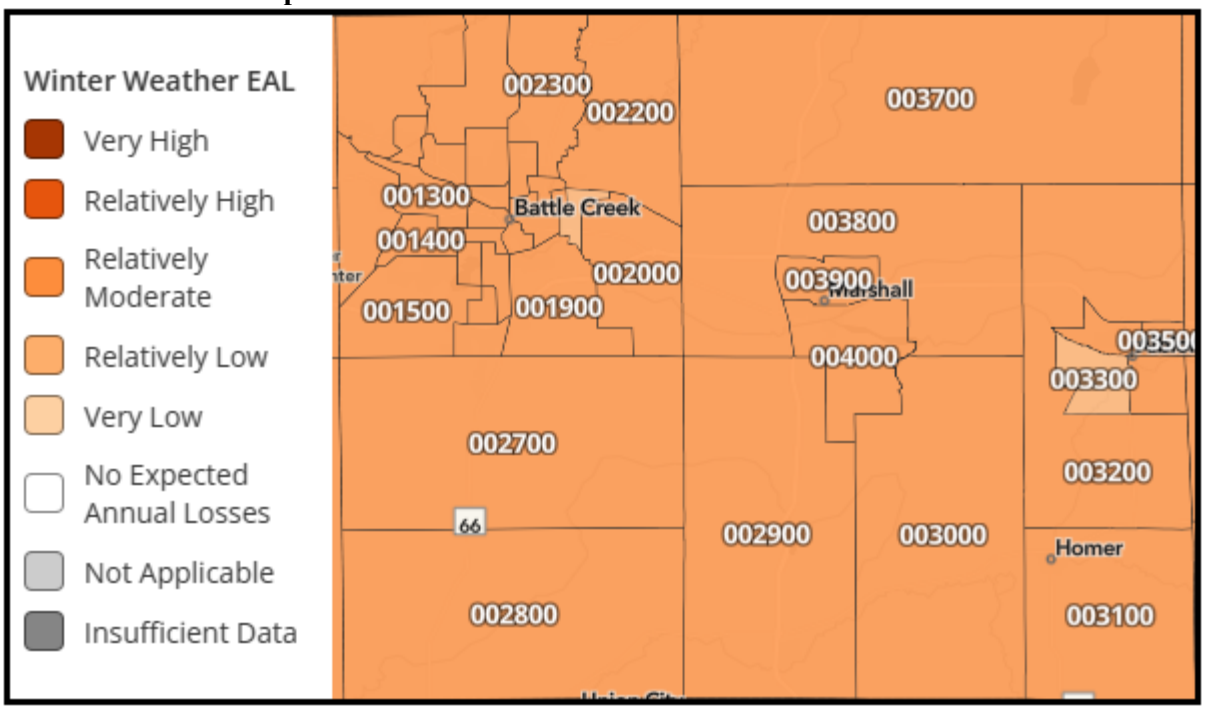
As part of the NRI, EAL represents the average economic loss in dollars resulting from natural hazards each year and is proportional to a community's risk. The following map indicates the EAL for ice storms and winter weather for participating jurisdictions within Calhoun County:

Map 79: FEMA NRI Jurisdictional Ice Storm EAL



Source: FEMA NRI

Map 80: FEMA NRI Jurisdictional Winter Weather EAL



Source: FEMA NRI

NRI data tables concerning winter weather information, by census tract, may be found in Appendix E.

The following table indicates the FEMA NRI and EAL analysis for winter weather for each participating Calhoun County jurisdiction:

Table 73: Calhoun County FEMA EAL and NRI for Winter Weather

Jurisdiction	Ice Storm EAL	Ice Storm Risk Index	Winter Storm EAL	Winter Storm Risk Index
Calhoun County	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate
City of Albion	Very Low	Relatively Low	Relatively Low	Relatively Moderate
City of Battle Creek	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate
City of Marshall	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate
City of Springfield	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate
Village of Athens	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate
Village of Burlington	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate
Village of Homer	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate
Village of Tekonsha	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate
Athens Township	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate
Emmett Charter Township	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate
Leroy Township	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate
Sheridan Township	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate
Tekonsha Township	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate
NHBP	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate

Source: FEMA NRI

Of particular concern, socially vulnerable and at-risk populations that may have difficulty with poverty or extremes in age may have an increased susceptibility to the impacts of this hazard. These populations suffer a disproportionate impact due to:

- Inadequate access to heating
- Constrained financial resources
- Age related sensitivity

The following table details identified socially vulnerable and at-risk populations for participating Calhoun County jurisdictions:

Table 74: Potential at Risk Population Data

Jurisdiction	Population 5 and Under (2021)	Population Over 65 (2021)	Estimated People in Poverty (2021)
Calhoun County	7,977 (5.9%)	23,659 (17.6%)	17,197 (12.8 %)
Albion	649 (8.4%)	978 (12.7%)	2,195 (28.5%)
Athens	77 (8.2%)	141 (15.1%)	100 (10.7%)
Battle Creek	3,659 (6.9 %)	8,131 (15.4 %)	11,599 (22.0 %)
Burlington	11 (3.9%)	57 (20.3%)	42 (14.9%)
Homer	120 (7.6%)	159 (10.1%)	250 (15.9 %)
Marshall	360 (5.3%)	1,521 (22.2%)	553 (8.1%)
Springfield	373 (7.0 %)	686 (13.0 %)	1,196 (22.4 %)
Tekonsha	22 (3.4%)	84 (12.8%)	158 (24.2%)
Athens Township	107 (4.4%	554 (22.7%)	221 (9.0%)
Emmett Charter Township	352 (3.0%)	2,637 (22.4%)	966 (8.2%)
Leroy Township	345 (9.3%)	677 (18.2%)	257 (6.9%)
Sheridan Township	95 (5.2%)	310 (17.1%)	217 (12.0%)

Table 74: Potential at Risk Population Data

Jurisdiction	Population 5 and Under (2021)	Population Over 65 (2021)	Estimated People in Poverty (2021)
NHBP*	4 (4.8%)	11 (13.3%)	20 (25.3%)

Source: United States Census Bureau

*: Data indicates total tribal population living on Tribal Reservation. Information provided by NHBP Planning Department

Since winter storms threaten the entire planning area equally, all tribal, municipal, and school district structures are considered exposed and vulnerable. Data from the FEMA Hazus system indicates the total value of property within Calhoun County is $25,481,727,000.

Section 5 –Capability Assessment

5.1 Introduction

This capability overview for Calhoun County documents programs, policies, and funding mechanisms for participating jurisdictions. All listed capabilities documented in the previous HMP were reviewed for relevance and updated to reflect the current environment, as necessary. Additionally, any programs, policies, or funding mechanisms that are no longer applicable, are outdated, or are no longer in existence have been removed. As part of this process, updated jurisdictional capability profiles were sent for review and, if necessary, further revision.

This section of the plan discusses the current capacity of regional communities to mitigate the effects of identified hazards. A capability assessment is conducted to determine the ability of a jurisdiction to execute a comprehensive mitigation strategy, and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs or projects.

A capability assessment helps to determine which mitigation actions are practical based on a jurisdiction's fiscal, staffing and political resources, and consists of:

- An inventory of relevant plans, ordinances, or programs already in place
- An analysis capacity to carry them out.

A thoughtful review of jurisdictional capabilities will assist in determining gaps that could limit current or proposed mitigation activities, or potentially aggravate a jurisdiction's vulnerability to an identified hazard. Additionally, a capability assessment can detail current successful mitigation actions that should continue to receive support.

5.2 Capabilities

Calhoun County, NHBP, and this plan's participating jurisdictions' governments utilize three emergency management agencies. The City of Battle Creek has its own emergency management agency which the Battle Creek Public Schools and Lakeview School District rely on during complex incidents. NHBP utilizes its Administration Department in concert with NHBP Police as first responders to manage emergency events. NHBP and Calhoun County have joint mutual aid agreements for emergency management and law enforcement agreements that allow for joint policing and emergency services. The Calhoun County Sheriff's Office Department of Emergency Management and Homeland Security serve the rest of the county and participating municipalities and school districts. All emergency management agencies within the county work collaboratively in all phases of emergency management.

The capabilities of participating jurisdictions vary based largely on the size and financial capabilities of the jurisdiction. While the county, Battle Creek, and NHBP have the capability needed to conduct mitigation planning, many participating jurisdictions rely on the technical expertise of Calhoun County to apply for grant funding and oversee mitigation projects. Augmenting local emergency management capabilities, the Michigan State Police, Emergency Management and Homeland Security Division aids with state and federal mitigation and emergency management initiatives and available funding opportunities. Other local personnel capabilities vary widely, and again are often tied to size and financial capabilities. In general, more urban, or larger jurisdictions have a greater range of full-time personnel dedicated to planning, engineering, mapping, and response, while smaller jurisdictions lack these capabilities.

Technical capabilities for each participating jurisdiction vary widely and are generally based on financial capabilities. As with personnel, and in general, more urban, or larger jurisdictions have a greater range of technical capabilities related to planning, engineering, mapping, and response, while smaller counties and jurisdictions lack these capabilities. It should be noted that the Michigan State Police, Emergency Management and Homeland Security Division offers a variety of programs to provide local jurisdictions with technical expertise, including mapping and planning.

On a yearly basis, Calhoun County and many participating jurisdictions fully allocated their tax revenue to basic services and programs. As a result, funding for mitigation projects is often unavailable or severely limited. While the capability to assess special taxes or issue bonds does exist, historically it has been shown that passing these measures is extremely

difficult. As a result, many needed mitigation projects throughout Calhoun County are not completed due to lack of funding.

The following table details local departments and positions and their roles in supporting hazard mitigation planning:

Table 75: Local Jurisdiction Department and Positions Supporting Mitigation Planning

Department or Position	Description	Role in Mitigation
Building Officials	Implements and enforces building codes and local zoning and subdivision adopted ordinances	Ensures construction standards are consistently applied.
Emergency Management Director	Directs local response, recovery, and mitigation programs.	Develops Local Emergency Operations Plan, Continuity Plans, and Hazard Mitigation Plans helping to minimize loss of life and property damage and the local level.
NFIP/CRS Coordinators	Oversees compliance with the NFIP and CRS and addresses flood determinations, mapping issues, and construction standards within SFHAs.	Reviews floodplain/building permits for structures within floodplains and inspects developments to determine compliance with the community development standards and NFIP requirements. Explains floodplain development requirements to community leaders, citizens, and the general public.
Planning Boards	Per the State Enabling Act, implements local subdivision regulations, recommends land use regulations	Coordinates with the NFIP Coordinator and the Local Hazard Mitigation Committee through the mitigation planning process and the implementation of the plans.
Public Works Departments	Responsible for municipal drainage and storm water management systems.	Provides for the ongoing maintenance and upgrading of local storm water systems to help reduce flood risks.
Town/City Council	Approves subdivision, zoning and land ordinances and bylaws and facilitates capital improvements budget and plan.	Provide leadership and approval for local hazard mitigation plans, projects, grants, and programs.

All future implemented mitigation projects will be overseen by the initiating jurisdiction. The corresponding local government involvement will vary by jurisdiction and be decided by that jurisdictional government as it sees it is fit to best plan, design, and implement mitigation projects.

Each jurisdiction has the ability to levee its own taxes through law, or in the case of school districts, through referendum. Taxation for the NHBP is directed by Title X: Tax under the Tribal Constitution and Codes. Each jurisdiction has its own budget to appropriate towards hazard mitigation as it deems appropriate or necessary. Additionally, both emergency management agencies will seek out grant opportunities through the State of Michigan and FEMA to help decrease the financial burden on local government.

The development and implementation of this plan comes with the full authority of the Calhoun County Sheriff's Office Department of Emergency Management and Homeland Security, the NHBP, and through the participating jurisdictions, utilizing all resources deemed appropriate and necessary.

Calhoun County, the NHBP, and all participating jurisdictions have extremely varied staff sizes. Staff levels for the appropriate departments are organizations are listed according to the expertise they can provide to mitigation efforts. Some of the smaller participating jurisdictions have fewer personnel and will work with neighboring jurisdictions to coordinate training and mitigation related activities. Additionally, the school districts don't have their own fire or police

force and will coordinate with the appropriate municipality's fire and police when appropriate for mitigation related activities. The following table outlines each jurisdiction's authorities, resources, policies, and programs as it relates to hazard mitigation. Personnel resources are measured on a scale according to the U.S. Small Business Administration's size categories: (1 – 6) Micro, (7 – 250) Small, (251 – 500) Medium, (501 – 1000) Large, and (> 1000) Enterprise. It is assumed any labor needed will be contracted for jurisdictions with no personnel resources pertaining to mitigation.

Table 76: Local Mitigation Capabilities

Jurisdiction	Leading Authority	Emergency Management Authority	Personnel Resources
Calhoun County	Board of Commissioners	Calhoun County	Fire (Small), Police (Small), Planning (Small), Public Works (Small)
Albion	City Council	Calhoun County	Fire (Small), Police (Small), Public Works (Small)
Battle Creek	City Council	Battle Creek	Fire (Small), Police (Small), Planning (Small), Public Works (Small)
Marshall	City Council	Calhoun County	Fire (Small), Police (Small), Planning (Micro), Public Works (Small)
Springfield	City Council	Calhoun County	Fire (Small), Police (Small), Public Works (Small)
Village of Athens	Village Council	Calhoun County	Fire (Micro), Police (Micro), Public Works (Micro)
Village of Burlington	Village Council	Calhoun County	Fire (Micro), Police (Micro), Public Works (Micro)
Village of Homer	Village Council	Calhoun County	Fire (Micro), Police (Micro), Public Works (Micro)
Village of Tekonsha	Village Council	Calhoun County	Fire (Micro), Police (Micro), Public Works (Micro)
Athens Township	Township Board	Calhoun County	Fire (Micro), Public Works (Micro)
Emmett Charter Township	Township Board	Calhoun County	Fire (Micro), Public Works (Micro)
Leroy Township	Township Board	Calhoun County	Fire (Micro), Public Works (Micro)
Sheridan Township	Township Board	Calhoun County	Fire (Micro), Public Works (Micro)
Tekonsha Township	Township Board	Calhoun County	Fire (Micro), Public Works (Micro)
Athens AS	School Board	Calhoun County	Maintenance/Public Works (Micro)
Battle Creek PS	School Board	Battle Creek	Maintenance/Public Works (Small)
Calhoun ISD	School Board	Calhoun County	Maintenance/Public Works (Small)
Harper Creek CS	School Board	Calhoun County	Maintenance/Public Works (Small)
Homer CS	School Board	Calhoun County	Maintenance/Public Works (Small)
Lakeview SD	School Board	Battle Creek	Maintenance/Public Works (Small)
Mar Lee School District	School Board	Calhoun County	Maintenance/Public Works (Small)
Marshall Public Schools	School Board	Calhoun County	Maintenance/Public Works (Small)
Tekonsha Community Schools	School Board	Calhoun County	Maintenance/Public Works (Small)
NHBP	Tribal Council	NHBP	Fire (Micro), Police (Micro), Planning (Micro), Public Works (Small)

5.3 Regulation of Development

The regulation of development plays a crucial role in helping a community become more resilient in the face of various hazards. Effective regulation of development contributes to community resilience through:

- Risk Reduction: Regulations guide land use and construction practices, ensuring that they provide strong protection against hazards.
- Public Safety: Building codes and land-use regulations establish minimum safety standards for construction, including structural integrity, fire resistance, and the use of resilient materials.
- Infrastructure Resilience: Regulations may require infrastructure improvements, such as the construction of resilient roads, bridges, utility systems, and drainage systems. This strengthens a community's ability to withstand hazards, ensures the continued operation of critical services, and aids in recovery.
- Floodplain Management: Regulations in flood-prone areas can mandate elevation requirements for new construction, ensuring that structures are built above the base flood elevation. This minimizes flood damage, reduces the need for costly post-disaster repairs, and protects property values.
- Land Use Planning: Effective land-use planning helps communities avoid inappropriate development in areas at high risk of hazards.
- Community Awareness: Public education and outreach can be incorporated into regulations, requiring communities to inform residents about local hazards, evacuation routes, and preparedness. Informed residents are more likely to take protective measures and respond effectively to disasters.

The following sections provide further detail on building codes, zoning ordinances, and floodplain management.

Building Codes

Pursuant to 1972 PA 230 (Stille-Derossett-Hale Single State Construction Code Act), adopted by the State of Michigan on November 5, 1974 and amended by 1999 PA 245, all communities in Michigan are subject to the State Construction Code. The State Construction Code is a compilation of the following:

- International Residential Code
- International Building Code
- International Mechanical Code
- International Plumbing Code
- National Electrical Code
- Michigan Uniform Energy Code
- International Property Maintenance Code

The State Construction Code establishes general minimum construction standards and is enforced through authorized local building inspection agencies and state inspectors. Building codes provide for:

- Life Safety: Building codes include provisions for fire safety, emergency egress, and the use of fire-resistant materials.
- Accessibility and Life Support: Building codes incorporate accessibility standards, ensuring that buildings are designed to accommodate all individuals. This is crucial during and after disasters when people with mobility issues may require assistance. Accessible features also benefit emergency responders and support recovery efforts.
- Retrofitting Existing Buildings: Building codes may require the retrofitting of older structures to meet modern safety standards.
- Public Awareness: Building codes promote public awareness of hazards and the importance of resilient construction. This can lead to informed decision-making by property owners, builders, and developers, resulting in safer structures.

Key hazard resistant building code provisions found in the Michigan Building Code include:

- Structural Design Requirements: Provides requirements for the structural design of buildings to ensure their resistance to various hazards, including earthquakes, high winds, and snow loads. These requirements are aimed at enhancing the overall structural integrity and safety of buildings.
- Wind Design Requirements: Provides specific provisions for wind design, considering the geographical location of the structure. Wind loads are calculated based on factors such as wind speed, exposure, and building height.
- Seismic Design Requirements: Incorporates seismic design provisions to address earthquake hazards. The code includes seismic design categories and requirements for the design and construction of buildings in seismic-prone regions.
- Flood-Resistant Design Requirements: Includes provisions related to flood-resistant design, particularly in areas prone to flooding. It may specify elevation requirements, construction materials, and other considerations to reduce the risk of flood damage. The vast majority of the regulations required by the NFIP are included within the International Building Code and the International Residential Code.
- Fire-Resistant Construction Requirements: Requirements for fire-resistant construction are included to mitigate the risk of fire hazards. This includes specifications for fire-resistant materials, assemblies, and building features.
- Material and Construction Standard Requirements: Establishes standards for building materials and construction methods to ensure the durability and safety of structures, considering various hazards.

The NHBP regulates building and development through Title IX: Land Housing under the Tribal Constitution and Codes. Tribal code does not specifically address the restriction of development in hazard prone areas. Waséyabek Development Company is a 100% Tribally owned holding company that manages the NHBP's non-gaming economic development activities.

All jurisdictional building code officials were invited to attend planning meetings and were encouraged to provide plan input and recommendations. The following table represents jurisdictional building code officials:

Table 77: Jurisdictional Building and Development Officials

Jurisdiction	Department	Title	Name
Calhoun County	**Community Development**	**Community Development Director**	**Jennifer Bombach**
City of Albion	Planning, Building, Zoning	Director	Ian Arnold
City of Battle Creek	Planning and Zoning	Administrator	Travis Sullivan
City of Marshall	Building and Trade Permits	Director	Eric Zuzga
City of Springfield	Planning and Zoning	Administrator	Vester Davis, Jr.
Village of Athens	Ordinance and Zoning	Zoning Administrator	Phillip Goodrich
Village of Burlington	Zoning	Zoning Administrator	Paul Walker
Village of Homer	Public Works	Director	Bob Taylor
Village of Tekonsha	Zoning and Building	Inspector	SafeBuilt (Consultant)
Athens Township	Ordinance and Zoning	Zoning Administrator	Phillip Goodrich
Emmett Charter Township	Building and Inspections	Building Official & Building Inspector	Justun Munn
Leroy Township	Planning and Zoning	Planning and Zoning Clerk	Kim Warden
Sheridan Township	Building and Zoning	Building Official	Bryan Powers
NHBP	Waséyabek Development Company	Waséyabek Development Company	Waséyabek Development Company

For specific information concerning the local application and enforcement of building codes it is essential to contact the local building department for the most accurate information. It is important to note that building codes are universally and evenly enforced across the state, and no obstacles to enforcing the hazard mitigation provisions in any codes have been identified.

Zoning Ordinances

Zoning ordinances in Calhoun County govern land use, development, and building requirements. These ordinances work by dividing the land into different zoning districts and establishing rules and guidelines for land use, building placement, density, and setback within the zoning districts. In general, zoning ordinances establish:

- **Zoning districts:** Areas designated for specific types of land use, such as residential, commercial, industrial, agricultural, mixed-use, or special districts.
- **Land usage within a zoning district:** Specifications as to which activities, buildings, and operations are permitted in each zoning district.
- **Enforcement:** Zoning ordinances are enforced by the local building department or zoning enforcement officers.

Zoning is the traditional, and most common, tool available to local jurisdictions to control the use of land. Zoning is used to promote health, safety, and the general welfare of the community. Zoning is used to dictate the type of land use and to set minimum specifications for use such as lot size, building height and setbacks, and density of population.

Zoning ordinances play a significant role in enhancing hazard resilience for communities and can help reduce vulnerability to various natural and man-made hazards by regulating land use and development practices. In Calhoun County, locally instituted and enforced zoning ordinances provide for:

- Land Use Planning: Zoning ordinances designate land use zones within a community, ensuring that certain areas are reserved for particular uses. This can prevent the construction of critical infrastructure, homes, or businesses in high-risk zones, such as floodplains or wildfire-prone areas.
- Setback Requirements: Zoning ordinances often mandate specific setbacks, which are distances between structures and property lines or natural features. These setbacks can help prevent buildings from being too close to potential hazards, potentially reducing the risk of damage.
- Building Height and Design Standards: Zoning codes can establish building height limits to reduce exposure to certain hazards. Design standards, including materials and construction methods, can be specified to make structures more resilient.
- Floodplain Management: Many zoning ordinances incorporate floodplain regulations, which dictate where and how buildings can be constructed within flood-prone areas. These regulations may require buildings to be elevated, use flood-resistant materials, or include openings to allow floodwaters to pass through.
- Wildfire Mitigation Zones: In regions susceptible to wildfires, zoning ordinances can establish wildfire mitigation zones with specific requirements for defensible space, fire-resistant landscaping, and building materials to reduce the risk of wildfires spreading to structures.

Properly applied, zoning restriction and historic preservation are some of the most effective hazard mitigation tools available against a wide variety of hazards.

Floodplain Management Standards

Floodplain ordinances and management are one of the most effective hazard mitigation tools available against flooding. Local floodplain ordinances, required for NFIP participants, are often used to prevent inappropriate development in floodplains and to reduce flood hazards. In general, they allow the jurisdiction to:

- Minimize the extent of floods by preventing obstructions that inhibit water flow and increase flood height and damage.

- Prevent and minimize loss of life, injuries, and property damage in flood hazard areas.
- Promote the public health, safety and welfare of citizens in flood hazard areas.
- Manage planned growth.
- Grant permits for use in development within special flood hazard areas that are consistent with the community ordinance and the NFIP under 44 CFR 60.3.

For each NFIP participating jurisdiction within Calhoun County the building department official is the NFIP Administrator (as referenced above). The NFIP floodplain management regulations work alongside building codes by providing specific flood-related requirements that must be met in addition to general building code standards. For residential structures within both FEMA and State of Michigan regulated floodplains the State Construction Code requires that the lowest floor be elevated one foot above the base flood elevation. Requirements also dictate that utilities and mechanical equipment be elevated above the base flood elevation and/or protected from a 1%-annual-chance flood.

The floodplain development prevention ordinances outright prevent development in a 100- or 500-year floodplain. It is possible to appeal this limitation by applying a development certificate which requires an inspector to show that new development will not alter a floodplain creating a hazard risk for other existing developments as well as requiring the development to be built one foot above the base flood elevation.

The NHBP does not have floodplain regulations, but currently its lands only border a 100-year floodplain, but do not encompass it.

Risk Mapping, Assessment, and Planning Program

Calhoun County and the Michigan State Police, Emergency Management and Homeland Security Division work closely with FEMA, tribal, and local partners to identify flood risk and promote informed planning and development practices through the Risk MAP program. Risk MAP is the process used to make FIRMs which both map flood risk and provide informational datasets. Mapping occurs in four phases:

- Discovery: An initial investigation into a community's flood risk, challenges, and goals.
- Analysis and Mapping: A complete engineering analysis is performed that leads to the initial updates to the flood maps. Work is completed with technical experts in each community to make sure the drafts line up with community knowledge.
- Preliminary Flood Map Release: A preliminary flood map and supporting preliminary flood hazard data is generated for review and comment.
- Map Adoption: Community takes full ownership of the updated flood maps and data.

