RESOLUTION 24-261

A RESOLUTION OF THE CITY OF SPRING HILL TO ADOPT THE 2024 WILLIAMSON COUNTY NATURAL HAZARD MITIGATION PLAN

WHEREAS, the participating jurisdictions of Williamson County have worked together to develop a strategy known as the Multi-Hazard Mitigation Plan to improve disaster resistance in the planning area; and

WHEREAS, the Federal Disaster Mitigation Act of 2000 (DMA2000) pursuant 44 CFR Part 201 and the Federal Emergency Management Agency (FEMA) require communities to adopt an approved hazard mitigation plan in order to be eligible to receive pre-disaster and post-disaster federal funding for mitigation purposes; and

WHEREAS, the participating jurisdiction has participated in the hazard mitigation plan by the formation of a Multi-Hazard Mitigation Planning Committee (MHMPC); and

WHEREAS, the MHMPC recommends the formal adoption of the Williamson County Multi-Hazard Mitigation Plan dated 10/16/2024 by the passing of this resolution; and

NOW, THEREFORE, BE IT RESOLVED by the Board of Mayor and Alderman of the City of Spring Hill, Tennessee, in the regular session assembled, that:

Section 1: The Board of Mayor and Alderman of the City of Spring Hill, Tennessee, hereby approves and adopts the updated Multi-Hazard Mitigation Plan in its entirety with projects as adopted by the MHMPC; and agrees to be governed by the Multi-Hazard Mitigation Plan dated 10/16/2024 attached hereto and incorporated.

Section 2: The Board of Mayor and Alderman of the City of Spring Hill, Tennessee, authorizes the appropriate participating officials to pursue funding opportunities for the implementation of proposals designated therein; and will, upon receipt of such funding or other necessary resources, seek to implement the actions contained in the hazard mitigation plan.

Section 3: The Board of Mayor and Alderman of the City of Spring Hill, Tennessee, will continue to cooperate and participate in the hazard mitigation planning process, holding regular meetings, including reporting progress as required by FEMA, the Tennessee Emergency Management Agency (TEMA), and the MHMPC.

Adopted this 4th day of November, 2024.

Jim Hagaman, Mayor

ATTEST:

April Goad, City Recorder

LEGAL FORM APPROVED:

Patrick Carter, City Attorney

City of SPRING HILL TENNESSEE

STAFF MEMORANDUM

TO: Board of Mayor and Alderman

FROM: Greg Boyd, EMA Director

DATE: November 1, 2024

RE: Resolution 24-261 Williamson Hazard Mitigation Plan

PURPOSE:
The City approves our partner county Hazard Mitigation Plans to ensure that specific vulnerabilities are addressed within the county frameworks. FEMA requires this local buy-in for cities to be eligible for federal funding and grants.

BACKGROUND:
Historically, approving Hazard Mitigation Plans for two counties has involved a collaborative process where each county identifies hazards specific to its geography, infrastructure, and population needs. This practice of intergovernmental cooperation ensures the City is better prepared and can access FEMA funding, creating a unified approach to reducing disaster impacts.

DESCRIPTIONS
A Hazard Mitigation Plan is a document required by FEMA that identifies natural hazards, assesses vulnerabilities, and outlines strategies to reduce or eliminate long-term risk to people and property. The plan is essential for communities to receive federal funding and assistance.

FINANCIAL IMPACT:
The adoption of the provided plan does not carry with it any required expenditures.

RECOMMENDATION:
Staff recommends that the Board of Mayor and Aldermen approve Resolution 24-261 as presented.
Reviewed and Approved by:
Greg Boyd
Graig Temple
Don Brite
Chris Dugan

CITY OF SPRING HILL TENNESSEE
OFFICE OF THE CITY ADMINISTRATOR
199 Town Center Parkway • Spring Hill, Tennessee 37174
931-486-2252, ext 215
www.springhilltn.org

Williamson County
Hazard Mitigation Plan
2024

Prepared By:

The Williamson County Hazard Mitigation Planning Committee

The Williamson County Emergency Management Agency

Assistance Provided By:

The Tennessee Emergency Management Agency

as part of the Tennessee Mitigation Initiative

Executive Summary

Over the past two decades, hazard mitigation has gained increased national attention due to the large number of natural disasters throughout the U.S. and the rapid rise in costs associated with those disaster recoveries. It has become apparent that money spent mitigating potential impacts of a disaster event can result in substantial savings of life and property. With these benefit-cost ratios extremely advantageous, the *Disaster Mitigation Act of 2000* was developed as U.S. Federal legislation reinforcing the importance of pre-disaster mitigation planning by calling for local governments to develop mitigation plans *(44 CFR 201)*.

A local hazard mitigation plan aims to identify the community's notable risks and specific vulnerabilities and then to create/implement corresponding mitigation projects to address those areas of concern. This methodology helps reduce human, environmental, and economic costs from natural and man-made hazards by creating long-term mitigation initiatives.

The advantages of developing a local hazard mitigation plan are numerous and include improved post-disaster decision-making, education on mitigation approaches, and an organizational method for prioritizing mitigation projects. Communities with a mitigation plan receive larger amounts of Federal and State funding opportunities for mitigation projects and can receive these funds faster than communities without a plan.

This 2024 update of the *Williamson County Hazard Mitigation Plan* (HMP) addresses Building Resilient Communities and Infrastructure (BRIC), Flood Mitigation Assistance (FMA), and Hazard Mitigation Grant Program (HMGP) requirements. Each jurisdiction within the county participated in the preparation of the update, including:

- City of Brentwood
- City of Fairview
- City of Franklin
- City of Spring Hill
- Town of Nolensville
- Town of Thompson Station
- Williamson County School District/Franklin Special School District
- Williamson County Unincorporated

In reference to federal code title *44 CFR 201*, the plan is required to be submitted to both the Tennessee Emergency Management Agency (TEMA) (State) and the Federal Emergency Management Agency (FEMA) (Federal) for review to be approved. When the plan is deemed "approval pending adoption" by FEMA *(44 CFR 201.6(c)5)*, each of the participating jurisdictions will adopt the plan through a local resolution.

EMAP Standard: EMAP Compliance The Williamson County Emergency Management Agency (WCEMA) continues to pursue the highest standards in the emergency management profession through seeking accreditation with the Emergency Management Accreditation Program (EMAP). All plans, policies, and procedures within the WCEMA are to be written in accordance with the EMAP Emergency Management Standard (EMS) 5-2022.

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Section One: The Planning Process

1.1 Purpose and Need, Authority and Statement of Problem

1.1.1 Purpose and Need

FEMA defines "hazard mitigation" as any sustained action taken to reduce or eliminate the long-term risk to life and property from a hazard event. Hazard mitigation planning is the process through which hazards are identified, likely impacts determined, mitigation goals set, and appropriate mitigation strategies defined, prioritized, and implemented. The HMP aims to identify, assess, and mitigate risk to better protect the people and property of Williamson County from the effects of natural hazards. This HMP documents the hazard mitigation planning process and identifies relevant hazards, vulnerabilities, and strategies the County and incorporated jurisdictions will use to decrease vulnerability and increase resiliency and sustainability. Additionally, this HMP demonstrates the participating communities' commitment to reducing risks from identified hazards and serves as a tool to help decision-makers direct mitigation activities and resources.

1.1.2 Authority

This Hazard Mitigation Plan will be adopted by Williamson County and all participating jurisdictions in accordance with the authority granted to local communities by the State of Tennessee. This Plan was and will be updated per state and federal rules and regulations governing local hazard mitigation plans. The Plan shall be reviewed annually and go through a complete update process every five years to remain eligible for hazard mitigation grants. The following legislation was used for guidance:

I. Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act or the Act), 42 U.S.C. 5165, enacted under Section 104 of the Disaster Mitigation Act of 2000 (DMA 2000) Public Law 106-390 of October 30, 2000, as implemented at 44 CFR 201.6 and 201.7 dated October 2011.

II. Tennessee Code Annotated
    a. T.C.A. 58-2-106(b)(16)
    b. T.C.A. 58-2-106(b)(1)
    c. T.C.A. 58-2-103(a)(5)

1.1.3 Statement of Problem

Each year in the United States, natural disasters take the lives of hundreds of people and injure thousands more. Taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. Unfortunately, this only partially reflects the cost of disasters because additional expenses incurred by insurance companies and non-governmental organizations are not reimbursed by tax dollars. Many natural disasters are predictable, and much of the damage caused by these events can be reduced or even eliminated.

Technological and human caused threats do pose a risk to the Williamson County people also. However, mitigation grants such as the HMGP, BRIC, and FMA do not cover these threats. As such, threat risks are assessed in the local risk assessment and will be considered for inclusion in the local prevention plan.

The original Williamson County Hazard Mitigation Plan was created and approved by FEMA in 2019. Per federal requirements stated in *44 CFR 201*, all local hazard mitigation plans are required to go through a FEMA approval process every five years to remain eligible for hazard mitigation grants. This plan will be re-evaluated and updated every five years to ensure local governments are continuing to assess the hazards and risks within their communities. This plan update has been prepared to meet requirements set forth by FEMA and the Tennessee Emergency Management Agency (TEMA) to ensure Williamson County is eligible for funding and technical assistance from state and federal hazard mitigation programs. All communities are welcome to address man-made hazards and risks in their hazard mitigation plan. However, it's important to note that the State and Federal governments only evaluate and approve based on natural hazards only as per federal code title 44 CFR 201.

1.2 Methodology, Update Process, and Participation Summary

This Hazard Mitigation Plan was developed under the guidance of a Hazard Mitigation Planning Committee (HMPC). The Committee included representatives of Williamson County, the City of Brentwood, the City of Fairview, the City of Franklin, the Town of Nolensville, the City of Spring Hill, the Town of Thompson's Station, and the Williamson County School District, and the Franklin Special School District.

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to communities and their residents by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruptions. This plan identifies activities that can be undertaken by both the public and the private sectors to reduce risk to safety, health, and property caused by natural and man-made hazards.

1.2.1 Local Government Participation

The planning regulations and guidance stress that each local government seeking FEMA approval of their mitigation plan must participate in the planning effort in the following ways:

- Participate in the process as part of the HMPC;
- Detail where within the planning area the risk differs from that facing the entire area;
- Identify potential mitigation actions; and
- Formally adopt the plan.

The role of additional participants may include more actions. For membership in the HMPC, "participation" means the following:

- Providing facilities for meetings;
- Attending and participating in the HMPC meetings;
- Collecting and providing other requested data (as available);
- Identifying mitigation actions for the plan;
- Reviewing and providing comments on plan drafts;
- Informing the public, local officials, and other interested parties about the planning process and providing opportunities for them to comment on the plan;
- Coordinating, and participating in the public input process; and

The HMPC met all the above-stated participation requirements. Williamson County and all its incorporated jurisdictions participated in the 2024 Plan update, as well as reviewed and provided timely comments on all draft components of the Plan. A summary of past and current community participation is shown below in *Table 1*. All participants were invited to this committee via email by the Williamson County Emergency Management Agency (WCEMA) Hazard Mitigation Planner under the authority granted by the County Emergency Management Director. With each meeting, initial attendees who had not initially responded were contacted once more to ensure participation in the planning process. All municipalities within Williamson County were active participants in the planning process and contributed mitigation projects to this plan as well as participated in the creation of the multi-jurisdictional projects list.

Table 1: Multi-Jurisdictional HMPC Participation

Jurisdiction	2017 Participation	2024 Participation
City of Brentwood	YES	YES
City of Fairview	YES	YES
City of Franklin	YES	YES
City of Spring Hill	YES	YES
Franklin Special School District	YES	YES
Town of Nolensville	YES	YES
Town of Thompson's Station	YES	YES
Williamson County School District	YES	YES
Williamson County	YES	YES

The HMPC for the 2024 plan update included key community representatives. *Table 2* details the HMPC members, meeting dates, associated FEMA Lifeline, and committee member attendance. FEMA Lifelines are a fundamental way for a community to recover, however, all participants might not be associated with a FEMA Lifeline. If they are not associated with a FEMA Lifeline, then they will be indicated as not applicable (NA).

The local Hazard Mitigation Planner under the authority of the Emergency Management Director invited individuals who represented regional and local agencies that have authority in regulating county/city development, individuals that represent vulnerable populations, as well as those that are responsible for responding to the identified hazards of prime concern. These partners include jurisdictional police, fire, public works, and health departments, community representatives, nonprofit organizations, local floodplain administration, the county/city school boards, elected officials, and electric utility companies. All committee members provided key information to recognize and mitigate hazards of prime community concern. A more detailed summary of HMPC meeting dates, members seeking approval and FEMA lifeline association follows in *Table 2*. Meeting sign-in sheets or proof of attendance are included in Appendix A. Although not all of these members were able to attend the HMPC meetings, they were instrumental in providing assistance and were active throughout the planning process.

Appendix F contains a list of references including the various agencies and other sources utilized during this planning process to ensure a more wholistic assessment of the hazards and goals of the community.

Table 2: HMPC Members

Name	Title	Associated FEMA Lifeline	Organization/ Jurisdiction	Meeting Dates							
				03/30/2023	04/26/2023	05/08/2023	06/19/2023	01/03/2024	01/04/2024	01/05/2024	01/08/2024
Sean Cothron	IT Director	Communications	Williamson County								
Jeff Stark	Planning & Training Exercise Coordinator	Communications	Metro-Nashville Davidson County								YES
Donny Parker	Senior Safety & Training Coordinator	Energy	Middle Tennessee Electric					YES		YES	YES
Mac Nolen	Director of Solid Waste	Hazardous Materials & Transportation	Williamson County			YES		YES		YES	YES
Cathy Montgomery	Health Department Director	Health & Medical and Food, Hydration, & Shelter	Williamson County					YES		YES	YES
John Walsh	President	Health and Medical	Emergency Awareness and Readiness Service for the Deaf and Hard of Hearing (EARS)		YES	YES				YES	

Table 2: HMPC Members

Name	Title	Associated FEMA Lifeline	Organization/ Jurisdiction	Meeting Dates							
				03/30/2023	04/26/2023	05/08/2023	06/19/2023	01/03/2024	01/04/2024	01/05/2024	01/08/2024
Greg Boyd	Emergency Management Director	Safety & Security	City of Spring Hill	YES	YES	YES					YES
Scott Williar	Emergency Management Coordinator	Safety & Security	City of Franklin		YES						
Gino Fantoni	Emergency Management Specialist	Safety & Security	City of Franklin	YES				YES		YES	YES
Jessica Stewart	Emergency Communications Operations Manager	Safety & Security	Williamson County					YES			
Todd Hoppenstedt	Public Works Director	Safety & Security and Transportation	City of Brentwood	YES							
Russell Peterson	Emergency Management Continuity Program Manager	Safety & Security	City of Brentwood	YES	YES	YES		YES		YES	YES

Table 2: HMPC Members

Name	Title	Associated FEMA Lifeline	Organization/ Jurisdiction	Meeting Dates							
				03/30/2023	04/26/2023	05/08/2023	06/19/2023	01/03/2024	01/04/2024	01/05/2024	01/08/2024
Scott Hughes	Fire Chief	Safety & Security	City of Fairview	YES							
Clint Derryberry	Planner	Safety & Security	Maury County			YES					
Ken McLawhon	Town Administrator	Safety & Security	Town of Thompson's Station		YES						
Brian Goss	Fire Chief	Safety & Security	City of Brentwood					YES			
Celby Glass	Supervisor of Attendance and Safety	Safety & Security	Franklin Special School District								
Marc Waltz	Fire & Emergency Coordinator	Safety & Security	Williamson County School District					YES			

Table 2: HMPC Members

Name	Title	Associated FEMA Lifeline	Organization/ Jurisdiction	Meeting Dates							
				03/30/2023	04/26/2023	05/08/2023	06/19/2023	01/03/2024	01/04/2024	01/05/2024	01/08/2024
Sam Killingsworth	Fire Captain	Safety & Security	Town of Nolensville		YES						
Kristen Corn	City Attorney	Safety & Security	City of Brentwood								
James Colvin	Assistant Police Chief	Safety & Security	City of Brentwood					YES			
Mark Elrod	Sheriff	Safety & Security	Williamson County								
Heidi Mariscal	Planning, Training, & Exercise Coordinator	Safety & Security	Metro-Nashville Davidson County								
Kim Anthony	Emergency Management Planning Manager	Safety & Security	State of Tennessee								

Table 2: HMPC Members

Name	Title	Associated FEMA Lifeline	Organization/ Jurisdiction	Meeting Dates							
				03/30/2023	04/26/2023	05/08/2023	06/19/2023	01/03/2024	01/04/2024	01/05/2024	01/08/2024
Jack Casner	District Coordinator	Safety & Security	State of Tennessee		YES						
Don Sowers	Tennessee State CERT Coordinator	Safety & Security	State of Tennessee								
Carey Clark	Grants Program Manager	Safety & Security	Rutherford County								
Amanda Siegel	Emergency Management Director	Safety & Security	Hickman County								
Jay Bonson	Fire Coordinator	Safety & Security	Williamson County							YES	
Mark King	Assistant Chief	Safety & Security	Williamson County					YES			

Table 2: HMPC Members

Name	Title	Associated FEMA Lifeline	Organization/ Jurisdiction	Meeting Dates							
				03/30/2023	04/26/2023	05/08/2023	06/19/2023	01/03/2024	01/04/2024	01/05/2024	01/08/2024
Katy Clouse	Executive Director of the Arc of Williamson County	Safety & Security and Food, Hydration, and Shelter	Williamson County					YES		YES	
Hanna Dennis	Field Supervisor for the TN Department of Human Services Sensory Division	Safety & Security	Williamson County								
Devon Russell	Parks and Recreation Event Manager	Safety & Security	Williamson County								
Matthew Lupo	Fire Marshal & Assistant Fire Chief	Safety & Security	Town of Nolensville					YES			YES
Dallas Clements	Emergency Management Reservist	Safety & Security	Williamson County								YES
Ed Hudgens	Emergency Management Reservist	Safety & Security	Williamson County								YES

Table 2: HMPC Members

Name	Title	Associated FEMA Lifeline	Organization/ Jurisdiction	Meeting Dates							
				03/30/2023	04/26/2023	05/08/2023	06/19/2023	01/03/2024	01/04/2024	01/05/2024	01/08/2024
Jeff Standifer	Emergency Management Reservist	Safety & Security	Williamson County					YES			
Phil Sherrod	Emergency Management Reservist	Safety & Security	Williamson County					YES		YES	
James Hooper	Emergency Management Reservist	Safety & Security	Williamson County					YES	YES		
Gene Cheathem	Emergency Management Reservist	Safety & Security	Williamson County					YES		YES	YES
Jill Burgin	Emergency Management External Affairs Officer	Safety & Security	Williamson County	YES	YES				YES		
Andrew Gossett	Emergency Management Reservist	Safety & Security	Williamson County						YES		

Table 2: HMPC Members

Name	Title	Associated FEMA Lifeline	Organization/ Jurisdiction	Meeting Dates							
				03/30/2023	04/26/2023	05/08/2023	06/19/2023	01/03/2024	01/04/2024	01/05/2024	01/08/2024
Joshua Walter	Emergency Management Operations Manager	Safety & Security	Williamson County					YES	YES		YES
Todd Horton	Director of Emergency Management	Safety & Security	Williamson County		YES	YES					
Nicholas Sturgeon	Emergency Management Officer	Safety & Security	Williamson County	YES	YES	YES		YES	YES	YES	YES
Ashlae Sympson	Emergency Management Officer	Safety & Security	Williamson County		YES				YES		
Tyler Scroggins	Public Works Director	Transportation	City of Spring Hill								
Bob Leeman	Planning & Codes Director	Water Systems	City of Brentwood	YES				YES		YES	

Table 2: HMPC Members

Name	Title	Associated FEMA Lifeline	Organization/ Jurisdiction	Meeting Dates							
				03/30/2023	04/26/2023	05/08/2023	06/19/2023	01/03/2024	01/04/2024	01/05/2024	01/08/2024
Mario Forgione	Development Compliance Specialist	Water Systems	Williamson County			YES		YES		YES	YES
Floyd Heflin	NFIP Coordinator & County Engineer	Water Systems	Williamson County								
Nicholas Parks	Stormwater Compliance Specialist	Water Systems	Williamson County								
Mekayle Houghton	Executive Director of the Cumberland River Compact	Water Systems	Williamson County								YES
Paul Tampien	Williamson County ARES	Communications	Williamson County		YES						
Erin Jakuboski	Williamson County Department of Emergency Communications	Communications	Williamson County		YES						

Table 2: HMPC Members

Name	Title	Associated FEMA Lifeline	Organization/ Jurisdiction	Meeting Dates							
				03/30/2023	04/26/2023	05/08/2023	06/19/2023	01/03/2024	01/04/2024	01/05/2024	01/08/2024
Bill Jorgensen	Williamson County Office of Public Safety	Communications and Safety & Security	Williamson County		YES						

1.2.2 Hazard Mitigation Planning Process

The 2024 Williamson County Hazard Mitigation Plan was updated following guidance put forth by FEMA in the *Local Mitigation Planning Policy Guide* which became effective on April 19, 2023. This guidance emphasized the need for a whole community planning approach to include representatives from all sectors of the community with an emphasis on the increased need for vulnerable and underserved population representation. The guidance also highlighted the increased emphasis on risk, vulnerability, and resilience assessments, the inclusion of high-hazard dams, and future weather trends/patterns.

FEMA guidance proposes a structured four-phase approach to completing an HMP as follows:

1) Planning Process
2) Risk Assessment
3) Mitigation Strategy
4) Plan Maintenance

Phase I - Planning Process

Organize to Prepare the Plan

The planning process officially began with a meeting held on 03/30/2023 at the Williamson County Public Safety Center. The meeting covered the scope of hazard mitigation, the purpose of planning, eligible grants, risk assessments and vulnerabilities impacting the community. During the planning process, the committee communicated through face-to-face meetings, email, and telephone conversations.