Calhoun County and the Michigan State Police, Emergency Management and Homeland Security Division work with FEMA during the map update process from discovery to map adoption. In addition, Calhoun County and the State of Michigan provide any available data to FEMA as requested.

Summary

Calhoun County and each participating jurisdiction have regulations aimed at reducing the effects or natural hazards and preventing careless development that would endanger their citizens. To accomplish this, with the exception of the NHBP, they all have floodplain development prevention ordinances, fire prevention codes, subdivision ordinances, and zoning plans. The following table details the status of these codes and ordinances for participating jurisdictions:

Table 78: Jurisdictional Codes and Ordinances

Jurisdiction	Building Code	Floodplain Ordinance	Zoning Ordinance
Calhoun County	**x**	**x**	**x**
City of Albion	x	x	x
City of Battle Creek	x	x	x

Table 78: Jurisdictional Codes and Ordinances

Jurisdiction	Building Code	Floodplain Ordinance	Zoning Ordinance
City of Marshall	x	x	x
City of Springfield	x	x	x
Village of Athens	x	x	x
Village of Burlington	x	x	x
Village of Homer	x	x	x
Village of Tekonsha	x	x	x
Athens Township	x	x	x
Emmett Charter Township	x	x	x
Leroy Township	x	x	x
Sheridan Township	x	x	x
Tekonsha Township	x	x	x
NHBP	x		

5.4 Jurisdictional Compliance with NFIP

All NFIP participating jurisdictions are required to meet the minimum standards set forth in the program. The jurisdictions' NFIP coordinator ensures all new construction projects are properly surveyed and receive an elevation certificate.

Participation in the NFIP is based on an agreement between the municipality and the federal government. If a municipality agrees to adopt and enforce a floodplain ordinance designed to reduce future flood risks, all citizens in the participating municipality can purchase flood insurance. As part of NFIP participation communities must:

- Use current NFIP flood maps in adopting floodplain management regulations.
- Require permits for all development in SFHAs
- Ensure that development does not increase the flood hazard on other properties.
- Meet current elevation standards. Ensuring the lowest occupied floor is elevated to or above the base flood elevation indicated on the NFIP flood map.

While most floodplain requirements have been incorporated into the building codes, some additional provisions and regulations may be required by a community. Communities participating in the NFIP are required to adopt, enforce and maintain a local floodplain ordinance as a stipulation of compliance with the program. The purpose of this ordinance is to ensure public safety, minimize impact to persons and property from flooding, protect watercourses from encroachment, and maintain the capability of floodplains to retain and carry off floodwaters. The local floodplain administrator is typically the municipal official responsible for overseeing the enforcement and update of the document.

The following figure represents both pre- and post-disaster community NFIP requirements:

Figure 4: Pre- and Post-Disaster Community NFIP requirements

Source: FEMA

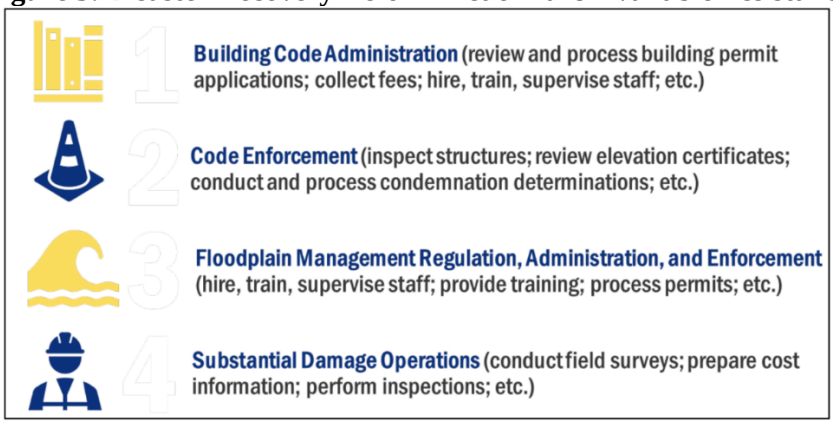
When structures located in the Special Flood Hazard Area are substantially modified (more than 50% damaged or improved) they are required to be brought into compliance with current NFIP standards and local building codes. In

cases of repairs being conducted as a result of damage, jurisdictional NFIP Coordinators are responsible for substantial damage and improvement determinations. These determinations are required for compliance in the NFIP and must be completed before residents begin repairs or permits are issued.

A May 2020 Report to Congressional Committees on the National Flood Insurance Program by the United States Government Accountability indicates "FEMA generally does not collect or analyze the results of these assessments, limiting its ability to ensure the process operates as intended. Furthermore, FEMA has not clarified how communities can access NFIP claims data. Such data would help communities target substantial damage assessments after a flood." This has been found to be true in Calhoun County, with submitted information and data underutilized and some FEMA available data unshared and/or unadvertised.

Section 1206 of the Disaster Recovery Reform Act of 2018 authorizes the FEMA to provide communities with the resources to administer and enforce building code and floodplain management ordinances following a major disaster declaration through FEMA's Public Assistance Program. To be eligible for reimbursement under the Public Assistance Program, including for the Disaster Recovery Reform Act of 2018 Section 1206, communities must be designated for Public Assistance permanent work under a major disaster declaration and be legally responsible to administer and enforce building codes or floodplain management regulations. Communities must also be in good standing with the NFIP. Available assistance includes:

Figure 5: Disaster Recovery Reform Act of 2018 Available Assistance



Source: FEMA

It is worth noting that this assistance is available for a variety of hazards occurrence types, not just flooding.

Key to achieving across the board reduction in flood damages is a robust community assistance, education, and awareness program. As such, NFIP participating jurisdictions will continue to develop both electronic (including social media) and in person outreach activities.

5.5 Jurisdictional Plans

Planning plays a critical role in hazard mitigation by helping communities identify, assess, and reduce risks associated with natural and man-made hazards. Effective planning involves a proactive, strategic, and comprehensive approach to minimize the impact of disasters and enhance community resilience. Jurisdictions were asked if they had completed the following plans:

- Comprehensive Plan: A comprehensive plan establishes the overall vision for a jurisdiction and serves as a guide to decision making, and generally contains information on demographics, land use, transportation, and facilities. As a comprehensive plan is broad in scope the integration of hazard mitigation measures can enhance the likelihood of achieving risk reduction goals.

- Emergency Operations Plan: An emergency operations plan outlines the responsibility and means and methods by which resources are deployed during and following an emergency or disaster. In Calhoun County, the overarching county provides emergency operation planning for the majority of jurisdictions within its borders.
- Flood Mitigation Assistance Plan: The purpose of the flood mitigation assistance plan is to reduce or eliminate the long-term risk of flood damage to buildings and other structures insured under the NFIP.

Calhoun County, NHBP, and the City of Battle Creek each maintain their own Emergency Operations Plans. Pending the adoption of this plan by the county and Battle Creek, this plan will become an accompanying document to these EOPs in multiple ways. Where identified hazards overlap, this HMP will function as that EOP hazard's risk assessment. Additionally, when each EOP is updated and revised, this HMP will be evaluated and be a considering factor in identifying hazards, their risks, and utilized for a number of other response functions such as flood evacuation planning, hazardous materials site identification, or others as deemed appropriate. The NHBP does not employ any comprehensive planning documents.

Table 79: Jurisdictional Plans

Jurisdiction	Comprehensive Plan	Emergency Operations Plan	Flood Mitigation Plan
Calhoun County	**x**	**x**	**x**
City of Albion		Under county	x
City of Battle Creek	x	x	x
City of Marshall		Under county	x
City of Springfield		Under county	x
Village of Athens		Under county	x
Village of Burlington		Under county	x
Village of Homer		Under county	x
Village of Tekonsha		Under county	x
Athens Township		Under county	x
Emmett Charter Township		Under county	x
Leroy Township		Under county	x
Sheridan Township		Under county	x
Tekonsha Township		Under county	x
NHBP		x	x

Each participating school district is required by the State of Michigan to maintain a five-year facilities master plan. These plans are intended to assess the maintenance and improvement of the school district's grounds and facilities. The assessments take into consideration the age of the buildings and the issues that accompany age, future facility needs given the growth or lack thereof for the school district, and budget and fiscal concerns.

5.6 Challenges and Opportunities for Capability Improvement

As always, challenges exist for all participating jurisdictions due to the day-to-day demands of the working environment including staffing issues, budget restrictions, and staffing turnover. These issues can, and do, impact the utilization and incorporation of the HMP and the completion of identified hazard mitigation projects.

As part of this planning process, the MPC worked to identify gaps and deficiencies identified in the completion of this HMP. Resulting from this assessment is a series of problem statements, concise descriptions of issues or challenges that need to be addressed. These problem statements were determined to be applicable to all participating jurisdictions:

- Continued climate change is driving an increased incidence of major hazard occurrences, stressing the response, recovery, and mitigation capabilities of even the most prepared jurisdiction.
- Available funding for the completion of hazard mitigation projects is at a premium, with all participating jurisdiction seeing minimal room in the budget for any required project match.

- The difficulties in applying for and managing hazard mitigation grants are beyond the capability of smaller jurisdictions.
- Staffing at all levels is stretched thin, with many personnel wearing multiple hats, compromising mitigation capabilities.

Improving capabilities can lead to enhanced performance, increased efficiency, and better outcomes in hazard mitigation planning and implementation. The following identify recommended improvements for all jurisdictions, with some recommendations being applicable to all jurisdictions, and other being specific to identified jurisdictions:

- All participating jurisdictions should build a relationship with local meteorologists and the NWS to give priority access to rapidly developing weather conditions.
- All participating jurisdictions could receive instruction from the Michigan State Police Emergency Management and Homeland Security and FEMA Region V on grant application processes and grant management strategies. These classes could help all participating jurisdictions receive available grant funding.
- Jurisdictions that do not currently participate in the NFIP should enroll in the program to allow citizens to purchase federally backed flood insurance.
- Current NFIP participants should apply for membership in the CRS to allow citizens to receive discounts off their federally backed flood insurance policies.
- All participating jurisdictions should explore engaging in public-private emergency planning partnerships to further increase hazard resiliency through the infusion of additional funding and expertise to help complete mitigation projects.

To help overcome many of these identified challenges, participating jurisdictions will work collaboratively using the following strategies, as appropriate:

- Innovation and Adaptation: Foster a culture of innovation and adaptability. Encourage employees to think creatively, embrace change, and explore new ways of doing things to overcome challenges.
- Training and Development: Invest in training and development to enhance skills and knowledge.
- Communication Improvement: Enhance communications and provide clear and transparent communication when sharing information, aligning teams, and addressing concerns.
- Collaboration and Teamwork: Encourage collaboration and teamwork which allows for the pooling of diverse skills and perspectives, leading to more effective problem-solving (the MPC is a good example of effective use of this strategy).
- Technology Adoption: Embrace technology to streamline operations and enhance productivity.
- Agile Project Management: Implement agile project management methodologies to enhance flexibility and responsiveness to changing conditions. Agile approaches allow teams to adapt quickly to challenges.

As appropriate, these strategies will be tailored for specific circumstances, with a combination of these strategies often being more effective than relying on a single approach.

Section 6 – Mitigation Strategy

6.1 Introduction

As part of this planning effort, Calhoun County, NHBP, and its participating jurisdictions worked to minimize the risk of future impacts from identified hazards to all citizens of the county. In an attempt to shape future regulations, ordinances and policy decisions, the MPC reviewed and developed a hazard mitigation strategy. This comprehensive strategy includes:

- The consistent review and revision, as necessary, of obtainable goals and objectives
- The consistent review, revision and development of a comprehensive list of potential hazard mitigation actions

The development of a robust mitigation strategy allows for:

- The ability to effectively direct limited resources for maximum benefit
- The ability to prioritize identified hazard mitigation projects to maximize positive outcomes
- The increase in public and private level participation in hazard mitigation through transparency and awareness
- The potential direction of future policy decisions through awareness and education
- The achievement of the ultimate goal of a safer Calhoun County for all our citizens

As per the previous hazard mitigation plan, and considering all of the factors listed above, the MPC continues to implement the following mitigation strategy:

- **Implement** the action plan recommendations of this plan.
- **Use** existing regulations, policies, programs, procedures, and plans already in place.
- **Monitor** multi-objective management opportunities, share and package funding opportunities, and garner broader constituent support.
- **Communicate** the hazard information collected and analyzed through this planning process so that local governments and residents better understand where disasters occur, and what they can do to mitigate their impacts. In doing so, also publicize the success stories that have been achieved through the County's ongoing mitigation efforts.

6.2 Identification of Goals

The following goals for hazard mitigation were established from the MPC's discovery and deliberation process, which consisted of:

- A review of identified hazards, vulnerabilities and impacts
- A review of hazard events subsequent to the last hazard mitigation plan revision
- A review of demographic, infrastructure and built environment data
- A review of the goals and objectives identified in previous hazard mitigation plans
- A review of local mitigation strategies and goals
- A review completed and remaining hazard mitigation actions

These goals represent a vision for hazard mitigation and disaster resistance for Calhoun County and the NHBP Tribal Reservation. Each mitigation goal was reviewed and approved by both MPC members and stakeholders. Through group discussions at meetings, the MPC refined and combined the identified goals from the previous hazard mitigation plan. During this process it was determined that the priorities of the overall community in relation to hazard mitigation planning have not changed during the five years of the previous planning cycle. The identified goals are as follows:

- **Goal 1:** Reduce the risk to the people and property from the identified hazards in this plan.
- **Goal 2:** Work to protect all vulnerable populations, structures, and critical facilities from the impacts of the identified hazards.

- **Goal 3:** Improve public outreach initiatives to include education, awareness, and partnerships with all entities in order to enhance the understanding identified hazards and hazard mitigation opportunities.

The MPC will continuously evaluate these identified goals against current capabilities and conditions. As part of this process, the MPC will utilize a monitoring and evaluation system to systematically track, assess, and measure the progress of activities and outcomes related to the goals outlined in this HMP. Key components to the monitoring and evaluation system include:

- Establishment of baseline data to quantify the starting point upon the approval of this plan. This will provide a reference against which progress can be measured.
- Enactment of a monitoring plan which outlines the specific activities, tasks, and responsibilities for regularly collecting, analyzing, and reporting data on the performance indicators.
- Identification and specification of the methods for collecting data, whether through surveys, interviews, focus groups, or observations.
- Definition of the criteria and methods for analyzing collected data. This includes determining how quantitative and qualitative data will be processed and interpreted to assess progress.
- Involvement of stakeholders to ensure that all perspectives are considered, and that feedback on the progress of achieving the delineated goals is taken into account.

In addition, the MPC will work with all local, county, regional, and state agencies and policy makers to help integrate the goals delineated in the HMP and goals and plans for combating climate change.

6.3 Classification of Mitigation Actions

For this plan update members of the MPC were provided with a complete list of previously identified mitigation actions and asked to review them to determine their status. Previously identified mitigation status was reported using the following definitions:

- **Completed:** The action has been fully completed.
- **Not Completed:** The action was not started or has been started and is not completed.
- **Revised:** Action has been revised to reflect current planning environment or identified changes.
- **Cancelled:** The action has been removed from consideration due to either a lack of resources or changing mitigation priorities.
- **Ongoing:** The action is completed and has become an ongoing activity or capability.

Additionally, MPC members and stakeholders were provided with forms to identify and incorporate newly identified actions based on the changing hazard environment or previously unidentified needs. A wide range of activities were considered based on the following factors:

- Updated state risk assessment and information from local risk assessments
- Goals and objectives
- Existing state actions
- State and local capabilities
- Actions identified in local plans

In preparing a mitigation strategy all reasonable and obtainable mitigation actions were considered to help achieve the general goals. Priorities were developed based on past damage, existing exposure to risk, and weaknesses identified by the State and local capability assessments. In identifying mitigation actions, the following activities were considered:

- The use of applicable building construction standards
- Hazard avoidance through appropriate land-use practices
- Relocation, retrofitting, or removal of structures at risk

- Removal or elimination of the hazard
- Reduction or limitation of the amount or size of the hazard
- Segregation of the hazard from that which is to be protected
- Modification of the basic characteristics of the hazard
- Control of the rate of release of the hazard
- Provision of protective systems or equipment for both cyber or physical risks
- Establishment of hazard warning and communication procedures
- Redundancy or duplication of essential personnel, critical systems, equipment, and information materials.

6.4 Prioritization of Mitigation Actions

The MPC and subject matter experts worked together to prioritize both previously identified and newly identified hazard mitigation actions. The methodology used to determine mitigation action priorities was based upon the following:

- Review of the updated risk assessments
- Review of revised goals and objectives
- Review of local capabilities

In formulating a mitigation strategy, a wide range of activities were considered to help achieve identified goals and to lessen the vulnerability to the effects of identified hazards.

A self-analysis method was used for determining and prioritizing mitigation actions. This methodology takes all considerations into account to ensure that, based on capabilities, funding, public wishes, political climate, and legal framework and context, reasonable actions are determined. The following provides a brief description of each consideration:

- Are all people within the jurisdiction being treated equally and fairly?
- Will the action disrupt the social fabric of the jurisdiction?
- Does the proposed action work and is it technically feasible?
- Does the action offer a long-term solution to the problem?
- Does the jurisdiction have adequate staffing?
- Is there someone to coordinate and lead the effort?
- Is there sufficient funding available?
- Are there ongoing administrative requirements that need to be met?
- Does the action have political and public support?
- Does the jurisdiction have the legal authority to implement the action?
- Will the jurisdiction be liable for the action or for any inaction?
- Could the action face any legal challenges?
- What are the costs and benefits of this action?
- Do the benefits exceed the costs?
- Has funding for the action been identified?

Identified actions were prioritized and were given one of the following rankings:

- **High Priority:** Actions that provide substantial progress towards improving resiliency and are determined as potentially urgent in nature by the MPC. This would include actions that strongly support the reduction of high hazard risks and meet mitigation goals. Additionally, actions in this ranking may have imminent funding availability or strong community support.
- **Medium Priority:** Actions that provide reasonable progress towards improving resiliency and are determined as moderately urgent in nature by the MPC. This would include actions that would lessen impact hazard events, but not eliminate the impact completely.

- **Low Priority:** Actions that provide incremental progress towards improving resiliency and are determined as slightly urgent in nature by the MPC. This would include actions that fall outside the normal jurisdictional authority or actions whose cost/benefit analysis returns a low yield.

Of major concern was the potential or identified cost of each action. In general, identified actions were proposed to reduce future damage. As such, it is critical that selected and implemented actions provide a greater saving over the life of the action than the initial cost. Prior to the implementation of any action a Benefit-Cost Analysis that determines the future risk reduction benefits of a hazard mitigation project and compares those benefits to its costs will be conducted as required. Applicants and sub-applicants must use FEMA approved methodologies and tools, such as the Benefit-Cost Analysis Toolkit, to demonstrate the cost-effectiveness of their projects. The result is a Benefit-Cost Ratio, and a project is considered cost-effective when the Benefit-Cost Ratio is 1.0 or greater. Depending on the project, either a full Benefit-Cost Analysis will be completed by entering documented values into the FEMA Benefit-Cost Analysis Toolkit, which calculates a benefit-cost ratio or, if the project meets specified criteria, a streamlined Benefit-Cost Analysis may be completed (FEMA's cost-effectiveness requirement is never waived).

For structural and property protection actions cost effectiveness is primarily assessed on:

- Likelihood of damages occurring
- Severity of the damages
- Potential effectiveness

For all other types of actions cost effectiveness is primarily assessed on likely future benefits as these actions may not easily result in a quantifiable reduction in damage.

6.5 Mitigation Action Funding Sources

It is generally recognized that mitigation actions help realize long term savings by preventing future losses due to hazard events. However, many mitigation actions are beyond the budgetary capabilities of a single jurisdiction. This section provides a general description of some of the avenues available to defray the cost of implementing mitigation actions.

FEMA provides financial assistance to state, local, tribal, and territorial governments, as well as certain private non-profit organizations, to implement projects that help reduce the risk and impact of future disasters. These grant programs are designed to support initiatives aimed at mitigating hazards and improving resilience. The main grant program offered by FEMA for hazard mitigation is the Hazard Mitigation Assistance (HMA) program. The HMA program includes four subprograms, the Hazard Mitigation Grant Program (HMGP), the HMGP Post-Fire, Building Resilient Infrastructure and Communities (BRIC), and the Flood Mitigation Assistance (FMA) grant program. Applicants to these grant programs are required to submit project proposals that demonstrate the effectiveness of their proposed mitigation projects. The eligibility criteria, application process, and specific requirements for each program are outlined by FEMA in their guidelines and announcements, which are typically published on FEMA's website.

The following provides a general overview of major grant funding streams:

- **HMGP and HMGP Fire:** The HMGP grants assist in implementing long-term hazard mitigation measures following Presidential disaster declarations, including fire declarations. Funding is available to implement projects in accordance with State, Tribal, and local priorities.
- **BRIC:** BRIC supports states, local communities, tribes and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards. The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency. Working in coordination with BRIC, the National Mitigation Investment Strategy is intended to provide a national, whole-community approach to investments in mitigation activities and risk management.
- **FMA Grant Program:** FMA is a competitive grant program that provides funding to states, local communities, federally recognized tribes and territories. Funds can be used for projects that reduce or eliminate the risk of

repetitive flood damage to buildings insured by the NFIP. FEMA chooses recipients based on the applicant's ranking of the project and the eligibility and cost-effectiveness of the project. FEMA requires state, local, tribal and territorial governments to develop and adopt hazard mitigation plans as a condition for receiving certain types of non-emergency disaster assistance, including funding for hazard mitigation assistance projects.

The following figure summarizes HMA grants programs:

Figure 6: HMA Grant Program Summary

HMA Program Comparison	HMGP	HMGP Post Fire	BRIC	FMA
Program Type	Post-disaster	Post-disaster	Pre-disaster	Pre-disaster
Funding Availability	Presidentially declared disaster	FMAG-declared disaster	6% set aside from federal post-disaster grant funding	Annual appropriations
Competitive?	No	No	Yes	Yes
Eligible Applicants	States, federally recognized tribes, territories and the District of Columbia (DC)	States, federally recognized tribes, territories and DC	States, federally recognized tribes, territories and DC	States, federally recognized tribes, territories and DC
Eligible Subapplicants	State agencies, local governments, tribes and private nonprofit organizations	State agencies, local governments, tribes and private nonprofit organizations	State agencies, local governments and tribes	State agencies, local governments and tribes
Hazard Mitigation Plan Requirement	Yes	Yes	Yes	Yes
NFIP Participation	Communities with projects in Special Flood Hazard Areas (SFHAs)	Communities with projects in SFHAs	Communities with projects in SFHAs	Subapplicants and properties

Source: FEMA

Additionally, the following provide available grant funding avenues for hazard mitigation projects:

- **Rehabilitation Of High Hazard Potential Dam (HHPD) Grant Program:** HHPD awards provide technical, planning, design and construction assistance in the form of grants for rehabilitation of eligible high hazard potential dams. A state or territory with an enacted dam safety program, the State Administrative Agency, or an equivalent state agency, is eligible for the grant.
- **Emergency Management Performance Grant:** Program provides state, local, tribal and territorial emergency management agencies with the resources required for implementation of the National Preparedness System and works toward the National Preparedness Goal of a secure and resilient nation. Allowable costs support efforts to build and sustain core capabilities across the prevention, protection, mitigation, response and recovery mission areas.
- **State Homeland Security Program:** Program includes a suite of risk-based grants to assist state, local, tribal and territorial efforts in preventing, protecting against, mitigating, responding to and recovering from acts of terrorism and other threats. This grant provides grantees with the resources required for implementation of the National Preparedness System, working toward the National Preparedness Goal of a secure and resilient nation.

- **Nonprofit Security Grant Program:** Program is one of three grant programs that support DHS/FEMA's focus on enhancing the ability of state, local, tribal, and territorial governments, as well as nonprofits, to prevent, protect against, prepare for, and respond to terrorist or other extremist attacks. These grant programs are part of a comprehensive set of measures authorized by Congress and implemented by DHS to help strengthen the nation's communities against potential terrorist or other extremist attacks. Among the five basic homeland security missions noted in the DHS Strategic Plan for Fiscal Years 2020-2024
- **Public Assistance Program:** The mission of FEMA's Public Assistance program is to provide assistance to State, Tribal and local governments, and certain types of Private Nonprofit organizations so that communities can quickly respond to and recover from major disasters or emergencies declared by the President. Through the Public Assistance program, FEMA provides supplemental Federal disaster grant assistance for debris removal, emergency protective measures, and the repair, replacement, or restoration of disaster-damaged, publicly owned facilities and the facilities of certain private non-profit organizations. The Public Assistance Program also encourages protection of these damaged facilities from future events by providing assistance for hazard mitigation measures during the recovery process. The Federal share of assistance is not less than 75% of the eligible cost for emergency measures and permanent restoration. The grantee determines how the non-Federal share (up to 25%) is split with the eligible applicants.
- **Individual Assistance Program:** After a disaster, the federal government determines if any county in the state meets the criteria for individual disaster assistance. The decision is based on damage related to the severity and magnitude of the event. When a county receives an Individual Assistance declaration from the President of the United States, anyone who lives in that county can apply for assistance.
- **Small Business Administration Disaster Loans:** The Small Business Administration provides low-interest disaster loans to homeowners, renters, businesses of all sizes, and most private nonprofit organizations. Small Business Administration disaster loans can be used to repair or replace the following items damaged or destroyed in a declared disaster: real estate, personal property, machinery and equipment, and inventory and business assets.
- **The Housing and Urban Development Agency**: Provides flexible grants to help cities, counties, and States recover from Presidentially declared disasters, especially in low-income areas, subject to availability of supplemental appropriations.
- **Community Development Block Grant Program**: This is a flexible program that provides communities with resources to address a wide range of unique community development needs. The program provides annual grants on a formula basis to general units of local government and States.
- **Individual and Households, Other Needs Assistance Program:** This program provides financial assistance to individuals or households who sustain damage or develop serious needs because of a natural or man-made disaster. The funding share is 75% federal funds and 25% state funds. The program provides grants for necessary expenses and serious needs that cannot be provided for by insurance, another federal program, or other source of assistance. The current maximum allowable amount for any one disaster to individuals or families is $25,000. The program gives funds for disaster-related necessary expenses and serious needs, including personal property, transportation, medical and dental, funeral, essential tools, flood insurance, and moving and storage.
- **WUI Grants:** The 10-Year Comprehensive Strategy focuses on assisting people and communities in the WUI to moderate the threat of catastrophic fire through the four broad goals of improving prevention and suppression, reducing hazardous fuels, restoring fire-adapted ecosystems, and promoting community assistance. The WUI Grant may be used to apply for financial assistance towards hazardous fuels and educational projects within the four goals of: improved prevention, re duction of hazardous fuels, restoration of fire-adapted ecosystems and promotion of community assistance.
- **Bureau of Indian Affairs Aid to Tribal Governments:** This program provides funds to Indian Tribal governments to support general Tribal government operations, to maintain up-to-date Tribal enrollment, to conduct Tribal elections, and to develop appropriate Tribal policies, legislation, and regulations. Funds may be used in a variety of ways to strengthen the capabilities of Indian tribes in self-government, community planning, and maintenance of membership records.

- **Bureau of Indian Affairs Replacement and Repair of Indian Schools:** Providing safe, functional, code-compliant, economical, and energy efficient education facilities for American Indian students attending BIA owned or funded primary and secondary schools or residing in Bureau owned or funded dormitories.
- **Bureau of Indian Affairs Wildland Fire Management:** Cooperative agreements for grants and reimbursable costs related to wildland fire management directly associated with programs contracted by tribes under the authority of the National Indian Forest Resources Management Act.

Small and impoverished communities that receive grants may receive a federal cost share of up to 90% of the total amount approved under the grant award. As defined in 44 CFR 201.2, a small and impoverished community is:

- A community of 3,000 or fewer individuals that is identified by the State as a rural community
- Is not a remote area within the corporate boundaries of a larger city
- Is economically disadvantaged, by having an average per capita annual income of residents not exceeding 80% of national, per capita income
- The local unemployment rate exceeds by one percentage point or more, the most recently reported, average yearly national unemployment rate
- Any other factors identified in the State Plan in which the community is located

6.6 Completed Mitigation Actions

Calhoun County and its participating jurisdictions remain committed to investigating and obtaining all available grant funding for the completion of hazard mitigation projects. Since the completion of the previous HMP, the MPC has been tracking the completion status of all identified hazard mitigation actions. Unfortunately, no hazard mitigation projects have been completed. Compounding issues, the onset of COVID-19 early in 2019 caused many available local resources, funding, and capabilities to be reassigned to help manage the pandemic.

6.7 Jurisdictional Mitigation Actions

During this plan update, the MPC assessed existing actions and developed new actions for consideration based on:

- Updated state risk assessment and information from local risk assessments
- Goals and objectives
- Existing state actions
- State and local capabilities
- Previously identified actions

Identified actions in the previous HMP were grouped together under the heading of “All Participating.” For this plan, each action was assigned to the relevant jurisdiction to allow that jurisdiction to take responsibility for each of their own individual actions.

When considering new mitigation actions, participating jurisdictions were guided to the January 2013 FEMA publication Mitigation Ideas, A Resource for Reducing Risk to Natural Hazards.

While the Calhoun County hazard mitigation program has matured over the years, an unfortunate lack of funding and grant opportunities has prevented the completion of any major hazard mitigation projects. As such, relevant actions from the previous hazard mitigation plan are identified as carried over and are awaiting funding to start. Additionally, Calhoun County elected to delete mitigation actions not related to any identified hazards detailed in this plan and elected to delete any actions that were significantly cost prohibitive. Deleted actions are identified in the following table along with the reason for deletion.

For each identified action, the following applies:

- New actions that have been added to this plan update are identified as such.

- Some actions have been reassigned or reclassified. In these cases, not all information is provided under the original listing, rather the newly assigned responsible entity has been given the opportunity to detail the requested information.
- All mitigation action information was provided by jurisdictional officials through outreach from the MPC.

The following table details the current status of mitigation actions identified in the previous HMP:

Table 80: Previous Plan Action Status

Jurisdiction	Actions	Current Status
All Participating	Advocate StormReady Program	Carried Over
All Participating	Alert, Broadcast, and Warning System Upgrade	Carried over
All Participating	Backups Generators	Carried Over
All Participating	Bury Utility Lines, Pipes, & Tanks	Deleted, cost prohibitive
All Participating	Elevate Structures	Deleted, cost prohibitive
All Participating	FEMA Code 361 Safe Room Projects	Carried over
All Participating	Insulation & Energy Efficiency Upgrade Program	Carried over
All Participating	Joint Public-Private Emergency Planning	Carried over
All Participating	Looped Power Grids	Deleted, cost prohibitive
All Participating	Property Buyout	Carried over
All Participating	Public Education & Awareness Campaign	Carried over
All Participating	Relocate Vulnerable Structures	Deleted, cost prohibitive
All Participating	River Restoration (Drainage)	Carried over, modified
All Participating	Snow Fence Installation Program	Carried over
All Participating	Storm Water Drainage System Upgrade	Carried over, modified
All Participating	Transportation Status & Routing Notification Systems	Carried over
All Participating	Tree Wire Installation	Carried over, modified
All Participating	Water Line Insulation Program	Carried over

Prior to the implementation of any action further feasibility analysis will be performed. Additionally, a Benefit-Cost Analysis that determines the future risk reduction benefits of a project and compares those benefits to its costs will be conducted as required. Applicants and sub-applicants will use FEMA approved methodologies and tools, such as the Benefit-Cost Analysis Toolkit, to demonstrate the cost-effectiveness of their projects. The result of the analysis is a Benefit-Cost Ratio, and a project is considered cost-effective when the Benefit-Cost Ratio is 1.0 or greater. Depending on the project, either a full Benefit-Cost Analysis will be completed by entering documented values into the FEMA Benefit-Cost Analysis Toolkit, which calculates a benefit-cost ratio or, if the project meets specified criteria, a streamlined Benefit-Cost Analysis may be completed (FEMA's cost-effectiveness requirement is never waived).

During this process, and after a thorough review and discussion with all participating jurisdictions and stakeholders, it was determined that the priorities of the overall community in relation to hazard mitigation planning have not changed during the five years of the previous planning cycle.

The following table provides a mitigation action cross check for each participating jurisdiction.

Table 81: Participating Jurisdiction Mitigation Action Cross Check

Jurisdictions	Drought	Extreme Temperatures	Flood	Severe Thunderstorm	Tornado	Winter Storm
Calhoun County	1, 2, 3, 22	4, 5, 6, 22	6, 7, 8, 9, 10, 11, 22	6, 11, 12 ,13, 13, 15, 16, 17, 22	6, 11, 14, 15, 16, 17, 18, 22	6, 11, 15, 16, 19, 20, 21, 22
Albion	1, 2	3, 4	5, 6, 7	8, 9, 10, 11, 15	8, 9. 12	4, 8, 9, 13
Athens	1, 2	3, 4, 5	6, 7, 8	9. 10. 11, 12	9, 12	4, 5, 9, 10, 13, 14

Table 81: Participating Jurisdiction Mitigation Action Cross Check

Jurisdictions	Drought	Extreme Temperatures	Flood	Severe Thunderstorm	Tornado	Winter Storm
Battle Creek	1, 2	3, 4	4, 5, 6, 7, 8	4, 9, 10, 11, 12, 13	4, 11, 12, 13, 14	4, 11, 12, 15, 16, 17
Burlington	1, 2	3, 4, 5	6, 7, 8	9, 10, 11, 12	9, 12	4, 5, 9, 10, 13, 14
Homer	1, 2	3, 4, 5	6, 7, 8	9, 10, 11, 12	9, 11, 12	4, 5, 9, 10, 13, 14
Marshall	1, 2	3, 4	5, 6, 7	8, 9, 10, 11, 12	8, 12	4, 8, 9, 13
Springfield	1, 2	3, 4	5, 6, 7	8, 9, 10, 11, 12	8, 12	4, 8, 9, 13
Tekonsha	1, 2	3, 4, 5	6, 7, 8	9, 10, 11, 12	9, 12	4, 5, 9, 10, 13, 14
Athens Township	1, 2	3, 4	5, 6, 7	8, 9, 10, 11, 15	8, 9. 12	4, 8, 9, 13
Emmet Charter Township	1, 2	3, 4	5, 6, 7	8, 9, 10, 11, 15	8, 9. 12	4, 8, 9, 13
Leroy Township	1, 2	3, 4	5, 6, 7	8, 9, 10, 11, 15	8, 9. 12	4, 8, 9, 13
Sheridan Township	1, 2	3, 4	5, 6, 7	8, 9, 10, 11, 15	8, 9. 12	4, 8, 9, 13
Tekonsha Township	1, 2	3, 4	5, 6, 7	8, 9, 10, 11, 15	8, 9. 12	4, 8, 9, 13
Athens Schools	1, 2	2, 4, 5	6, 7	8, 9, 10 ,11	8, 11	4, 5, 8, 9, 12, 13
Battle Creek Schools	1, 2	2, 4, 5	6, 7	8, 9, 10 ,11	8, 11	4, 5, 8, 9, 12, 13
Calhoun Intermediate Schools	1, 2	2, 4, 5	6, 7	8, 9, 10 ,11	8, 11	4, 5, 8, 9, 12, 13
Harper Creek Community Schools	1, 2	2, 4, 5	6, 7	8, 9, 10 ,11	8, 11	4, 5, 8, 9, 12, 13
Homer Community Schools	1, 2	2, 4, 5	6, 7	8, 9, 10 ,11	8, 11	4, 5, 8, 9, 12, 13
Lakeview Schools	1, 2	2, 4, 5	6, 7	8, 9, 10 ,11	8, 11	4, 5, 8, 9, 12, 13
Mar Lee School District	1, 2	2, 4, 5	6, 7	8, 9, 10 ,11	8, 11	4, 5, 8, 9, 12, 13
Marshall Public Schools	1, 2	2, 4, 5	6, 7	8, 9, 10 ,11	8, 11	4, 5, 8, 9, 12, 13
Tekonsha Community Schools	1, 2	2, 4, 5	6, 7	8, 9, 10 ,11	8, 11	4, 5, 8, 9, 12, 13
NHBP	1, 2	3, 4	4, 5, 6,	4, 7, 8, 9, 10, 11	4, 9, 10, 11	4, 9, 10, 12, 13, 14

The following tables identify mitigation action items for each participating jurisdiction, along with the following information:

- Hazard addressed
- Responsible party
- Overall priority
- Goal(s) addressed
- Estimated cost
- Potential funding source
- Proposed completion timeframe
- Current status

Table 82: Calhoun County Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Calhoun County 1	Conduct agricultural education program on water reduction methods.	Drought	Emergency Manager	High	1, 3	Staff Time	Local budgets	Five years	New
Calhoun County 2	Revise building codes to require low water flow toilets and faucets.	Drought	Building Commissioner, Calhoun County Administration	High	1, 2	Staff Time	Local budgets	Five years	New
Calhoun County 3	Conduct a Xeriscaping program for all jurisdictional owned facilities	Drought	Emergency Manager, Director of Public Works	Low	1, 2	$5,000 - $50,000 per location	HMGP, BRIC, Local budgets	Five years	New
Calhoun County 4	Modernization air conditioning and ventilation systems in jurisdictional facilities.	Extreme Temperatures	Building Commissioner	Low	1, 2	$25,000 per facility	HMGP, BRIC, Local budgets	Five years	New
Calhoun County 5	Purchase extreme cold gear for first responders.	Extreme Temperatures	Emergency Manager, Local Fire Chiefs, Local Police Chiefs	Low	1, 2	$35,000	Local budgets	Five years	New
Calhoun County 6	Identify and establish new shelter locations throughout the county.	Extreme Temperatures, Flood, Severe Thunderstorm, Tornado, Winter Storm	Emergency Manager	Medium	1, 2	Staff time	Local budgets	Five years	Carried over due to lack of staff
Calhoun County 7	Purchase and demolish flood prone properties	Flood	Emergency Manager, Floodplain Manager	High	1, 2	Per property cost	FMA, HMGP, BRIC, Local budgets	Ten years	Carried over due to lack of funding
Calhoun County 8	Conduct a flood insurance awareness program.	Flood	Floodplain Manager	High	1, 3	Staff Time	Local budgets	Five years	New

Table 82: Calhoun County Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Calhoun County 9	Construct rainwater retention/detention ponds at strategic locations.	Flood	Floodplain Manager, Director of Public Works	Medium	1, 2	Facility size dependent	HMGP, BRIC, Local budgets	Ten years	Carried over due to lack of funding
Calhoun County 10	Procure permanent signage to warn of flood hazard areas	Flood	Floodplain Manager, Emergency Manager	Medium	1, 2	Location dependent	HMGP, BRIC, Local budgets	Five years	Carried over due to lack of funding
Calhoun County 11	Purchase electronic mobile traffic notification signs.	Flood, Severe Thunderstorm, Tornado, Winter Storm	Emergency Manager, Director of Public Works	Medium	1, 2	$35,000	Local budgets	Five years	New
Calhoun County 12	Install surge protectors in all jurisdictional facilities.	Severe Thunderstorms	Building Commissioner	Medium	1, 2	$10,000 per location	HMGP, BRIC, Local budgets	Five years	New
Calhoun County 13	Install hail resistant roofing on all jurisdictional facilities.	Severe Thunderstorms	Building Commissioner	Medium	1, 2	$50,000 per location	HMGP, BRIC, Local budgets	Five years	New
Calhoun County 14	Purchase and install new warning sirens throughout the county.	Severe Thunderstorms, Tornado	Emergency Manager	Medium	1, 2, 3	$300,000	HMGP, BRIC, Local budgets	Five years	Carried over due to lack of funding
Calhoun County 15	Purchase and install critical facility backup generators.	Severe Storms, Tornado, Winter Storm	Emergency Manager	High	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding
Calhoun County 16	Conduct a regular tree trimming and tree wire installation program.	Severe Storms, Tornado, Winter Storm	Emergency Manager	High	1, 2	$25,000 per occurrence	HMGP, BRIC, Local Budgets	Five years	New
Calhoun County17	Construct community safe rooms throughout the county to required building standards	Severe Storms, Tornado	Emergency Manager	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, Local budgets	Ten years	Carried over due to lack of funding
Calhoun County 18	Research and adopt an ordinance requiring installation of onsite tornado shelters for any new locations with	Tornado	Building Commissioner, Calhoun County Administration	Medium	1, 2	Staff time	Local budget	Five years	New

Table 82: Calhoun County Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
	more than 10 mobile home spaces.								
Calhoun County 19	Conduct an insulation and energy upgrade efficiency program for all jurisdictional buildings.	Winter Storm	Emergency Manager. Calhoun County Facilities	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, Local budgets	Five years	New
Calhoun County 20	Construct snow fences along major transportation routes.	Winter Storm	Director of Public Works	Low	1, 2	$25,000 - $100,000 per location	HMGP, PDM, Local budgets	Ten years	Carried over due to lack of funding
Calhoun County 21	Insulate water lines in all jurisdictional facilities.	Winter Storm	Building Commissioner	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, Local budgets	Five years	Carried over due to lack of funding
Calhoun County 22	Work to develop joint public-private emergency planning	All hazards	Emergency Manager	High	1, 2, 3	Staff time	Local budgets	On-going	On-going

Table 83: Albion Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Albion 1	Install low flow utilities in all jurisdictional buildings.	Drought	Albion Director Planning, Building, Zoning	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding
Albion 2	Conduct a xeriscaping program for all jurisdictional owned facilities	Drought	Albion Director Planning, Building, Zoning	Low	1, 2	$5,000 - $20,000 per location	HMGP, BRIC, Local Budgets	Ten years	Carried over due to lack of funding
Albion 3	Prepare local facilities to serve as local cooling centers.	Extreme Temperatures	Albion City Manager	Low	1, 2	$3,000 per facility	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding
Albion 4	Conduct an insulation and energy upgrade efficiency program for all jurisdictional buildings.	Extreme Temperatures, Winter Storm	Albion Director Planning, Building, Zoning	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding
Albion 5	Continued participation and compliance with **NFIP**	Flood	Albion NFIP Administrator	High	1, 2, 3	Staff time	Local budget	On-going	On-going
Albion 6	Conduct an education program on the dangers of entering flooded areas.	Flood	Albion NFIP Administrator	Low	3	Staff time	Local Budgets	As required	New
Albion 7	Clean and repair drainage ditches and culverts to maintain capacity.	Flood	Albion Director of Public Services	Low	1, 2	$100,000	HMGP, BRIC, Local Budgets	Five years	New
Albion 8	Purchase and install critical facility backup generators.	Severe Storms, Tornadoes, Winter Storm	Albion Director Planning, Building, Zoning	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budgets	Five years	New
Albion 9	Conduct a tree trimming program along all roadways.	Severe Thunderstorm, Winter Storm	Albion City Manager	High	1, 2	$50,000	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding

Table 83: Albion Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Albion 10	Install surge protectors in all jurisdictional facilities.	Severe Thunderstorms	Albion Director Planning, Building, Zoning	Medium	1, 2	$10,000 per location	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding
Albion 11	Install hail resistant roofing on all jurisdictional facilities.	Severe Thunderstorms	Albion Director Planning, Building, Zoning	Low	1, 2	$50,000 per location	HMGP, BRIC, Local Budgets	Five years	New
Albion 12	Construct community safe rooms to required building standards	Severe Storms, Tornado	Albion Director Planning, Building, Zoning	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, Local budgets	Ten years	Carried over due to lack of funding
Albion 13	Insulate water lines in all jurisdictional facilities.	Winter Storm	Albion Director Planning, Building, Zoning	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding

Table 84: Athens Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Athens1	Install low flow utilities in all jurisdictional buildings.	Drought	Athens Council President	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budget	Five years	New
Athens 2	Conduct a xeriscaping program for all jurisdictional owned facilities	Drought	Athens Council President	Low	1, 2	$10,000 -per location	HMGP, BRIC, Local Budget	Ten years	New
Athens 3	Select and prepare local facilities to serve as heating and cooling centers.	Extreme Temperatures	Athens Council President	Low	1, 2	$3,000 per facility	HMGP, BRIC, Local Budget	Five years	New
Athens 4	Replace water in all unit heaters with glycol to prevent freezing	Extreme Temperatures, Winter Storm	Athens Council President	High	1, 2	$50,000 -- $75,000 - $125,000	HMGP, BRIC, Local Budget	Five years	New
Athens 5	Conduct an insulation and energy upgrade efficiency program for all jurisdictional buildings.	Extreme Temperatures, Winter Storm	Athens Council President	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, Local Budget	Five years	New
Athens 6	Continued participation and compliance with **NFIP**	Flood	Athens Council President	High	1, 2, 3	Staff time	Local budget	On-going	On-going
Athens 7	Install and upgrade drainage throughout city.	Flood	Athens Council President	High	1, 2	$750,000	HMGP, BRIC, Local Budget	Five years	New
Athens 8	Construct rainwater gardens adjacent to paved areas.	Flood	Athens Council President	Low	1, 2	Location and size dependent	HMGP, BRIC, Local Budget	As required	New
Athens 9	Purchase and install mobile and fixed backup generators.	Severe Storms, Tornado, Winter Storm	Athens Council President	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budget	Five years	New
Athens 10	Conduct a tree trimming program along utility lines.	Severe Thunderstorm, Winter Storm	Athens Council President	High	1, 2	$50,000	HMGP, BRIC, Local Budget	Five years	New
Athens 11	Install surge protectors in all critical facilities.	Severe Thunderstorms	Athens Council President	Medium	1, 2	$10,000 per location	HMGP, BRIC, Local Budget	Five years	New

Table 84: Athens Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Athens 12	Construct community safe rooms to required building standards	Severe Storms, Tornado	Athens Council President	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, Local Budget	Ten years	New
Athens 13	Conduct winter driving education programs for citizens	Winter Storm	Athens Council President	Low	1, 2	$2,500	Local Budget	As required	New
Athens 14	Insulate water lines in all critical facilities.	Winter Storm	Athens Council President	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, Local Budget	Five years	New

Table 85: Battle Creek Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Battle Creek 1	Revise building codes to require low water flow toilets and faucets.	Drought	Battle Creek Emergency Manager	High	1, 2	Staff Time	Local budgets	Five years	New
Battle Creek 2	Conduct a Xeriscaping program for all jurisdictional owned facilities	Drought	Battle Creek Director of Public Works	Low	1, 2	$5,000 - $50,000 per location	HMGP, BRIC, Local budgets	Five years	New
Battle Creek 3	Modernize air conditioning and ventilation systems in jurisdictional facilities.	Extreme Temperatures	Battle Creek Emergency Manager	Low	1, 2	$25,000 per facility	HMGP, BRIC, Local budgets	Five years	New
Battle Creek 4	Identify and establish new shelter locations throughout the county.	Extreme Temperatures, Flood, Severe Thunderstorm, Tornado, Winter Storm	Battle Creek Emergency Manager	Medium	1, 2	Staff time	Local budgets	Five years	Carried over due to lack of staff
Battle Creek 5	Continued participation and compliance with **NFIP**	Flood	Battle Creek NFIP Administrator	High	1, 2, 3	Staff time	Local budget	On-going	On-going
Battle Creek 6	Purchase and demolish flood prone properties	Flood	Battle Creek Emergency Manager	High	1, 2	Per property cost	FMA, HMGP, BRIC, Local budgets	Ten years	Carried over due to lack of funding
Battle Creek 7	Conduct a flood insurance awareness program.	Flood	Battle Creek Emergency Manager	High	1, 3	Staff Time	Local budgets	Five years	New
Battle Creek 8	Construct rainwater retention/detention ponds at strategic locations.	Flood	Battle Creek Emergency Manager	Medium	1, 2	Facility size dependent	HMGP, BRIC, Local budgets	Ten years	Carried over due to lack of funding
Battle Creek 9	Install surge protectors in all jurisdictional facilities.	Severe Thunderstorms	Battle Creek Emergency Manager	Medium	1, 2	$10,000 per location	HMGP, BRIC, Local budgets	Five years	New

Table 85: Battle Creek Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Battle Creek 10	Install hail resistant roofing on all jurisdictional facilities.	Severe Thunderstorms	Battle Creek Emergency Manager	Medium	1, 2	$50,000 per location	HMGP, BRIC, Local budgets	Five years	New
Battle Creek 11	Purchase and install critical facility backup generators.	Severe Storms, Tornado, Winter Storm	Battle Creek Emergency Manager	High	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding
Battle Creek 12	Conduct a regular tree trimming and tree wire installation program.	Severe Storms, Tornado, Winter Storm	Battle Creek Director of Public Works	High	1, 2	$25,000 per occurrence	HMGP, BRIC, Local Budgets	Five years	New
Battle Creek 13	Construct community safe rooms throughout the city to required building standards	Severe Storms, Tornado	Battle Creek Emergency Manager	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, Local budgets	Ten years	Carried over due to lack of funding
Battle Creek 14	Adopt an ordinance requiring installation of onsite tornado shelters for locations with more than 10 mobile home spaces.	Tornado	Battle Creek City Manager	Medium	1, 2	Staff time	Local budget	Five years	New
Battle Creek 15	Conduct an insulation and energy upgrade efficiency program for all jurisdictional buildings.	Winter Storm	Battle Creek Emergency Manager	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, Local budgets	Five years	New
Battle Creek 16	Construct snow fences along major transportation routes.	Winter Storm	Battle Creek Emergency Manager	Low	1, 2	$25,000 - $100,000 per location	HMGP, PDM, Local budgets	Ten years	Carried over due to lack of funding
Battle Creek 17	Insulate water lines in all jurisdictional facilities.	Winter Storm	Battle Creek Emergency Manager	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, Local budgets	Five years	Carried over due to lack of funding