The City of Spring Hill is in both Williamson County and Maury County. As such, the Maury County Emergency Management Agency was invited to participate and attended meetings throughout the planning process. The other surrounding counties were sent drafts of the HMP so that they could contribute to the plan and were invited to the Hazard Mitigation Planning Committee (HMPC) meetings. Members from both the Nashville-Metro Davidson County Office of Emergency Management and the Maury County Emergency Management Agency opted to attend at least one HMPC meeting. All other surrounding jurisdictions opted not to participate.

Involve the Public

Early discussions established the significance of involving the public. The HMPC agreed to an approach using established public information mechanisms and resources within the community. Public involvement activities for this plan update included public meeting notices in flyer form, stakeholder and public meetings, and the collection of public and stakeholder comments on the draft plan. In order to ensure socially vulnerable and underserved populations were included in organizing efforts, the WCEMA contacted organizations that had roots within the community such as neighborhood shopping stores (Ex. Kroger, Costco, Tractor Supply, etc.) and the Emergency Awareness and Readiness Services (EARS) – for the Deaf and Hard of Hearing. The WCEMA also contacted the local Chamber of Commerce to offer an opportunity to participate in the planning process. Due to the nature of the public meetings; neighboring communities, agencies, utilities, academia, civic organizations, and other interested parties were given the opportunity to participate.

Numerous notices were shared on April 8th, 2023, at the monthly Williamson County Amateur Radio Emergency Service (WCARES) meeting. These notices invited the group as a whole to

attend and those invited were given a chance to discuss the plan with the responsible individual at the WCEMA. These notices provided as flyers invited members of the group to attend the April 26th, 2023 Hazard Mitigation Plan Public meeting. In addition to dispersing these flyers at the monthly WCARES meeting, these flyers were placed strategically around the county in places such as grocery stores, parks, libraries, and in neighborhoods. To ensure the greatest representation of the Williamson County citizenry, planners utilized the FEMA Resilience Analysis and Planning Tool (RAPT) to identify areas of priority for publishing flyers. Finally, the WCEMA Hazard Mitigation Planner and External Affairs Officer both spoke on mitigation and notified the public of the public meeting on the local WAKM 950 AM radio. This channel covers the entirety of Williamson County and covers or partially covers 22 middle-Tennessee counties. Documentation to support outreach efforts such as emails, community flyers, and social media postings can be found in Appendix A.

In addition to the public meeting held on 04/26/2023, the emergency management representative with the Town of Nolensville held an additional public mitigation meeting on 06/19/2023. Although similar outreach efforts were made to the public, nobody participated from the public. Documentation to support outreach efforts for this meeting such as emails, community flyers, and social media postings can be found in Appendix A.

Sign-in sheets from all meetings are included in Appendix A. The meeting date and topics discussed are summarized below in *Table 3*. The meetings on 04/26/2023, 06/19/2023, and 01/04/2024 (virtual) were open to the public and announced via papers across the county.

Table 3: Summary of Hazard Mitigation Planning Meetings

Meeting Number	Meeting Topic	Meeting Date	Meeting Location
Meeting #1 (HMPC)	Overview of hazard mitigation	03/30/2023	Williamson County Public Safety Center – 304 Beasley Drive, Franklin TN, 37064
	Hazard Mitigation Planning Process		
	Purpose of the HMP		
	Area growth and changes		
	Identification of Hazards		
	Future weather predictions		
	Assessment of risk, vulnerabilities, resilience		
	Review of NFIP		
	Previous HMP goals/projects		
	New goals/projects		

Meeting Number	Meeting Topic	Meeting Date	Meeting Location
Meeting #2 (Public)	Overview of hazard mitigation.	04/26/2023	
	Hazard mitigation planning process		
	Area growth and changes		
	Assessment of risk and vulnerabilities		
Meeting #3 (HMPC)	Recap of mitigation concepts	05/08/2023	
	Introduction of mitigation project requirements		
	Recap of natural hazards and the Williamson County Threat and Hazard Identification and Risk Assessment (THIRA).		
	Recommendations for applicable mitigation projects		
	Next steps for later meetings		
Meeting #4 (Public)	Overview of hazard mitigation	06/19/2023	Town of Nolensville Meeting Room – 7218 Nolensville Road, Nolensville TN, 37135
	Hazard Mitigation Planning Process		
	Purpose of the HMP		
	Area growth and changes		
	Identification of Hazards		
	Future weather predictions		
	Assessment of risk, vulnerabilities,		

Meeting Number	Meeting Topic	Meeting Date	Meeting Location
	resilience		
	Review of NFIP		
	Previous HMP goals/projects		
	New goals/projects		
Meeting #5 (HMPC)	Hazard mitigation overview	01/03/2024	This meeting was held virtually via WebEx.
	Hazard mitigation planning process		
	Purpose of the Hazard Mitigation Plan (HMP)		
	Area growth and changes		
Meeting #6 (Public)	Overview of hazard mitigation	01/04/2024	This meeting was held virtually via WebEx.
	Hazard Mitigation Planning Process		
	Purpose of the HMP		
	Area growth and changes		
	Identification of Hazards		
	Future weather predictions		
	Assessment of risk, vulnerabilities, resilience		
	Review of NFIP		
	Previous HMP goals/projects		
	New goals/projects		
Meeting #7 (HMPC)	Identification of hazards/threats {Review of Threat and Hazard Identification and Risk	01/05/2024	This meeting was held virtually via WebEx.

Meeting Number	Meeting Topic	Meeting Date	Meeting Location
	Assessment (THIRA)}		
	Future weather predictions from East Tennessee State University (ETSU)		
	Assessment of risk, vulnerabilities, and resilience		
Meeting #8 (HMPC)	Review of the National Flood Insurance Program (NFIP)	01/08/2024	This meeting was held virtually via WebEx.
	Previous HMP goals/projects		
	New goals/projects		

Coordination

Early in the planning process, the committee determined that the risk assessment, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local and state partners to participate in the process. The coordination involved contacting these agencies through email, flyers, in-person, and phone conversations. All groups and agencies were advised on how to become involved in the plan development process and were solicited asking for their assistance and input. A summary of agencies and organizations actively involved in the HMPC is as follows:

- City of Brentwood
- City of Fairview
- City of Franklin
- City of Spring Hill
- Emergency Awareness and Readiness Service (EARS) – for the Deaf and Hard of Hearing
- Tennessee Cumberland River Compact
- Tennessee Department of Human Services Sensory Division
- Tennessee Emergency Management Agency (TEMA)
- The Arc of Williamson County
- The Franklin Special School District
- Town of Nolensville
- Town of Thompson’s Station
- Volunteer Tennessee
- Williamson County
- Williamson County School District

Coordination with other community planning efforts was also paramount to the success of this plan. Mitigation planning involves identifying existing policies, tools, and actions that will

reduce a community's risk and vulnerability to hazards. Williamson County uses a variety of planning mechanisms such as land development regulations and ordinances to guide growth and development. Integrating existing planning efforts, mitigation policies, and action strategies into this plan establishes a credible and comprehensive plan that ties into and supports other community programs.

Table 4 identifies the existing planning mechanisms that were reviewed and how they were incorporated into the 2024 Hazard Mitigation Plan Update.

Table: 4 Planning Mechanism Review

Existing Planning Mechanisms	Reviewed? (Yes/No)	Method of Use in Hazard Mitigation Plan
State Hazard Mitigation Plan	Yes	Identifying hazards, assessing vulnerabilities, and mitigation strategies
Local Emergency Operations Plan	Yes	Identify major capabilities
Community Data Profile	Yes	Development trends, capability assessment
Stormwater Ordinance	Yes	Capability assessment, mitigation strategies
Building and Zoning Codes and Ordinances	Yes	Different years of code regulations utilized in different jurisdictions
CDC Social Vulnerability Index	Yes	Analyze vulnerable populations in jurisdictions
FEMA's National Risk Index	Yes	Analyze natural hazard risk within each jurisdiction
Land Use Maps	Yes	Assessing vulnerabilities, development trends, and mitigation strategies
Critical2TN Infrastructure Database	Yes	Assessing vulnerabilities, mitigation strategies
NOAA Archives	Yes	Analyze weather data and trends
ETSU Geoinformatics & Disaster Science Lab	Yes	Analyze future weather trends and patterns
U.S. Census Bureau	Yes	Analyze community demographic data and trends
Local County Hazard Mitigation Plan	Yes	Analyze previous plan for updates
Flood Insurance Rate Maps	Yes	Analyze flood-prone areas within the community
Budget Hearings	Yes	Financial budgeting

These and other documents were reviewed and considered, as appropriate, during the collection of hazard identification, vulnerability assessment, and capability assessment. Data from these plans and ordinances were incorporated into the risk assessment and hazard vulnerability sections of the plan as appropriate. The data was also used in determining the capability of the community in being able to implement certain mitigation strategies.

Phase II – Risk Assessment

Identify the Hazard, Assess the Risk and Vulnerabilities

The committee completed a comprehensive effort to identify/update, document, and profile all hazards that have, or could have, an impact on the community. The committee also conducted a capability assessment to review and document the planning area's current capabilities and gaps. By collecting information about existing government programs, policies, regulations, ordinances, and emergency plans, the committee could assess the activities and measures already in place that contribute to mitigating some of the risks and vulnerabilities identified. A more detailed description of the risk assessment process and the results are included in Chapter 2 Risk and Vulnerability Assessment as well as within the *2023 Williamson County Emergency Management Agency Threat and Hazard Identification and Risk Assessment (THIRA) (094-C-2023).*

Phase III – Mitigation Strategy

Set Goals and Review Actions

The HMPC meetings and various public meetings facilitated brainstorming and discussion sessions that described the purpose and process of developing planning goals and objectives, a comprehensive range of mitigation alternatives, and a method of selecting and defending recommended mitigation actions using a series of selection criteria. This information is included in Chapter 3 Mitigation Strategy.

Draft an Action Plan

A complete first draft of the plan was prepared based on information and input collected during the HMPC meetings, and various agencies and individuals were invited to comment on this draft. Public and agency comments were integrated into the final draft for TEMA and FEMA Region IV to review and approve, contingent upon final adoption by Williamson County.

Phase IV – Plan Maintenance

Adopt the Plan

To secure buy-in and officially implement the plan, the plan was reviewed and adopted by the appropriate governing bodies.

Implement, Evaluate, and Revise the Plan

Implementation and maintenance of the plan is critical to the overall success of hazard mitigation planning and actions. Chapter 4 Plan Integration and Maintenance discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

1.3 Plan Update

The 2024 Williamson County Hazard Mitigation Plan contained a threat and hazard identification and risk assessment for all jurisdictions and a corresponding action list aimed at

mitigating risk. The information in this risk assessment primarily comes from the *2023 Williamson County Emergency Management Agency Threat and Hazard Identification and Risk Assessment (THIRA) (094-C-2023)* which the whole of the HMPC approved in the early mitigation meetings. Since that time, progress has been made by both the County and incorporated jurisdictions on the implementation of the mitigation strategy with 16 completed actions and 33 in progress. This chapter includes an overview of the approach to updating the plan and identifies new analyses and information included in this plan update.

1.3.1 The New Plan

The updated plan involved a comprehensive review and revision of each section of the 2017 HMP and included an assessment of the success of the County and the incorporated jurisdictions in evaluating, monitoring, and implementing the mitigation strategy outlined therein. Only the information and data still valid from the 2017 HMP was carried forward as applicable in this update. The following requirements were addressed during this plan update process with consideration of the priorities and goals of the HMPC:

- Consider changes in vulnerability due to action implementation;
- Document success stories where mitigation efforts have proven effective;
- Document areas where mitigation actions were not effective;
- Document any new hazards that may arise or were previously overlooked;
- Document NFIP as related to the county and jurisdictions;
- Incorporate new data or studies on hazards and risks;
- Incorporate new data related to future climate patterns and trends;
- Incorporate new capabilities or changes in capabilities;
- Incorporate social vulnerability data and vulnerable population information;
- Incorporate growth and development-related changes to inventories; and
- Incorporate new action recommendations or changes in action prioritization;
- Enhanced public outreach and multi-agency coordination efforts.

1.3.2 2017 HMP Strategy Review

During the 2017 update of the Williamson County Hazard Mitigation Plan, the HMPC identified 81 actions as relevant to the county. Of these 81 actions, 16 have been completed, 33 are in progress, and 32 have not been started. Actions that had not been pursued were discussed for relevance to the new plan and were either carried over to the 2024 plan or deleted from the strategy. 41 of these projects were determined to still be viable and are carried over or revised in this plan update. Details and the status of all previous actions are in *Table 5.*

The mitigation planning process that occurred in 2023 and 2024 included a review of the prior HMP that was submitted to and approved by FEMA. This review primarily looked at the risks that were identified to form the initial basis for the risk assessment process. As stated earlier, the plan was also used to perform an update on previously submitted mitigation actions. However, not all components of the plan were revised or carried over to the new plan as the plan update intends to incorporate more vulnerable populations, climate trends, public and stakeholder involvement, and more thorough risk assessments. Many of the positions and people from the previous plan were incorporated to continue bringing experienced individuals into the planning process. However, the HMPC was expanded to include a more diverse basis of individuals who contributed to the overall planning effort.

Table 5: Mitigation Action Progress Summary (2017 Plan)

Project Number in 2017 HMP	Action Description	Responsible Dept.	Location	Current Status			2024 Plan Update		Funding Source				Priority Score	Est. Cost	New or Existing Infra-structure
				Complete	In-Progress	Not yet Started	Delete Action	Carry Forward or Revise	HMGP	BRIC[1]	FMA	Local			
Flooding															
1	Purchase 5 properties located in the floodway/floodplain.	City of Franklin	Citywide in floodway/ floodplain	X			X						NA	NA	NA
3	Participation in the NFIP and CRS with initial FIRMS dated November 1981; Updates in 1989, 1993, 2003, 2006, and 2016.	Williamson County Government	County-wide		X			X				X	14	$1,500	Both
6	Convert three manual stream gauges to automated/monitored.	City of Brentwood	Citywide	X								X	13	$60,000	New
8	Enforcement of updated floodplain regulation.	Town of Thompson's Station Planning & Zoning	1110 Fountain View Blvd, Thompson ’s Station TN, 37179		X			X	X			X	12	$5,000	Both
12	Continuous cleaning of drainage ditches and drainage way to help alleviate flooding.	City of Spring Hill	Citywide		X			X				X	11	$100,000	Pre-Existing

[1] BRIC previously referred to as PDM in the 2017 Hazard Mitigation Plan

Project Number in 2017 HMP	Action Description	Responsible Dept.	Location	Current Status			2024 Plan Update		Funding Source				Priority Score	Est. Cost	New or Existing Infra-structure
				Complete	In-Progress	Not yet Started	Delete Action	Carry Forward or Revise	HMGP	BRIC[1]	FMA	Local			
14	Voluntary acquisition and removal of qualified properties as disaster declarations make grant funding available. Current repetitive loss properties do not meet benefit cost requirements.	Williamson County, State of Tennessee, and FEMA	County-wide			X		X	X		X	X		$4,340,000	Both
17	Re-establish riparian buffer zones at all applicable water resources owned by the City of Franklin.	City of Franklin, Parks Department	Citywide			X	X					X	NA	NA	Pre-Existing
18	Adopt new storm water regulations sizing storm water detention ponds to 100 year.	City of Spring Hill	Citywide	X			X					X	NA	$0.0	Pre-Existing
19	Participation in NFIP.	City of Spring Hill	Citywide	X				X				X	11	$1,000	Pre-Existing
26	Purchase dump truck for clearing of underbrush and dead trees along the Harpeth river, Spencer Creek, and future park properties along existing tributaries.	City of Franklin Parks Department	Citywide			X	X					X	NA	NA	Pre-Existing
29	SW16002, Parkview Drainage Project	City of Franklin, Stormwater	Citywide			X	X					X	NA	NA	Pre-Existing
30	SW16003, 100 Block of Battle Avenue Drainage improvement.	City of Franklin, Stormwater	Citywide			X	X					X	NA	NA	Pre-Existing
32	Maintain dedicated emergency access ways.	City of Brentwood	Citywide		X			X				X	12	$10,000	New

Project Number in 2017 HMP	Action Description	Responsible Dept.	Location	Current Status			2024 Plan Update		Funding Source				Priority Score	Est. Cost	New or Existing Infra-structure
				Complete	In-Progress	Not yet Started	Delete Action	Carry Forward or Revise	HMGP	BRIC[1]	FMA	Local			
36	Harpeth river bank stabilization at WRF FY17-18	City of Franklin, Stormwater	Citywide	X			X					X	NA	NA	Pre-Existing
40	Continued application and enforcement of the Zoning ordinance (floodplain management) and Storm Water Management Regulations.	Williamson County Government	County-wide		X			X	X			X	12	$25,000	Both
41	Use GIS/FIRM mapping in engineering department to identify floodplain and floodway.	City of Spring Hill, City Engineer and Public Works	Citywide	X			X					X	NA	$0.0	Pre-Existing
43	Enforce maximum lot coverage requirement/encourage green space.	City of Brentwood	Citywide		X			X				X	11	$0.00	New
44	Regular maintenance on ditches and culverts.	Town of Thompson's Station Maintenance Department	1110 Fountain View Blvd, Thompson's Station TN, 37179		X			X	X			X	10	$10,000	Both
48	Establish and maintain riparian buffers per Tennessee Department of Environmental Conservation (TDEC).	Town of Thompson's Station Planning and Zoning	1110 Fountain View Blvd, Thompson's Station		X			X	X			X	9	$5,000	Both

Project Number in 2017 HMP	Action Description	Responsible Dept.	Location	Current Status			2024 Plan Update		Funding Source				Priority Score	Est. Cost	New or Existing Infra-structure
				Complete	In-Progress	Not yet Started	Delete Action	Carry Forward or Revise	HMGP	BRIC[1]	FMA	Local			
			TN, 37179												
53	Clean and improve drainage ditches and retention areas within the park system, as well as protection of property from flood events.	City of Franklin, Parks Department	Citywide		X			X				X	10	$3,000	Pre-Existing
55	A study of how to and/or mitigation of flooding along Lewisburg Pike and Heath Place at Carnton.	City of Franklin, Stormwater	Citywide			X	X					X	NA	NA	New
56	Procure AVL capabilities for all city vehicles enabling real time vehicle asset tracking for more accurate deployment of resources.	City of Franklin	Citywide		X			X				X	11	$10,000	New
58	Elevate waste water lift station control panels to prevent loss from flooding.	City of Franklin, Water	Citywide	X			X					X	NA	NA	NA
59	A study of how to and/or mitigation of flooding of the Cool Springs Mall and nearby stream.	City of Franklin, Stormwater	Citywide			X	X					X	NA	NA	NA
61	Conduct inspections on stormwater detention ponds to ensure they are maintained and function properly.	City of Spring Hill	Citywide	X				X				X	10	$10,000	Pre-Existing
65	Undertake a new development drainage study.	City of Franklin, Stormwater	Citywide			X	X					X	NA	NA	New

Project Number in 2017 HMP	Action Description	Responsible Dept.	Location	Current Status			2024 Plan Update		Funding Source				Priority Score	Est. Cost	New or Existing Infra-structure
				Complete	In-Progress	Not yet Started	Delete Action	Carry Forward or Revise	HMGP	BRIC[1]	FMA	Local			
66	Continuous cleaning of drainage ditches to help alleviate flooding.	Town of Nolensville Public Works Department	Citywide		X			X				X	10	$35,000	Pre-Existing
69	Milcrofton Long Lane water line connection project.	City of Franklin, water	Citywide			X	X					X	NA	NA	New
70	Jordan Branch (Cool Springs E) Stream Restoration FY17	City of Franklin, Stormwater	Citywide			X	X					X	NA	NA	New
73	Ralston Creek at Liberty Hills Stream restoration	City of Franklin, Stormwater	Citywide		X			X				X	10	$50,000	New
74	Figuers Drive area drainage improvements FY17-19.	City of Franklin, Stormwater	Citywide			X	X					X	NA	NA	Pre-Existing
75	Establish an open space prioritization and acquisition program to endure maximum success with limited funds.	City of Franklin, Parks department	Citywide			X	X					X	NA	NA	Pre-Existing
78	Utilize GIS mapping to better determine floodplain and floodway.	City of Brentwood	Citywide		X			X				X	11	$0.00	New
79	Enforce strict detention requirements.	City of Brentwood and downstream communities	Citywide		X			X				X	10	$0.00	New
Tornado															
7	Designate Community shelter location	Town of Thompson's Station	1110 Fountain			X		X				X	12	$0.00	New

Project Number in 2017 HMP	Action Description	Responsible Dept.	Location	Current Status			2024 Plan Update		Funding Source				Priority Score	Est. Cost	New or Existing Infra-structure
				Complete	In-Progress	Not yet Started	Delete Action	Carry Forward or Revise	HMGP	BRIC[1]	FMA	Local			
			View Blvd, Thompson ’s Station TN, 37179												
20	Fund and construct Tornado shelters at High use parks	City of Spring Hill				X	X					X	NA	NA	Pre-Existing
22	Reinforce critical infrastructure at Water Treatment Plant.	City of Franklin, Water	Citywide			X	X					X	NA	NA	New
23	Install pumps at lift stations bypass pumping during power outages	City of Franklin, Water	Citywide			X	X					X	NA	NA	New
24	Tornado shelters at all staffed city facilities	All jurisdictions	All Staffed City Facilities			X	X					X	NA	NA	New
27	Distribute brochures to trail heads, park offices, and park properties on protecting residents near the river from tornados and flooding. Educating citizens regarding steps to take to reduce vulnerability, minimize future tornado and flooding damage.	City of Franklin, Parks Department	Citywide			X	X					X	NA	NA	New
31	Hardening of fleet facility.	City of Franklin, Streets	Citywide			X	X					X	NA	NA	New
34	Fortify/harden existing school structures in order to withstand high winds/tornado impacts	Williamson County School	All school locations		X			X				X	13	$46,000	Both

Project Number in 2017 HMP	Action Description	Responsible Dept.	Location	Current Status			2024 Plan Update		Funding Source				Priority Score	Est. Cost	New or Existing Infra-structure
				Complete	In-Progress	Not yet Started	Delete Action	Carry Forward or Revise	HMGP	BRIC[1]	FMA	Local			
		District, Franklin Special School District													
35	Annual service agreement for weather monitoring system and tornado sirens	City of Brentwood/City of Franklin	Citywide	X	X			X				X	14	$4,000	Both
38	Construct new city hall that includes tornado sheltering for 200+ employees and visitors during the day and provides for some sheltering during downtown special events.	City of Franklin	Citywide		X			X				X	10	$5,000,000	New
42	Installation of fiber optic cable connecting the City of Franklin, City of Brentwood, Williamson County, and Metro Nashville	City of Franklin MIT, City of Brentwood, Williamson County, and Metro Nashville	Citywide			X	X					X	NA	NA	New
46	Construct fire station 7 that includes tornado sheltering for its occupants.	City of Franklin, Fire	Citywide	X			X					X	NA	NA	New
47	Procure a 4000+ fuel truck	City of Franklin, Streets	Citywide			X	X					X	NA	NA	New

Project Number in 2017 HMP	Action Description	Responsible Dept.	Location	Current Status			2024 Plan Update		Funding Source				Priority Score	Est. Cost	New or Existing Infra-structure
				Complete	In-Progress	Not yet Started	Delete Action	Carry Forward or Revise	HMGP	BRIC[1]	FMA	Local			
49	Promote the use of social media, text messaging, X, etc. for public announcement of tornado warning and watches similar to amber alerts/Nixle.	City of Spring Hill	Citywide	X				X				X	12	$5,000	Pre-Existing
52	Fortify new jail structure to withstand weather impacts from high winds/tornados	Williamson County Sheriff's Office	408 Century Court, Franklin, TN 37064 & 135 4th Ave S, Franklin, TN 37064		X			X				X	10	$280,000,000	Both
54	Hardening of sheds for heavy equipment storage or underground storage of key vehicle assets.	City of Franklin, Streets/Solid waste/Water	Citywide			X	X					X	NA	NA	New
64	Upgrade 800MHz radio system to latest software release for better communications with other agencies.	City of Franklin MIT	Citywide			X	X					X	NA	NA	New
71	Complete remaining fiber to connect critical infrastructure.	City of Franklin, IT	Citywide			X	X					X	NA	NA	New
72	Complete fiber and Wifi installation to alleviate dependencies on outside vendors in case of major events. Complete fiber to radio	City of Franklin MIT	Citywide			X	X					X	NA	NA	New

Project Number in 2017 HMP	Action Description	Responsible Dept.	Location	Current Status			2024 Plan Update		Funding Source				Priority Score	Est. Cost	New or Existing Infra-structure
				Complete	In-Progress	Not yet Started	Delete Action	Carry Forward or Revise	HMGP	BRIC[1]	FMA	Local			
	tower sites, camera system to monitor all sites.														
Winter Weather															
2	Purchase of snow chains for patrol cars for the purpose of increased mobility on snow- and ice-covered roads.	City of Spring Hill, Police Department	Citywide		X			X				X	10	$1,500	Both
4	Need for a truck with dump capabilities, spreader capabilities, and a backhoe with a front-end loader.	Town of Nolensville Public Works Department	Town-wide	X			X					X	NA	$0.00	Pre-Existing
5	Replace aging/damaged snow removal equipment.	City of Brentwood Public Works Department	Citywide		X			X				X	12	$50,000	New
9	Purchase new snow removal equipment (Truck, plow, salt spreader).	Town of Thompson's Station Maintenance Department	1110 Fountain View Blvd, Thompson 's Station TN, 37179		X			X	X	X	X	X	10	$100,000	New
13	Develop and adopt a snow and ice control plan.	City of Spring Hill	Citywide	X			X					X	NA	$1,000	Pre-Existing
16	Maintain/update snow removal routes.	City of Brentwood, Public Works Department	Citywide		X			X				X	13	$0.00	New

Project Number in 2017 HMP	Action Description	Responsible Dept.	Location	Current Status			2024 Plan Update		Funding Source				Priority Score	Est. Cost	New or Existing Infra-structure
				Complete	In-Progress	Not yet Started	Delete Action	Carry Forward or Revise	HMGP	BRIC[1]	FMA	Local			
21	Establish salt inventory and storage areas.	Town of Thompson's Station Maintenance Department	1110 Fountain View Blvd, Thompson 's Station TN, 37179			X		X	X			X	10	$5,000	New
28	Clearing of ice and snow for emergency vehicles and citizens.	City of Franklin, Streets Department	Citywide		X			X				X	11	$10,000	Pre-Existing
33	Stockpile 2,300-2,500 tons of salt at two weather protected strategic locations.	City of Brentwood, Public Works Department	Citywide		X			X				X	12	$100,000	New
37	Stockpile salt for roadways at 1,500 tons annually.	Williamson County Highway Department	302 Beasley Drive, Franklin, TN 37064		X			X				X	13	$135,750	Pre-Existing
39	Annually, prior to winter, check/prepare all snow removal equipment	City of Brentwood, Public Works Department	Citywide		X			X				X	10	$25,000	New
57	Stage trucks pre-loaded with salt prior to expected winter weather events.	City of Brentwood, Public Works Department	Citywide		X			X				X	11	$5,000	Pre-Existing
60	Removal of dead trees, shrubbery, and stumps and evaluation, treatment and trimming of trees in area parks and other park properties.	City of Franklin, Parks Department	Citywide		X			X				X	12	$4,000	New

Project Number in 2017 HMP	Action Description	Responsible Dept.	Location	Current Status			2024 Plan Update		Funding Source				Priority Score	Est. Cost	New or Existing Infra-structure
				Complete	In-Progress	Not yet Started	Delete Action	Carry Forward or Revise	HMGP	BRIC[1]	FMA	Local			
67	Expansion of current storage shed for salt stockpile to double current size (current size is 65 tons).	City of Fairview, Streets Department	Citywide			X	X					X	NA	NA	Pre-Existing
81	Trimming of trees along roadway to protect Middle Tennessee Electric Membership Cooperation Power lines.	Thompson's Station and Middle Tennessee Electric Membership Cooperation	1110 Fountain View Blvd, Thompson's Station TN, 37179		X			X	X			X	11	$10,000	Both
Drought and Extreme Heat															
10	Institute a ban on all fireworks within the city.	City of Spring Hill	Citywide			X	X					X	NA	$10,000	Pre-Existing
11	Institute a social media awareness program via X, Facebook, etc. informing residents what actions to take to minimize health concerns.	City of Spring Hill	Citywide	X			X					X	NA	$10,000	Pre-Existing
15	Impose water restrictions based on Brentwood's Drought Mitigation Plan	City of Brentwood	Citywide		X		X					X	NA	NA	Pre-Existing
25	Recoupment of funds due to drought/fire damage	Town of Nolensville Public Works Department	Citywide			X	X					X	NA	NA	Pre-Existing

Project Number in 2017 HMP	Action Description	Responsible Dept.	Location	Current Status			2024 Plan Update		Funding Source				Priority Score	Est. Cost	New or Existing Infra-structure
				Complete	In-Progress	Not yet Started	Delete Action	Carry Forward or Revise	HMGP	BRIC[1]	FMA	Local			
45	Evaluate structure vulnerability to wildfire events at parks, work with Franklin Fire Department. Protection of buildings in natural settings from wild fire with good landscaping practices.	City of Franklin, Parks Department in coordination with City of Franklin Fire Department.	Citywide			X	X					X	NA	NA	New
50	Specify and adopt native plants, shrubbery and trees for incorporation into the city's new uniform development code.	City of Spring Hill Planning Department	Citywide	X				X				X	11	$1,000	Pre-Existing
51	Enforcement of the State of Tennessee Forestry Department Burn permitting and Burn banning program.	City of Brentwood	Citywide		X			X				X	12	$0.00	Both
62	Enforcement of the State of Tennessee Forestry Department Burn permitting and Burn banning program.	Town of Thompson's Station Building and Planning	1110 Fountain View Blvd, Thompson's Station TN, 37179		X			X				X	11	$5,000	Both
63	Impose water restrictions in drought conditions in accordance with the city's	City of Spring Hill Water Department	Citywide	X				X				X	10	$1,000	Pre-Existing

Project Number in 2017 HMP	Action Description	Responsible Dept.	Location	Current Status			2024 Plan Update		Funding Source				Priority Score	Est. Cost	New or Existing Infra-structure
				Complete	In-Progress	Not yet Started	Delete Action	Carry Forward or Revise	HMGP	BRIC[1]	FMA	Local			
	emergency response plan and drought management plan.														
68	In brown-out situations, provide fans to social service agencies for distribution to homeless shelters and locations designated by Spring Hill Social Services	City of Spring Hill and Spring Hill Social Services	Citywide		X			X				X	10	$15,000	Pre-Existing
76	Purchase a wildland fire truck with a CAF system.	City of Franklin, Fire	Citywide	X			X					X	NA	NA	New
77	Clearing of underbrush and dead trees along the Harpeth River of city owner properties.	City of Franklin, Parks and Recreation Department	Citywide			X	X					X	NA	NA	New
80	Enforcement of the State of Tennessee Forestry Department Burn permitting and Burn banning program.	State Forestry Department with the Nolensville Fire and Rescue and Williamson County Emergency Communications cooperation and enforcement at the local level	County-wide			X	X					X	11	N/A	Pre-Existing

1.4 Multi-Jurisdictional Special Considerations

1.4.1 Hazards Assessment

All of the natural hazards identified within this plan have an impact on both Williamson County and the incorporated jurisdictions. Some hazards have a larger impact on the County rather than the incorporated jurisdictions and vice versa. Impacts of identified hazards differ the most at the rural and urban interface where flooding can have different severity levels. Therefore, the flooding section emphasizes the depth, duration, and timing of severe flooding events. Below is a table that shows whether a hazard will have multi-jurisdictional impacts.

Hazards	Will the hazard have multi-jurisdictional differences?
Flood	Yes
Tornado	Yes
Wildfire/Brush Fire	Yes
Drought/Excessive Heat	Yes
Severe Winter Weather	Yes
Earthquake/Seismic Activity	Yes
Geological Incident	Yes
Pandemic	Yes

1.5 Public Participation

Public involvement included press releases, public meetings, and a public comment period on the draft plan. Organizations representing vulnerable and underserved populations were contacted in an effort to gain further input from populations most at risk during hazardous events. The formal public meetings for this plan are summarized in *Table 3* (Section 1.2.2) discussed early in this chapter. The HMPC meetings on 04/26/2023, 06/19/2023, and 01/04/2024 were open to the public.

A public notice was posted in numerous physical places and online for each of these events. Documentation to support the public outreach efforts can be found in Appendix A. All sign-ups and sign-in sheets are available in Appendix A. Over the past five years, the community was kept involved in the planning process through the implementation of projects in the plan.

1.6 County Data Profile

1.6.1 Resources and Assets

The Williamson Medical Center provides 24-hour emergency care to residents of the county and is home to 185 beds. The county also has 275 volunteer firefighters with 14 stations, and 368

total paid staff at the Sheriff's office. The Williamson County Office of Public Safety employs a total of 85 full-time positions which also includes the Department of Emergency Communications (ECOMM) and the WCEMA. The WCEMA makes up 22 of the full-time positions and employs an additional 21 part-time positions. The Williamson County School District facilitates the learning of approximately 42,000 students via their system of 50 schools within the county. Of the 50 schools, there are 11 high schools, 11 middle schools, 27 elementary schools, and one K-8 school. According to the RWJ Foundation County Health Rankings profile, in Williamson County, the average, per-pupil spending among school districts was $6,403 above the estimated amount needed to support students in achieving average US test scores.

Williamson County houses two radio stations {WAKM AM 950 and WHEW AM 1380 (Spanish)}. The main phone companies in the area are T-Mobile, AT&T, and Verizon. Residents in the county can either obtain internet via Comcast, AT&T, Spectrum, or United Telephone Company. Communication resources, a vital component of emergency response and preparedness, is above the national average in Williamson County. Between 2017 and 2021, 97.7% of households had a computer and 95% had broadband internet access according to the United States Census Bureau.

The Harpeth River is the largest waterway in the county. Other smaller waterways that can be found throughout Williamson County are the McCutcheon Creek, Leipers Creek, Grassy Branch Creek and the Gin Branch River. A further analysis of these water systems will be explored in the hazard flood section as related to their propensity for flood events when applicable. The main roadways that travel through the county are US Highway 31, 41, 431 and State Highways 6, 11, 16, 46, 96, 100, 106, 246, 247, 248, 252, 253, 396, 397, 441, and 840. The nearest interstates are 1-40 and I-65.

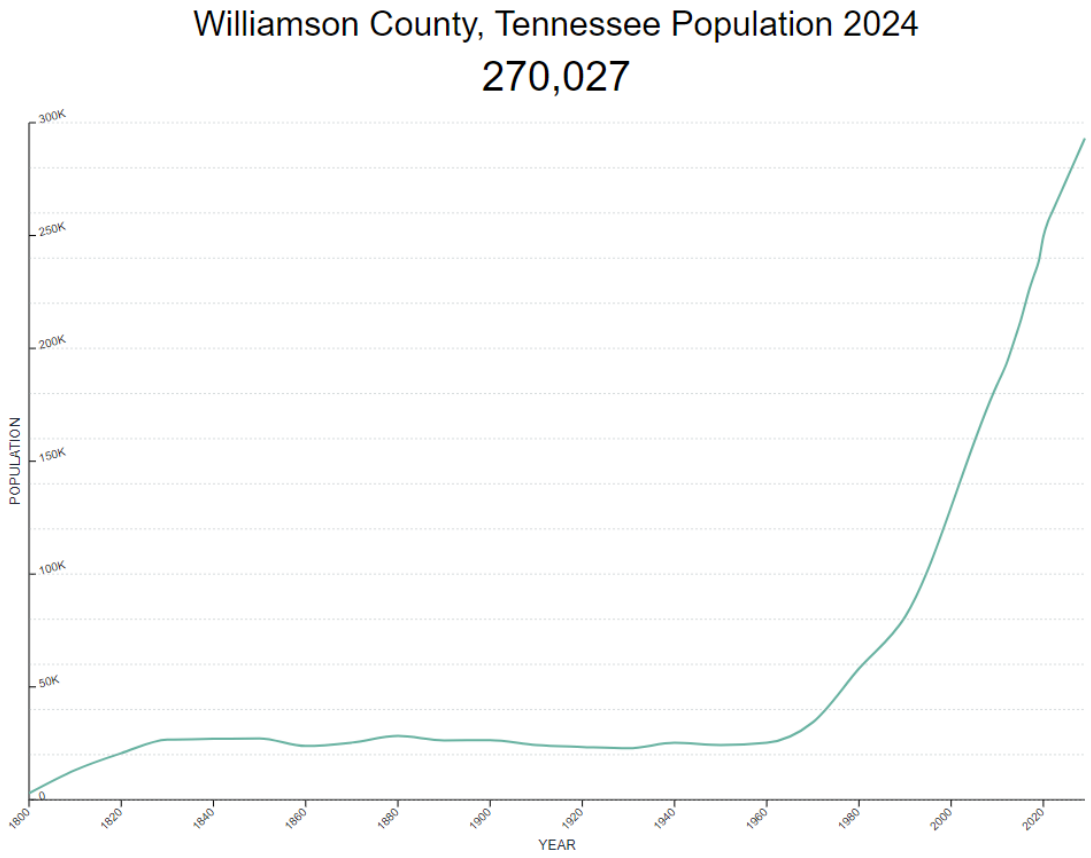
The nearest international airport is BNA (approx. 24.6 miles) with approximately 450 flights per day. Given the congested public transportation options and the rural environment of Williamson County, 45% of working individuals endure a commute of more than 30 minutes and 81% of all working individuals drive alone to work. Two commercial railways and two transportation pipelines pass through Williamson County.

Williamson County is governed by an elected County Mayor and Board of Commissioners (twenty-four members). The incorporated jurisdictions within Williamson County are governed by an elected Mayor and Council. There are multiple regulatory committees that are appointed by both the County Mayor and the Board of Commissioners.

1.6.2 Development and Growth

Along with most of Middle Tennessee, Williamson County, has been experiencing rapid growth over the past few years. The population of the county increased by ~7.4% between the 2010 and 2020 censuses from 183,182 to 247,726. 4% of the 85,311 Williamson County households live with income below the poverty level. Most of Williamson Counties' employed population work within the professional, scientific, and technical services industry (12.1%) and the retail trade industry (10.6%). Williamson County is a member of Joint Economic and Community Development Boards to ensure and promote economic growth within the county and for its constituents. This is part of a 10-county regional market that includes the Counties of Cheatham, Davidson, Dickson, Maury, Montgomery, Robertson, Rutherford, Sumner, Williamson, and Wilson. As stated, Williamson County has experienced much growth since the last planning

period, specifically residentially/industrially/commercially. It is noteworthy that through the increased growth in recent years, the Williamson County School District, Optum Inc., and Nissan North America are the three top employers in the county. This growth is expected to continue with some projections suggesting that we may have a population of 293,057 in the year 2029, and doubling the existing population by 2040.



1.6.3 Demographics

Throughout the planning process, the Williamson County HMPC remained committed to recognizing socially vulnerable and underserved populations. In order to maintain this commitment, the HMPC reached out to key stakeholders as discussed in Section 1.2 and reviewed the CDC/ATSDR Social Vulnerability Index (SVI). SVI information is located in Appendix B.

Table 6 below illustrates the population data of the county according to the 2020 U.S Census. Other important demographics obtained via the U.S Census Bureau and County Health Rankings (RWJ Foundation) are presented in list form. Of the 247,726 residents living within Williamson County:

- The median household income is $116,492 (in 2021 dollars)
- 4% live below the national poverty line
- 19% live in rural areas
- 9.1 Food Environment Index compared to 6.2 in Tennessee and 7.8 in the U.S.
- 4.3% of the under 65 years of age population live with a disability

- 7.1% of the under-65 population do not have health insurance
- Population as of 2020 was approximately 450 people per square mile

Table 6: Population Data

Demographic	Percentage		
Age Group	Male	Female	Total
Under 5	6.10%	5.70%	5.90%
Under 18	28.10%	26.20%	27.10%
18-64	59.60%	59.90%	59.70%
Over 65	12.30%	14.00%	13.20%
Race/Ethnicity (one)			
White (not Hispanic/Latin)	87.10%		
Asian	4.70%		
Black or African American	4.10%		
American Indian or Alaskan Native	0.40%		
Hispanic/Latino	4.90%		
Education	Williamson	Tennessee	
Population Aged 25-64 With High School Degree Or Higher	96.40%	89.50%	
Population Aged 25-64 With Bachelor's Degree Or Higher	61.40%	28.70%	

Data sources:

https://www.census.gov/quickfacts/fact/table/US/PST045221

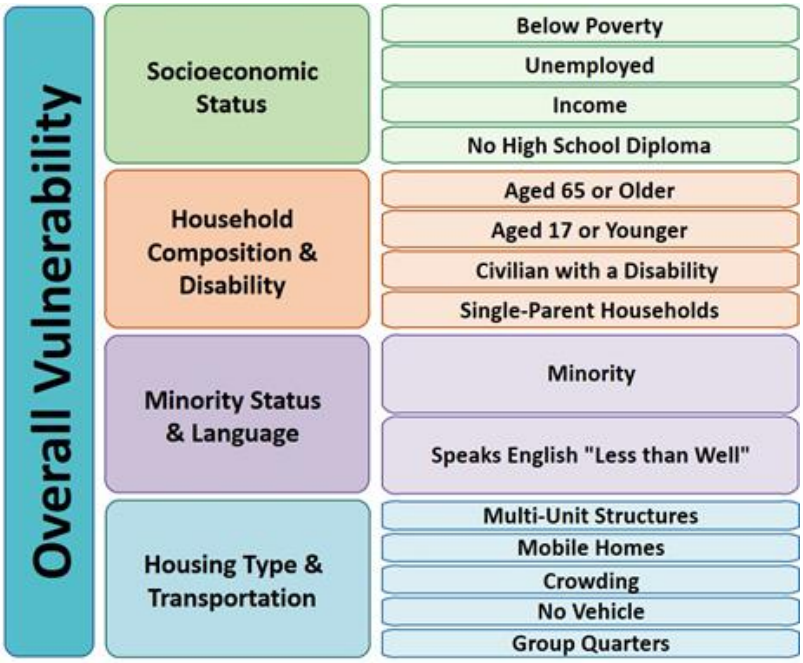
https://www.countyhealthrankings.org/app/tennessee/2022/overview

1.6.4 Social Vulnerability

Social vulnerability refers to a community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, to human-caused threats, such as toxic chemical spills. Social vulnerability considerations were included in this plan update to identify areas across the planning area that might be more vulnerable to hazard impacts based on several factors. The Williamson County Emergency Operations Plan (EOP) will also incorporate this information to improve response efforts in socially vulnerable neighborhoods.

The Center for Disease Control and Prevention (CDC) has developed a social vulnerability index (SVI) to measure the resilience of communities when confronted by external stresses such as natural or human-caused disasters or disease outbreaks. The SVI is broken down to the census tract level and provides insight into vulnerable populations to assist emergency planners and public health officials in identifying communities more likely to require additional support

before, during, and after a hazardous event. The SVI index combines four main themes of vulnerability, which are, in turn, broken down into subcategories for 16 vulnerability factors. The themes are outlined in the below table.