Table 86: Burlington Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Burlington 1	Install low flow utilities in all jurisdictional buildings.	Drought	Burlington Manager	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budget	Five years	New
Burlington 2	Conduct a xeriscaping program for all jurisdictional owned facilities	Drought	Burlington Manager	Low	1, 2	$10,000 -per location	HMGP, BRIC, Local Budget	Ten years	New
Burlington 3	Select and prepare local facilities to serve as heating and cooling centers.	Extreme Temperatures	Burlington Manager	Low	1, 2	$3,000 per facility	HMGP, BRIC, Local Budget	Five years	New
Burlington 4	Replace water in all unit heaters with glycol to prevent freezing	Extreme Temperatures, Winter Storm	Burlington Manager	High	1, 2	$50,000 -- $75,000 - $125,000	HMGP, BRIC, Local Budget	Five years	New
Burlington 5	Conduct an insulation and energy upgrade efficiency program for all jurisdictional buildings.	Extreme Temperatures, Winter Storm	Burlington Manager	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, Local Budget	Five years	New
Burlington 6	Continued participation and compliance with **NFIP**	Flood	Burlington Manager	High	1, 2, 3	Staff time	Local budget	On-going	On-going
Burlington 7	Install and upgrade drainage throughout city.	Flood	Burlington Manager	High	1, 2	$750,000	HMGP, BRIC, Local Budget	Five years	New
Burlington 8	Construct rainwater gardens adjacent to paved areas.	Flood	Burlington Manager	Low	1, 2	Location and size dependent	HMGP, BRIC, Local Budget	As required	New
Burlington 9	Purchase and install mobile and fixed backup generators.	Severe Storms, Tornado, Winter Storm	Burlington Manager	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budget	Five years	New
Burlington 10	Conduct a tree trimming program along utility lines.	Severe Thunderstorm, Winter Storm	Burlington Manager	High	1, 2	$50,000	HMGP, BRIC, Local Budget	Five years	New
Burlington 11	Install surge protectors in all critical facilities.	Severe Thunderstorms	Burlington Manager	Medium	1, 2	$10,000 per location	HMGP, BRIC, Local Budget	Five years	New

Table 86: Burlington Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Burlington 12	Construct community safe rooms to required building standards	Severe Storms, Tornado	Burlington Manager	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, Local Budget	Ten years	New
Burlington 13	Conduct winter driving education programs for citizens	Winter Storm	Burlington Manager	Low	1, 2	$2,500	Local Budget	As required	New
Burlington 14	Insulate water lines in all critical facilities.	Winter Storm	Burlington Manager	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, Local Budget	Five years	New

Table 87: Homer Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Homer 1	Install low flow utilities in all jurisdictional buildings.	Drought	Village President	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budget	Five years	New
Homer 2	Conduct a xeriscaping program for all jurisdictional owned facilities	Drought	Village President	Low	1, 2	$10,000 -per location	HMGP, BRIC, Local Budget	Ten years	New
Homer 3	Select and prepare local facilities to serve as heating and cooling centers.	Extreme Temperatures	Village President	Low	1, 2	$3,000 per facility	HMGP, BRIC, Local Budget	Five years	New
Homer 4	Replace water in all unit heaters with glycol to prevent freezing	Extreme Temperatures, Winter Storm	Village President	High	1, 2	$50,000 -- $75,000 - $125,000	HMGP, BRIC, Local Budget	Five years	New
Homer 5	Conduct an insulation and energy upgrade efficiency program for all jurisdictional buildings.	Extreme Temperatures, Winter Storm	Village President	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, Local Budget	Five years	New
Homer 6	Continued participation and compliance with **NFIP**	Flood	Village President	High	1, 2, 3	Staff time	Local budget	On-going	On-going
Homer 7	Install and upgrade drainage throughout city.	Flood	Village President	High	1, 2	$750,000	HMGP, BRIC, Local Budget	Five years	New
Homer 8	Construct rainwater gardens adjacent to paved areas.	Flood	Village President	Low	1, 2	Location and size dependent	HMGP, BRIC, Local Budget	As required	New
Homer 9	Purchase and install mobile and fixed backup generators.	Severe Storms, Tornado, Winter Storm	Village President	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budget	Five years	New
Homer 10	Conduct a tree trimming program along utility lines.	Severe Thunderstorm, Winter Storm	Village President	High	1, 2	$50,000	HMGP, BRIC, Local Budget	Five years	New
Homer 11	Install surge protectors in all critical facilities.	Severe Thunderstorms	Village President	Medium	1, 2	$10,000 per location	HMGP, BRIC, Local Budget	Five years	New

Table 87: Homer Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Homer 12	Construct community safe rooms to required building standards	Severe Storms, Tornado	Village President	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, Local Budget	Ten years	New
Homer 13	Conduct winter driving education programs for citizens	Winter Storm	Village President	Low	1, 2	$2,500	Local Budget	As required	New
Homer 14	Insulate water lines in all critical facilities.	Winter Storm	Village President	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, Local Budget	Five years	New

Table 88: Marshall Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Marshall 1	Install low flow utilities in all jurisdictional buildings.	Drought	Marshall Director of Public Service	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding
Marshall 2	Conduct a xeriscaping program for all jurisdictional owned facilities	Drought	Marshall Director of Public Service	Low	1, 2	$5,000 - $20,000 per location	HMGP, BRIC, Local Budgets	Ten years	Carried over due to lack of funding
Marshall 3	Prepare local facilities to serve as local cooling centers.	Extreme Temperatures	Marshall City Manager	Low	1, 2	$3,000 per facility	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding
Marshall 4	Conduct an insulation and energy upgrade efficiency program for all jurisdictional buildings.	Extreme Temperatures, Winter Storm	Marshall Director of Public Service	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding
Marshall 5	Continued participation and compliance with **NFIP**	Flood	Marhsall NFIP Administrator	High	1, 2, 3	Staff time	Local budget	On-going	On-going
Marshall 6	Conduct an education program on the dangers of entering flooded areas.	Flood	Marhsall NFIP Administrator	Low	3	Staff time	Local Budgets	As required	New
Marshall 7	Clean and repair drainage ditches and culverts to maintain capacity.	Flood	Marshall Director of Public Works	Low	1, 2	$100,000	HMGP, BRIC, Local Budgets	Five years	New
Marshall 8	Purchase and install critical facility backup generators.	Severe Storms, Tornadoes, Winter Storm	Marshall City Manager	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budgets	Five years	New
Marshall 9	Conduct a tree trimming program along all roadways.	Severe Thunderstorm, Winter Storm	Marshall Director of Public Works	High	1, 2	$50,000	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding
Marshall 10	Install surge protectors in all jurisdictional facilities.	Severe Thunderstorms	Marshall Director of Public Service	Medium	1, 2	$10,000 per location	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding

Table 88: Marshall Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Marshall 11	Install hail resistant roofing on all jurisdictional facilities.	Severe Thunderstorms	Marshall Director of Public Service	Low	1, 2	$50,000 per location	HMGP, BRIC, Local Budgets	Five years	New
Marshall 12	Construct community safe rooms to required building standards	Severe Storms, Tornado	Marshall Director of Public Service	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, Local budgets	Ten years	Carried over due to lack of funding
Marshall 13	Insulate water lines in all jurisdictional facilities.	Winter Storm	Marshall Director of Public Service	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding

Table 89: Springfield Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Springfield 1	Install low flow utilities in all jurisdictional buildings.	Drought	Springfield City Manager	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding
Springfield 2	Conduct a xeriscaping program for all jurisdictional owned facilities	Drought	Springfield City Manager	Low	1, 2	$5,000 - $20,000 per location	HMGP, BRIC, Local Budgets	Ten years	Carried over due to lack of funding
Springfield 3	Prepare local facilities to serve as local cooling centers.	Extreme Temperatures	Springfield City Manager	Low	1, 2	$3,000 per facility	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding
Springfield 4	Conduct an insulation and energy upgrade efficiency program for all jurisdictional buildings.	Extreme Temperatures, Winter Storm	Springfield City Manager	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding
Springfield 5	Continued participation and compliance with **NFIP**	Flood	Springfield City Manager	High	1, 2, 3	Staff time	Local budget	On-going	On-going
Springfield 6	Conduct an education program on the dangers of entering flooded areas.	Flood	Springfield City Manager	Low	3	Staff time	Local Budgets	As required	New
Springfield 7	Clean and repair drainage ditches and culverts to maintain capacity.	Flood	Springfield City Manager	Low	1, 2	$100,000	HMGP, BRIC, Local Budgets	Five years	New
Springfield 8	Purchase and install critical facility backup generators.	Severe Storms, Tornadoes, Winter Storm	Springfield City Manager	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budgets	Five years	New
Springfield 9	Conduct a tree trimming program along all roadways.	Severe Thunderstorm, Winter Storm	Springfield City Manager	High	1, 2	$50,000	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding
Springfield 10	Install surge protectors in all jurisdictional facilities.	Severe Thunderstorms	Springfield City Manager	Medium	1, 2	$10,000 per location	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding

Table 89: Springfield Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Springfield 11	Install hail resistant roofing on all jurisdictional facilities.	Severe Thunderstorms	Springfield City Manager	Low	1, 2	$50,000 per location	HMGP, BRIC, Local Budgets	Five years	New
Springfield 12	Construct community safe rooms to required building standards	Severe Storms, Tornado	Springfield City Manager	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, Local budgets	Ten years	Carried over due to lack of funding
Springfield 13	Insulate water lines in all jurisdictional facilities.	Winter Storm	Springfield City Manager	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, Local Budgets	Five years	Carried over due to lack of funding

Table 90: Tekonsha Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Tekonsha 1	Install low flow utilities in all jurisdictional buildings.	Drought	Village President	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budget	Five years	New
Tekonsha 2	Conduct a xeriscaping program for all jurisdictional owned facilities	Drought	Village President	Low	1, 2	$10,000 -per location	HMGP, BRIC, Local Budget	Ten years	New
Tekonsha 3	Select and prepare local facilities to serve as heating and cooling centers.	Extreme Temperatures	Village President	Low	1, 2	$3,000 per facility	HMGP, BRIC, Local Budget	Five years	New
Tekonsha 4	Replace water in all unit heaters with glycol to prevent freezing	Extreme Temperatures, Winter Storm	Village President	High	1, 2	$50,000 -- $75,000 - $125,000	HMGP, BRIC, Local Budget	Five years	New
Tekonsha 5	Conduct an insulation and energy upgrade efficiency program for all jurisdictional buildings.	Extreme Temperatures, Winter Storm	Village President	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, Local Budget	Five years	New
Tekonsha 6	Continued participation and compliance with **NFIP**	Flood	Village President	High	1, 2, 3	Staff time	Local budget	On-going	On-going
Tekonsha 7	Install and upgrade drainage throughout city.	Flood	Village President	High	1, 2	$750,000	HMGP, BRIC, Local Budget	Five years	New
Tekonsha 8	Construct rainwater gardens adjacent to paved areas.	Flood	Village President	Low	1, 2	Location and size dependent	HMGP, BRIC, Local Budget	As required	New
Tekonsha 9	Purchase and install mobile and fixed backup generators.	Severe Storms, Tornado, Winter Storm	Village President	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budget	Five years	New
Tekonsha 10	Conduct a tree trimming program along utility lines.	Severe Thunderstorm, Winter Storm	Village President	High	1, 2	$50,000	HMGP, BRIC, Local Budget	Five years	New
Tekonsha 11	Install surge protectors in all critical facilities.	Severe Thunderstorms	Village President	Medium	1, 2	$10,000 per location	HMGP, BRIC, Local Budget	Five years	New

Table 90: Tekonsha Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Tekonsha 12	Construct community safe rooms to required building standards	Severe Storms, Tornado	Village President	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, Local Budget	Ten years	New
Tekonsha 13	Conduct winter driving education programs for citizens	Winter Storm	Village President	Low	1, 2	$2,500	Local Budget	As required	New
Tekonsha 14	Insulate water lines in all critical facilities.	Winter Storm	Village President	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, Local Budget	Five years	New

Table 91: Athens Township Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Athens Township 1	Install low flow utilities in all jurisdictional buildings.	Drought	Township Board Supervisor	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budgets	Five years	New
Athens Township 2	Conduct a xeriscaping program for all jurisdictional owned facilities	Drought	Township Board Supervisor	Low	1, 2	$5,000 - $20,000 per location	HMGP, BRIC, Local Budgets	Ten years	New
Athens Township 3	Prepare local facilities to serve as local cooling centers.	Extreme Temperatures	Township Board Supervisor	Low	1, 2	$3,000 per facility	HMGP, BRIC, Local Budgets	Five years	New
Athens Township 4	Conduct an insulation and energy upgrade efficiency program for all jurisdictional buildings.	Extreme Temperatures, Winter Storm	Township Board Supervisor	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, Local Budgets	Five years	New
Athens Township 5	Continued participation and compliance with **NFIP**	Flood	Township Board Supervisor	High	1, 2, 3	Staff time	Local budget	On-going	New
Athens Township 6	Conduct an education program on the dangers of entering flooded areas.	Flood	Township Board Supervisor	Low	3	Staff time	Local Budgets	As required	New
Athens Township 7	Clean and repair drainage ditches and culverts to maintain capacity.	Flood	Township Board Supervisor	Low	1, 2	$100,000	HMGP, BRIC, Local Budgets	Five years	New
Athens Township 8	Purchase and install critical facility backup generators.	Severe Storms, Tornadoes, Winter Storm	Township Board Supervisor	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budgets	Five years	New
Athens Township 9	Conduct a tree trimming program along all roadways.	Severe Thunderstorm, Winter Storm	Township Board Supervisor	High	1, 2	$50,000	HMGP, BRIC, Local Budgets	Five years	New
Athens Township 10	Install surge protectors in all jurisdictional facilities.	Severe Thunderstorms	Township Board Supervisor	Medium	1, 2	$10,000 per location	HMGP, BRIC, Local Budgets	Five years	New

Table 91: Athens Township Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Athens Township 11	Install hail resistant roofing on all jurisdictional facilities.	Severe Thunderstorms	Township Board Supervisor	Low	1, 2	$50,000 per location	HMGP, BRIC, Local Budgets	Five years	New
Athens Township 12	Construct community safe rooms to required building standards	Severe Storms, Tornado	Township Board Supervisor	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, Local budgets	Ten years	New
Athens Township 13	Insulate water lines in all jurisdictional facilities.	Winter Storm	Township Board Supervisor	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, Local Budgets	Five years	New

Table 92: Emmett Charter Township Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Emmett Charter Township 1	Install low flow utilities in all jurisdictional buildings.	Drought	Emmett Charter Township Supervisor	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budgets	Five years	New
Emmett Charter Township 2	Conduct a xeriscaping program for all jurisdictional owned facilities	Drought	Emmett Charter Township Supervisor	Low	1, 2	$5,000 - $20,000 per location	HMGP, BRIC, Local Budgets	Ten years	New
Emmett Charter Township 3	Prepare local facilities to serve as local cooling centers.	Extreme Temperatures	Emmett Charter Township Supervisor	Low	1, 2	$3,000 per facility	HMGP, BRIC, Local Budgets	Five years	New
Emmett Charter Township 4	Conduct an insulation and energy upgrade efficiency program for all jurisdictional buildings.	Extreme Temperatures, Winter Storm	Emmett Charter Township Supervisor	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, Local Budgets	Five years	New
Emmett Charter Township 5	Continued participation and compliance with **NFIP**	Flood	Emmett Charter Township Supervisor	High	1, 2, 3	Staff time	Local budget	On-going	New
Emmett Charter Township 6	Conduct an education program on the dangers of entering flooded areas.	Flood	Emmett Charter Township Supervisor	Low	3	Staff time	Local Budgets	As required	New
Emmett Charter Township 7	Clean and repair drainage ditches and culverts to maintain capacity.	Flood	Emmett Charter Township Supervisor	Low	1, 2	$100,000	HMGP, BRIC, Local Budgets	Five years	New
Emmett Charter Township 8	Purchase and install critical facility backup generators.	Severe Storms, Tornadoes, Winter Storm	Emmett Charter Township Supervisor	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budgets	Five years	New
Emmett Charter Township 9	Conduct a tree trimming program along all roadways.	Severe Thunderstorm, Winter Storm	Emmett Charter Township Supervisor	High	1, 2	$50,000	HMGP, BRIC, Local Budgets	Five years	New
Emmett Charter Township 10	Install surge protectors in all jurisdictional facilities.	Severe Thunderstorms	Emmett Charter Township Supervisor	Medium	1, 2	$10,000 per location	HMGP, BRIC, Local Budgets	Five years	New

Table 92: Emmett Charter Township Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Emmett Charter Township 11	Install hail resistant roofing on all jurisdictional facilities.	Severe Thunderstorms	Emmett Charter Township Supervisor	Low	1, 2	$50,000 per location	HMGP, BRIC, Local Budgets	Five years	New
Emmett Charter Township 12	Construct community safe rooms to required building standards	Severe Storms, Tornado	Emmett Charter Township Supervisor	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, Local budgets	Ten years	New
Emmett Charter Township 13	Insulate water lines in all jurisdictional facilities.	Winter Storm	Emmett Charter Township Supervisor	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, Local Budgets	Five years	New

Table 93: Leroy Township Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Leroy Township 1	Install low flow utilities in all jurisdictional buildings.	Drought	Leroy Township Supervisor	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budgets	Five years	New
Leroy Township 2	Conduct a xeriscaping program for all jurisdictional owned facilities	Drought	Leroy Township Supervisor	Low	1, 2	$5,000 - $20,000 per location	HMGP, BRIC, Local Budgets	Ten years	New
Leroy Township 3	Prepare local facilities to serve as local cooling centers.	Extreme Temperatures	Leroy Township Supervisor	Low	1, 2	$3,000 per facility	HMGP, BRIC, Local Budgets	Five years	New
Leroy Township 4	Conduct an insulation and energy upgrade efficiency program for all jurisdictional buildings.	Extreme Temperatures, Winter Storm	Leroy Township Supervisor	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, Local Budgets	Five years	New
Leroy Township 5	Continued participation and compliance with **NFIP**	Flood	Leroy Township Supervisor	High	1, 2, 3	Staff time	Local budget	On-going	New
Leroy Township 6	Conduct an education program on the dangers of entering flooded areas.	Flood	Leroy Township Supervisor	Low	3	Staff time	Local Budgets	As required	New
Leroy Township 7	Clean and repair drainage ditches and culverts to maintain capacity.	Flood	Leroy Township Supervisor	Low	1, 2	$100,000	HMGP, BRIC, Local Budgets	Five years	New
Leroy Township 8	Purchase and install critical facility backup generators.	Severe Storms, Tornadoes, Winter Storm	Leroy Township Supervisor	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budgets	Five years	New
Leroy Township 9	Conduct a tree trimming program along all roadways.	Severe Thunderstorm, Winter Storm	Leroy Township Supervisor	High	1, 2	$50,000	HMGP, BRIC, Local Budgets	Five years	New
Leroy Township 10	Install surge protectors in all jurisdictional facilities.	Severe Thunderstorms	Leroy Township Administration	Medium	1, 2	$10,000 per location	HMGP, BRIC, Local Budgets	Five years	New

Table 93: Leroy Township Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Leroy Township 11	Install hail resistant roofing on all jurisdictional facilities.	Severe Thunderstorms	Leroy Township Administration	Low	1, 2	$50,000 per location	HMGP, BRIC, Local Budgets	Five years	New
Leroy Township 12	Construct community safe rooms to required building standards	Severe Storms, Tornado	Leroy Township Administration	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, Local budgets	Ten years	New
Leroy Township 13	Insulate water lines in all jurisdictional facilities.	Winter Storm	Leroy Township Administration	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, Local Budgets	Five years	New

Table 94: Sheridan Township Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Sheridan Township 1	Install low flow utilities in all jurisdictional buildings.	Drought	Sheridan Township Supervisor	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budgets	Five years	New
Sheridan Township 2	Conduct a xeriscaping program for all jurisdictional owned facilities	Drought	Sheridan Township Supervisor	Low	1, 2	$5,000 - $20,000 per location	HMGP, BRIC, Local Budgets	Ten years	New
Sheridan Township 3	Prepare local facilities to serve as local cooling centers.	Extreme Temperatures	Sheridan Township Supervisor	Low	1, 2	$3,000 per facility	HMGP, BRIC, Local Budgets	Five years	New
Sheridan Township 4	Conduct an insulation and energy upgrade efficiency program for all jurisdictional buildings.	Extreme Temperatures, Winter Storm	Sheridan Township Supervisor	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, Local Budgets	Five years	New
Sheridan Township 5	Continued participation and compliance with **NFIP**	Flood	Sheridan Township Supervisor	High	1, 2, 3	Staff time	Local budget	On-going	New
Sheridan Township 6	Conduct an education program on the dangers of entering flooded areas.	Flood	Sheridan Township Supervisor	Low	3	Staff time	Local Budgets	As required	New
Sheridan Township 7	Clean and repair drainage ditches and culverts to maintain capacity.	Flood	Sheridan Township Supervisor	Low	1, 2	$100,000	HMGP, BRIC, Local Budgets	Five years	New
Sheridan Township 8	Purchase and install critical facility backup generators.	Severe Storms, Tornadoes, Winter Storm	Sheridan Township Supervisor	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budgets	Five years	New
Sheridan Township 9	Conduct a tree trimming program along all roadways.	Severe Thunderstorm, Winter Storm	Sheridan Township Supervisor	High	1, 2	$50,000	HMGP, BRIC, Local Budgets	Five years	New
Sheridan Township 10	Install surge protectors in all jurisdictional facilities.	Severe Thunderstorms	Sheridan Township Supervisor	Medium	1, 2	$10,000 per location	HMGP, BRIC, Local Budgets	Five years	New

Table 94: Sheridan Township Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Sheridan Township 11	Install hail resistant roofing on all jurisdictional facilities.	Severe Thunderstorms	Sheridan Township Supervisor	Low	1, 2	$50,000 per location	HMGP, BRIC, Local Budgets	Five years	New
Sheridan Township 12	Construct community safe rooms to required building standards	Severe Storms, Tornado	Sheridan Township Supervisor	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, Local budgets	Ten years	New
Sheridan Township 13	Insulate water lines in all jurisdictional facilities.	Winter Storm	Sheridan Township Supervisor	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, Local Budgets	Five years	New

Table 95: Tekonsha Township Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Tekonsha Township 1	Install low flow utilities in all jurisdictional buildings.	Drought	Tekonsha Township Supervisor	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budgets	Five years	New
Tekonsha Township 2	Conduct a xeriscaping program for all jurisdictional owned facilities	Drought	Tekonsha Township Supervisor	Low	1, 2	$5,000 - $20,000 per location	HMGP, BRIC, Local Budgets	Ten years	New
Tekonsha Township 3	Prepare local facilities to serve as local cooling centers.	Extreme Temperatures	Tekonsha Township Supervisor	Low	1, 2	$3,000 per facility	HMGP, BRIC, Local Budgets	Five years	New
Tekonsha Township 4	Conduct an insulation and energy upgrade efficiency program for all jurisdictional buildings.	Extreme Temperatures, Winter Storm	Tekonsha Township Supervisor	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, Local Budgets	Five years	New
Tekonsha Township 5	Continued participation and compliance with **NFIP**	Flood	Tekonsha Township Supervisor	High	1, 2, 3	Staff time	Local budget	On-going	New
Tekonsha Township 6	Conduct an education program on the dangers of entering flooded areas.	Flood	Tekonsha Township Supervisor	Low	3	Staff time	Local Budgets	As required	New
Tekonsha Township 7	Clean and repair drainage ditches and culverts to maintain capacity.	Flood	Tekonsha Township Supervisor	Low	1, 2	$100,000	HMGP, BRIC, Local Budgets	Five years	New
Tekonsha Township 8	Purchase and install critical facility backup generators.	Severe Storms, Tornadoes, Winter Storm	Tekonsha Township Supervisor	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Local Budgets	Five years	New
Tekonsha Township 9	Conduct a tree trimming program along all roadways.	Severe Thunderstorm, Winter Storm	Tekonsha Township Supervisor	High	1, 2	$50,000	HMGP, BRIC, Local Budgets	Five years	New
Tekonsha Township 10	Install surge protectors in all jurisdictional facilities.	Severe Thunderstorms	Tekonsha Township Supervisor	Medium	1, 2	$10,000 per location	HMGP, BRIC, Local Budgets	Five years	New

Table 95: Tekonsha Township Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Tekonsha Township 11	Install hail resistant roofing on all jurisdictional facilities.	Severe Thunderstorms	Tekonsha Township Supervisor	Low	1, 2	$50,000 per location	HMGP, BRIC, Local Budgets	Five years	New
Tekonsha Township 12	Construct community safe rooms to required building standards	Severe Storms, Tornado	Tekonsha Township Supervisor	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, Local budgets	Ten years	New
Tekonsha Township 13	Insulate water lines in all jurisdictional facilities.	Winter Storm	Tekonsha Township Supervisor	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, Local Budgets	Five years	New

Table 96: Athens Area Schools Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Athens Area Schools 1	Install low flow utilities in all school buildings.	Drought	Athens Area Schools Superintendent	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, School Budget	Five years	New
Athens Area Schools 2	Conduct a xeriscaping program for all school facilities	Drought	Athens Area Schools Superintendent	Low	1, 2	$10,000 -per location	HMGP, BRIC, School Budget	Ten years	New
Athens Area Schools 3	Select and prepare school facilities to serve as heating and cooling centers.	Extreme Temperatures	Athens Area Schools Superintendent	Low	1, 2	$3,000 per facility	HMGP, BRIC, School Budget	Five years	New
Athens Area Schools 4	Replace water in all unit heaters with glycol to prevent freezing	Extreme Temperatures, Winter Storm	Athens Area Schools Superintendent	High	1, 2	$50,000 -- $75,000 - $125,000	HMGP, BRIC, School Budget	Five years	New
Athens Area Schools 5	Conduct an insulation and energy upgrade efficiency program for all school buildings.	Extreme Temperatures, Winter Storm	Athens Area Schools Superintendent	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, School Budget	Five years	New
Athens Area Schools 6	Install and upgrade drainage throughout district.	Flood	Athens Area Schools Superintendent	High	1, 2	$750,000	HMGP, BRIC, School Budget	Five years	New
Athens Area Schools 7	Construct rainwater gardens adjacent to paved areas.	Flood	Athens Area Schools Superintendent	Low	1, 2	Location and size dependent	HMGP, BRIC, School Budget	As required	New
Athens Area Schools 8	Purchase and install mobile and fixed backup generators.	Severe Storms, Tornado, Winter Storm	Athens Area Schools Superintendent	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, School Budget	Five years	New
Athens Area Schools 9	Conduct a tree trimming program around school power lines.	Severe Thunderstorm, Winter Storm	Athens Area Schools Superintendent	High	1, 2	$10,000	HMGP, BRIC, School Budget	Five years	New

Table 96: Athens Area Schools Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Athens Area Schools 10	Install surge protectors in all school facilities.	Severe Thunderstorms	Athens Area Schools Superintendent	Medium	1, 2	$10,000 per location	HMGP, BRIC, School Budget	Five years	New
Athens Area Schools 11	Construct school safe rooms to required building standards	Severe Storms, Tornado	Athens Area Schools Superintendent	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, School Budget	Ten years	New
Athens Area Schools 12	Conduct winter driving education programs for students.	Winter Storm	Athens Area Schools Superintendent	Low	1, 2	$2,500	School Budget	As required	New
Athens Area Schools 13	Insulate water lines in all school facilities.	Winter Storm	Athens Area Schools Superintendent	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, School Budget	Five years	New

Table 97: Battle Creek Public Schools Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Battle Creek Public Schools 1	Install low flow utilities in all school buildings.	Drought	Battle Creek Public Schools Superintendent	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, School Budget	Five years	New
Battle Creek Public Schools 2	Conduct a xeriscaping program for all school facilities	Drought	Battle Creek Public Schools Superintendent	Low	1, 2	$10,000 -per location	HMGP, BRIC, School Budget	Ten years	New
Battle Creek Public Schools 3	Select and prepare school facilities to serve as heating and cooling centers.	Extreme Temperatures	Battle Creek Public Schools Superintendent	Low	1, 2	$3,000 per facility	HMGP, BRIC, School Budget	Five years	New
Battle Creek Public Schools 4	Replace water in all unit heaters with glycol to prevent freezing	Extreme Temperatures, Winter Storm	Battle Creek Public Schools Superintendent	High	1, 2	$50,000 -- $75,000 - $125,000	HMGP, BRIC, School Budget	Five years	New
Battle Creek Public Schools 5	Conduct an insulation and energy upgrade efficiency program for all school buildings.	Extreme Temperatures, Winter Storm	Battle Creek Public Schools Superintendent	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, School Budget	Five years	New
Battle Creek Public Schools 6	Install and upgrade drainage throughout district.	Flood	Battle Creek Public Schools Superintendent	High	1, 2	$750,000	HMGP, BRIC, School Budget	Five years	New
Battle Creek Public Schools 7	Construct rainwater gardens adjacent to paved areas.	Flood	Battle Creek Public Schools Superintendent	Low	1, 2	Location and size dependent	HMGP, BRIC, School Budget	As required	New
Battle Creek Public Schools 8	Purchase and install mobile and fixed backup generators.	Severe Storms, Tornado, Winter Storm	Battle Creek Public Schools Superintendent	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, School Budget	Five years	New
Battle Creek Public Schools 9	Conduct a tree trimming program around school power lines.	Severe Thunderstorm, Winter Storm	Battle Creek Public Schools Superintendent	High	1, 2	$10,000	HMGP, BRIC, School Budget	Five years	New

Table 97: Battle Creek Public Schools Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Battle Creek Public Schools 10	Install surge protectors in all school facilities.	Severe Thunderstorms	Battle Creek Public Schools Superintendent	Medium	1, 2	$10,000 per location	HMGP, BRIC, School Budget	Five years	New
Battle Creek Public Schools 11	Construct school safe rooms to required building standards	Severe Storms, Tornado	Battle Creek Public Schools Superintendent	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, School Budget	Ten years	New
Battle Creek Public Schools 12	Conduct winter driving education programs for students.	Winter Storm	Battle Creek Public Schools Superintendent	Low	1, 2	$2,500	School Budget	As required	New
Battle Creek Public Schools 13	Insulate water lines in all school facilities.	Winter Storm	Battle Creek Public Schools Superintendent	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, School Budget	Five years	New

Table 98: Calhoun Intermediate School District Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Calhoun Intermediate School District 1	Install low flow utilities in all school buildings.	Drought	Calhoun Intermediate School District Superintendent	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, School Budget	Five years	New
Calhoun Intermediate School District 2	Conduct a xeriscaping program for all school facilities	Drought	Calhoun Intermediate School District Superintendent	Low	1, 2	$10,000 -per location	HMGP, BRIC, School Budget	Ten years	New
Calhoun Intermediate School District 3	Select and prepare school facilities to serve as heating and cooling centers.	Extreme Temperatures	Calhoun Intermediate School District Superintendent	Low	1, 2	$3,000 per facility	HMGP, BRIC, School Budget	Five years	New
Calhoun Intermediate School District 4	Replace water in all unit heaters with glycol to prevent freezing	Extreme Temperatures, Winter Storm	Calhoun Intermediate School District Superintendent	High	1, 2	$50,000 -- $75,000 - $125,000	HMGP, BRIC, School Budget	Five years	New
Calhoun Intermediate School District 5	Conduct an insulation and energy upgrade efficiency program for all school buildings.	Extreme Temperatures, Winter Storm	Calhoun Intermediate School District Superintendent	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, School Budget	Five years	New
Calhoun Intermediate School District 6	Install and upgrade drainage throughout district.	Flood	Calhoun Intermediate School District Superintendent	High	1, 2	$750,000	HMGP, BRIC, School Budget	Five years	New
Calhoun Intermediate School District 7	Construct rainwater gardens adjacent to paved areas.	Flood	Calhoun Intermediate School District Superintendent	Low	1, 2	Location and size dependent	HMGP, BRIC, School Budget	As required	New
Calhoun Intermediate School District 8	Purchase and install mobile and fixed backup generators.	Severe Storms, Tornado, Winter Storm	Calhoun Intermediate School District Superintendent	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, School Budget	Five years	New
Calhoun Intermediate School District 9	Conduct a tree trimming program around school power lines.	Severe Thunderstorm, Winter Storm	Calhoun Intermediate School District Superintendent	High	1, 2	$10,000	HMGP, BRIC, School Budget	Five years	New

Table 98: Calhoun Intermediate School District Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Calhoun Intermediate School District 10	Install surge protectors in all school facilities.	Severe Thunderstorms	Calhoun Intermediate School District Superintendent	Medium	1, 2	$10,000 per location	HMGP, BRIC, School Budget	Five years	New
Calhoun Intermediate School District 11	Construct school safe rooms to required building standards	Severe Storms, Tornado	Calhoun Intermediate School District Superintendent	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, School Budget	Ten years	New
Calhoun Intermediate School District 12	Conduct winter driving education programs for students.	Winter Storm	Calhoun Intermediate School District Superintendent	Low	1, 2	$2,500	School Budget	As required	New
Calhoun Intermediate School District 13	Insulate water lines in all school facilities.	Winter Storm	Calhoun Intermediate School District Superintendent	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, School Budget	Five years	New

Table 99: Harper Creek Community Schools Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Harper Creek Community Schools 1	Install low flow utilities in all school buildings.	Drought	Harper Creek Community Schools Superintendent	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, School Budget	Five years	New
Harper Creek Community Schools 2	Conduct a xeriscaping program for all school facilities	Drought	Harper Creek Community Schools Superintendent	Low	1, 2	$10,000 -per location	HMGP, BRIC, School Budget	Ten years	New
Harper Creek Community Schools 3	Select and prepare school facilities to serve as heating and cooling centers.	Extreme Temperatures	Harper Creek Community Schools Superintendent	Low	1, 2	$3,000 per facility	HMGP, BRIC, School Budget	Five years	New
Harper Creek Community Schools 4	Replace water in all unit heaters with glycol to prevent freezing	Extreme Temperatures, Winter Storm	Harper Creek Community Schools Superintendent	High	1, 2	$50,000 -- $75,000 - $125,000	HMGP, BRIC, School Budget	Five years	New
Harper Creek Community Schools 5	Conduct an insulation and energy upgrade efficiency program for all school buildings.	Extreme Temperatures, Winter Storm	Harper Creek Community Schools Superintendent	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, School Budget	Five years	New
Harper Creek Community Schools 6	Install and upgrade drainage throughout district.	Flood	Harper Creek Community Schools Superintendent	High	1, 2	$750,000	HMGP, BRIC, School Budget	Five years	New
Harper Creek Community Schools 7	Construct rainwater gardens adjacent to paved areas.	Flood	Harper Creek Community Schools Superintendent	Low	1, 2	Location and size dependent	HMGP, BRIC, School Budget	As required	New
Harper Creek Community Schools 8	Purchase and install mobile and fixed backup generators.	Severe Storms, Tornado, Winter Storm	Harper Creek Community Schools Superintendent	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, School Budget	Five years	New
Harper Creek Community Schools 9	Conduct a tree trimming program around school power lines.	Severe Thunderstorm, Winter Storm	Harper Creek Community Schools Superintendent	High	1, 2	$10,000	HMGP, BRIC, School Budget	Five years	New

Table 99: Harper Creek Community Schools Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Harper Creek Community Schools 10	Install surge protectors in all school facilities.	Severe Thunderstorms	Harper Creek Community Schools Superintendent	Medium	1, 2	$10,000 per location	HMGP, BRIC, School Budget	Five years	New
Harper Creek Community Schools 11	Construct school safe rooms to required building standards	Severe Storms, Tornado	Harper Creek Community Schools Superintendent	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, School Budget	Ten years	New
Harper Creek Community Schools 12	Conduct winter driving education programs for students.	Winter Storm	Harper Creek Community Schools Superintendent	Low	1, 2	$2,500	School Budget	As required	New
Harper Creek Community Schools 13	Insulate water lines in all school facilities.	Winter Storm	Harper Creek Community Schools Superintendent	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, School Budget	Five years	New

Table 100: Homer Community Schools Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Homer Community Schools 1	Install low flow utilities in all school buildings.	Drought	Homer Community Schools Superintendent	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, School Budget	Five years	New
Homer Community Schools 2	Conduct a xeriscaping program for all school facilities	Drought	Homer Community Schools Superintendent	Low	1, 2	$10,000 -per location	HMGP, BRIC, School Budget	Ten years	New
Homer Community Schools 3	Select and prepare school facilities to serve as heating and cooling centers.	Extreme Temperatures	Homer Community Schools Superintendent	Low	1, 2	$3,000 per facility	HMGP, BRIC, School Budget	Five years	New
Homer Community Schools 4	Replace water in all unit heaters with glycol to prevent freezing	Extreme Temperatures, Winter Storm	Homer Community Schools Superintendent	High	1, 2	$50,000 -- $75,000 - $125,000	HMGP, BRIC, School Budget	Five years	New
Homer Community Schools 5	Conduct an insulation and energy upgrade efficiency program for all school buildings.	Extreme Temperatures, Winter Storm	Homer Community Schools Superintendent	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, School Budget	Five years	New
Homer Community Schools 6	Install and upgrade drainage throughout district.	Flood	Homer Community Schools Superintendent	High	1, 2	$750,000	HMGP, BRIC, School Budget	Five years	New
Homer Community Schools 7	Construct rainwater gardens adjacent to paved areas.	Flood	Homer Community Schools Superintendent	Low	1, 2	Location and size dependent	HMGP, BRIC, School Budget	As required	New
Homer Community Schools 8	Purchase and install mobile and fixed backup generators.	Severe Storms, Tornado, Winter Storm	Homer Community Schools Superintendent	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, School Budget	Five years	New
Homer Community Schools 9	Conduct a tree trimming program around school power lines.	Severe Thunderstorm, Winter Storm	Homer Community Schools Superintendent	High	1, 2	$10,000	HMGP, BRIC, School Budget	Five years	New

Table 100: Homer Community Schools Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Homer Community Schools 10	Install surge protectors in all school facilities.	Severe Thunderstorms	Homer Community Schools Superintendent	Medium	1, 2	$10,000 per location	HMGP, BRIC, School Budget	Five years	New
Homer Community Schools 11	Construct school safe rooms to required building standards	Severe Storms, Tornado	Homer Community Schools Superintendent	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, School Budget	Ten years	New
Homer Community Schools 12	Conduct winter driving education programs for students.	Winter Storm	Homer Community Schools Superintendent	Low	1, 2	$2,500	School Budget	As required	New
Homer Community Schools 13	Insulate water lines in all school facilities.	Winter Storm	Homer Community Schools Superintendent	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, School Budget	Five years	New

Table 101: Lakeview School District Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Lakeview School District 1	Install low flow utilities in all school buildings.	Drought	Lakeview School District Superintendent	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, School Budget	Five years	New
Lakeview School District 2	Conduct a xeriscaping program for all school facilities	Drought	Lakeview School District Superintendent	Low	1, 2	$10,000 -per location	HMGP, BRIC, School Budget	Ten years	New
Lakeview School District 3	Select and prepare school facilities to serve as heating and cooling centers.	Extreme Temperatures	Lakeview School District Superintendent	Low	1, 2	$3,000 per facility	HMGP, BRIC, School Budget	Five years	New
Lakeview School District 4	Replace water in all unit heaters with glycol to prevent freezing	Extreme Temperatures, Winter Storm	Lakeview School District Superintendent	High	1, 2	$50,000 -- $75,000 - $125,000	HMGP, BRIC, School Budget	Five years	New
Lakeview School District 5	Conduct an insulation and energy upgrade efficiency program for all school buildings.	Extreme Temperatures, Winter Storm	Lakeview School District Superintendent	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, School Budget	Five years	New
Lakeview School District 6	Install and upgrade drainage throughout district.	Flood	Lakeview School District Superintendent	High	1, 2	$750,000	HMGP, BRIC, School Budget	Five years	New
Lakeview School District 7	Construct rainwater gardens adjacent to paved areas.	Flood	Lakeview School District Superintendent	Low	1, 2	Location and size dependent	HMGP, BRIC, School Budget	As required	New
Lakeview School District 8	Purchase and install mobile and fixed backup generators.	Severe Storms, Tornado, Winter Storm	Lakeview School District Superintendent	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, School Budget	Five years	New
Lakeview School District 9	Conduct a tree trimming program around school power lines.	Severe Thunderstorm, Winter Storm	Lakeview School District Superintendent	High	1, 2	$10,000	HMGP, BRIC, School Budget	Five years	New

Table 101: Lakeview School District Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Lakeview School District 10	Install surge protectors in all school facilities.	Severe Thunderstorms	Lakeview School District Superintendent	Medium	1, 2	$10,000 per location	HMGP, BRIC, School Budget	Five years	New
Lakeview School District 11	Construct school safe rooms to required building standards	Severe Storms, Tornado	Lakeview School District Superintendent	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, School Budget	Ten years	New
Lakeview School District 12	Conduct winter driving education programs for students.	Winter Storm	Lakeview School District Superintendent	Low	1, 2	$2,500	School Budget	As required	New
Lakeview School District 13	Insulate water lines in all school facilities.	Winter Storm	Lakeview School District Superintendent	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, School Budget	Five years	New

Table 102: Mar Lee School District Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Mar Lee School District 1	Install low flow utilities in all school buildings.	Drought	Mar Lee School District Superintendent	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, School Budget	Five years	New
Mar Lee School District 2	Conduct a xeriscaping program for all school facilities	Drought	Mar Lee School District Superintendent	Low	1, 2	$10,000 -per location	HMGP, BRIC, School Budget	Ten years	New
Mar Lee School District 3	Select and prepare school facilities to serve as heating and cooling centers.	Extreme Temperatures	Mar Lee School District Superintendent	Low	1, 2	$3,000 per facility	HMGP, BRIC, School Budget	Five years	New
Mar Lee School District 4	Replace water in all unit heaters with glycol to prevent freezing	Extreme Temperatures, Winter Storm	Mar Lee School District Superintendent	High	1, 2	$50,000 -- $75,000 - $125,000	HMGP, BRIC, School Budget	Five years	New
Mar Lee School District 5	Conduct an insulation and energy upgrade efficiency program for all school buildings.	Extreme Temperatures, Winter Storm	Mar Lee School District Superintendent	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, School Budget	Five years	New
Mar Lee School District 6	Install and upgrade drainage throughout district.	Flood	Mar Lee School District Superintendent	High	1, 2	$750,000	HMGP, BRIC, School Budget	Five years	New
Mar Lee School District 7	Construct rainwater gardens adjacent to paved areas.	Flood	Mar Lee School District Superintendent	Low	1, 2	Location and size dependent	HMGP, BRIC, School Budget	As required	New
Mar Lee School District 8	Purchase and install mobile and fixed backup generators.	Severe Storms, Tornado, Winter Storm	Mar Lee School District Superintendent	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, School Budget	Five years	New
Mar Lee School District 9	Conduct a tree trimming program around school power lines.	Severe Thunderstorm, Winter Storm	Mar Lee School District Superintendent	High	1, 2	$10,000	HMGP, BRIC, School Budget	Five years	New

Table 102: Mar Lee School District Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Mar Lee School District 10	Install surge protectors in all school facilities.	Severe Thunderstorms	Mar Lee School District Superintendent	Medium	1, 2	$10,000 per location	HMGP, BRIC, School Budget	Five years	New
Mar Lee School District 11	Construct school safe rooms to required building standards	Severe Storms, Tornado	Mar Lee School District Superintendent	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, School Budget	Ten years	New
Mar Lee School District 12	Conduct winter driving education programs for students.	Winter Storm	Mar Lee School District Superintendent	Low	1, 2	$2,500	School Budget	As required	New
Mar Lee School District 13	Insulate water lines in all school facilities.	Winter Storm	Mar Lee School District Superintendent	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, School Budget	Five years	New

Table 103: Marshall Public Schools Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Marshall Public Schools 1	Install low flow utilities in all school buildings.	Drought	Marshall Public Schools Superintendent	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, School Budget	Five years	New
Marshall Public Schools 2	Conduct a xeriscaping program for all school facilities	Drought	Marshall Public Schools Superintendent	Low	1, 2	$10,000 -per location	HMGP, BRIC, School Budget	Ten years	New
Marshall Public Schools 3	Select and prepare school facilities to serve as heating and cooling centers.	Extreme Temperatures	Marshall Public Schools Superintendent	Low	1, 2	$3,000 per facility	HMGP, BRIC, School Budget	Five years	New
Marshall Public Schools 4	Replace water in all unit heaters with glycol to prevent freezing	Extreme Temperatures, Winter Storm	Marshall Public Schools Superintendent	High	1, 2	$50,000 -- $75,000 - $125,000	HMGP, BRIC, School Budget	Five years	New
Marshall Public Schools 5	Conduct an insulation and energy upgrade efficiency program for all school buildings.	Extreme Temperatures, Winter Storm	Marshall Public Schools Superintendent	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, School Budget	Five years	New
Marshall Public Schools 6	Install and upgrade drainage throughout district.	Flood	Marshall Public Schools Superintendent	High	1, 2	$750,000	HMGP, BRIC, School Budget	Five years	New
Marshall Public Schools 7	Construct rainwater gardens adjacent to paved areas.	Flood	Marshall Public Schools Superintendent	Low	1, 2	Location and size dependent	HMGP, BRIC, School Budget	As required	New
Marshall Public Schools 8	Purchase and install mobile and fixed backup generators.	Severe Storms, Tornado, Winter Storm	Marshall Public Schools Superintendent	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, School Budget	Five years	New
Marshall Public Schools 9	Conduct a tree trimming program around school power lines.	Severe Thunderstorm, Winter Storm	Marshall Public Schools Superintendent	High	1, 2	$10,000	HMGP, BRIC, School Budget	Five years	New

Table 103: Marshall Public Schools Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Marshall Public Schools 10	Install surge protectors in all school facilities.	Severe Thunderstorms	Marshall Public Schools Superintendent	Medium	1, 2	$10,000 per location	HMGP, BRIC, School Budget	Five years	New
Marshall Public Schools 11	Construct school safe rooms to required building standards	Severe Storms, Tornado	Marshall Public Schools Superintendent	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, School Budget	Ten years	New
Marshall Public Schools 12	Conduct winter driving education programs for students.	Winter Storm	Marshall Public Schools Superintendent	Low	1, 2	$2,500	School Budget	As required	New
Marshall Public Schools 13	Insulate water lines in all school facilities.	Winter Storm	Marshall Public Schools Superintendent	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, School Budget	Five years	New

Table 104: Tekonsha Community Schools Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Tekonsha Community Schools 1	Install low flow utilities in all school buildings.	Drought	Tekonsha Community Schools Superintendent	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, School Budget	Five years	New
Tekonsha Community Schools 2	Conduct a xeriscaping program for all school facilities	Drought	Tekonsha Community Schools Superintendent	Low	1, 2	$10,000 -per location	HMGP, BRIC, School Budget	Ten years	New
Tekonsha Community Schools 3	Select and prepare school facilities to serve as heating and cooling centers.	Extreme Temperatures	Tekonsha Community Schools Superintendent	Low	1, 2	$3,000 per facility	HMGP, BRIC, School Budget	Five years	New
Tekonsha Community Schools 4	Replace water in all unit heaters with glycol to prevent freezing	Extreme Temperatures, Winter Storm	Tekonsha Community Schools Superintendent	High	1, 2	$50,000 -- $75,000 - $125,000	HMGP, BRIC, School Budget	Five years	New
Tekonsha Community Schools 5	Conduct an insulation and energy upgrade efficiency program for all school buildings.	Extreme Temperatures, Winter Storm	Tekonsha Community Schools Superintendent	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, School Budget	Five years	New
Tekonsha Community Schools 6	Install and upgrade drainage throughout district.	Flood	Tekonsha Community Schools Superintendent	High	1, 2	$750,000	HMGP, BRIC, School Budget	Five years	New
Tekonsha Community Schools 7	Construct rainwater gardens adjacent to paved areas.	Flood	Tekonsha Community Schools Superintendent	Low	1, 2	Location and size dependent	HMGP, BRIC, School Budget	As required	New
Tekonsha Community Schools 8	Purchase and install mobile and fixed backup generators.	Severe Storms, Tornado, Winter Storm	Tekonsha Community Schools Superintendent	Medium	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, School Budget	Five years	New
Tekonsha Community Schools 9	Conduct a tree trimming program around school power lines.	Severe Thunderstorm, Winter Storm	Tekonsha Community Schools Superintendent	High	1, 2	$10,000	HMGP, BRIC, School Budget	Five years	New

Table 104: Tekonsha Community Schools Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Tekonsha Community Schools 10	Install surge protectors in all school facilities.	Severe Thunderstorms	Tekonsha Community Schools Superintendent	Medium	1, 2	$10,000 per location	HMGP, BRIC, School Budget	Five years	New
Tekonsha Community Schools 11	Construct school safe rooms to required building standards	Severe Storms, Tornado	Tekonsha Community Schools Superintendent	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, School Budget	Ten years	New
Tekonsha Community Schools 12	Conduct winter driving education programs for students.	Winter Storm	Tekonsha Community Schools Superintendent	Low	1, 2	$2,500	School Budget	As required	New
Tekonsha Community Schools 13	Insulate water lines in all school facilities.	Winter Storm	Tekonsha Community Schools Superintendent	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, School Budget	Five years	New