The specific breakdown for Williamson County and its participating jurisdictions is as follows:

Williamson County Social Vulnerability Factors		
Factor	**Number**	**Percentage**
Total Square Miles	582.86	N/a
Total Population (as of 2021)	262,560	N/a
Housing Units Estimated	94,954	N/a
Households	91,435	N/a
Persons below Poverty, Percent	10,502	4.0%
Age 16+ unemployed	2,977	1.13%
Per Capita Income	$56,545	N/a
Age 25+ w/ no HS Diploma	2.7%	7,254
Aged 65+ & older	37,021	14.1%
Age 17 & younger	68,791	26.2%
Civilian noninstitutionalized population with a disability	12,127	19.87%
Single Parent HH w/ children under 18	1,762	0.67%
Minority (all persons except white, non-Hispanic)	2,973	5.45%
Persons (age 5+) who speak English "less than well"	86	0.12%
Housing in structures with 10 or more units	706	2.32%
Mobile Homes	3, 985	16.22%
At Household level (occupied housing units) more people than rooms	323	1.22%

Williamson County Social Vulnerability Factors		
Households w/ no vehicle	1,017	4.96%
Persons in Group Quarters	865	1.3%

1.6.5 Critical Infrastructure

Critical Infrastructure are assets in a community that are considered vital to the public's health and safety. Due to the sensitivity of these assets in Williamson County and the incorporated jurisdictions, these assets are restricted for public viewing. However, the data is viewable to restricted personnel on the State of Tennessee's Critical2TN Database. The county and incorporated jurisdictions currently have 52 assets identified and continue to invest in this program. As more facilities are identified, they are being registered in this database for viewing by the appropriate parties.

1.7 Resource Capabilities

The committee gathered the following resource capabilities to determine what existing staff and resources are being used to support mitigation programs. The Williamson County School District does not have governing authority and therefore is not included in this table. As such, its capabilities are those shared by the county.

Table 7: Jurisdictional Mitigation Capabilities

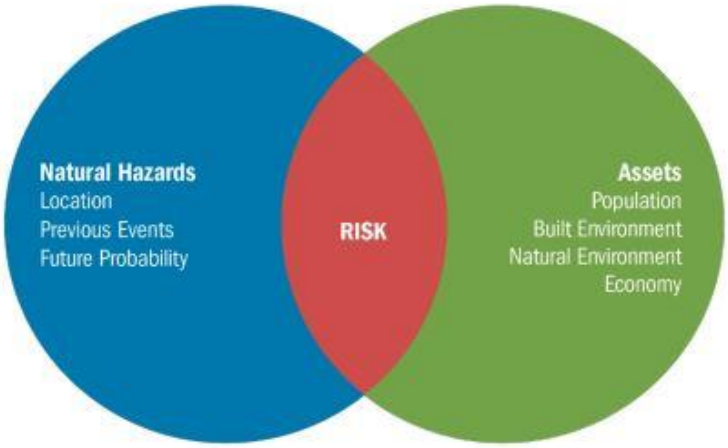
Mitigation Capabilities	Williamson County	City of Brentwood	City of Fairview	City of Franklin	City of Spring Hill	Town of Nolensville	Town of Thompson's Station
Regulatory Capabilities							
Building Codes	YES	YES	YES	YES	YES	YES	YES
Zoning Codes	YES	YES	YES	YES	YES	YES	YES
Subdivision Ordinance	YES	YES	YES	YES	YES	YES	YES
Stormwater Ordinance	YES	YES	YES	YES	YES	YES	YES
Floodplain Ordinance	YES	YES	YES	YES	YES	YES	YES
Erosion, Sedimentation and Pollution Control Ordinance	YES	YES	NO	YES	YES	YES	YES
Stormwater Management Program	YES	YES	YES	YES	YES	YES	NO
Site Plan Review Requirements	YES	YES	YES	YES	YES	YES	YES
Capital Improvements Plan	YES	YES	YES	YES	YES	YES	YES
Economic Development Plan	YES	YES	NO	YES	YES	YES	NO
Local Emergency Operations Plan	YES	YES	NO	YES	YES	YES	YES
Flood Insurance Study or Other Engineering Study for Streams	YES	YES	YES	YES	YES	YES	YES
Repetitive Loss Plan	YES	YES	NO	YES	NO	NO	NO
Elevation Certificates	YES	YES	YES	YES	YES	YES	YES
Administrative Capabilities							
Grant writer	YES	YES	NO	YES	NO	NO	YES
Public Information Officer	YES	YES	YES	YES	YES	YES	NO
Floodplain Manager	YES	YES	NO	YES	YES	NO	YES
Full Time Fire Service	NO	YES	YES	YES	YES	YES	NO
Law Enforcement	YES	YES	YES	YES	YES	YES	NO
Emergency Manager	YES	YES	NO	YES	YES	YES	NO
GIS Personnel	YES	YES	YES	YES	YES	YES	YES
Fiscal Capabilities							
Capital improvements project funding	YES	YES	YES	YES	YES	YES	YES
Fees for water, sewer, gas, or electric services	NO	YES	NO	YES	YES	NO	YES
Impact fees for new development	YES	YES	NO	YES	YES	YES	YES
General obligation bonds	YES	YES	YES	YES	NO	YES	YES
Withhold spending in hazard-prone areas	NO	YES	NO	NO	NO	NO	NO

Section Two: Threat and Hazard Identification and Risk Assessment

2.1 Risk Assessment Overview

Hazard Mitigation Planning is about developing a strategy to reduce risk in the long term. An essential part of the process is identifying hazards, risks, impacts and vulnerabilities. In mitigation planning, "risk" is the potential for damage or loss when a hazard interacts with an asset. Assets can be people, buildings, infrastructure, the economy, or natural and cultural resources.

The risk assessment helps communicate vulnerabilities, develop priorities, and inform decision making. It is the factual basis for the mitigation strategy. The hazards and associated impacts in the risk assessment should be the hazards and impacts the mitigation strategy seeks to address. If, for example, the risk assessment shows that the state will have hurricane damage in a specific area, the mitigation strategy should include actions to protect state assets and jurisdictions, especially underserved communities, and socially vulnerable populations, in those areas.



The Williamson County HMPC conducted a Threat and Hazard Identification and Risk Assessment (THIRA) to determine the natural hazards as well as human-caused and technological threats that place the county at risk. Existing hazard data from TEMA, FEMA, the National Oceanic and Atmospheric Administration (NOAA), and other sources were examined to assess the significance of these hazards to the planning area. Hazard data from the ETSU Geoinformatics & Disaster Science Lab was also analyzed as related to the changing weather trends and their significance.

Representatives from all municipalities and the county met in-person to discuss the risks assessed in the THIRA. All municipalities agreed upon a universal set of hazards and threats identified and agreed that the results of the risk assessment were applicable to all municipalities and the county universally. As such, the results of the risk assessment are not identified on a per-jurisdiction basis and instead are applicable to all municipalities.

2.2 Risk Scoring Description

When conducting this research, the categories that are used to determine risk guided the data collection process. In accordance with the Emergency Management Accreditation Program (EMAP) Standard 4.1.1 (2022) and from the recommendations provided by the Tennessee Emergency Management Agency (TEMA); a set of equations were developed to determine and rank the risk of each hazard. The first requirement is to determine the community's vulnerability by adding impacts to humans, property, businesses, operations, and the environment together then dividing by five. The formula is as follows:

$$\frac{\boldsymbol{Human(H)} + \boldsymbol{Property(P)} + \boldsymbol{Business(B)} + \boldsymbol{Operations(O)} + \boldsymbol{Environment(E)}}{\mathbf{5}} = \boldsymbol{Vulnerability(V)}$$

Vulnerability Formula

Once the vulnerability has been calculated, it must be added to the probability which will give the final risk score. This formula is as shown below:

$$\boldsymbol{Vulnerability(V)} + \boldsymbol{Probability(Prob.)} = \boldsymbol{Risk\ Score}$$

Risk Score Formula

The risk score is categorized into five different categories. These five categories are as follows:

Risk Scoring Chart:	
Low	**2-3.6**
Moderate	**3.7-5.2**
Medium	**5.3-6.8**
High	**6.9-8.4**
Severe	**8.5-10**

The risk score is utilized to determine the most significant hazards to the county and establish priorities for future planning processes. Although ranked by score, each hazard has potential to strain at least one of Williamson County's core capabilities as identified by CPG 201.

2.3 Impact Category Descriptions

Each category must have definable values that can be associated with each hazard. These descriptions are important in providing a numerical value to the threats impact in order to calculate risk. The values can be found below:

Impact Category Descriptions:	
Human	**Business**
Probability of injuries and death from hazard	**Amount of business damage**

Impact Category Descriptions:			
1	Death very unlikely, injuries are unlikely	1	Less than 3 businesses closed for only one day
2	Death unlikely, injuries are minimal	2	More than 3 businesses closed for a week
3	Death unlikely, injuries may be substantial	3	More than 3 businesses closed for a few months
4	Death possible, injuries may be substantial	4	More than 3 businesses closed indefinitely or relocated
5	Death probable, injuries will likely be substantial	5	A top 10 local employer closed indefinitely *(The top ten employers can be found with the Tennessee Department of Economic and Community Development)*
Property		**Probability**	
Amount of residential property damage		**Probability of hazard occurring**	
1	Less than $500 in damages	1	Less than once every 10 years
2	$500 - $10,000 in damages	2	About once every 5 – 10 years
3	$10,000 – $500,00 in damages	3	About once every 2 – 5 years
4	$500,000 - $2,000,000 in damages	4	About once a year
5	More than $2,000,000 in damages	5	More than once a year
Operations		**Environment**	
Impact on government services		**Damage done to the environment**	
1	Negative consequences are negligible; experienced as inconveniences for short period of time; public & private sector services are not impacted; impact is limited to a small number of people/small geographical location.	1	There are little to no impacts on the environment which will cause no lasting effects.
2	Negative consequences are minor; not all sectors affected but those that are have reduced capacity for short period of time.	2	There is some damage to the environment that may last less than one year.
3	Negative consequences are significant; not all sectors are affected but those that are lose significant capacity for multiple days/weeks.	3	There is moderate damage to the environment that may last less than five years and longer than one year.
4	Negative consequences are profound; all sectors affected with some losing capacity for periods longer than weeks.	4	There is significant damage to the environment that may last less than ten years and no less than five years.

Impact Category Descriptions:			
5	Negative consequences are catastrophic; experienced as significant loss in variety of sectors and geographical areas.	5	There is catastrophic damage to the environment that may last longer than 10 years.

2.4 Standardized Impacts

This assessment also analyzes the impacts and consequences of the threats and hazards identified. This is done by providing context to the hazard through previous events or potential events, then analyzing the impact based on reputable sources. These sources are identified with each hazard and may include but are not limited to real-world events, modeling tools, other After-Action Reports (AAR), subject matter experts, and GIS tools such as the FEMA Resilience Analysis and Planning Tool (RAPT).

To further focus on the list of identified hazards for this plan update, the HMPC researched past events that resulted in a federal and/or state emergency or disaster declaration in Williamson County to identify known hazards. *Table 8* presents a list of all major disaster and emergency declarations that have occurred in Williamson County since 1953, illustrating which hazards pose the greatest risk to the County.

Table 8: Presidential Disaster Declarations in Williamson County (1953-2024)

Declaration #	Date	Event Details	Individual Assistance	Public Assistance
DR-424-TN	04/04/1974	Tornados impacted Williamson County	YES	YES
DR-459-TN	03/22/1975	Severe Storms and Flooding	YES	YES
DR-585-TN	05/07/1979	Severe Storms. Tornados, and Flooding	YES	YES
DR-1010-TN	02/09-11/1994	Ice Storm, Severe Winter Storm, and Flash Flooding	NO	YES
DR-1215-TN	04/16-05/18/1988	Severe Storms, Tornados, and Flooding	YES	NO
DR-1275-TN	05/05-19/1999	Severe Storms, Tornados, and Flooding	YES	YES

Declaration #	Date	Event Details	Individual Assistance	Public Assistance
DR-1464-TN	05/04-30/2003	Severe Storms, Tornados, and Flooding	YES	YES
EM-3217-TN	08/29-10/01/2005	Hurricane Katrina Evacuation	NO	YES
02/05-06/2008	DR-1745-TN	Severe Storms, Tornados, Straight-Line Winds, and Flooding	YES	YES
04/30-05/18/2010	DR-1909-DR	Severe Storms, Tornados, Straight-Line Winds, and Flooding	YES	YES
01/20/2020-05/11/2023	EM-3473-TN	COVID-19 Pandemic	NO	YES
01/20/2020-05/11/2023	DR-4514-TN	COVID-19 Pandemic	YES	NO
03/25-04/03/2021	4601-DR-TN	Severe Storms, Tornados, and Flooding	YES	YES

Table 9 documents the hazards of interest to Williamson County and the decision to re-evaluate or delete them from this plan update. The hazards of concern were altered as necessary to ensure the Williamson County Hazard Mitigation Plan is in accordance with the Tennessee Mitigation Strategy and with approval by the HMPC. Mitigation and the applicable grants only cover natural hazards. Therefore, human-caused and technological threats are covered in a separate document with the WCEMA.

Table 9: Overview of Updates to Chapter 2: Risk and Vulnerability Assessment

Williamson County 2017 HMP	Status
Hazardous Materials Release	Removed
Transportation Accident	Removed
Flood	Existing

Williamson County 2017 HMP	Status
Tornado	Existing
Biological (Including epidemics: disease outbreak)	Existing w/ Name Change
Energy Failure Communications Failure	Removed
Severe Winter Weather	Existing
Terrorism (Cyber, Chemical, Biological, Radiological, Conventional)	Removed
Drought/Extreme Heat	Existing
Financial System Collapse	Removed
Civil Disturbance (Including Riots; Civil Unrest)	Removed
Dam or Levee Failure	Removed
Earthquake/Seismic Activity	Existing
Geologic	Existing
Enemy Attack/War	Removed
Nuclear Accident (Fixed Nuclear Facility; Nuclear Exp Centers)	Removed
Wildfire	New

2.5 Summary of changes in the 2024 plan update:

- Hazardous Materials Release was removed in the 2024 HMP plan update. It is not a natural hazard and will be considered for inclusion in a local prevention plan.
- Transportation Incidents were removed in the 2024 HMP plan update. It is not a natural hazard and will be considered for inclusion in a local prevention plan.
- Biological (Including epidemics: disease outbreak) is included in the 2024 HMP plan update though it has been changed to show as Pandemic/Communicable Disease.

- Energy Failure/Communications Failure was removed in the 2024 HMP plan update. It is not a natural hazard and will be considered for inclusion in a local prevention plan.
- Terrorism (Cyber, Chemical, Biological, Radiological, Conventional) was removed in the 2024 HMP plan update. It is not a natural hazard and will be considered for inclusion in a local prevention plan.
- Drought/Extreme Heat is included in the 2024 HMP plan update though it has been changed to show as Drought/Excessive Heat.
- Financial System Collapse was removed in the 2024 HMP plan update. It is not a natural hazard and will be considered for inclusion in a local prevention plan.
- Civil Disturbance (Including Riots; Civil Unrest) was removed in the 2024 HMP plan update. It is not a natural hazard and will be considered for inclusion in a local prevention plan.
- Dam or Levee Failure was removed in the 2024 HMP plan update. Although there are numerous dams throughout Williamson County, none present a great risk and most are privately maintained.
- Geologic is included in the 2024 HMP update though it has been changed to show as Geological Incident.
- Enemy Attack/War was removed in the 2024 HMP plan update. It is not a natural hazard and will be considered for inclusion in a local prevention plan.
- Nuclear Accident (Fixed Nuclear Facility; Nuclear Exp Centers) was removed in the 2024 HMP plan update. It is not a natural hazard and will be considered for inclusion in a local prevention plan.

The complete list of hazards to be addressed in this 2024 plan include:

- Flooding
- Tornadoes
- Wildfire/Brush Fire
- Drought/Excessive Heat
- Severe Winter Weather
- Earthquake/Seismic Activity
- Geological Incident
- Pandemic/Communicable Diseases

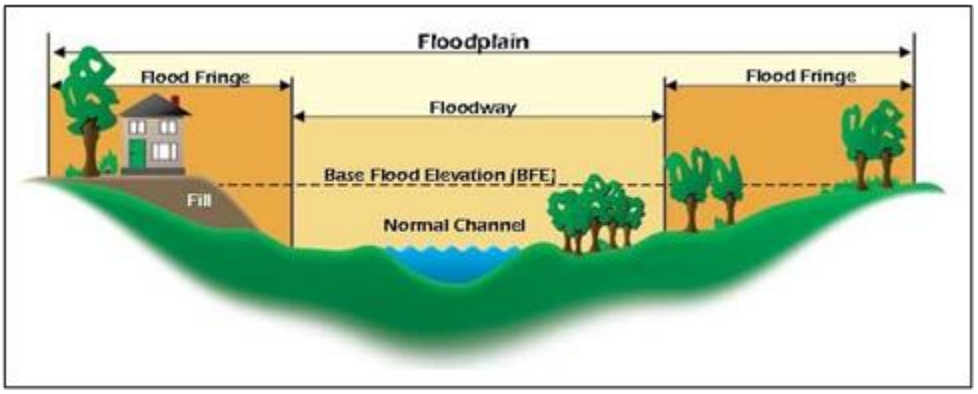
2.6 Flood

2.6.1 Hazard Overview

Flooding events occur when excess water from rivers and other bodies of water overflow onto riverbanks and adjacent floodplains. In addition, lower-lying regions can collect water from rainfall, and poorly drained land can accumulate rain through ponding on the surface. Floods in Williamson County are usually caused by rain, but may also be caused by snowmelt and man-made incidents.

The area adjacent to a channel is the floodplain, as shown in *Figure 1*. A floodplain is flat or nearly flat land adjacent to a stream or river that experiences occasional or periodic flooding. It includes the floodway, which consists of the stream 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. Floodplains are made when floodwaters exceed the capacity of the main channel or escape the channel by eroding its banks. When this occurs, sediments (including rocks and debris) are deposited that gradually build up over time to create the floor of the floodplain. Floodplains generally contain unconsolidated sediments, often extending below the stream's bed.

Figure 1: Characteristics of a Floodplain (Source: FEMA)



Three general health hazards common to flood events:

1. Floodwaters carry anything on the ground that the upstream runoff picked up, including dirt, oil, bacteria, animal waste, lawn, farm, and industrial chemicals. Pastures and areas where farm animals are kept or their wastes are stored can contribute to polluted waters in the receiving streams. Floodwaters also saturate the ground, which leads to infiltration into sanitary sewer lines. When wastewater treatment plants are flooded, there is nowhere for the sewage to flow. Infiltration and lack of treatment can lead to overloaded sewer lines that can back up into low-lying areas and homes. Even when flood waters dilute it, raw sewage can be a breeding ground for bacteria such as E. coli and other disease-causing agents.
2. The second health problem arises after most water has gone. Stagnant pools can become breeding grounds for mosquitoes, and wet building areas that have not been adequately cleaned breed mold and mildew. A building that is not thoroughly cleaned becomes a health hazard, especially for small children and the elderly. Another health hazard occurs when ducts in a forced air system are not adequately cleaned after inundation. When the furnace or air conditioner is turned on, the sediments left in the ducts are circulated throughout the building and breathed in by the occupants. If the county water system

loses pressure, a boil order may be issued to protect people and animals from contaminated water.

3. The third problem is the long-term psychological impact of having been through a flood and seeing one's home damaged and personal belongings destroyed. The cost and labor needed to repair a flood-damaged home severely strain people, especially the unprepared and uninsured. There is also a long-term problem for those who know their homes can be flooded again. The resulting stress on floodplain residents takes its toll in the form of aggravated physical and mental health problems.

2.6.2 County Profile

Riverine flooding occurs from inland water bodies such as streams and rivers. In Tennessee, flooding is highly dependent on precipitation amounts and is highly variable within the State.

HAZUS is a regional multi-hazard loss estimation model developed by FEMA and the National Institute of Building Sciences (NIBS). The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates are used primarily by local, state, and regional officials to plan and stimulate efforts to reduce multi-hazard risks to prepare for emergency response and recovery.

Table 10: Mapped Flood Insurance Zones

Flood Hazard Area	Description
HAZUS (100-yr)	Areas subject to inundation by the 1-percent-annual-chance flood event are generally determined using approximate methodologies. Mandatory flood insurance purchase requirements and floodplain management standards apply.
HAZUS (500-yr)	A 500-year flood zone is a moderate flood hazard area and is an area between the limits of the base flood and the 0.2- percent-annual-chance (or 500-year) flood. Mandatory flood insurance is not required.
Non-highlighted Areas	Minimal risk areas outside the 1-percent and .2 percent-annual-chance floodplains.