Table 105: Nottawaseppi Huron Band of the Potawatomi Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Nottawaseppi Huron Band of the Potawatomi 1	Revise building practices to require low water flow toilets and faucets.	Drought	NHBP Emergency Manager	High	1, 2	Staff Time	Tribal Budget, BIA Funding	Five years	New
Nottawaseppi Huron Band of the Potawatomi 2	Conduct a Xeriscaping program for all tribal owned facilities	Drought	NHBP Emergency Manager	Low	1, 2	$5,000 - $50,000 per location	HMGP, BRIC, Tribal Budget, BIA Funding	Five years	New
Nottawaseppi Huron Band of the Potawatomi 3	Modernize air conditioning and ventilation systems in tribal facilities.	Extreme Temperatures	NHBP Emergency Manager	Low	1, 2	$25,000 per facility	HMGP, BRIC, Tribal Budget, BIA Funding	Five years	New
Nottawaseppi Huron Band of the Potawatomi 4	Identify and establish new shelter locations throughout the tribal reservation.	Extreme Temperatures, Flood, Severe Thunderstorm, Tornado, Winter Storm	NHBP Emergency Manager	Medium	1, 2	Staff time	Tribal Budget, BIA Funding	Five years	Carried over due to lack of staff
Nottawaseppi Huron Band of the Potawatomi 5	Conduct education programs not entering flooded areas.	Flood	NHBP Emergency Manager	High	3	Staff time	FMA, HMGP, BRIC, Tribal Budget, BIA Funding	Ten years	Carried over due to lack of funding
Nottawaseppi Huron Band of the Potawatomi 6	Construct rainwater retention/detention ponds at strategic locations.	Flood	NHBP Emergency Manager	Medium	1, 2	Facility size dependent	HMGP, BRIC, Tribal Budget, BIA Funding	Ten years	Carried over due to lack of funding
Nottawaseppi Huron Band of the Potawatomi 7	Install surge protectors in all tribal facilities.	Severe Thunderstorms	NHBP Emergency Manager	Medium	1, 2	$10,000 per location	HMGP, BRIC, Tribal Budget, BIA Funding	Five years	New
Nottawaseppi Huron Band of the Potawatomi 8	Install hail resistant roofing on all tribal facilities.	Severe Thunderstorms	NHBP Emergency Manager	Medium	1, 2	$50,000 per location	HMGP, BRIC, Tribal Budget, BIA Funding	Five years	New

Table 105: Nottawaseppi Huron Band of the Potawatomi Mitigation Actions

Action Identification	Description	Hazard Addressed	Responsible Party	Overall Priority	Goal(s) Addressed	Estimated Cost	Potential Funding Source	Proposed Completion Timeframe	Status
Nottawaseppi Huron Band of the Potawatomi 9	Purchase and install critical facility backup generators.	Severe Storms, Tornado, Winter Storm	NHBP Emergency Manager	High	1, 2	$25,000 - $50,000 per facility	HMGP, BRIC, Tribal Budget, BIA Funding	Five years	Carried over due to lack of funding
Nottawaseppi Huron Band of the Potawatomi 10	Conduct a regular tree trimming and tree wire installation program.	Severe Storms, Tornado, Winter Storm	NHBP Emergency Manager	High	1, 2	$25,000 per occurrence	HMGP, BRIC, Tribal Budget, BIA Funding	Five years	New
Nottawaseppi Huron Band of the Potawatomi 11	Construct tribal safe rooms throughout the city to required building standards	Severe Storms, Tornado	NHBP Emergency Manager	Medium	1, 2	$1,000,000 per facility	HMGP, BRIC, Tribal Budget, BIA Funding	Ten years	Carried over due to lack of funding
Nottawaseppi Huron Band of the Potawatomi 12	Conduct an insulation and energy upgrade efficiency program for all tribal buildings.	Winter Storm	NHBP Emergency Manager	Low	1, 2	$75,000 - $125,000	HMGP, BRIC, Tribal Budget, BIA Funding	Five years	New
Nottawaseppi Huron Band of the Potawatomi 13	Construct snow fences along transportation routes.	Winter Storm	NHBP Emergency Manager	Low	1, 2	$25,000 - $100,000 per location	HMGP, PDM, Tribal Budget, BIA Funding	Ten years	Carried over due to lack of funding
Nottawaseppi Huron Band of the Potawatomi 14	Insulate water lines in all tribal facilities.	Winter Storm	NHBP Emergency Manager	Low	1, 2	$10,000 - $50,000 per location	HMGP, BRIC, Tribal Budget, BIA Funding	Five years	Carried over due to lack of funding

6.8 Mitigation Action Implementation and Monitoring

Calhoun County, the NHBP, and all participating jurisdictions are responsible for implementing their mitigation actions. To foster accountability and increase the likelihood that actions will be implemented, every proposed action is assigned to a specific department or position as a champion. In general:

- The identified champion will be responsible for tracking and reporting on action status.
- The identified champion should provide input on whether the action as implemented is successful in reducing vulnerability, if applicable.
- If the action is unsuccessful in reducing vulnerability, the identified champion will be tasked with identifying deficiencies and additional required actions.

Additionally, each action has been assigned a proposed completion timeframe to determine if the action is being implemented according to plan.

In general, CCOEM is responsible for monitoring the progress of mitigation activities and projects throughout the county in conjunction with participating jurisdictions, while the NHBP monitors progress of all Tribal actions. To facilitate the tracking of any awarded hazard mitigation grants, CCOEM, in conjunction with participating jurisdictions, and the NHBP will compile a list of projects funded throughout the calendar year, if any, and add it to an electronic database. Additionally, the MPC will be solicited annually to provide information on any other mitigation projects that were not funded through hazard mitigation grants for addition to the electronic database.

To track mitigation projects from initiation to closeout, participating jurisdictions will use a project tracking spreadsheet that includes, at a minimum, the following information:

- Applicant/Subrecipient
- Grant Identifier
- Contractor
- Total Cost Estimate
- Federal/Local share
- Award Date
- Period of Performance
- Quarterly Reports
- Subrecipient Risk
- Reimbursements

Upon completion of a project, a member of the CCOEM, the NHBP, or the awarded participating jurisdiction will conduct a closeout site visit to:

- Review all files and documents
- Review all procurement files and contracts to third parties
- Take photos of the completed project

Project closeout packages will generally be submitted 90 days after a project has been completed, and will include the following:

- Summary of documentation
- Pictures of completed project
- Materials, labor and equipment forms, if required
- Close-out certification

6.9 Plan Integration

The Calhoun County HMP will be incorporated into existing planning mechanisms in varying processes. These processes will be tailored to the unique characteristics of the planning mechanism and the governing structure of each participating jurisdiction. The HMP will be integrated, when possible, into the following:

- **Emergency Management Planning**
  All jurisdictions in the Calhoun County HMP, with the exception of the NHBP, have deferred their emergency management authority to the CCOEM. Both CCOEM and the NHBP will utilize the HMP in all planning decisions.
- **Emergency Operations Plans**
  The Calhoun County Emergency Operations Plan will be reviewed and updated to reflect the most probable and dangerous hazard event scenarios from the HMP's risk assessment. This revision is the responsibility of the CCOEM for all of the jurisdictions participating in this plan. Upon revision completion, all participating jurisdictions and appropriate emergency services will be notified of the revisions and send out new copies.
- **State of Michigan Hazard Mitigation Plan**
  The state's HMP is required by FEMA regulation to include all local HMPs. The process of integrating the Calhoun County HMP into this plan is already an established process and is managed by MSP/EMHSD.
- **Infrastructure, Development, and Construction Projects**
  Data from this plan will be utilized to provide an understanding of potential hazards and allow for proper construction design parameters to be utilized.
- **Calhoun County EMAC**
  The Calhoun County EMAC is a conduit for all mitigation actions and projects. It is headed by the CCOEM and meets regularly, although there is flexibility in their schedule. The location of the meetings is not fixed so as to increase jurisdictional participation. Members of the EMAC come from all jurisdictions and a wide variety of local agencies and departments.
- **Capital Improvement & Economic Development Planning**
  Data from this plan will be utilized to provide an understanding of potential hazards and allow for sensible economic and development planning.
- **NHBP Tribal Constitution and Codes**
  Data from this plan will be utilized in any revisions or adoptions.

As detailed in Section 2.5, plan incorporation and integration are crucial for creating a cohesive and coordinated approach to address various aspects of hazard mitigation. While are stakeholders and participating jurisdictions will utilize their internal procedures for plan incorporation and integration, the following represent commonly utilized methods:

- Cross-Referencing:
- Consistency Checks:
- Joint Planning Committees:
- Collaborative Workshops and Meetings:
- Alignment with State and Regional Plans:
- Data Sharing and Analysis:
- Unified Implementation Strategies: This involves identifying common actions and initiatives that contribute to the achievement of multiple goals outlined in various plans.

All participating jurisdictions within Calhoun County have good working relationships with both each other, the State of Michigan, and FEMA indicating great potential for plan incorporation and integration across the planning area. Where appropriate, Calhoun County and NHBP will take the lead in integrating this HMP into overarching plans, codes, ordinances and any other relevant documents, policies, or procedures.

Integration of hazard mitigation into these various plans ensures that resilience efforts are embedded in the broader fabric of community development. Coordination and collaboration among different sectors and stakeholders are essential for the successful implementation of hazard mitigation strategies on the local level. Plan incorporation and integration is crucial for creating a cohesive and coordinated approach to address various aspects of hazard mitigation.

All stakeholders and participating jurisdictions utilize similar internal procedures for plan incorporation and integration. The following represent commonly utilized methods by all participating jurisdictions

- Cross-Referencing: Identify and cross-reference relevant sections of different plans and policies. This involves explicitly noting connections between the goals, strategies, and actions outlined in one plan with those in others.
- Consistency Checks: Conduct consistency checks to ensure that the language, objectives, and strategies in different plans and policies align with each other.
- Joint Planning Committees: Establish joint planning committees or task forces that involve representatives from different departments or agencies responsible for various plans (for example, the MPC). These committees facilitate communication, collaboration, and the coordination of planning efforts across sectors.
- Collaborative Workshops and Meetings: Organize collaborative workshops and meetings to bring together stakeholders involved in different planning processes (as seen in the planning meetings for the HMP). These forums provide an opportunity for stakeholders to share information and discuss common goals.
- Alignment with State and Regional Plans: Ensure that local plans align with broader regional and state plans. This involves considering regional and state priorities and incorporating them into local planning efforts to create a harmonized approach to development.
- Data Sharing and Analysis: Share relevant data among planning efforts and conduct joint data analysis. This helps in creating a common understanding of the challenges and opportunities, facilitating evidence-based decision-making across different plans.
- Unified Implementation Strategies: This involves identifying common actions and initiatives that contribute to the achievement of multiple goals outlined in various plans.

All participating jurisdictions within Calhoun County have good working relationships with both each other, the State of Michigan, and FEMA, indicating great potential for plan incorporation and integration across the planning area. Where appropriate, the Calhoun County MPC will take the lead in integrating this HMP into overarching plans, codes, ordinances and any other relevant documents, policies, or procedures.

Calhoun County and the State of Michigan work closely with FEMA in all aspects of planning, response, and mitigation. To ensure understanding and cooperation, the State of Michigan State Hazard Mitigation Officer and Calhoun County and Battle Creek Emergency Managers regularly interface with the State of Michigan State Hazard Mitigation Officer and FEMA mitigation staff on changing FEMA guidelines and opportunities for closer working relationships.

The State of Michigan is currently working with FEMA to apply the FEMA GO system to all FEMA grants. The FEMA GO system allows users to apply, track, and manage all disaster and non-disaster grants and helps improve oversight and monitoring.

Appendix A – FEMA Approval Documentation

U.S. Department of Homeland Security
FEMA Region 5
536 S. Clark St. 6th Floor
Chicago, IL 60605

FEMA

October 16, 2024

Mr. Matt Schnepp
State Hazard Mitigation Officer
Michigan State Police
Emergency Management and Homeland Security Division
P.O. Box 30634
Lansing, MI 48909

Dear Mr. Schnepp:

Thank you for submitting the Calhoun County Hazard Mitigation Plan update for our review. The plan was reviewed based on the local plan criteria contained in 44 CFR Part 201, as authorized by the Disaster Mitigation Act of 2000. The Calhoun County Hazard Mitigation Plan met the required criteria for a multi-jurisdiction hazard mitigation plan. Formal approval of this plan is contingent upon the adoption by the participating jurisdictions of this plan. Once FEMA Region 5 receives documentation of adoption from the participating jurisdictions, we will send a letter of official approval to your office.

An approved local mitigation plan, including adoption by the local government, is one of the conditions for applying for and/or receiving FEMA mitigation grants from the following programs:

- Hazard Mitigation Grant Program (HMGP)
- HMGP Post-Fire
- Building Resilient Infrastructure and Communities
- Flood Mitigation Assistance

Please note that participating jurisdictions that adopt the plan more than one year after APA status has been issued must either:

- Validate that their information in the plan remains current with respect to both the risk assessment (no recent hazard events, no changes in development) and their mitigation strategy (no changes necessary); or
- Make the necessary updates before submitting the adoption resolution to FEMA.

We look forward to receiving the adoption resolution(s) and discussing options for implementing this mitigation plan. If there are any questions from either you or the communities, please contact Meghan Cuneo, at (202) 615-5294 or email at Meghan.Cuneo@fema.dhs.gov.

Sincerely,

John Wethington
Chief, Risk Analysis Branch
Mitigation Division

Appendix B – Jurisdictional Resolutions of Adoption

At a Regular Session of the Calhoun County Board of Commissioners, held in Board Chambers, Calhoun County Building, 315 West Green Street, Marshall, Michigan, on Thursday, December 7, 2023, with Vice Chair Steve Frisbie presiding, the following action was taken:

RESOLVED that the Calhoun County Board of Commissioners does hereby approve the resolution to adopt the November 2023 Calhoun County Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan as presented and acknowledges that while content related to Calhoun County, MI may require revisions to meet the plan approval requirements, changes occurring after adoption will not require the Calhoun County Board of Commissioners to re-adopt any further iterations of the plan. Subsequent plan updates following the approval period for this plan will require separate adoption resolutions.

Res.159-2023

"Moved Comr. Miller, second by Comr. Thompson to hereby approve the resolution to adopt the November 2023 Calhoun County Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan, as presented by Consent Agenda.

On a **VOICE VOTE**
Present - 4, Comrs. Frisbie, King, Miller, and Thompson.
Absent/Excused – 3, Comrs. Vette, French, and Hatcher.
Motion **CARRIED**.

STATE OF MICHIGAN)
) SS
COUNTY OF CALHOUN)

I, the undersigned, Calhoun County Deputy Clerk and Secretary to the Board of Commissioners, do hereby certify that the foregoing is a true and complete copy of certain proceedings taken by the Calhoun County Board of Commissioners at its regular meeting held on Thursday, December 7, 2023, relative to adoption of the resolution therein set forth; that said meeting was conducted and public notice of said meeting was given pursuant to and in full compliance with the Open Meetings Act, being Act 267, Public Acts of Michigan, 1976, and that the minutes of said meeting were kept and will be made available as required by said Act.

Dated: December 7, 2023

Susan M. Connolly
Deputy Clerk and Secretary to the
Board of Commissioners

CALHOUN COUNTY, MI

RESOLUTION NO. 159-2023

A RESOLUTION OF THE CALHOUN COUNTY BOARD OF COMMISSIONERS ADOPTING THE NOVEMBER 2023 CALHOUN COUNTY MICHIGAN MULTI-JURISDICTIONAL NATURAL HAZARD MITIGATION PLAN

WHEREAS the Calhoun County Board of Commissioners recognizes the threat that natural hazards pose to people and property within Calhoun County, MI; and

WHEREAS the Calhoun County Board of Commissioners has prepared a multi-hazard mitigation plan, hereby known as the November 2023 Calhoun County Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan in accordance with federal laws, including the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended; the National Flood Insurance Act of 1968, as amended; and the National Dam Safety Program Act, as amended; and

WHEREAS the November 2023 Calhoun County Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Calhoun County, MI from the impacts of future hazards and disasters; and

WHEREAS adoption by the Calhoun County Board of Commissioners demonstrates its commitment to hazard mitigation and achieving the goals outlined in the November 2023 Calhoun County Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan.

NOW THEREFORE, BE IT RESOLVED THAT THE CALHOUN COUNTY BOARD OF COMMISSIONERS,

adopts the November 2023 Calhoun County Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan. While content related to Calhoun County, MI may require revisions to meet the plan approval requirements, changes occurring after adoption will not require the Calhoun County Board of Commissioners to re-adopt any further iterations of the plan. Subsequent plan updates following the approval period for this plan will require separate adoption resolutions.

ADOPTED by a vote of 4 in favor and 0 against, and 0 abstaining, this 7 day of December, 2023.

By: Steve Fnsbie (print name)

ATTEST: By: Susan Connolly (print name)

APPROVED AS TO FORM: By: Susan Connolly (print name)

CONFIDENTIAL

NOTTAWASEPPI HURON BAND OF THE POTAWATOMI
RESOLUTION NO. 11-16-23-08

Nottawaseppi Huron Band of the Potawatomi Acknowledges and Adopts the Calhoun County Hazard Mitigation Plan November 2023.

WHEREAS: On December 21, 1995, the Department of the Interior recognized the Nottawaseppi Huron Band of the Potawatomi, as a federally recognized Indian Tribe pursuant to the Federal Acknowledgment Process (60 Fed. Reg. 66315); and

WHEREAS: Article VI, Sections 1(h) and (i) of the Tribe's Constitution empowers the Tribal Council to manage all economic affairs of the Tribe and to regulate the use of funds received for tribal purposes; and

WHEREAS: Article VI, Section 1(g) of the Tribe's Constitution empowers the Tribal Council to protect the interests of minors, the incompetent and the elderly; and

WHEREAS: Article VI, Section 1(e) of the Tribe's Constitution empowers the Tribal Council to confer, negotiate, consult and enter into contracts, compacts or agreements with the federal, state and local governments and their agencies, other tribal governments and their agencies and individual corporations on behalf of the Tribe; and

WHEREAS: Calhoun County, Michigan has prepared a hazard mitigation plan, herby known as *Calhoun County, Michigan Multi-Jurisdictional Hazard Mitigation Plan (CCHMP)* in accordance with federal laws, including the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended; the National Flood Insurance Act of 1968, as amended; and the National Dam Safety Program Act, as amended; and

WHEREAS: the CCHMP identifies goals and actions to reduce or eliminate long-term risk to people and property within Nottawaseppi Huron Band of the Potawatomi from the impacts of future hazards and disasters; and

WHEREAS: the NHBP Hazard Mitigation Plan team has been working with Calhoun County as the Tribe's representative in order to be included in the Calhoun County CCHMP; and

WHEREAS: adoption of the CCHMP by NHBP demonstrates its commitment to hazard mitigation and achieving the goals outlined in the CCHMP; and

WHEREAS: NHBP is a jurisdiction that is identified within the CCHMP; and

PINE CREEK INDIAN RESERVATION
1485 MNO-BMADZEWEN WAY • FULTON, MI 49052

WHEREAS: the TEPC has made a recommendation to the NHBP Tribal Council to acknowledge and adopt the CCHMP; and

NOW THEREFORE BE IT RESOLVED, the NHBP Tribal Council acknowledges and adopts the *Calhoun County, Michigan Multi-Jurisdictional Hazard Mitigation Plan* November 2023 attached herein as Exhibit A.

BE IT FURTHER RESOLVED, while content related to the Nottawaseppi Huron Band of the Potawatomi may require revisions to meet the plan approval requirements, changes occurring after adoption will not require NHBP to re-adopt any further iterations of this plan. Subsequent plan updates following the approval period for this plan will require separate adoption resolutions.

###

CERTIFICATION

On November 16, 2023, this resolution was approved at a duly called regular meeting of the Tribal Council held on the Pine Creek Reservation, a quorum being present, by an affirmative vote 4 members, 0 opposing, 1 absent, and 0 abstaining, this 16th day of November 2023.

Dorie Rios, Secretary Pro-Tem

Jamie Stuck, Chairperson

Distribution: Tribal Council Records
Chief Planning Officer
Emergency Manager
Health and Safety Officer
Calhoun County Emergency Management Coordinator

NHBP Government Records Certified Copy
True Certified Copy Shall Be Embossed
Signed by
Date 11/17/23

PINE CREEK INDIAN RESERVATION
1485 MNO-BMADZEWEN WAY • FULTON, MI 49052

CITY OF MARSHALL, MICHIGAN
RESOLUTION NO. 2023-33

A RESOLUTION TO ADOPT THE NOVEMBER 2023 CALHOUN COUNTY MICHIGAN MULTI-JURISDITIONAL NATURAL HAZARD MITIGATION PLAN

Minutes of a regular meeting of the Council of the City of Marshall, held on December 4, 2023, at 7:00 PM.

PRESENT: Mayor Schwartz, Chaney-Huggett, Gates, Traver, Underhill and Wolfersberger

ABSENT: Caron

The following preamble and resolution were offered by Wolfersberger and supported by Chaney-Huggett.

WHEREAS, the City of Marshall recognizes the threat that natural hazards pose to people and property within the City of Marshall; and

WHEREAS, the City of Marshall has prepared a multi-hazard mitigation plan, hereby known as the November 2023 Calhoun County Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan in accordance with federal laws, including the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended; the National Flood Insurance Act of 1968, as amended; and the National Dam Safety Program Act, as amended; and

WHEREAS, the November 2023 Calhoun County Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the City of Marshall from the impacts of future hazards and disasters; and

WHEREAS, adoption by the City of Marshall demonstrates its commitment to hazard mitigation and achieving the goals outlined in the November 2023 Calhoun County Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan; and

NOW THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF MARSHALL hereby adopts the November 2023 Calhoun County Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan. While content related to the City of Marshall may require revisions to meet the plan approval requirements, changes occurring after adoption will not require the City of Marshall to re-adopt any further iterations of the plan during the approval period. Subsequent plan updates following the approval period for this plan will require separate adoption resolutions.

Resolution declared adopted this 4th day of December 2023.

Jennifer Pickford, Deputy City Clerk

I, Jennifer Pickford, being duly sworn as the Deputy City Clerk for the City of Marshall, hereby certify that the foregoing is a true and complete copy of the resolution adopted by the City Council, City of Marshall, County of Calhoun, State of Michigan, at a regular meeting held on December 4, 2023 and that the said meeting was conducted and that the minutes of the meeting were kept and will be or have been made available.

Jennifer Pickford, Deputy City Clerk

CITY OF Springfield

December 18, 2023 **RESOLUTION** **No. 85-23**

A RESOLUTION OF THE COUNCIL OF THE CITY OF SPRINGFIELD ADOPTING THE NOVEMBER 2023 CALHOUN COUNTY MICHIGAN MULTI-JURISDICTIONAL NATURAL HAZARD MITIGATION PLAN

WHEREAS, THE COUNCIL OF THE CITY OF SPRINGFIELD recognizes the threat that natural hazards pose to people and property within the City; and

WHEREAS, THE COUNCIL OF THE CITY OF SPRINGFIELD has prepared a multi-hazard mitigation plan, hereby known as (Calhoun County, Michigan Multi-Jurisdictional Hazard Mitigation Plan, dated November, 2023) in accordance with federal laws, including the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended; the National Flood Insurance Act of 1968, as amended; and the National Dam Safety Program Act, as amended; and

WHEREAS, November 2023 Calhoun County Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in (local government) from the impacts of future hazards and disasters; and

WHEREAS, adoption by the Council of the City of Springfield demonstrates its commitment to hazard mitigation and achieving the goals outlined in the (title and date of mitigation plan).

NOW THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF SPRINGFIELD, MICHIGAN, THAT:

Section 1. In accordance with the City Charter, the Council of the City of Springfield adopts the November, 2023 Calhoun County Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan. While content related to the City of Springfield may require revisions to meet the plan approval requirements, changes occurring after adoption will not require the Council of the City of Springfield to re-adopt any further iterations of the plan. Subsequent plan updates following the approval period for this plan will require separate adoption resolutions.

I, Kristin R. Vogel Clerk of the City of Springfield. hereby certify the above and foregoing is true and correct copy of a resolution adopted by the City Council at a regular meeting held on the 18 day of Dec, 2023

Kristin R. Vogel

MOVED: Mayor Pro-tem Hollingsworth

SECONDED: Council Member Holcomb

All ayes. Resolution adopted.

Resolution #2024-01

Resolution to approve **Resolution 2024-01** to adopt the Calhoun County, Michigan Multi-Jurisdictional Hazard Mitigation Plan.

The Resolution to approve the adoption of the Calhoun County, Michigan Multi-Jurisdictional Hazard Mitigation Plan was made by, Rusty Smith and seconded by, Scott Frederick.

Roll Call Vote Rusty Smith, Scott Frederick, Hayley England, Stephanie Craig, Richard Parker

Absent Board Member: None

The Resolution is declared approved.

Date: 1/16/24 Stephanie Craig

Sheridan Township Clerk

ATHENS AREA SCHOOLS
Board of Education
East Leroy, Michigan 49051
December 18, 2023

A RESOLUTION OF ATHENS AREA SCHOOL ADOPTING THE NOVEMBER 2023 CALHOUN COUNTY MICHIGAN MULTI-JURISDICTIONAL NATURAL HAZARD MITIGATION PLAN

WHEREAS the **Athens Area Schools School Board** recognizes the threat that natural hazards pose to people and property within **the District;** and

WHEREAS the (local government) has prepared a multi-hazard mitigation plan, hereby known as (title and date of mitigation plan) in accordance with federal laws, including the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended; the National Flood Insurance Act of 1968, as amended; and the National Dam Safety Program Act, as amended; and

WHEREAS November 2023 Calhoun County Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in (local government) from the impacts of future hazards and disasters; and

WHEREAS adoption by the **Athens Area Schools School Board** demonstrates its commitment to hazard mitigation and achieving the goals outlined in the MULTI-JURISDICTIONAL NATURAL HAZARD MITIGATION PLAN.

NOW THEREFORE, BE IT RESOLVED BY THE (LOCAL GOVERNMENT), MICHIGAN, THAT:

Section 1. In accordance with **Board Policy** the **Athens Area Schools School Board** adopts the November 2023 Calhoun County Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan. While content related to (local government) may require revisions to meet the plan approval requirements, changes occurring after adoption will not require **Athens Area Schools School Board** to re-adopt any further iterations of the plan. Subsequent plan updates following the approval period for this plan will require separate adoption resolutions.

Motion: Jason Stanton.
Second: Hilary Setlak.
Ayes: 7 Nays: Ø.
Passed: ✓. Defeated: _____.

Erin M. McCune
Athens Area Schools Board Secretary

12/18/2023
Date

Harper Creek Community Schools

To: Members of the Board of Education

From: Rob Ridgeway, Superintendent

Date: December 11, 2023

Re: November 2023 Calhoun County, Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan

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Motion by Wallace, supported by Smith,

That the Harper Creek Board of Education approves the November 2023, Calhoun County, Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan as discussed, and reviewed.

Roll Call Vote:
Mrs. Wallace Y, Mr. Smith Y, Mr. Bess Y, , Mrs. Allwardt Y.Dr.

Borders Y, Mrs. Waterson Y, Mr. Halverson Y

Motion carried 7-0.

Motion failed _____.

Erin Allwardt
Secretary, Board of Education
December 11, 2023

Harper Creek Board of Education, Battle Creek, Michigan

A RESOLUTION OF Harper Creek Board of Education ADOPTING THE NOVEMBER 2023 CALHOUN COUNTY MICHIGAN MULTI-JURISDICTIONAL NATURAL HAZARD MITIGATION PLAN

WHEREAS the Harper Creek Board of Education recognizes the threat that natural hazards pose to people and property within **the Harper Creek Community School District;** and

WHEREAS the Governing Body of Calhoun County, Michigan has prepared a multi-hazard mitigation plan, hereby known as Calhoun County, Michigan Multi-Jurisdictional Hazard Mitigation Plan, November 2023 in accordance with federal laws, including the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended; the National Flood Insurance Act of 1968, as amended; and the National Dam Safety Program Act, as amended; and

WHEREAS November 2023 Calhoun County Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Harper Creek Community School District from the impacts of future hazards and disasters; and

WHEREAS adoption by the **Harper Creek Board of Education** demonstrates its commitment to hazard mitigation and achieving the goals outlined in the Calhoun County, Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan.

NOW THEREFORE, BE IT RESOLVED BY THE HARPER CREEK BOARD OF EDUCATION, THAT:

Section 1. In accordance with the Governing Board of **Calhoun County, MI**, the **Harper Creek Board of Education** adopts the November 2023 Calhoun County Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan. While content related to Harper Creek Community Schools may require revisions to meet the plan approval requirements, changes occurring after adoption will not require the **Harper Creek Board of Education** to re-adopt any further iterations of the plan. Subsequent plan updates following the approval period for this plan will require separate adoption resolutions.

ADOPTED by a vote of 7 in favor and 0 against, and 0 abstaining, this 11th day of December 2023.

By: Sara Wallace (print name)

ATTEST: By: Barry Smith (print name)

APPROVED AS TO FORM: By: Erin Allwardt (print name)

Tekonsha Community Schools
Board of Education Resolution

A RESOLUTION OF **Tekonsha Community Schools ("School") Board of Education (the "Board")** ADOPTING THE NOVEMBER 2023 CALHOUN COUNTY MICHIGAN MULTI-JURISDICTIONAL NATURAL HAZARD MITIGATION PLAN

WHEREAS the **Board** recognizes the threat that natural hazards pose to people and property within **Tekonsha Community Schools;** and

WHEREAS the Calhoun County has prepared a multi-hazard mitigation plan, hereby known as Calhoun County, Michigan Multi-Jurisdictional Hazard Mitigation Plan - November 2023 in accordance with federal laws, including the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended; the National Flood Insurance Act of 1968, as amended; and the National Dam Safety Program Act, as amended; and

WHEREAS November 2023 Calhoun County Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Tekonsha Community Schools from the impacts of future hazards and disasters; and

WHEREAS adoption by the **Board** demonstrates its commitment to hazard mitigation and achieving the goals outlined in the Calhoun County, Michigan Multi-Jurisdictional Hazard Mitigation Plan - November 2023.

NOW THEREFORE, BE IT RESOLVED THAT:

Section 1. The **Board** adopts the November 2023 Calhoun County Michigan Multi-Jurisdictional Natural Hazard Mitigation Plan. While content related to the School may require revisions to meet the plan approval requirements, changes occurring after adoption will not require **the Board** to re-adopt any further iterations of the plan. Subsequent plan updates following the approval period for this plan will require separate adoption resolutions.

ADOPTED by a vote of 6 in favor and ____ against, and ____ abstaining,
this 17 day of January, 2024.

By: Brandie Aldrich. President
Brandie Aldrich (print name)
Date: 01-17-24

ATTEST: Sara Griffith Secretary
Sara Griffith (print name)
Date: 1/17/2024

Appendix C – Public Survey Data

Calhoun County, MI Hazard Mitigation Plan Survey

Project Engagement

VIEWS	PARTICIPANTS	RESPONSES	COMMENTS
130	16	95	56

Where in Calhoun County do you live?

Sheridan

2 months ago

Athens

3 months ago

Emmet Township

3 months ago

Marshall

3 months ago

Athens Twp.

3 months ago

Eckford Twp.

3 months ago

Emmett Township

3 months ago

Athens

3 months ago

Sheridan Township

3 months ago

Lakeview School District

3 months ago

Homer

3 months ago

Leroy Township

3 months ago

Lee twp

3 months ago

Tekonsha

3 months ago

Battle Creek

3 months ago

Springfield

3 months ago

Marshall

3 months ago

The following natural hazards have been identified as having the potential to impact Calhoun County. Please tell us about your concerns about the identified hazards.

	No Concern	Some Concern	Moderate Concern	Significant Concern
Drought	44% No Concern	38% Some Concern	12% Moderate Concern	6% Significant Concern
Extreme Temperatures	12% No Concern	50% Some Concern	19% Moderate Concern	19% Significant Concern
Flash Flood / Flood	40% No Concern	33% Some Concern	27% Moderate Concern	- Significant Concern
Severe Storm (including Lightning, Thunderstorms, Hail, and Wind)	- No Concern	12% Some Concern	44% Moderate Concern	44% Significant Concern
Tornadoes	6% No Concern	19% Some Concern	44% Moderate Concern	31% Significant Concern
Winter Storms	- No Concern	25% Some Concern	38% Moderate Concern	38% Significant Concern

16 respondents

Have you been impacted by any of the identified hazards in the last five years? If yes, please tell us about what happened.

Winter weather impacts my ability to get to work and access grocery stores.

3 months ago

High winds take down trees and powerlines, vehicles hit the down trees.

3 months ago

Power outages due to storms

3 months ago

Not impacted.

3 months ago

no

3 months ago

Power Outages and Cyberattacks

3 months ago

Storms that knock out power for several days.

3 months ago

Ice storms in previous year.

3 months ago

Wind - trees and limps blocking roadway.

3 months ago

we have severe storms and winter storms in the Tekonsha area. Ice, power outage

3 months ago

Hail damage in 2020 to house. Wind damage to school structure (roofs, facia, tree limbs)

3 months ago

Sever storms and Winter storms have affected our electric power and has contributed to the loss of power.

3 months ago

Storms, strong winds - tree damage and debris.

3 months ago

Are there any other hazards that were not identified that may be worth consideration for inclusion in the Hazard Mitigation Plan?

nope.

3 months ago

not sure if railroad derailments or spills of hazardous materials on the highway or electric vehicle emergencies, qualifies for the type of hazard mitigation you are asking about.

3 months ago

no

3 months ago

No.

3 months ago

Solar fires and safety and battery fires.

3 months ago

Storms that knock out power for several days.

3 months ago

None at this time.

3 months ago

Gas leak or Oil spill? We have several pipelines in our community.

3 months ago

I69 - spills

3 months ago

what about Natural gas leaks or Hazmat incident on the expressways

3 months ago

no

3 months ago

None.

3 months ago

Are there any projects that could help make safer communities in Calhoun County that you would like to be considered for the Hazard Mitigation Plan? (Example: construction of stormwater retention ponds or severe weather safe rooms)

no

3 months ago

No

3 months ago

Establishing cooling centers for extreme heat

3 months ago

Country wide storm sirens.

3 months ago

storm sirens in all townships

3 months ago

Heat/Cooling Stations. Drainage. Plumbing upgrades.

3 months ago

Stormwater bioswales in neighborhoods could help mitigate flooding and stormwater contamination.

3 months ago

Is there anything else concerning Hazard Mitigation that you would like us to know?

no

3 months ago

No, The HMP was thorough and comprehensive.

3 months ago

Establishing solar field procedures for fires.
Auto accident training for battery fires.

3 months ago

No

3 months ago

Electric car battery fires

3 months ago

no

3 months ago

No

3 months ago

Appendix D – Critical Facilities

Fire Departments

Albion Department of Public Safety
201 N. Clinton St.
Albion, MI 49224

Albion Township Fire Department
28051 F Drive South
Albion, MI 49224

Athens Fire Department
130 E. Burr Oak St.
Athens, MI 49011

Battle Creek City Fire Department
Station 1 195 E Michigan, 49014
Station 2 145 N Washington, 49037
Station 3 222 Cliff St, 49014
Station 4 8 South 20th, 49015
Station 5 1170 W Michigan, 49037
Station 6 2401 Capital Ave SW, 49015

Bedford Township Fire
Station 1
21962 N. Bedford Rd.
Battle Creek, MI 49017

Station 2
115 S. Uldricks Drive.
Battle Creek, MI 49037

Station 3
5902 E. Morgan Rd.
Battle Creek, MI 49037

Burlington Fire Department
215 W. Leroy St.
Burlington MI 49029

Emmett Township Public Safety
617 Cliff St.
Battle Creek, MI 49014

Fredonia Township Fire Department
8803 17 Mile Rd.
Marshall, MI 49068

Homer Fire Department
130 E. Main St.
Homer, MI 49245

Leroy Township Fire Department
8146 4 Mile Rd.
East Leroy, MI 49051

Marengo Township Fire Department
14021 23 Mile Rd.
Albion, MI 49224

Marshal City Fire Department
1201 Arms St.
Marshall, MI 49068

Marshall Township Fire Department
Station 1
13551 15 Mile Rd.
Marshall, MI 49068

Station 2
16993 Burlingame Rd.
Marshall, MI 49068

Newton Township Fire Department
7988 G Drive S.
Battle Creek, MI 49014

Pennfield Township Fire Department
20260 Capital Ave. NE
Battle Creek, MI 49017

Sheridan Township Fire Department
13355 29 Mile Rd.
Albion, MI 49224

Springfield City Fire Department
601 Avenue A
Springfield, MI 49037

Tekonsha Fire Department
166 Spires Pkwy
Tekonsha, MI 49092

VA Fire Department
5500 Armstrong Rd.
Building 25
Battle Creek, MI 49037

Police Departments

Albion Department of Public Safety
112 W. Cass St.
Albion, MI 49224

City of Battle Creek Police Department
34 N. Division St.
Battle Creek, MI 49014

Calhoun County Sheriff's Office
Administration Office
161 E. Michigan Ave.
Battle Creek, MI

Corrections
185 E. Michigan Ave.
Battle Creek, MI

Main Law Enforcement Division
714 Old US 27 N.
Marshall, MI 49068

Homer Office
130 E. Main St.
Homer MI 49245

Pennfield Office
132 Primrose Trail
Battle Creek, MI 49017

Springfield Office
601 Avenue A.
Springfield, MI 49037

Marshall City Police Department
714 Old US 27 N.
Marshall, MI 49068

Michigan State Police Post 54
714 Old US 27 N.
Marshall, MI 49068

Michigan DNR – Calhoun County
714 Old US 27 N.
Marshall, MI 49068

Nottawaseppi Huron Band of the Potawatomi (NHBP) Tribal Police
Pine Creel Reservation Office
2221 1 ½ Mile Rd.
Fulton MI 49052

Firekeepers Office
11177 E. Michigan Ave.
Battle Creek, MI 49014

VA Police Department
5500 Armstrong Rd.
Building 27
Battle Creek, MI 49037

Ambulance Services

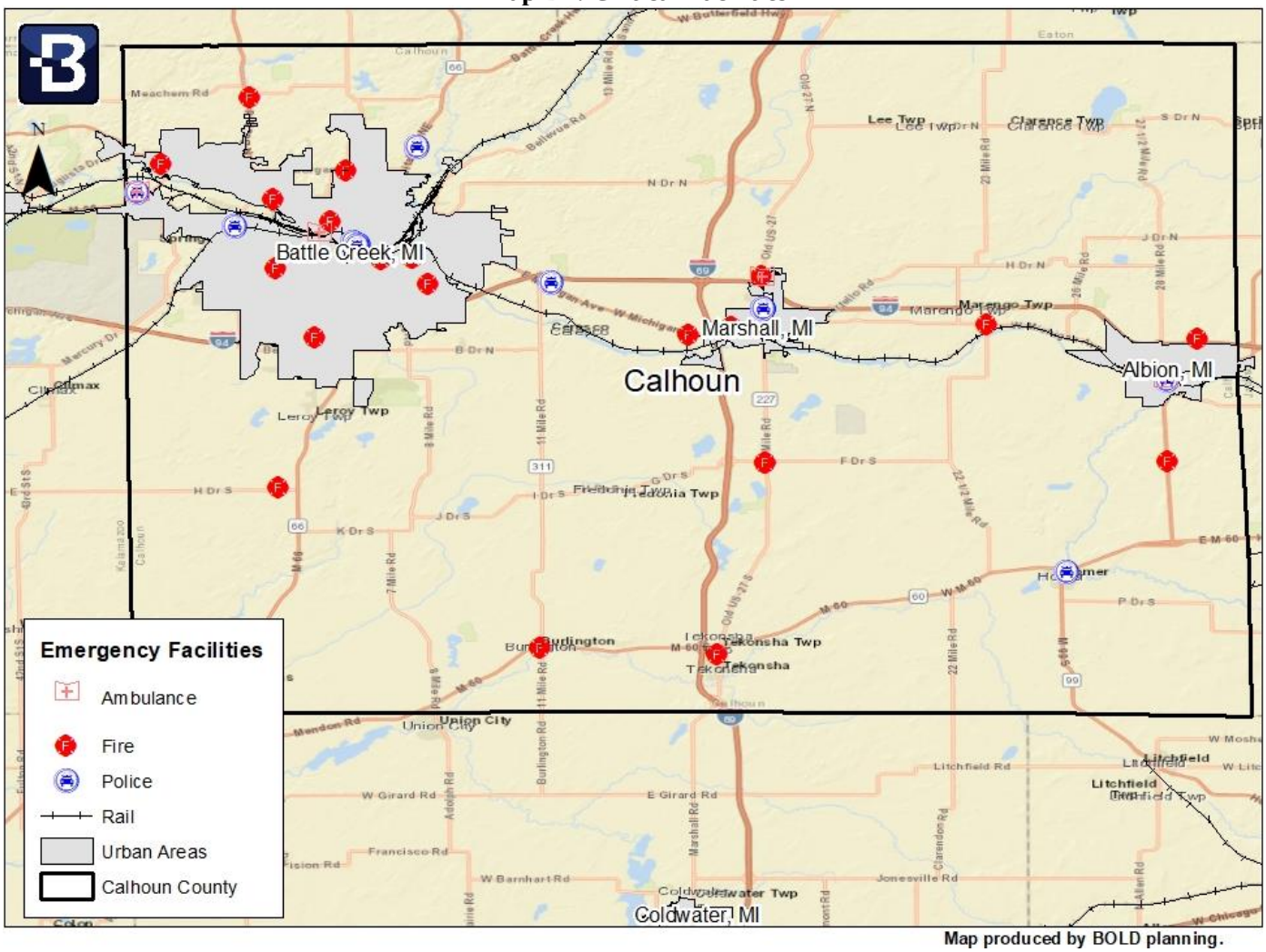
Albion Community Ambulance Service
201 N. Clinton St.
Albion, MI 49224

LifeCare Ambulance Service
330 W. Hamblin Ave.
Battle Creek, MI 49037

Marshall Area Fire Fighters Ambulance Authority (MAFFAA)
16984 Burlingame Dr.
Marshall, MI 49068

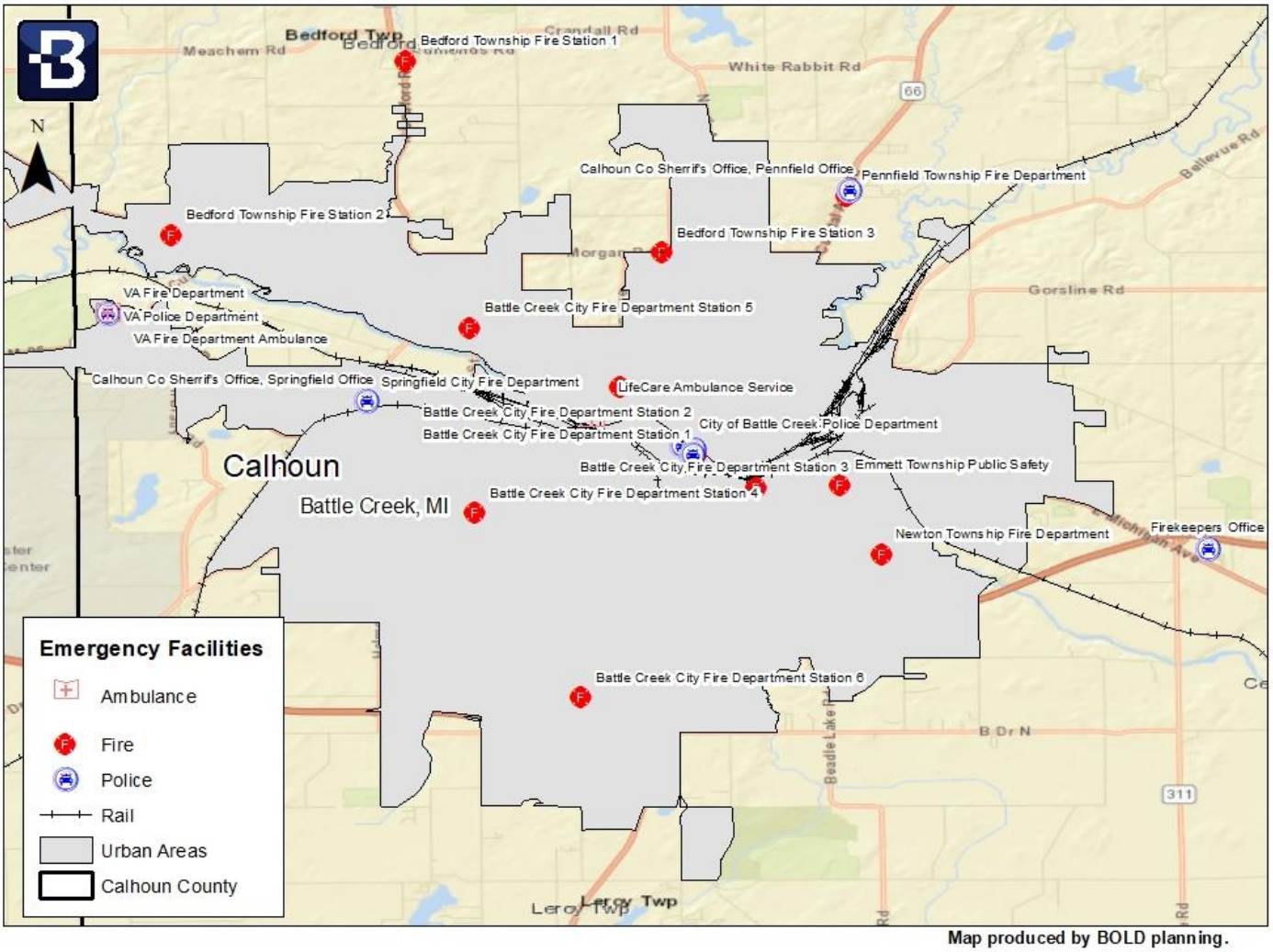
VA Fire Department Ambulance
5500 Armstrong Rd.
Building 25
Battle Creek, MI 49037

Map D1: Critical Facilities



Source: Calhoun County

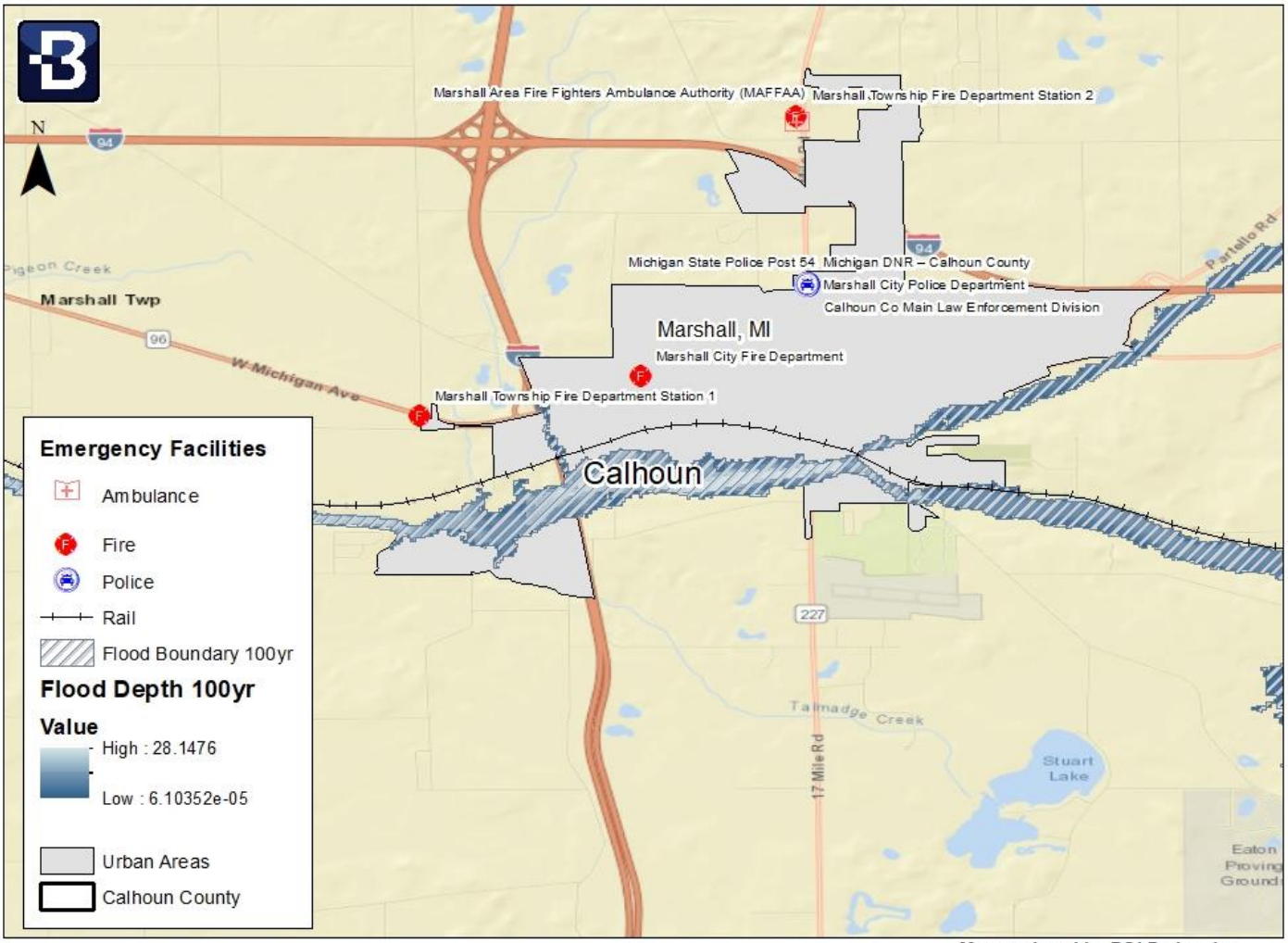
Map D2: Critical Facilities



Map produced by BOLD planning.