Figure 2: HAZUS 100-year Flood Map

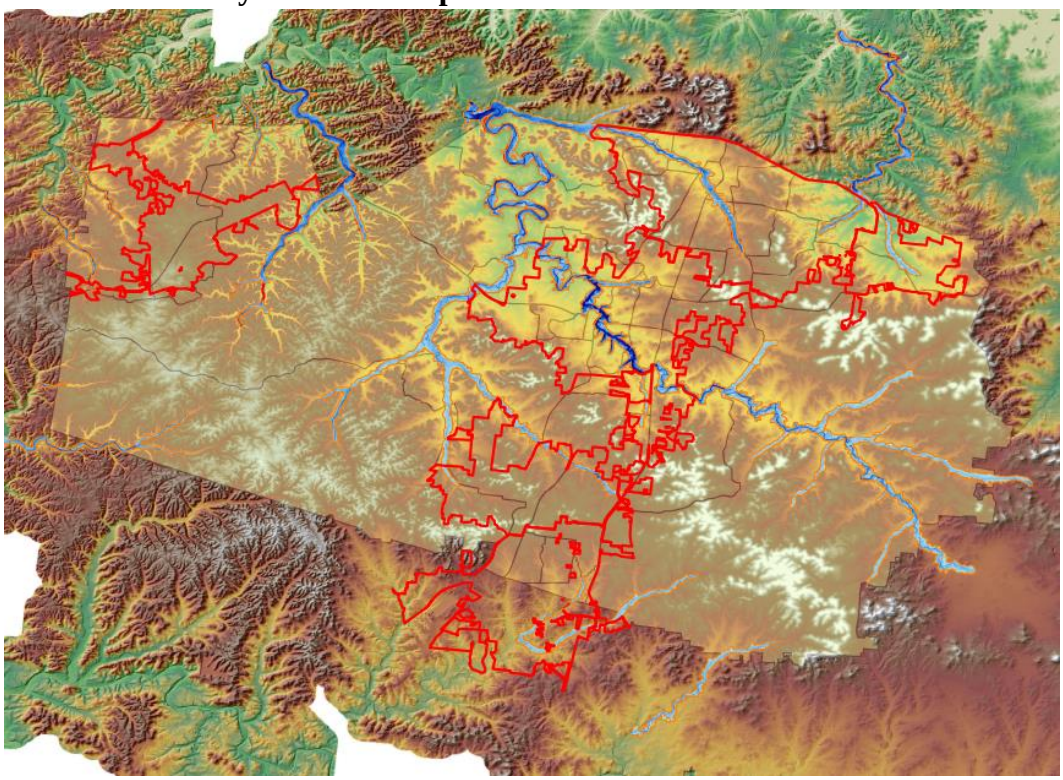


Figure 3: HAZUS 500-year Flood Map

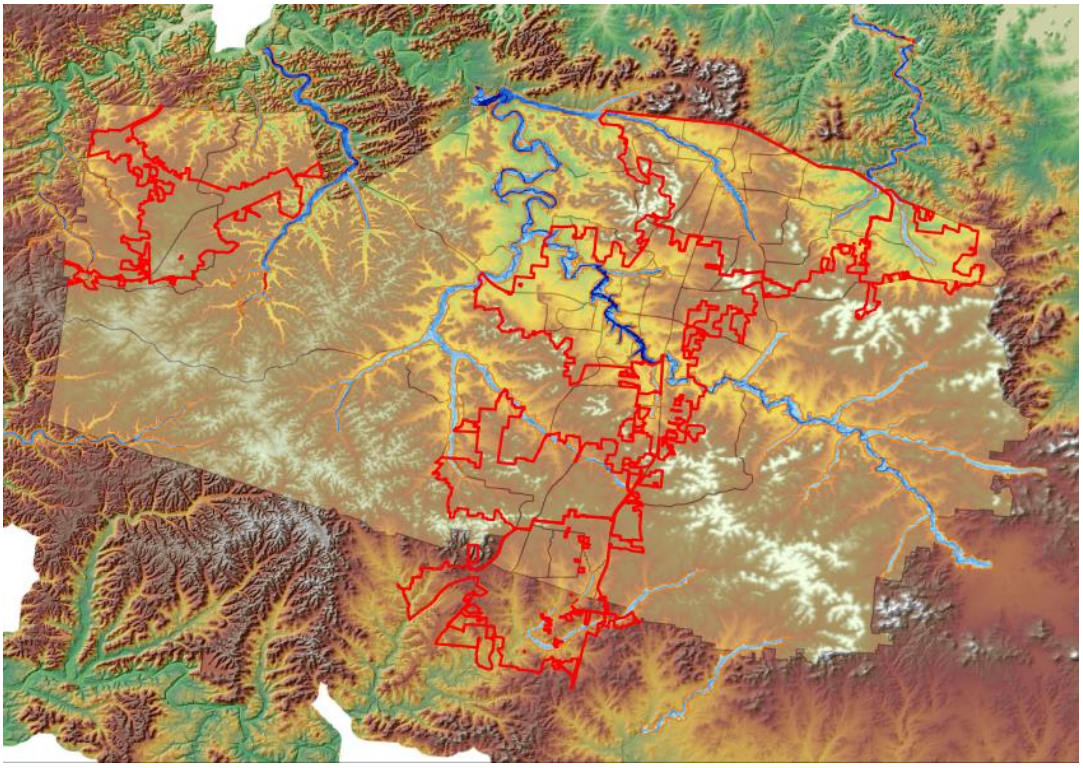


Table 11: NFIP Policy Data

NFIP Policy Data for Williamson County				
Jurisdiction	**CID Number**	**Policies In-Force**	**Insurance In-Force Whole $**	**Written Premium In-Force**
Williamson County	470204D	485	$152,122,800	$393,010
City of Brentwood	470205D	357	$107,865,100	$355,783
City of Fairview	470242D	11	$3,033,000	$6,275
City of Franklin	470206D	444	$132,578,000	$369,074
City of Spring Hill	470278#	66	$18,698,000	$36,962
Town of Nolensville	470425D	49	$15,493,000	$39,416
Town of Thompson Station	470424#	15	$4,288,000	$8,974

Policies In-force: number of NFIP flood insurance policies

Insurance In-force whole $: the value of building and contents insured by the NFIP

Written Premium In-force: total premiums paid for NFIP insurance policies

According to the National Flood Insurance Program (NFIP), repetitive flood loss is a facility or structure that has experienced two or more insurance claims of at least $1,000 in any given 10-year period since 1978. Severe repetitive loss is defined as a facility or structure that has experienced four or more insurance claims exceeding $5,000 or two claims exceeding the value of the building. Within the NFIP, flood loss properties are usually considered the most vital structures to mitigate. The chart below provides a summary of repetitive and severe repetitive losses for Williamson County. All recorded losses in Williamson County and its municipalities have been single family occupancies.

Table 12: NFIP Loss Data

NFIP Loss Data for Williamson County					
Jurisdiction	**Total Losses**	**Closed Losses**	**Open Losses**	**CWOP Losses**	**Total Payments**
Williamson County Unincorporated	RL: 2	2	0	0	$53,828.27
	SRL: 0	0	0	0	$0.00
City of Brentwood	RL: 7	7	0	0	$209,907.65
	SRL: 0	0	0	0	$0.00

NFIP Loss Data for Williamson County					
Jurisdiction	**Total Losses**	**Closed Losses**	**Open Losses**	**CWOP Losses**	**Total Payments**
City of Fairview	RL: 0	0	0	0	$0.00
	SRL: 0	0	0	0	$0.00
City of Franklin	RL: 58	55	1	2	$1,677,451.90
	SRL: 20	20	0	0	$475,732.94
City of Spring Hill	SRL: 0	0	0	0	$0.00
	SRL: 0	0	0	0	$0.00
Town of Nolensville	RL: 13	12	0	1	$1,769,269.20
	SRL: 0	0	0	0	$0.00
Town of Thompson's Station	RL: 0	0	0	0	$0.00
	SRL: 0	0	0	0	$0.00
Williamson County School Districts	RL: -	-	-	-	-
	SRL: -	-	-	-	-

RL: Repetitive Loss

SRL: Severe Repetitive Loss

Total Losses: number of flood insurance claims filed by policyholders

Closed Losses: number of flood insurance claims paid to policyholders

Open Losses: claims that are still being processed

CWOP Losses: claims that were "closed without payment"

Total Payments: total dollars paid to policyholders

It is important to note that while the impacted areas and extent of flooding is dependent on the storm that causes the flooding, the majority of Williamson County and its municipalities experiences flooding similarly. As such, most flooding tends to occur along existing waterways where property can see a few additional inches to feet of water for a short period of time. This scenario is suggested by subject-matter experts as no recorded narrative of such extent is available. Significant rainfall may increase the extent such as in 2010. However, each municipality experiences this extent of rainfall. The Williamson County School District does not have any recorded history of impacts on their facilities though they maintain a status of at risk in the future. Since 12/16/1996, when the NOAA began recording these events for Williamson County, there have been approximately 87 flooding/flash flooding events in Williamson County. 37 of these flooding events have occurred since the beginning of 2017, the year of the previous HMP. A table of NOAA-reported flooding events is located in Appendix C. The following narratives were obtained via the NOAA Storm Event Database. Only events resulting in injury,

death, or extensive damage (greater than $200K property/crop damage) were included as expanded narratives.

Event Narrative 1: 03/27/2021

NOAA Episode Narrative: “An historic flash flooding event affected the central third of Middle Tennessee from the early morning hours on March 27 through the day into the early morning hours on March 28. A warm front moved northward into Middle Tennessee early on March 27 before stalling near the I-40 corridor. Between 0300-0400 AM CDT, numerous showers and thunderstorms developed along the warm front, many of which became severe and produced large hail up to half dollar size along with frequent lightning and heavy rainfall. Showers and storms continued off and on the rest of the day across Middle Tennessee, particularly near the stalled warm front. In fact, another round of severe thunderstorms including supercells developed during the afternoon and evening hours near and south of the warm front. These storms dropped large hail up to tennis ball size and caused a few reports of wind damage, but the main impact was additional heavy rainfall which began causing flash flooding south of Nashville. Flooding only worsened as showers and storms redeveloped over the same areas through the evening, with numerous Flash Flood Warnings issued and several reports of flooded roads and water rescues.

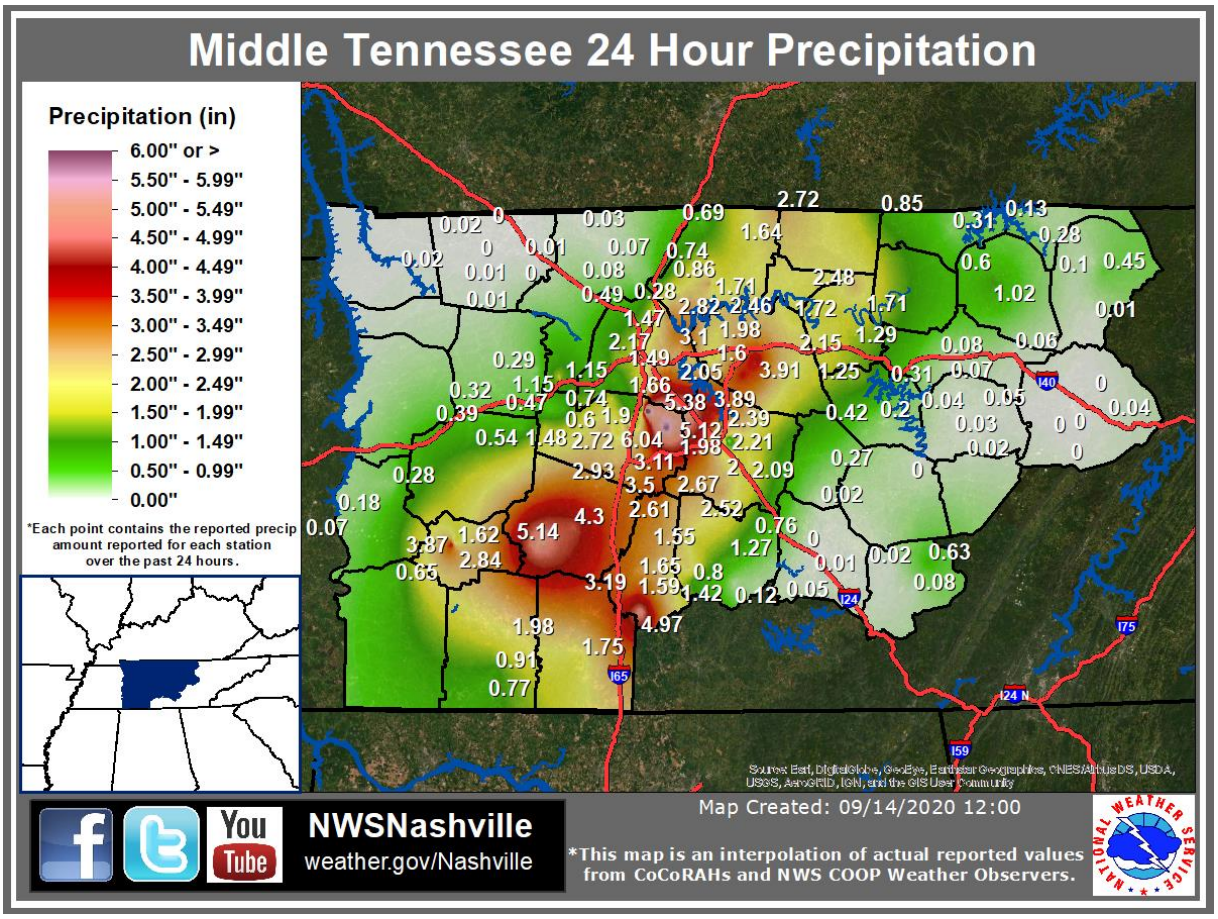
After midnight, even more heavy rainfall falling along the already waterlogged I-40 corridor prompted a rare Flash Flood Emergency for the southern and eastern Nashville metro area, including southeastern Davidson County, western Wilson County, and northern Williamson County. These areas received between 7 to 9 inches of rain, causing rapid rises on several Nashville metro creeks and streams, including Sevenmile Creek (which reached its highest level on record), Browns Creek, and Mill Creek, among others. Many of these creeks reached within their 2nd or 3rd highest water levels on record. The rapid water rises flooded hundreds of homes and businesses, with reports of some people trapped in the attics or on the roofs of their houses. Dozens of roadways were flooded and impassable, including both I-24 and I-40, with many cars submerged in the flood waters and people forced to cling onto trees to avoid getting swept away. Although the flood waters receded quickly on Sunday, March 28, many area rivers reached flood stage in the week after the event, including the Cumberland River, Harpeth River, and Duck River.

A total of 7 deaths were reported from the flooding across Middle Tennessee, with 5 in Davidson County, 1 in Cheatham County, and 1 in Maury County. Emergency management reports indicate over 500 homes and businesses were flooded, and a Presidential Disaster Proclamation was declared for many counties in May 2021. This flash flood event was the worst seen in Middle Tennessee since the May 1-2, 2010 flood.”

Aerial Image of May 2010 Flood

Event Narrative 2: 09/13/2020

NOAA Episode Narrative: “A stationary frontal boundary stalled across the central portions of Middle Tennessee from Saturday, September 12, 2020 into Sunday, September 13, 2020. Persistent southwest flow aloft brought copious amounts of Gulf of Mexico moisture northward and interacted with this boundary, causing a roughly 7-hour period of nearly continuous heavy rain and thunderstorms. Rainfall totals reached 5 to over 8 inches in some locations, resulting in major flash flooding and river flooding along a narrow corridor across Lawrence, Lewis, Maury, Williamson, Davidson, Rutherford, Wilson, Sumner, and Macon Counties. Numerous water rescues were conducted and many homes and businesses were flooded, with some of the worst flooding occurring in the Mill Creek basin across northeast Williamson County and southeast Davidson County. In fact, Mill Creek at Nolensville reached 19.53 feet, which is the second highest crest ever at that location - only surpassed by the record of 22.53 feet in the May 2010 flood.”



Event Narrative 3: 02/20/2019

NOAA Episode Narrative: “After an already very wet month, additional heavy rainfall and thunderstorms moved into Middle Tennessee from Tuesday February 19 into Wednesday February 20. With the airmass being initially cold and dry, the rainfall briefly fell as a mix of rain and sleet across southern Middle Tennessee, although no measurable sleet accumulation was reported. Considerable cloud to ground positive lightning also occurred, which caused several fires to structures. By Wednesday February 20, the prolonged heavy rainfall led to flash flooding in many areas.

Numerous roads were flooded and closed across Williamson County, including Brittain Lane at the Mill Creek Bridge, Arno Road, Lewisburg Pike, Peytonsville Road, York Road, North Chapel Road, Blazer Road, Trinity Road, Old Natchez Trace, and many others. Several cars were also flooded in the Brentwood YMCA parking lot on Concord Road.”

Event Narrative 4: 05/02/2010

NOAA Episode Narrative: “A frontal boundary setup across Western and Middle Tennessee late Friday night (April 30), and remained through the weekend. A persistent southerly flow fed moisture into the area and precipitable water values rose to almost 2 inches, based on data from KOHX upper air soundings. As a series of shortwaves moved through, a band of showers and thunderstorms developed and remained nearly stationary for much of the day on Saturday, May 1st and Sunday, May 2nd, resulting in widespread record flooding across much of Middle

Tennessee. Some of these thunderstorms became severe also, resulting in thunderstorm wind damage and seven confirmed tornadoes across Middle Tennessee.

Nolensville road, south of Nashville, was flooded. Some cars were left abandoned. Details concerning amount of damage to cars abandoned were unknown. Also, numerous homes, numerous businesses, numerous noncommercial buildings, along with several county, state, and federal roads across the county received damage due to the flood."

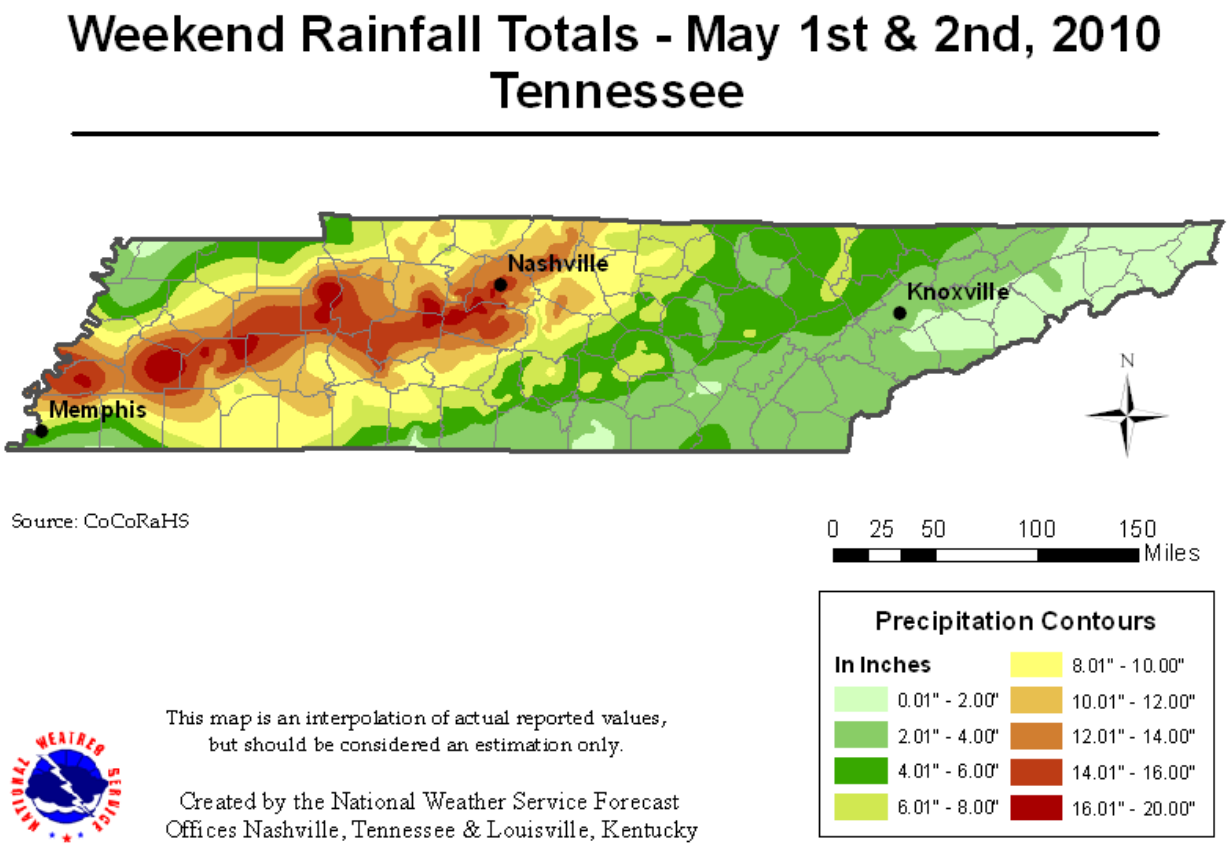


Table 13: Flooding Extent History

Location	Extent & Impact	Event Date
Williamson County Unincorporated	According to the National Oceanic and Atmospheric Administration (NOAA), "Scattered thunderstorms developed across several counties in Middle Tennessee during the afternoon hours on Thursday, July 7th. Two of these thunderstorms reached severe thresholds, resulting in thunderstorm wind damage in Sumner County and flash flooding in Williamson County. Several cars were trapped on water-covered roads including Cool Springs Blvd., Bakers Bridge Avenue, and Duke Drive. These roads had an estimated 10" of water on them for roughly	07/07/2011

Location	Extent & Impact	Event Date
	two days. Media also reported that water rescues occurred in this area, along with railroad trains having to be diverted following damage to the railroad tracks near Moores Lane in south Brentwood, where about four feet of floodwaters inundated Empire Beauty School and a BP gas station on either side of these tracks. Specific details on amount of damage and associated damage repair costs to the Empire Beauty School and the BP gas station where unknown."	
City of Brentwood	The City Manager of the City of Brentwood reported that 75 buildings may have been damaged due to significant flooding and about 1,500 other homes could be without water due to major line breaks caused by the flooding. The local officials reported that they would be in contact with the county emergency management agency in order to get portable water to the residents. To further complicate the flooding concerns, the Murray Lane, Robert E. Lee, and Annadale booster pump stations had been lost due to a power failure. Franklin Road between Holly Tree Gap and Willowick was closed due to a landslide that had occurred at the top of the hill. A section of Holly Tree Gap Rd. between Manley Lane and Holly Tree Farms (in the County) collapsed making only one lane passable but unsafe to travel. Water that was rising on the Little Harpeth at Granny White Pike near Belle River flowed over the road making it impassable. There was an estimated 7" of water that flowed over the roads. Flood related expenses number in the $100,000's for the City of Brentwood. This includes $33,550 for bike trails repairs, $40,286 for flood debris clean-up, $44,925 for emergency drainage stabilization, $19.895 for remediation of mudslide and stabilization of bank, $15,625 for additional mud and debris removal, $25,665 for emergency mudslide removal and bank repair with sheet rock, $26,873 for repair of the River Park restroom facility, and $41,164 for repair of the Tower Park restroom facility. These costs total $247,983 due to a single flooding incident.	05/20/2010
City of Fairview	According to the National Oceanic and Atmospheric Administration (NOAA), A stalled warm front and plentiful amounts of atmospheric moisture helped to set the stage for a persistent wet pattern that lasted several days in early December across Middle Tennessee. By	12/07/2022

Location	Extent & Impact	Event Date
	December 7, 2022, an estimated 2 to 4 inches of rain over the course of this event had begun to cause creeks to overfill their banks. Minor flooding was reported across areas mainly south of Interstate 40, particularly in the Spring Hill area where several flooding reports were received along with road closures. Persistent rainfall, which was heavy at times, forced the closure of Hill Hughes Road near Fairview due to flooding. The road had approximately 17" of water over it during the peak flood stage.	
City of Franklin	The City of Franklin is often challenged by rising waters along the Harpeth River. This time, the water surrounded individuals' homes and the surrounding roads. Drone footage shows trouble spots along Del Rio Pike where flooding is still problematic. The Franklin Police Department reported a rescue of a homeowner in this area, in addition to about 18 other individuals that live along the Harpeth River. In this event, the Harpeth River grew to 30.5 feet where the record is 35 feet and three inches which resulted in significant flooding in the local residential areas.	03/28/2020
City of Spring Hill	Old Kedron Road, among a few others in the City of Spring Hill, were closed due to flash flooding. Photos and video reported to the local news station, WKRN, and their own footage show high levels of water crossing over the road, roughly 2' deep, and bringing debris across it. On Port Royal road, a tree was seen blocking the water way and therefore spilling more water onto the road creating hazardous conditions. The Spring Hill Police Department removed the tree from blocking the water flow which helped with the roads flooded condition.	05/03/2021
Town of Nolensville	According to the National Oceanic and Atmospheric Administration (NOAA), "A stationary frontal boundary stalled across the central portions of Middle Tennessee from Saturday, September 12, 2020 into Sunday, September 13, 2020. Persistent southwest flow aloft brought copious amounts of Gulf of Mexico moisture northward and interacted with this boundary, causing a roughly 7-hour period of nearly continuous heavy rain and thunderstorms. Rainfall totals reached 5 to over 8 inches in some locations, resulting in major flash flooding and river flooding along a narrow corridor across Lawrence, Lewis, Maury, Williamson, Davidson,	09/13/2020

Location	Extent & Impact	Event Date
	Rutherford, Wilson, Sumner, and Macon Counties. Numerous water rescues were conducted and many homes and businesses were flooded with 5”-7” of standing water, with some of the worst flooding occurring in the Mill Creek basin across northeast Williamson County and southeast Davidson County. In fact, Mill Creek at Nolensville reached 19.53 feet, which is the second highest crest ever at that location - only surpassed by the record of 22.53 feet in the May 2010 flood.”	
Town of Thompson’s Station	According to the National Oceanic and Atmospheric Administration (NOAA), “after an unusually wet January, another strong storm system brought more heavy rainfall, flooding, and severe storms to parts of Middle Tennessee on February 5th. A line of strong to severe thunderstorms known as a QLCS (Quasi-linear Convective System) developed in northern Mississippi and moved across southern and eastern Middle Tennessee during the afternoon and evening hours. These storms spawned 6 weak tornadoes and widespread straight-line wind damage. In addition, heavy rainfall affected much of Middle Tennessee throughout the day, causing significant flooding in many areas.” The National Weather Service has not reported any flooding incident with particular details on flood extents or damage due to flooding in the Town of Thompson’s Station.	02/05/2020
Williamson County School District	According to Austin Thompson with the Williamson Herald, “Due to heavy rains causing flooding and more expected, both Williamson County Schools and Franklin Special School District closed Friday. WCS also dismissed two hours early on Wednesday for heavy rains. According to WCS Communications Director Carol Birdsong, the "high-risk and life-threatening flooding," was the cause for closure. "We have been working with the National Weather Service and the Williamson County Emergency Management Agency throughout the day [Thursday]," she wrote in an email to parents. "Based on the forecast by the National Weather Service of high-risk and life-threatening flooding, Williamson County Schools will be closed tomorrow, Friday, Feb. 22, 2019." The WCS School Age Child Care program is operating at inclement weather sites on the inclement weather	02/21/2019

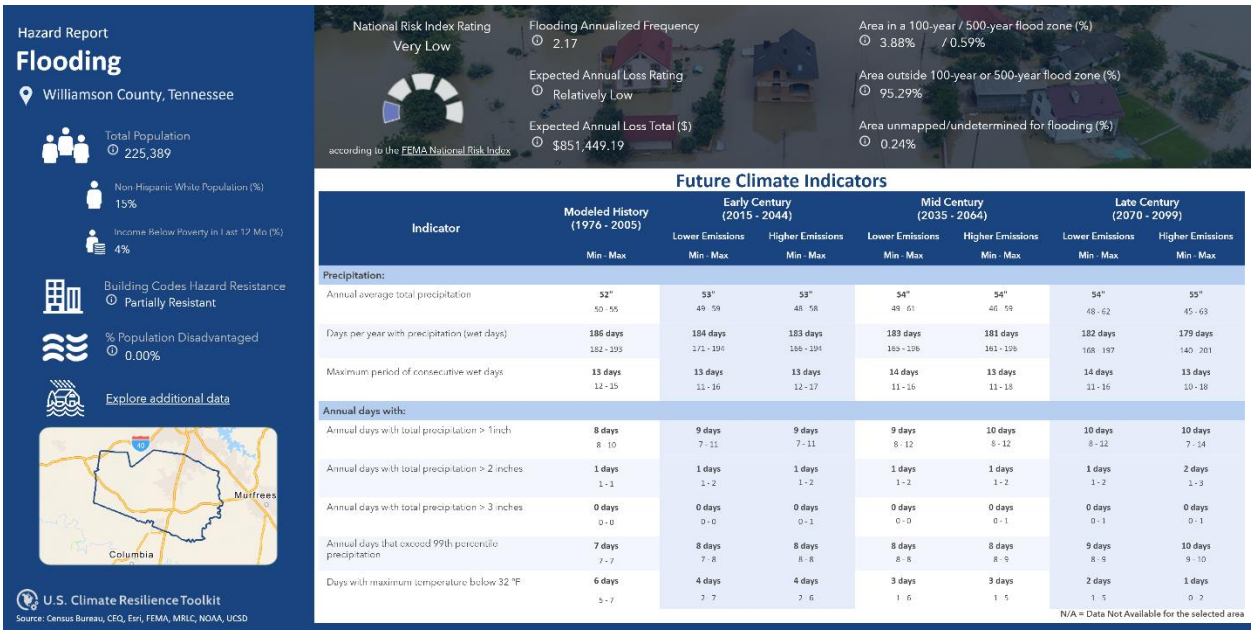
Location	Extent & Impact	Event Date
	schedule, and 12-month employees should follow the inclement weather protocol, Birdsong also wrote. Likewise, FSSD announced Thursday that hazardous driving conditions caused its closure Friday. While there is no school for FSSD students, MAC will be open at the district site, 1406 Cannon Street in Franklin, from 7 a.m. until 5 p.m. MAC students need to bring a lunch." Although this article reports that flooding had impacted operations of the school, no flooding has been reported to have occurred on any school site.	

Probability of Future Events - Likely

The impact of extreme weather events may increase the frequency and intensity of flash flooding within Tennessee, particularly in highly urbanized regions such as Memphis, Nashville, Knoxville, and Chattanooga. Any area with extreme changes in deep terrain, predominately in East Tennessee, will experience significant flooding impacts.

Based on a historical record of 87 flood events over 74 years (1950 - 2022), there is a likelihood for a flood event to occur annually or semiannually. In conjunction with the future weather projections developed by ETSU Geoinformatics & Disaster Science Lab, it can be assumed that a flooding event could occur in Williamson County multiple times a year. *Figure 4* illustrates the projections developed by the ETSU Geoinformatics & Disaster Science Lab.

Figure 4: Climate Mapping Risk Assessment Report for Flooding in Williamson County. (Source: US Climate Resilience Toolkit)



2.6.3 Risk Assessment

The HMPC meeting cited flooding as a repetitive hazard in the county and jurisdictions. Discussion of commonly flood-prone areas took place, as did mention of improvements that have already been made to mitigate risks, such as the currently active project to help restore Trace Creek to its natural state. Over past years, Trace Creek has been inundated with invasive species and its banks have significantly eroded. Through the Cumberland River Compact, the creek is being restored to assist generations to come, repair the environment and its natural inhabitants, and ensure that the Harpeth River is not damaged as the creek runs directly into it. Through active participation in the HMPC and through various public meetings, emergency management officials were able to identify projects that may help in other areas throughout Williamson County that solves similar concerns.

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for natural hazards. It was built and designed by FEMA in close collaboration with various stakeholders and partners in academia; local, state and federal government. The Risk Index leverages available source data for natural hazards and community risk factors to develop a baseline relative risk assessment for each county and census trace. Some of these community risk factors include social vulnerability which is determined by the data pulled from the Census performed every ten years. A higher social vulnerability score is proportional to a higher risk score.

National Risk Index Score for Flooding = Very Low

Although the National Risk Index is a well-valued tool it fails to properly show the feedback from the participating jurisdictions. Therefore, all identified hazards were evaluated in regard to risk by an established risk-scoring system provided by the Williamson County Emergency Management Agency and approved by the HMPC. Local jurisdictions evaluated the conditions using a mid-level impact scenario of the identified hazard. All Williamson County municipal representatives in the HMPC agreed and approved of the risk score for their unique municipality. The results are below:

Flooding Risk as Determined by the HMPC THIRA

To determine the overall risk of a flood in Williamson County, data was also requested and received from the National Weather Service (NWS), the National Centers for Environmental Information (NCEI) by the National Oceanic and Atmospheric Administration (NOAA), WebEOC, the Williamson County Computer Aided Dispatch (CAD) system and from local news reports.

When identifying flood data in Williamson County, consideration was also given to events that the NWS or NOAA did not label as a flood, but impacted the people in our county to a significant degree. For example, a strong thunderstorm may produce a large quantity of rain water that causes a road closure but the NWS does not report as a flood. These incidents are also accounted for in the data collection process. A review of the dam inventory took place and it was decided not to include dam failure as a single hazard, but further information regarding this inventory is included in Appendix E.

The impact and probability numbers assigned to this hazard are as follows:

Human Impact	Property Impact	Business Impact	Operational Impact	Environmental Impact	Probability	Risk Score
3	4	1	2	2	5	7.4

HAZUS Data

HAZUS Methodology

A Level I HAZUS analysis was completed using a probabilistic risk assessment for the 100-year and 500-year return periods. The Level I vulnerability assessment is presented below by return period.

Building Inventory (General Building Stock)

HAZUS estimates that 63,263 buildings in the region have an aggregate total replacement value of $54,685 million. The tables below present the relative distribution of the value concerning the general occupancies by Study Region and Scenario, respectively.

Table 14: Building Exposure by Occupancy Type (HAZUS)

Williamson County (Study Region)		
Occupancy Type	**Exposure ($1000)**	**Percent Total**
Agricultural	163,401	0.3%
Commercial	10,443,597	19.1%
Education	1,949,883	3.6%
Government	231,344	0.4%
Industrial	1,899,509	3.5%
Religion	1,009,276	1.8%
Residential	38,988,257	71.3%
Total	54,685,267	100%

Table 15: Building Exposure by Occupancy Type for 100-yr Flood Scenario (HAZUS)

100-year River Flood Scenario		
Occupancy Type	**Exposure ($1000)**	**Percent Total**
Agricultural	35,313	0.5%
Commercial	1,258,420	16.3%
Education	511,506	6.6%
Government	29,333	0.4%
Industrial	245,961	3.2%
Religion	148,849	1.9%

100-year River Flood Scenario		
Occupancy Type	Exposure ($1000)	Percent Total
Residential	5,508,716	71.2%
Total	7,738,098	100%

Table 16: Building Exposure by Occupancy Type for 500-yr Flood Scenario (HAZUS)

500-yr River Flood Scenario		
Occupancy Type	Exposure ($1000)	Percent Total
Agricultural	35,756	0.5%
Commercial	1,097,519	14.0%
Education	430,332	5.5%
Government	26,842	0.3%
Industrial	213,203	2.7%
Religion	145,817	1.9%
Residential	5,878,291	75.1%
Total	7,827,760	100%

Essential Facility Inventory

HAZUS indicates that there are 2 hospitals in the region with a total capacity of 225 beds. There are 77 schools, 21 fire stations, 5 police stations, and 1 emergency operation centers.

General Building Stock Damage

For the 100-year flood scenario, HAZUS estimates that about 314 buildings will be at least moderately damaged. This is over 47% of the total number of buildings in the scenario. There are an estimated 56 buildings that will be destroyed completely. *Table 17* below summarizes the expected damage by general occupancy type for the buildings in the County during a 100-year flood scenario.

Table 17: Expected Building Damage by Occupancy for 100-yr Flood Scenario (HAZUS)

% Damaged	1-10		11-20		21-30		31-40		41-50		>50%	
Occupancy	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Agricultural	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	7	23	6	19	4	13	5	16	7	23	2	6
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0

% Damaged	1-10		11-20		21-30		31-40		41-50		>50%	
Occupancy	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Religion	0	0	1	100	0	0	0	0	0	0	0	0
Residential	35	11	77	24	60	19	52	16	46	14	54	17
Total	**42**		**84**		**64**		**57**		**53**		**56**	

For the 500-year flood scenario, HAZUS estimates that about 292 buildings will be at least moderately damaged. This is over 50% of the total number of buildings in the scenario. There are estimated 50 buildings that will be destroyed completely. *Table 18* below summarizes the expected damage by general occupancy type for the buildings in the County during a 500-year flood scenario.

Table 18: Expected Building Damage by Occupancy for 500-yr Flood Scenario (HAZUS)

% Damaged	1-10		11-20		21-30		31-40		41-50		>50%	
Occupancy	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Commercial	6	18	9	27	3	9	5	15	5	15	5	15
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Religion	0	0	3	100	0	0	0	0	0	0	0	0
Residential	36	12	79	27	51	17	51	17	36	12	45	15
Total	**42**		**91**		**54**		**56**		**41**		**50**	

Essential Facility Damage

Table 19 and *Table 20* summarize the expected damage to essential facilities following a 100-year and 500-year flood, respectively. Both scenarios analyzed have determined that on the day of the event, all 225 beds in the local hospital would be available for use.

Table 19: Expected Damage to Essential Facilities 100-yr Flood Scenario (HAZUS)

Classification	Total	Number of Facilities		
		At Least Moderate	At Least Substantial	Loss of Use
EOC	6	0	0	0
Fire Stations	21	0	0	0
Hospitals	2	0	0	0
Police Stations	6	0	0	0
Schools	77	0	0	0

Table 20: Expected Damage to Essential Facilities 500-yr Flood Scenario (HAZUS)

Classification	Total	Number of Facilities		
		At Least Moderate	At Least Substantial	Loss of Use
EOC	6	0	0	0
Fire Stations	21	0	0	0
Hospitals	2	0	0	0
Police Stations	6	0	0	0
Schools	77	0	0	0

Debris Generation

100-year Scenario

The model estimates that a total of 3,269 tons of debris will be generated. Of the total amount, Finishes comprises 47% of the total, Structure comprises 28% of the total, and Foundation comprises 25%. If the debris tonnage is converted into an estimated number of truckloads, it will require 131 truckloads (@25 tons/truck) to remove the debris generated by the flood.

500-year Scenario

The model estimates that a total of 3,403 tons of debris will be generated. Of the total amount, Finishes comprises 51% of the total, Structure comprises 27% of the total, and Foundation comprises 23%. If the debris tonnage is converted into an estimated number of truckloads, it will require 137 truckloads (@25tons/truck) to remove the debris generated by the flood.

Shelter Requirements

HAZUS estimates the number of households expected to be displaced due to the flood and the associated potential evacuation. HAZUS also estimates those displaced people who will require accommodations in temporary public shelters.

100-year Scenario

The model estimates 1,006 households (or 3,017 people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 378 people (out of a total population of 247,523) will seek temporary shelter in public shelters.

500-year Scenario

The model estimates 1,098 households (or 3,293 people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 394 people (out of a total population of 247,523) will seek temporary shelter in public shelters.

Building Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the

damage caused to the building and its contents. Business interruption losses are the losses associated with the inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those displaced from their homes because of the flood. Total building-related losses were $503.78 million in the 100-year flood scenario and $544.77 million in the 500-year flood scenario. *Table 21* and *Table 22* summarize the losses associated with the building damage in each scenario.

Table 21: Building Related Economic Loss Estimates for the 100-yr Flood Scenario ($ Millions) (HAZUS)

Category	Area	Residential	Commercial	Industrial	Other	Total
Building Loss	Building	189.84	38.06	3.57	7.34	238.81
	Content	97.02	106.56	8.67	32.35	244.59
	Inventory	0.00	15.39	1.54	3.45	20.38
	Subtotal	286.86	160.00	13.77	43.15	503.78
Business Interruption	Income	1.41	73.75	0.23	12.16	87.54
	Relocation	38.81	19.78	0.21	6.62	65.43
	Rental Income	14.36	13.76	0.04	0.51	28.68
	Wage	3.33	81.58	0.38	58.11	143.40
	Subtotal	57.91	188.88	0.86	77.40	325.05
Total		**344.77**	**348.88**	**14.63**	**120.54**	**828.83**

Table 21: Building Related Economic Loss Estimates for the 500-yr Flood Scenario ($ Millions) (HAZUS)

Category	Area	Residential	Commercial	Industrial	Other	Total
Building Loss	Building	192.82	42.62	4.22	8.51	248.17
	Content	98.88	125.39	10.79	40.20	275.26
	Inventory	0.00	16.19	2.02	3.13	21.34
	Subtotal	291.69	184.20	17.03	51.84	544.77
Business Interruption	Income	2.08	81.40	0.35	13.99	97.82
	Relocation	38.63	21.96	0.37	7.51	68.48
	Rental Income	14.82	14.88	0.09	0.61	30.39
	Wage	4.90	86.86	0.58	48.06	139.40
	Subtotal	60.43	204.09	1.39	70.18	336.09
Total		**352.12**	**388.29**	**18.43**	**122.02**	**880.86**

2.6.4 Land Use and Development

All future development within the floodplain may be considered at risk. An increase in population will likely increase the number of buildings and infrastructure. New development in unincorporated areas could potentially occur in areas prone to flooding and increase vulnerabilities and potential losses; however, most land use regulations require the consideration of flooding during the development process.

2.6.5 Multi-Jurisdictional Differences

Flooding affects all jurisdictions differently; that is why it is essential to document the depth, duration, and time that flooding occurred. These differences are noted in past occurrences to demonstrate the toll that flooding can take on the county's rural and urban areas. Due to the topography of Williamson County with its rolling hills and occasional "bowl-shaped" topography, flood events are prone to occur near streams within the county. FIRM Panels are located within Appendix D to help illustrate a few of the areas at risk and depth of flooding within the county and its incorporated jurisdictions. These firms are samples of some areas and additional needs regarding FIRM panels require a visit to the FEMA website.

Intersections & Roads that consistently flood in Williamson County:

- 1532 Lewisburg Pike
- Del Rio Pike @ White Hall Road
- Beechcroft Road @ Meadows of Spring Hill
- Del Rio Pike btw Cotton Lane and Old Hillsboro Road
- Temple Road @ Old Natchez Road
- Moran Road @ River Rest Subdivision
- Patton Road @ Horton Highway
- Johnson Hollow Road
- Southall Road near Old Hillsboro Road
- Floyd Road near Old Hillsboro Road
- Blazer Road near Boyd Mill
- Concord Road near Bluff Road
- Duplex Road @ Buckner Lane (west side of road)
- Eddy Lane (near the Co-Op) btw Liberty Pike and Murfreesboro Road
- 821 Lewisburg Pike @ Carriage Park Drive
- Miles Johnson (Old Kedron Road) btw Kedron Road and Duplex Road
- Main Street (Spring Hill) @ Chapman's Crossing
- Arno Road @ Trinity Road
- 4500 Peytonsville Road
- 3rd Avenue (Franklin) btw Hillsboro Road and Margin
- Patton Road near Cox Road (near Arrington Vineyard)
- Old Horton Highway @ bridge near McCandless

Waterways that are prone to flooding in Williamson County:

- Mill Creek along Nolensville Road
- Snake Creek

- Areas near the Harpeth River

2.6.6 Summary

Severe flooding has the potential to inflict significant damage in Williamson County. The total economic loss estimated for the 100-year riverine flood is $828.83 million. The total economic loss estimated for the 500-year riverine flood is $880.86 million. Residential, commercial, and public buildings and critical infrastructures such as transportation, water, energy, and communication systems may be damaged or destroyed by flood waters. During a flood event, chemicals and other hazardous substances may contaminate local water bodies. Flooding kills animals and, in general, disrupts the ecosystem. Snakes and insects may also make their way to the flooded areas increasing potential health risks. In Williamson County, flooding has cost millions of dollars and has caused significant danger to the well-being of the citizenry.

2.7 Tornadoes/Severe Winds

2.7.1 Hazard Overview

Tornadoes have the potential to produce winds over 200 mph (EF5 on the Enhanced Fujita Scale) and can be very expansive. Before February 1, 2007, tornado intensity was measured by the Fujita (F) scale. This scale was revised and is now the Enhanced Fujita scale. Both scales are wind estimates (not measurements) based on damage. The new scale provides more damage indicators (28) and associated degrees of damage. *Table 22* shows the wind speeds associated with the enhanced Fujita scale ratings and the damage that could result at different intensity levels.