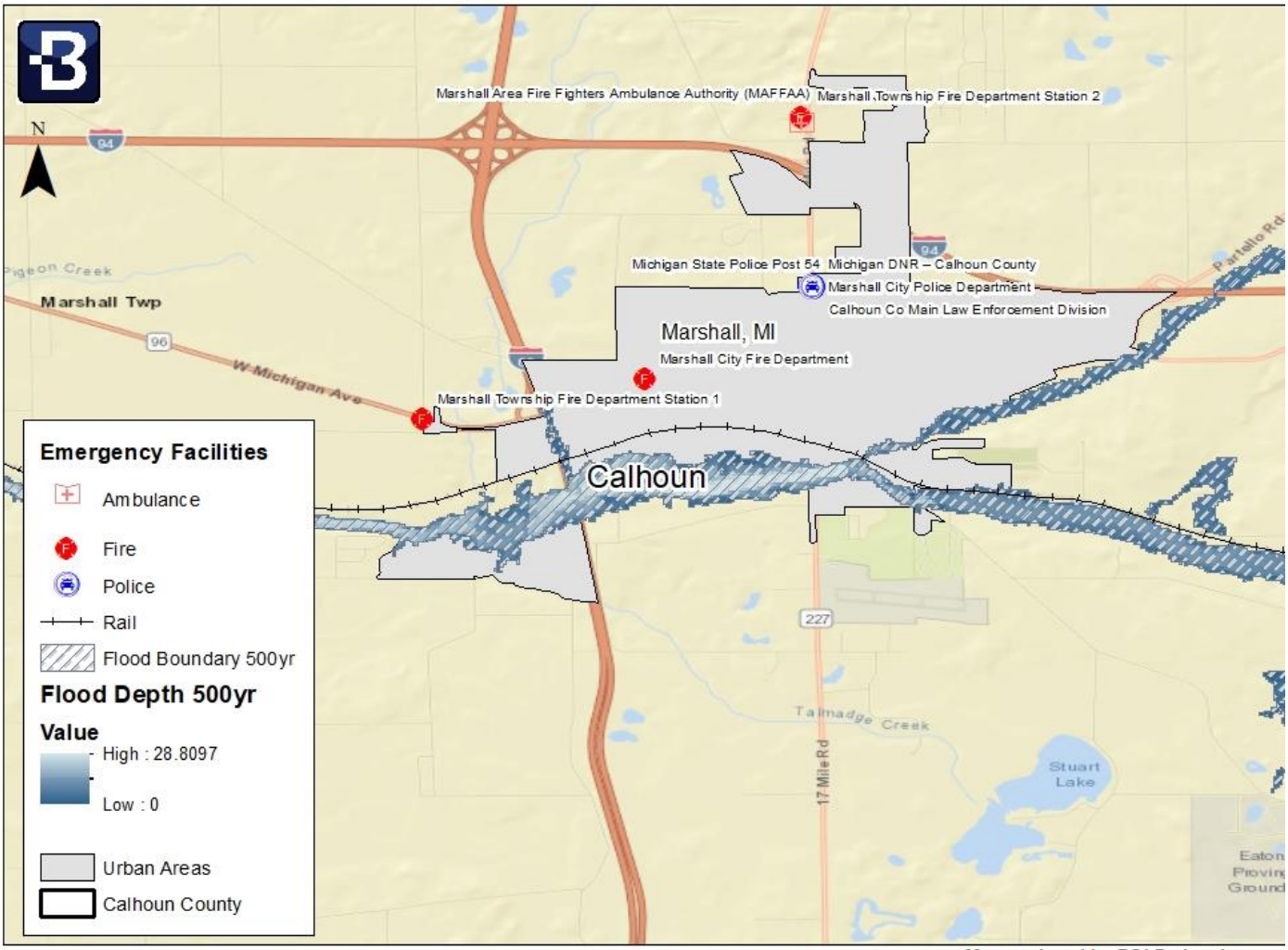
Source: Calhoun County

Map D3: Critical Facilities



Source: Calhoun County

Map D4: Critical Facilities

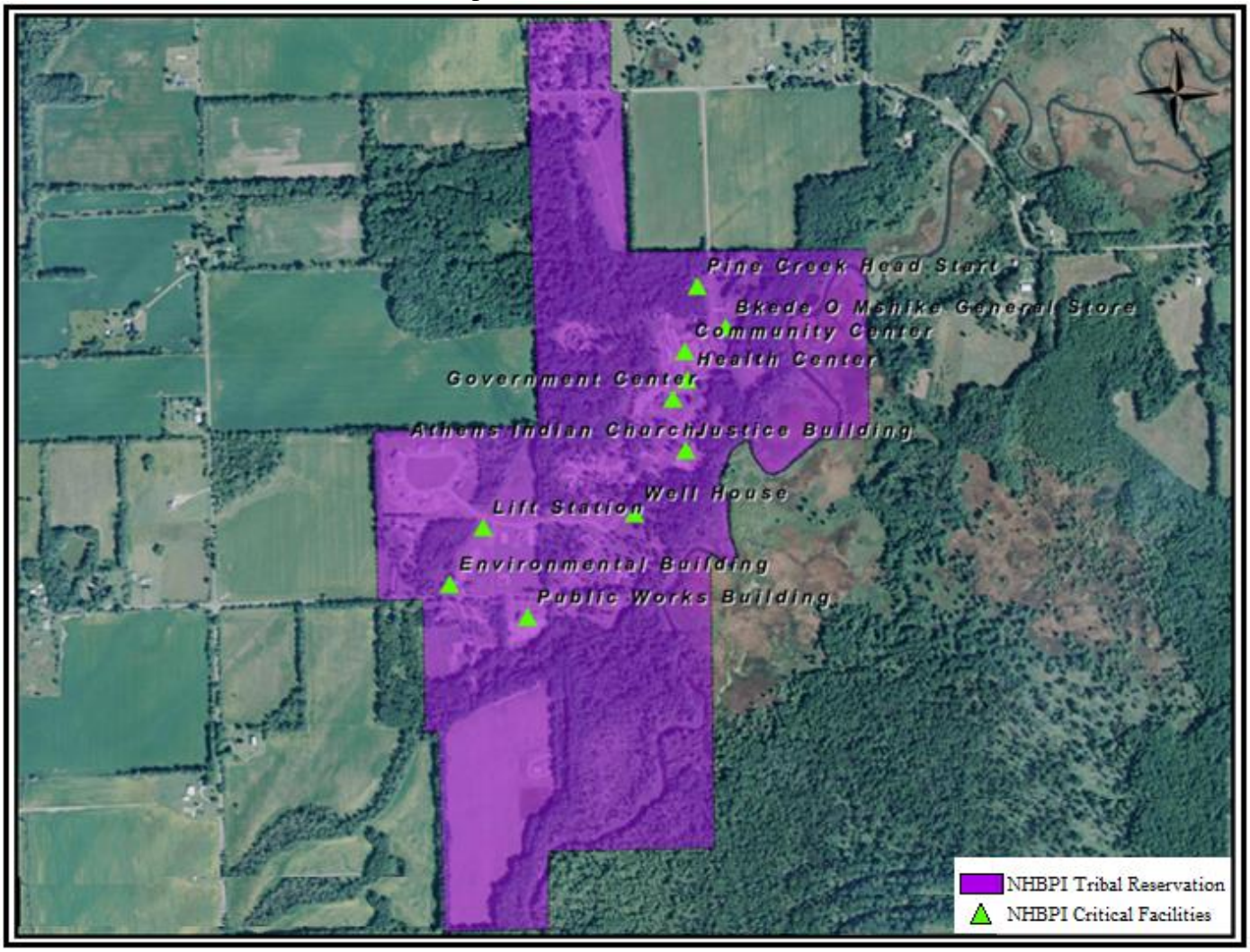


Source: Calhoun County

Table D1: NHBP Critical Facilities

Name	Location
Athens Indian Church	Operations are critical to the tribe
Bkedé O Mshiké General Store	Operations are critical to the tribe
Community Center	Operations are critical to the tribe
Environmental Building	Operations are critical to the tribe
Government Center	Operations are critical to the tribe
Health Center	Operations are critical to the tribe
Justice Building	Operations are critical to the tribe
Lift Station	Operations are critical to the tribe
Pine Creek Head Start	Operations are critical to the tribe
Public Works Building	Operations are critical to the tribe
Well House	Operations are critical to the tribe

Map D5: NHBP Critical Facilities



Source: NHBP

Appendix E – FEMA National Risk Index Data

Map E1: Calhoun County Census Tracts

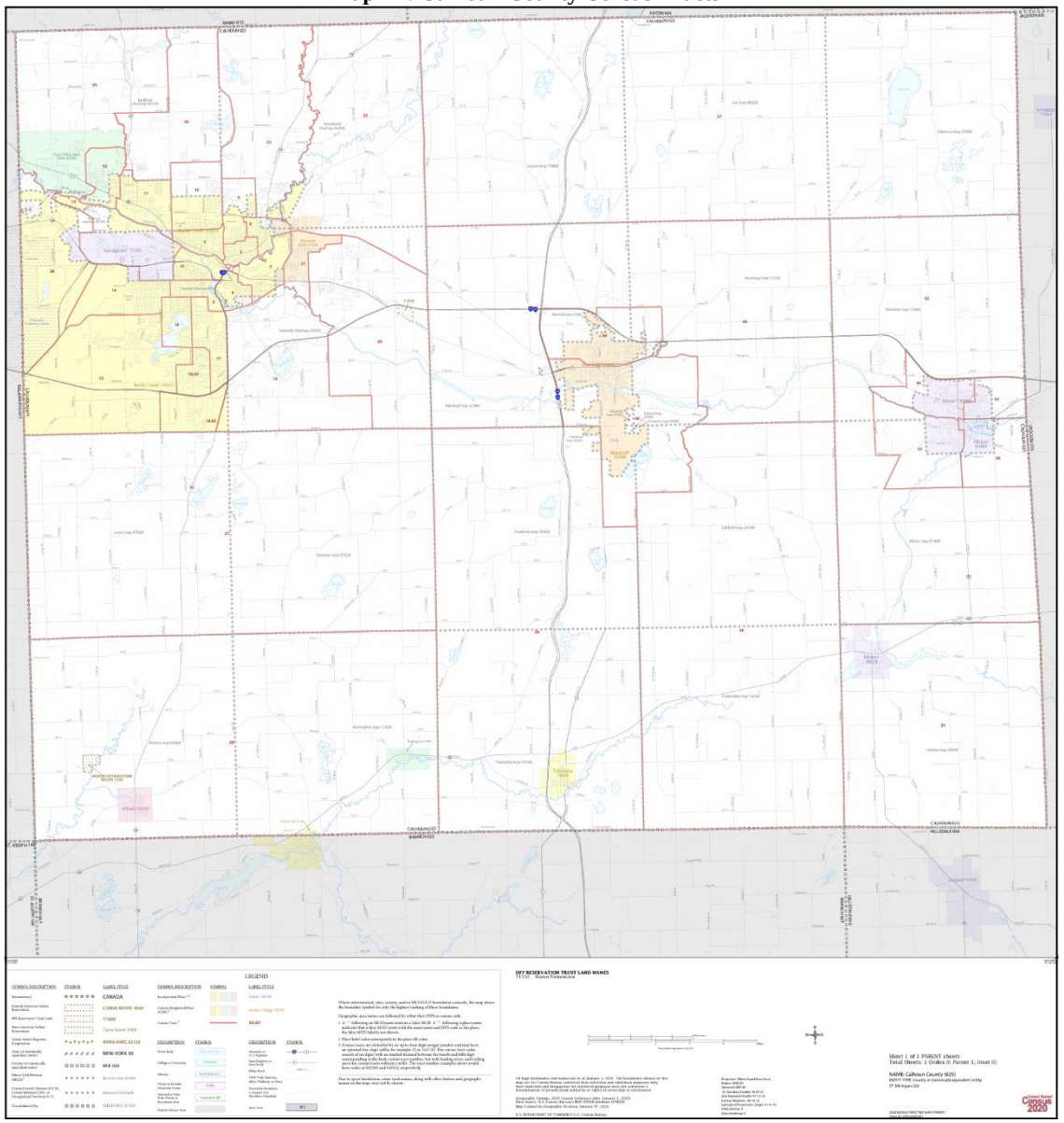


Table E1: FEMA NRI Census Tract General Data

Census Tract	Population	Building Value	Agricultural Value	Area	All Hazard Risk Rating	All Hazard EAL	Social Vulnerability Rating	Community Resilience Rating
200	3,930	$450,351,013	$0	0.69	Relatively Low	Relatively Low	Very High	Very High
300	2,025	$567,561,447	$0	1.03	Relatively Low	Very Low	Very High	Very High
500	3,366	$256,650,617	$0	0.86	Relatively Low	Very Low	Very High	Very High
600	2,824	$383,955,982	$0	0.90	Relatively Low	Very Low	Very High	Very High
700	2,955	$859,634,398	$2,138	1.78	Relatively Low	Relatively Low	Very High	Very High
800	2,948	$308,574,525	$2,937	0.91	Very Low	Very Low	Relatively Moderate	Very High
900	3,459	$811,025,788	$3,819	1.67	Relatively Low	Relatively Low	Relatively Moderate	Very High
1000	4,243	$397,456,471	$55,878	3.05	Relatively Low	Very Low	Very High	Very High
1100	4,294	$435,566,604	$12,483	2.24	Relatively Low	Very Low	Very High	Very High
1200	2,445	$241,315,752	$8,031	1.81	Very Low	Very Low	Relatively Low	Very High
1300	4,120	$774,970,110	$60,970	4.39	Relatively Low	Relatively Low	Very High	Very High
1400	4,172	$624,003,695	$90,763	3.44	Relatively Low	Relatively Low	Very High	Very High
1500	5,891	$1,267,594,740	$2,598,236	13.78	Relatively Low	Relatively Low	Relatively Low	Very High
1600	2,646	$497,435,306	$2,203	1.33	Very Low	Very Low	Relatively Low	Very High
1700	4,574	$605,924,419	$735	1.97	Relatively Low	Relatively Low	Relatively Moderate	Very High
1801	2,175	$532,601,088	$0	1.17	Very Low	Very Low	Very Low	Very High
1802	3,961	$628,002,374	$23,351	2.13	Relatively Low	Relatively Low	Relatively High	Very High
1900	4,064	$1,007,726,375	$1,898,788	13.24	Relatively Low	Relatively Low	Relatively Low	Very High
2000	5,029	$683,656,795	$2,948,842	15.77	Relatively Low	Relatively Low	Relatively Moderate	Very High
2100	1,116	$244,156,888	$59,094	1.60	Very Low	Very Low	Relatively High	Very High
2200	3,272	$418,915,770	$5,301,612	23.95	Very Low	Very Low	Relatively Low	Very High
2300	3,712	$595,025,391	$2,189,703	12.50	Very Low	Relatively Low	Very Low	Very High
2400	2,760	$388,433,724	$1,295,359	9.38	Very Low	Very Low	Relatively Moderate	Very High
2500	3,425	$509,028,306	$3,930,481	16.93	Very Low	Very Low	Relatively Low	Very High
2600	2,083	$1,461,220,486	$146,524	8.48	Relatively Low	Relatively Low	Relatively High	Very High
2700	6,435	$1,079,527,397	$13,680,149	73.56	Relatively Low	Relatively Low	Relatively Low	Very High
2800	4,398	$600,175,168	$12,640,532	72.96	Relatively Low	Relatively Low	Relatively Moderate	Very High
2900	2,981	$597,562,301	$11,422,007	70.07	Very Low	Relatively Low	Relatively Low	Very High
3000	2,160	$1,199,652,114	$12,267,639	69.14	Relatively Low	Relatively Low	Very Low	Very High
3100	2,896	$477,443,572	$7,128,160	36.54	Relatively Low	Very Low	Relatively High	Very High
3200	2,202	$343,618,486	$11,050,347	55.51	Very Low	Very Low	Relatively Moderate	Very High
3300	2,123	$222,175,231	$731,970	5.58	Very Low	Very Low	Very High	Very High
3400	1,992	$581,007,917	$630,650	4.05	Very Low	Very Low	Relatively Low	Very High
3500	2,313	$407,681,946	$229,138	2.04	Very Low	Very Low	Relatively Moderate	Very High
3600	1,973	$463,643,423	$260,474	2.84	Very Low	Very Low	Very High	Very High

Table E1: FEMA NRI Census Tract General Data

Census Tract	Population	Building Value	Agricultural Value	Area	All Hazard Risk Rating	All Hazard EAL	Social Vulnerability Rating	Community Resilience Rating
3700	4,466	$622,523,689	$22,321,861	107.8	Relatively Low	Relatively Low	Relatively Moderate	Very High
3800	4,194	$768,867,187	$14,079,895	58.98	Very Low	Relatively Low	Very Low	Very High
3900	4,311	$875,803,053	$814,513	5.61	Relatively Low	Relatively Low	Relatively Moderate	Very High
4000	4,115	$1,157,917,536	$2,703,720	14.54	Relatively Low	Relatively Low	Relatively High	Very High
4100	2,231	$1,247,406,663	$736	1.18	Relatively Low	Relatively Low	Very High	Very High

Source: FEMA NRI

Table E2: FEMA NRI Identified Hazard Ratings

Census Tract	Drought EAL	Drought Risk Rating	Cold Wave EAL	Cold Wave Risk Rating	Heatwave EAL	Heatwave Risk Rating
200	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate
300	No Expected Annual Losses	No Rating	Relatively Low	Relatively Low	Relatively Low	Relatively Low
500	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Low	Relatively Moderate
600	No Expected Annual Losses	No Rating	Relatively Low	Relatively Moderate	Relatively Low	Relatively Low
700	No Expected Annual Losses	No Rating	Relatively Low	Relatively Moderate	Relatively Low	Relatively Low
800	No Expected Annual Losses	No Rating	Relatively Low	Relatively Low	Relatively Low	Relatively Low
900	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Low	Relatively Low
1000	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate
1100	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate
1200	No Expected Annual Losses	No Rating	Relatively Low	Relatively Low	Relatively Low	Relatively Low
1300	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate
1400	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate
1500	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate
1600	No Expected Annual Losses	No Rating	Relatively Low	Relatively Low	Relatively Low	Relatively Low
1700	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
1801	No Expected Annual Losses	No Rating	Relatively Low	Relatively Low	Relatively Low	Relatively Low
1802	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate
1900	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
2000	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate
2100	No Expected Annual Losses	No Rating	Relatively Low	Relatively Low	Relatively Low	Relatively Low
2200	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Low	Relatively Low
2300	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Low	Relatively Low	Relatively Low
2400	No Expected Annual Losses	No Rating	Relatively Low	Relatively Low	Relatively Low	Relatively Low
2500	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Low	Relatively Low
2600	No Expected Annual Losses	No Rating	Relatively Low	Relatively Low	Relatively Low	Relatively Low
2700	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate
2800	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate
2900	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Low	Relatively Low
3000	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Low	Relatively Low	Relatively Low
3100	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Low	Relatively Low
3200	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Low	Relatively Low
3300	No Expected Annual Losses	No Rating	Relatively Low	Relatively Low	Relatively Low	Relatively Low
3400	No Expected Annual Losses	No Rating	Relatively Low	Relatively Low	Relatively Low	Relatively Low
3500	No Expected Annual Losses	No Rating	Relatively Low	Relatively Low	Relatively Low	Relatively Low
3600	No Expected Annual Losses	No Rating	Relatively Low	Relatively Low	Relatively Low	Relatively Low

Table E2: FEMA NRI Identified Hazard Ratings

Census Tract	Drought EAL	Drought Risk Rating	Cold Wave EAL	Cold Wave Risk Rating	Heatwave EAL	Heatwave Risk Rating
3700	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate
3800	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
3900	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
4000	No Expected Annual Losses	No Rating	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate
4100	No Expected Annual Losses	No Rating	Relatively Low	Relatively Low	Relatively Low	Relatively Low

Source: FEMA NRI

Table E3: FEMA NRI Identified Hazard Ratings

Census Tract	Riverine Flood EAL	Riverine Flood Risk Rating	Hail EAL	Hail Risk Rating	Lightning EAL	Lightning Risk Rating	Strong Wind EAL	Strong Wind Risk Rating
200	Very Low	Very Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
300	Very Low	Very Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively High
500	Very Low	Very Low	Very Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
600	Very Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
700	Relatively Moderate	Relatively Moderate	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
800	Very Low	Very Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
900	No Expected Annual Losses	No Rating	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
1000	Very Low	Very Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
1100	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
1200	Relatively Low	Relatively Low	Very Low	Very Low	Very Low	Relatively Low	Relatively Low	Relatively High
1300	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
1400	No Expected Annual Losses	No Rating	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
1500	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Very High
1600	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Low	Relatively High
1700	Very Low	Very Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
1801	Relatively Low	Relatively Low	Relatively Low	Very Low	Relatively Low	Relatively Low	Relatively Low	Relatively High
1802	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
1900	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Very High
2000	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Very High
2100	Very Low	Very Low	Very Low	Very Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate
2200	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
2300	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
2400	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
2500	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
2600	Very Low	Very Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Very High
2700	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively High	Relatively Moderate	Very High
2800	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
2900	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
3000	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Very High
3100	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
3200	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively High
3300	Very Low	Very Low	Very Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively High
3400	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively High
3500	No Expected Annual Losses	No Rating	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively High
3600	Very Low	Very Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively High
3700	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High
3800	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Very High
3900	Very Low	Very Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Very High
4000	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Relatively Moderate	Relatively Moderate	Very High

Table E3: FEMA NRI Identified Hazard Ratings

Census Tract	Riverine Flood EAL	Riverine Flood Risk Rating	Hail EAL	Hail Risk Rating	Lightning EAL	Lightning Risk Rating	Strong Wind EAL	Strong Wind Risk Rating
4100	Relatively Moderate	Relatively Moderate	Relatively Low	Relatively Low	Relatively Moderate	Relatively Low	Relatively Moderate	Very High

Source: FEMA NRI

Table E4: FEMA NRI Identified Hazard Ratings

Census Tract	Ice Storm EAL	Ice Storm Risk Rating	Winter Weather EAL	Winter Weather Rating	Tornado EAL	Tornado Risk Rating
200	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively High	Relatively Low
300	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
500	Very Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate	Very Low
600	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
700	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High	Relatively High	Relatively Low
800	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
900	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High	Relatively High	Relatively Low
1000	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
1100	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively High	Relatively Low
1200	Very Low	Relatively Moderate	Relatively Low	Relatively Moderate	Relatively Low	Very Low
1300	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High	Relatively High	Relatively Low
1400	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively High	Relatively Low
1500	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High	Relatively High	Relatively Low
1600	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
1700	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
1801	Relatively Low	Relatively Moderate	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Low
1802	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively High	Relatively Low
1900	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High	Relatively High	Relatively Low
2000	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High	Relatively High	Relatively Low
2100	Very Low	Relatively Low	Relatively Low	Relatively Low	Relatively Low	Very Low
2200	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
2300	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
2400	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
2500	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
2600	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High	Relatively High	Relatively Low
2700	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High	Relatively High	Relatively Low
2800	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
2900	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
3000	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High	Relatively Moderate	Relatively Low
3100	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
3200	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
3300	Very Low	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Very Low
3400	Relatively Low	Relatively Moderate	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Low
3500	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
3600	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Moderate	Relatively Low
3700	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High	Relatively Moderate	Relatively Low

Table E4: FEMA NRI Identified Hazard Ratings

Census Tract	Ice Storm EAL	Ice Storm Risk Rating	Winter Weather EAL	Winter Weather Rating	Tornado EAL	Tornado Risk Rating
3800	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High	Relatively Moderate	Relatively Low
3900	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High	Relatively High	Relatively Low
4000	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High	Relatively High	Relatively Low
4100	Relatively Low	Relatively Moderate	Relatively Moderate	Relatively High	Relatively High	Relatively Low

Source: FEMA NRI