Table 22: Enhanced Fujita Scale

EF Rating	3 Second Wind Gust (mph)	Estimated Damage
0	65-85	**Light Damage.** Slight damage to roofs, gutters, siding, tree branches broken, shallow-rooted trees overturned
1	86-110	**Moderate Damage**. Mobile homes damaged, exterior portions of homes damaged or lost (i.e., roofs, doors, windows)
2	111-135	**Considerable Damage**. Mobile homes destroyed, cars lifted, well-constructed home frames shifted, roofs torn off, light-object missiles generated, large trees uprooted or snapped.
3	136-165	**Severe Damage**. Severe damage to large buildings, entire home stories destroyed, trees debarked, trains overturned, heavy vehicles lifted and thrown, structures with weaker foundations thrown
4	166-200	**Devastating Damage.** Well-constructed houses and whole frame houses leveled, cars thrown, small missiles generated
5	200+	**Incredible Damage**. Substantial frame houses leveled off foundations and the automobile-sized missiles generated, and high rises experience considerable damage and deformation

According to the Glossary of Meteorology (AMS 2000), a tornado is "a violently rotating column of air, pendant from a cumuliform cloud or underneath a cumuliform cloud, and often (but not always) visible as a funnel cloud." Most tornadoes move from southwest to northeast or west to east.

Although tornadoes can occur in any location, most of the tornado activity in the United States exists in the Mid-West and Southeast. An exact season does not exist for tornadoes; however, most occur between early spring and mid-summer (February – June). The onset of tornado events is rapid, giving those in danger minimal time to seek shelter. The current average lead time, according to NOAA, is 13 minutes. A tornado can reach wind speeds of 40 mph to 250 mph and higher. The following map illustrates the frequency of tornadoes in Tennessee.

2.7.2 County Profile

Figure 5: Tornadoes by County (NWS/NOAA)

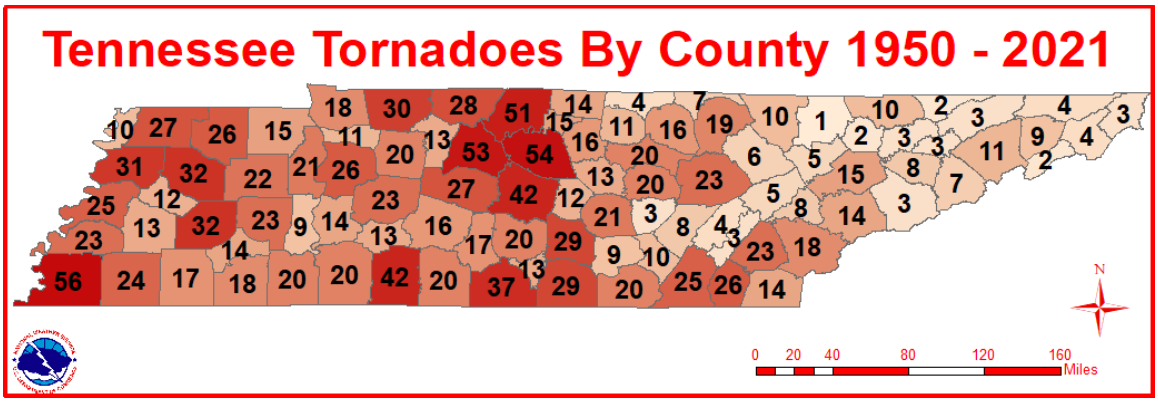
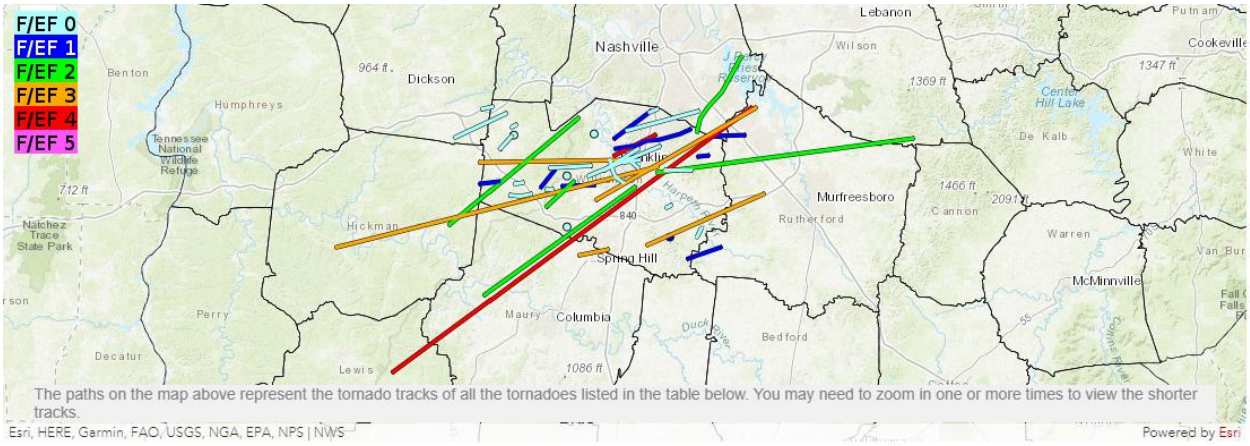


Figure 6 illustrates the track of tornadoes through Williamson County as recorded by the National Weather Service Nashville and the National Climatic Data Center and compiled into a visual database by Mississippi State University. Tornadoes commonly hit between 3:00pm and 8:00pm.

Figure 6: NWS Nashville Tornado Database (Mississippi State University)



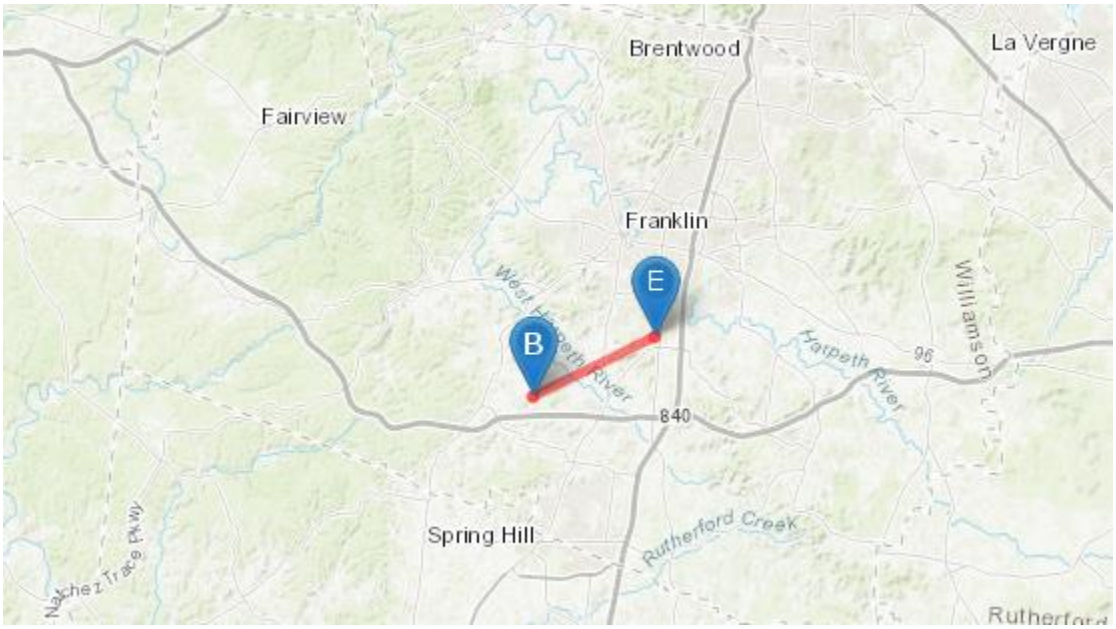
The following narratives were obtained via the NOAA Storm Event Database. Only events resulting in injury, death, or extensive damage (greater than $200K property/crop damage) were included as expanded narratives. A table containing all NOAA-recorded tornadoes between 1950- 2024 for Williamson County is contained in Appendix C.

Event Narrative 1: 12/24/1988

A tornado touched down shortly after 0600 in the Rebel Meadows area of northwest Franklin. The tornado moved northeast at around 45mph, leaving a spotty path of damage. The damage was severe in the places that it touched down. It lifted up for good in the Brenthaven area of the eastern part of Brentwood. Property damage was estimated at around $8 million. Approximately 54 homes, 13 apartment units, 31 businesses, and six parked airplanes were damaged or destroyed. There were seven reported injuries. One man was killed when the roof of his house fell in on him. The tornado had a length of six miles and a width of 150 yards. It cost approximately $25 million in total and ranked as an F4.

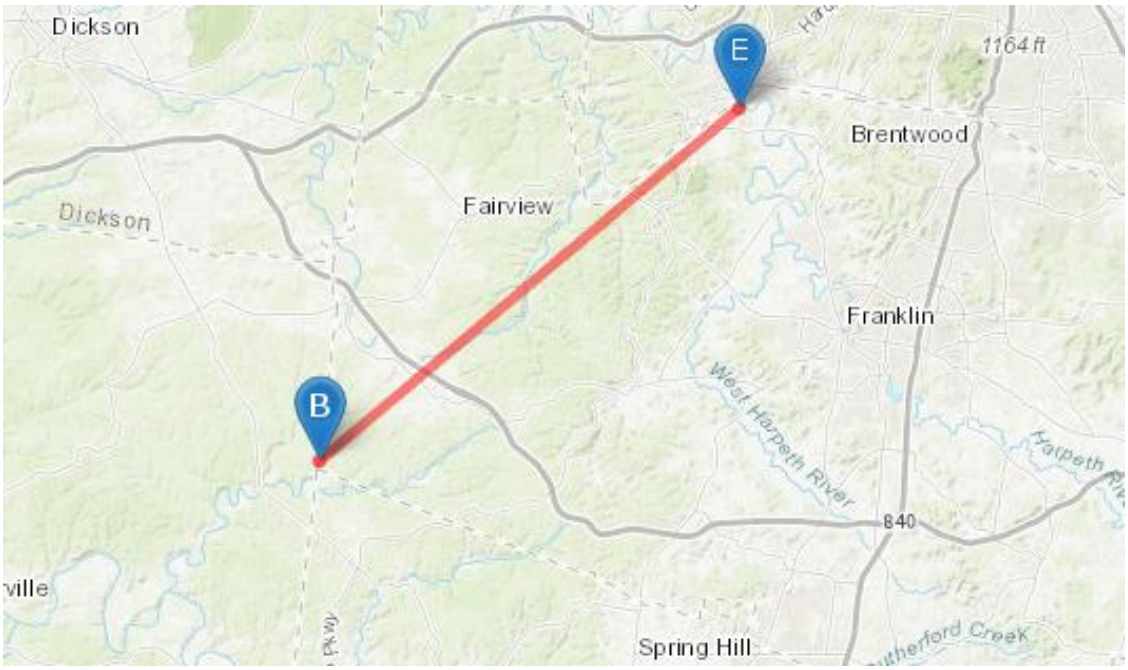
Event Narrative 2: 05/05/2003

A tornado event began at 0038 on May 5th and resulted in approximately $3 million in property damage. 85 homes were damaged, 2 barns were destroyed, and five businesses were damaged. The Tornado had a length of four miles and a width of 100 yards. It was determined to be an F1. In the City of Fairview, a well-built home was 75% destroyed by strong winds. A home on Shady Glen Court near Franklin burned completely down after being struck by lightning.



Event Narrative 3: 02/05/2008

The Super Severe Weather Outbreak on Feb. 5, 2008 produced supercelluar thunderstorms, well in advance of a multicell line of thunderstorms. The whole episode lasted about 6 hours. This occurred ironically while many states, including Tennessee, were participating in the Super Tuesday Primary Election. Fortunately, polls had already closed in the mid-state when these tornadoes struck. Numerous homes were damaged in the Liepers Fork area. One house collapsed and hit another on Cold Water Road. The tornado had a length of 19.98 miles and a width of 300 yards. It ranked as an EF2 and cost about $250 thousand in property damage.

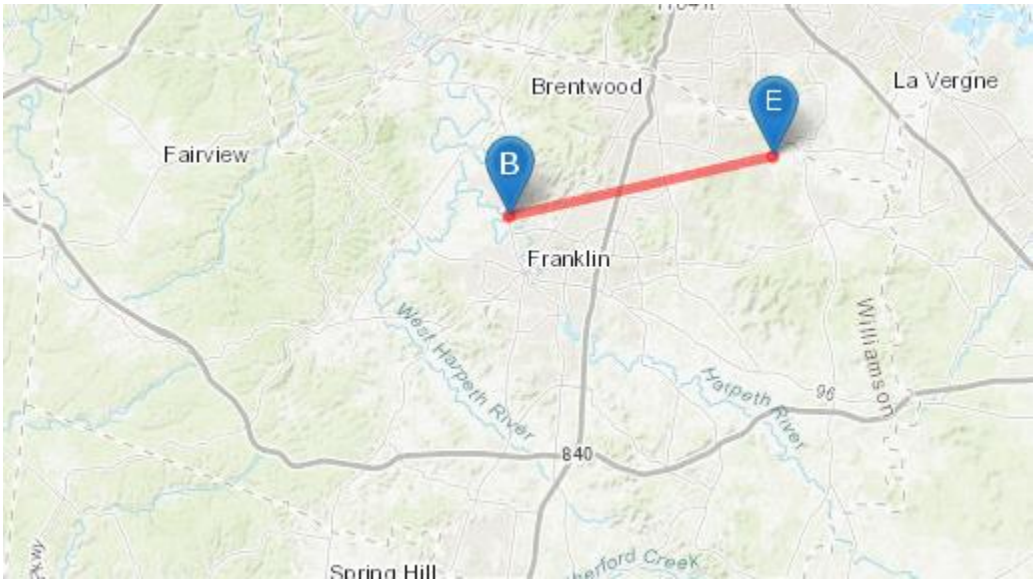


Event Narrative 4: 12/23/15

The most damaging severe weather outbreak in Middle Tennessee since the December 23, 2015 Tornado Outbreak struck during the morning hours on March 1, 2017. A line of strong to severe thunderstorms with embedded circulations, known as a Quasi-Linear Convective System (or QLCS), moved rapidly across Middle Tennessee at 60-70 mph from west to east between 0600 and 1000 CST. Additional severe thunderstorms developed later in the morning and affected areas of southern Middle Tennessee from the late morning into the early afternoon hours. Widespread damaging winds were reported in nearly every county along and north of I-40 across Middle Tennessee, with winds estimated up to 90 mph in some areas. These intense downburst winds caused 3 injuries - two in Clarksville when a tree fell on a mobile home, and one in Lavergne when a tractor-trailer flipped over. In addition to the damaging winds, 7 confirmed tornadoes also touched down from the Nashville metro area eastward to the Upper Cumberland, damaging hundreds of homes and businesses. Several reports of large hail were also received in parts of southern Middle Tennessee.

An EF-1 tornado touched down along Hillsboro Road just northwest of the city of Franklin, then moved rapidly east-northeast across the Cool Springs and Brentwood areas of northern Williamson County before lifting just west of the Davidson County line. The first evidence of damage was several trees blown down in the Monticello neighborhood on Poteat Place and Spencer Creek Road near Hillsboro Road. Two sheds were destroyed and more trees snapped and uprooted along South Berrys Chapel Road. Several more trees were blown down and an outbuilding damaged along Mallory Station Road and Jackson Lake Drive, and numerous homes suffered minor to moderate roof, siding, and chimney damage along Sunrise Circle and Brentwood Pointe. Several businesses suffered damage along Mallory Lane and Galleria Boulevard including blown out garage doors and roof damage, and a video of the tornado was taken from a car dashcam on Commerce Way. The tornado then weakened as it crossed Interstate 65, but still blew down seven interstate highway signs along the roadway. As the tornado moved through Brentwood, it continued to blow down trees and cause minor damage to homes and

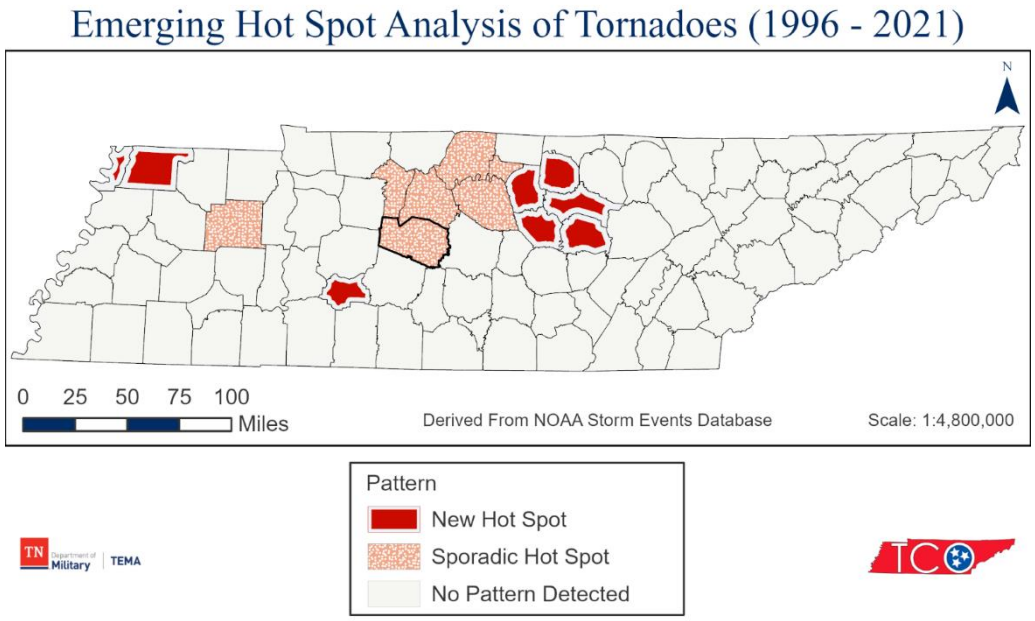
businesses on Westgate Circle, Gordon Petty Drive, Wilson Pike, Demery Court, Crockett Road, and in the Governor's Club neighborhood. The tornado then intensified as it traveled down Concord Road, with dozens of trees snapped and uprooted and numerous homes suffering roof and exterior damage. The tornado then lifted near Owl Creek Park along Chestnut Springs Road just before reaching the Davidson County line. Preliminary estimates from Williamson County Emergency Management indicated that 472 homes and businesses received minor damage, 49 sustained moderate damage, and one home on Sunrise Circle suffered major damage for a total of 522 damaged structures. Damage totals are estimated at $7.27 million.



Probability of Future Events - Likely

Historical data and weather patterns were analyzed to determine the likelihood of future tornado occurrence in Williamson County. Since 1950, 28 tornadoes have occurred within the county. In conjunction with the future weather projections developed by ETSU Geoinformatics & Disaster Science Lab, it can be assumed that a tornado could occur in Williamson County on a yearly basis. *Figure 7* illustrates the Emerging Hot Spot Analysis based on the Number of Tornadoes per year recorded in the NCEI Storm Events Database from 1996 to 2021

Figure 7: Emerging Hot Spot Analysis based on the Number of Tornadoes per Year Recorded in the NCEI Storm Events Database from 1996 to 2021, Williamson County Outlined in Bold.



2.7.3 Risk Assessment

The entirety of Williamson County can be considered at risk for a tornado. This includes the entire County population, all critical facilities, buildings (commercial and residential), and infrastructure. Tornadoes tracked in Tennessee predominantly travel in a northeasterly direction in the state. While all assets are considered at risk from this hazard, a particular tornado would only cause damages along its specific track.

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for natural hazards. It was built and designed by FEMA in close collaboration with various stakeholders and partners in academia; local, state and federal government. The Risk Index leverages available source data for natural hazards and community risk factors to develop a baseline relative risk assessment for each county and census trace. Some of these community risk factors include social vulnerability which is determined by the data pulled from the Census performed every ten years. A higher social vulnerability score is proportional to a higher risk score.

National Risk Index Score for Tornado = Relatively Moderate

Although the National Risk Index is a well-valued tool, it fails to properly show the feedback from the participating jurisdictions. Therefore, all identified hazards were evaluated in regard to risk by an established risk-scoring system provided by the Williamson County Emergency Management Agency and approved by the HMPC. Local jurisdictions evaluated the conditions using a mid-level impact scenario of the identified hazard. The results are below:

Tornado Risk as Determined by the HMPC THIRA

When identifying tornado data in Williamson County, only data provided by the NWS was used. Although other sources confirmed that these events occurred, the data provided from the NWS was the primary data, due to the confusion between strong winds produced in thunderstorms and the winds from tornados.

The impact and probability numbers assigned to this hazard are as follows:

Human Impact	Property Impact	Business Impact	Operational Impact	Environmental Impact	Probability	Risk Score
4	5	2	3	3	4	7.4

Given the information above it becomes vital that all participating jurisdictions are able to prioritize the necessity of mitigation actions in the following lifeline categories so that they can become more resilient in the whole community that they serve.

2.7.4 Land Use and Development Trends

Williamson County codes include proper wind strength and safety regulations consistent with state and federal regulations. While the adopted code provides adequate protection, older and mobile homes are highly susceptible to tornado events. There are multiple mobile home areas in the county that fall into this additional risk category.

2.7.5 Multi-Jurisdictional Differences

The entirety of Williamson County and its incorporated jurisdictions are at risk for a tornado event; however, it is often difficult to fully understand the damage done by disasters in some of the rural parts of the county compared to some of its more urban counterparts. It is also worth noting that given the county's sizeable rural component, some tornadic events may have gone unreported.

2.7.6 Summary

The entirety of Williamson County can be considered at risk for a tornado. This includes the entire county population, all critical facilities, buildings (commercial and residential), and infrastructure. While all assets are considered at risk from this hazard, a tornado would only cause damages along its specific track. The weakest tornadoes, EF0, can cause minor roof damage, and stronger tornadoes can destroy frame buildings and badly damage steel-reinforced concrete structures. Given the strength of the wind impact and construction techniques, buildings are vulnerable to direct impact, including potential destruction, from tornadoes and wind debris that tornadoes turn into missiles. Structures constructed of light materials like mobile homes are most susceptible to damage.

2.8 Wildfire

2.8.1 Hazard Overview

According to the Tennessee Division of Forestry, debris burning, and arson are the two leading causes of wildfires. Generally, three significant factors sustain wildfires and allow predictions of a given area's potential to burn. These factors include, fuel, topography; and weather.

Fuel is the material that feeds the fire and is a critical factor in wildfire behavior. Fuel is generally classified by type and by volume. Fuel sources are diverse and include everything from dead tree needles, twigs, and branches to dead standing trees, live trees, brush, and cured grasses. Artificial structures and other associated combustibles are also considered a fuel source. The type of prevalent fuel directly influences the behavior of wildfire. Light fuels such as grasses burn quickly and catalyze spreading wildfires.

An area's topography (terrain and land slopes) affects its susceptibility to wildfire spread. Fire intensities and rates of spread increase as the slope increases due to the tendency of heat from a fire to rise via convection and radiation. The natural arrangement of vegetation throughout a hillside can also contribute to increased fire activity on slopes.

Weather components such as temperature, relative humidity, wind, and lightning also affect the potential for wildfire. High temperatures and low relative humidity dry out the fuels that feed the wildfire, creating a situation where fuel will more readily ignite and burn more intensely. The wind is the most treacherous weather factor. The issue of drought conditions contributes to concerns about wildfire vulnerability.

2.8.2 County Profile

Williamson County is a healthy mix of both suburban and rural areas. As such, there are vast amounts of land susceptible to wildfires. Information recorded by the Tennessee Division of Forestry and other agencies often fails to record the full scope of fires that pose risks to the health and safety of Williamson County Citizens. As such, information regarding fires in Williamson County was pulled from the Computer Aided Dispatch (CAD) system, which maintains a record of all fires in Williamson County that emergency services were called to. In using this source, fires of a smaller scale that threatened property or the safety of the Williamson County citizenry are also guaranteed to be included. For an additional record of wildfire and brush fire events, please view the spreadsheet located in Appendix C.

Event Narrative 1: 11/19/2023

At approximately 1700 on 11/19/2023, firefighters were dispatched to a possible 10-acre brush fire near Zebe Lane in Fairview. The steep terrain in the area made it difficult for firefighters to fully extinguish or approach the fire. Additionally, rapidly changing weather conditions allowed the fire to grow more rapidly. The fire was mostly extinguished by firefighters walking the perimeter using hand tools. The Tennessee Division of Forestry paired with fire crews were able to utilize bulldozers to help contain the fire. Initially, about 35 firefighters worked the fire until approximately 2100 when the fire was extinguished. The Williamson County Emergency Management Agency provided a drone for aerial views of the fire and related hot spots.

The following Monday, at approximately 5:00 am, firefighters returned to the scene after the fire had rekindled. The fire was investigated and likely caused due to hunters who had built a small

warming fire that grew out of control. The fire was started during an active burn ban across the county.

Event Narrative 2: 11/07/2023

On the Tuesday morning of November 7th, half a dozen agencies responded to a large brush fire that spread to consume more than 150 acres of land. The fire was started after a logging company lit the log pile as people were clearing the property. Before everyone left, the pile was buried but reignited later on.

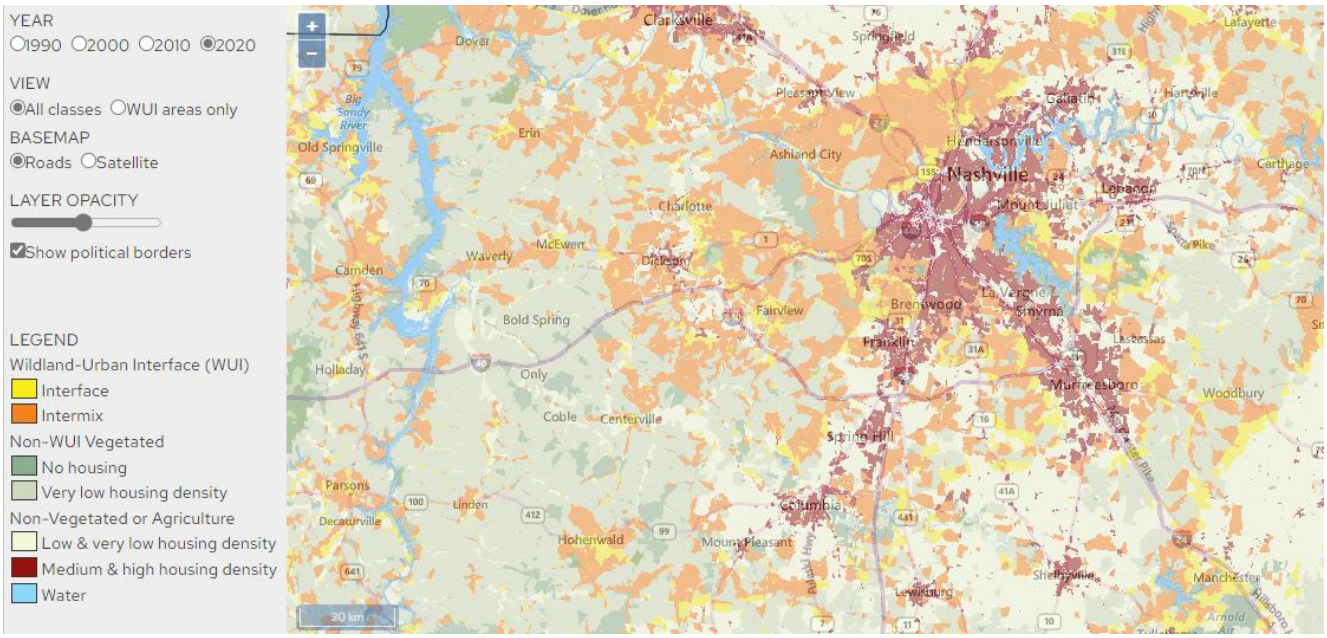
Crews from Franklin Fire, Fairview Fire, Williamson County Emergency Management, Williamson County Sheriff's Office Air 1, Tennessee State Forestry, and Williamson County Fire and Rescue responded. They contained the fire within two hours. Units stayed on the scene throughout the day to deal with hot spots.

This fire marked the 18th brush fire reported in the first week of November, according to Jill Burgin, the external affairs officer for the Williamson County Emergency Management Agency. Williamson County experienced a 155% increase in brush fires from September to November during prolonged drought conditions. The majority were caused by open burning, she said.

Event Summary:

Unincorporated Williamson County is served by all volunteer fire personnel. As such, manpower can be limited during normal weekday business hours. Due to the terrain and rural nature of the county, wildfire poses a significant risk to the region's agricultural resources and residential structures. As seen by the Wildland Urban Interface map below, most of the unincorporated county is either low housing density or intermix. The sparse population and the availability of fuel create an environment where fires could develop and spread rapidly and have a delayed ability to be noticed and summon a response.

Figure 8: Wildland-Urban Interface (SILVIS LAB)



Probability of Future Events – Likely

It is hard to predict the likelihood of wildfires as many factors contribute to the ignition of a wildfire. Wildfires can be part of a natural and healthy forest disturbance process, but they have become increasingly frequent and severe in recent years. Higher spring and summer temperatures cause soils to be drier for longer, increasing the likelihood of drought and a more extended wildfire season. These hot, dry conditions also increase the chance that wildfires will be more intense and long-burning once they are started by lightning strikes or human carelessness. With the current growth being experienced in the County, human caused wildfires will continue to occur more often from land clearing and construction activities.

Due to changing precipitation patterns, future conditions make forests more susceptible to severe fires. Wildfires emit carbon dioxide, greenhouse gases, and air pollutants such as methane and nitrous oxide, up to 3% of annual U.S. greenhouse gas emissions. Wildfires release carbon that has been sequestered by the burned trees. However, these effects are not uniform across all forests.

Additionally, the Climate Risk and Resilience Portal states that conditions prone to increase wildfires and brush fires are likely to increase. The maximum average temperature annually was historically 65.49 degrees. However, the mid-century numbers are suggesting 68.21 degrees (RCP 4.5) and 67.7 degrees (8.5 RCP). By the end of the century, temperatures are expected to increase to 69.79 degrees (RCP 4.5) and 73.38 (RCP 8.5). Drought can be intensified by unusually warm temperatures. When combined with very low precipitation and snowpack, extreme heat can lead to decreased streamflow, dry soils, and large-scale tree deaths. These conditions create increased potential for extreme wildfires that spread rapidly, burn with more severity, and are costly to suppress. With increasing temperatures, it is expected that these conditions will become more frequent and wildfire/brush fire risk will increase.

The Fire Weather Index (FWI) estimates weather-related wildfire danger using daily readings of temperature, relative humidity, wind speed, and precipitation. It considers conditions that influence the spread of wildfires, including the dryness of fuel sources and high winds. Higher FWI values represent greater danger of wildfires due to weather conditions, though FWI values signal different levels of relative fire danger across regions. Values above 25 typically represent a high level of danger in the northern regions, whereas values above 40-45 often represent a high level of danger in the Southwest. Williamson County is estimated to have an FWI of 38.65 recorded for Summer as the percent change between end of century estimates and the historical number data. This suggests that climate change is likely to contribute to this risk becoming greater in the future for all of Williamson County.

This assessment has been well supported by the increase in brush fires and wildfires that have occurred in Williamson County. In the fall of 2023, a burn ban was placed into effect to help limit the occurrences of these incidents that required a response from the county emergency management agency and county/municipal fire departments. Pre-existing strategies such as the implementation of burn bans are increasingly more necessary as the risk remains high for these types of events.

2.8.3 Risk Assessment

Wildfires are more likely to occur during drought periods due to dryer foliage being quicker to ignite and spread.

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for natural hazards. FEMA built and designed it in close collaboration with various stakeholders and partners in academia; local, state and federal government. The Risk Index leverages available source data for natural hazards and community risk factors to develop a baseline relative risk assessment for each county and census trace. Some of these community risk factors include social vulnerability which is determined by the data pulled from the Census preformed every ten years. A higher social vulnerability score is proportional to a higher risk score.

National Risk Index Score for Wildfire = Very Low

Although the National Risk Index is a well-valued tool, it fails to show the feedback from the participating jurisdictions properly. Therefore, all identified hazards were evaluated regarding risk by an established risk-scoring system provided by the Williamson County Emergency Management Agency and approved by the HMPC. Local jurisdictions evaluated the conditions using a mid-level impact scenario of the identified hazard. .

Wildfire/Brush Fire Risk as Determined by HMPC THIRA

To determine the overall risk of a Wildfire/Brush Fire in Williamson County, data was taken from the National Centers for Environmental Information (NCEI) by the National Oceanic and Atmospheric Administration (NOAA) as well as the Williamson County Computer Aided Dispatch (CAD) system. Additionally, the risk assessment from the Southern Group of State Foresters (SGSF) and the Tennessee Wildfire Risk Assessment is also included. This risk assessment states Williamson County is at a low risk of experiencing a wildfire.

According to the National Wildfire Coordinating Group (NWCG), a wildfire exists in one of seven classes. These are:

- Class A - one-fourth acre or less;
- Class B - more than one-fourth acre, but less than 10 acres;
- Class C - 10 acres or more, but less than 100 acres;
- Class D - 100 acres or more, but less than 300 acres;
- Class E - 300 acres or more, but less than 1,000 acres;
- Class F - 1,000 acres or more, but less than 5,000 acres;
- Class G - 5,000 acres or more.

Any fire within Williamson County that falls into any of these classes will be included. A history of fires that have been recorded across Williamson County since 2005 is included in the local threat and hazard data as provided in Appendix C.

The impact and probability numbers assigned to this hazard are as follows:

Human Impact	Property Impact	Business Impact	Operational Impact	Environmental Impact	Probability	Risk Score
2	3	1	2	3	5	7.2

Given the information above it becomes vital that all participating jurisdictions are able to prioritize the necessity of mitigation actions in the following lifeline categories so that they can become more resilient in the whole community that they serve.

2.8.4 Land Use and Development Trends

Many residential and commercial buildings and most infrastructure networks throughout the county may be vulnerable to wildfire impacts. Many of these structures are at risk for direct and indirect impacts; such as downed electrical lines, decreased water quality, decreased air quality, devastated agriculture crops, and restricted travel routes.

2.8.5 Multi-Jurisdictional Differences

Due to the nature of wildfires, Williamson County and all incorporated jurisdictions are equally susceptible to them. Due to the rapidly growing population, residential density is adding increased chances of loss of life or injury if a wildfire were to occur. Due to a high amount of rural farmland, there is an increased crop or farm animal loss potential. Fire response by emergency personnel in municipal areas of the county occurs more rapidly than in unincorporated Williamson County.

2.8.6 Summary

Williamson County and the incorporated jurisdictions are equally vulnerable to wildfire. Fires, smoke, and air quality can affect people’s health and safety. Therefore, it is essential to have proper measures in place to prevent critical structures, homes, and businesses from being vulnerable to fire and smoke damage.

2.9 Drought/Excessive Heat

2.9.1 Hazard Overview

Drought is a deficiency in precipitation over an extended period. It is a standard, recurrent feature of climate that occurs in virtually all climate zones. The duration of droughts varies widely. In some cases, drought develops relatively quickly and lasts a very short time, exacerbated by extreme heat and/or wind. There are other cases when drought spans multiple years or even decades. Studying the paleoclimate record is often helpful in identifying when long-lasting droughts have occurred. Common types of droughts are detailed below.

Table 23: Drought Classifications

Type	Details
Meteorological Drought	Meteorological Drought is based on the degree of dryness (rainfall deficit) and the length of the dry period.
Agricultural Drought	Agricultural Drought is based on the impacts on agriculture by factors such as rainfall deficits, soil water deficits, reduced groundwater, or reservoir levels needed for irrigation.
Hydrological Drought	Hydrological Drought is based on the impact of rainfall deficits on the water supply, such as stream flow, reservoir and lake levels, and groundwater table decline.
Socioeconomic Drought	Socioeconomic drought is based on the impact of conditions (meteorological, agricultural, or hydrological drought) on the supply and demand of some economic goods. Socioeconomic deficiency occurs when the demand for an economic good exceeds the supply due to a weather-related deficit in the water supply.

The wide variety of disciplines affected by drought, its diverse geographical and temporal distribution, and the many scales drought operates on make it difficult to develop a definition to describe drought and an index to measure it. Many quantitative measures of droughts have been developed in the United States, depending on the discipline affected, the region being considered, and the particular application. Several indices developed by Wayne Palmer and the Standardized Precipitation Index help describe the many scales of drought.

The U.S. Drought Monitor summarizes drought conditions across the United States 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 and local expert input into a single composite drought indicator.

The Standardized Precipitation Index (SPI) measures drought, which differs from the Palmer Drought Index (PDI). Like the PDI, this index is negative for lack and positive for wet conditions. But the SPI is a probability index that considers only precipitation, while Palmer's indices are water balance indices that consider water supply (rain), demand (evapotranspiration), and loss (runoff).

The Palmer Drought Severity Index (PDSI), devised in 1965, was the first drought indicator to assess moisture status comprehensively. It uses temperature and precipitation data to calculate

water supply and demand, incorporates soil moisture, and is considered the most effective for unirrigated cropland. It primarily reflects the Perry-term drought and has been used extensively to initiate drought relief. It is more complex than the SPI and the Drought Monitor.

2.9.2 County Profile

Drought

According to the trend analysis map shown in *Figure 9*, Middle Tennessee has a relatively low risk of drought hazards. However, drought cannot be confined to geographic or political boundaries, and some areas may experience more severe drought events than what is shown on the map.

Figure 9: Trend Analysis of U.S. Drought Monitor from 2000 – 2021, Williamson County Outlined in Bold.

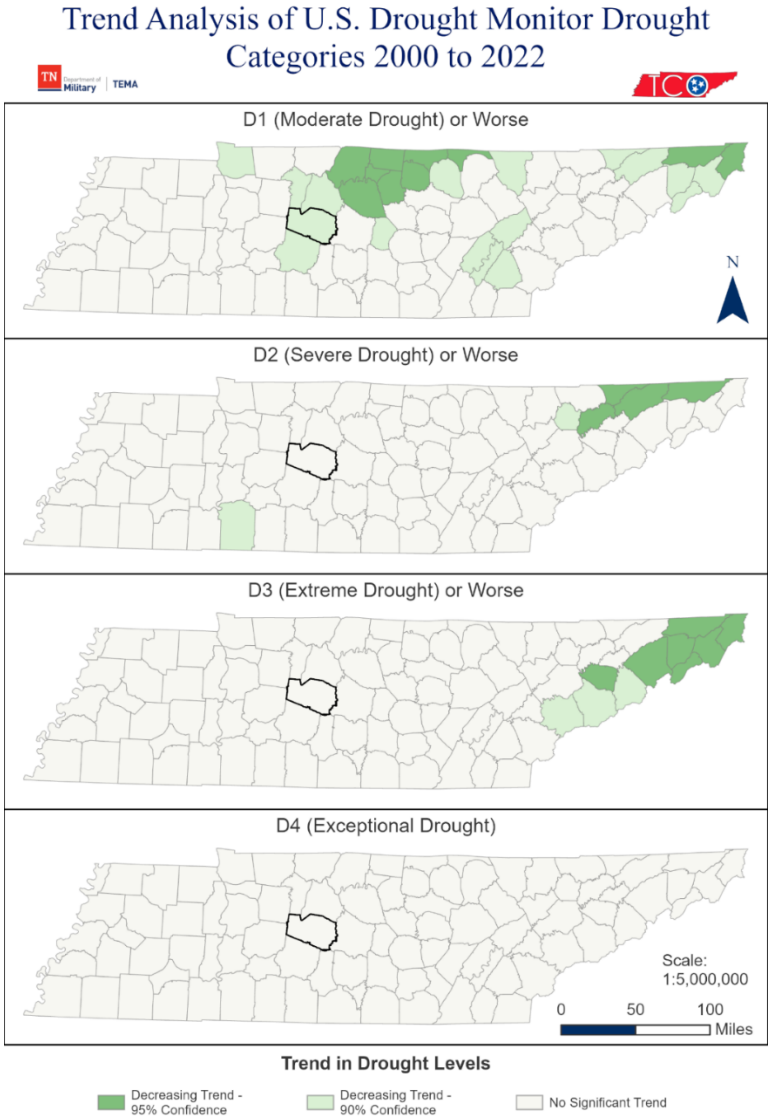


Figure 10: Drought Monitor Time Series (Source: National Drought Mitigation Center)

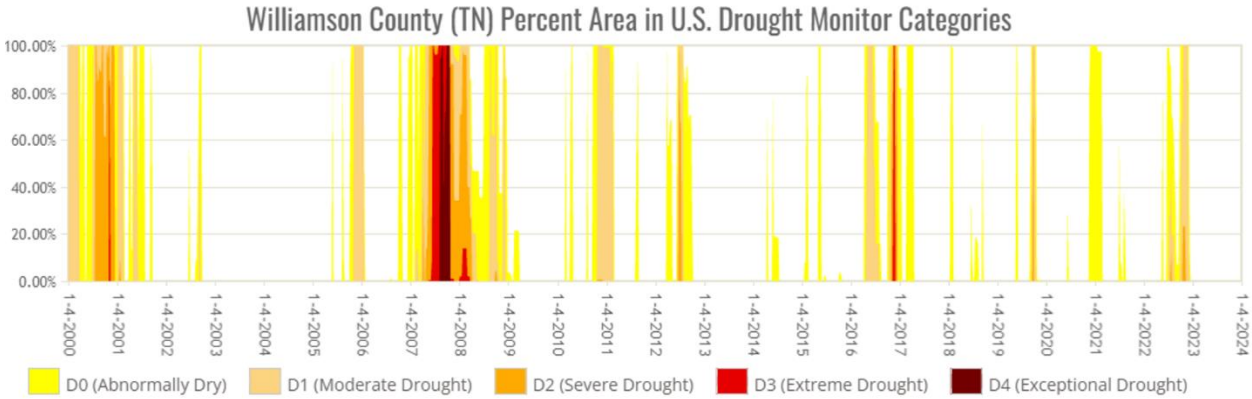


Figure 10 above illustrates drought conditions within Williamson County between 2000 and 2024. According to the National Drought Mitigation Center, the last Exceptional Drought (D4) period occurred in 2007. D4 (exceptional drought) is categorized by browning grass, low lake levels, municipality water restrictions, and increased water prices. D0 (abnormally dry) conditions consist of hard ground and declining agriculture ponds and creeks. A table containing all NOAA-recorded drought events between 2000 - 2023 for Williamson County is included in Appendix C.

Event Narrative 1: 05/01/2007

Drought conditions started in March 2007, but farmers felt its effects in May. The hay quality was poorer, and yield was down by as much as 60 to 70 percent. There were 14 consecutive days in May, specifically from May 17-30, when no rain fell in Nashville. There was a trace of rain on May 31. May had 3.30 inches of rain, which was 1.77 inches below normal.

The longest period on record for no rain was 36 consecutive days from September 11, 1923 through October 16, 1923. This drought affected much Middle Tennessee, including surrounding counties: Humphreys, Hickman, Lewis, Wayne, and Benton. Many reports of poor/low-quality crops were made: dairy cows were producing 20% less milk, fish were dying by the thousands, and numerous ponds, creeks, streams, and some wells were drying up. Tennessee crop losses in 2007 approximated around $750 million. Some counties/cities had to implement water restrictions throughout the drought.

Event Narrative 2: 07/03/2012

After several weeks of below-normal rainfall, drought conditions across several Middle Tennessee counties reached the D2 Severe Drought Classification Criteria as stated in the U.S. Drought Monitor on Tuesday, July 3rd. As the month progressed, the drought conditions across these counties ended as ground moisture levels approached average levels for this time of year.

Event Narrative 3: 11/01/2022

With much of November 2022 remaining abnormally dry, drought conditions across Middle Tennessee worsened. By the end of November, 100 percent of Middle Tennessee was in at least moderate drought with about 34 percent in severe drought. Drought conditions worsened the most for counties near the Tennessee River and those along and near the Cumberland Plateau. For much of the month, precipitation totals were well below normal, generally ranging from 1 to

3 inches. A beneficial storm system brought widespread rainfall during the last couple days of November helped improve drought conditions in the update released in December. Severe drought conditions from October 2022 improved to moderate drought in November.

Event Narrative 4: 10/17/2023

With an abnormally dry fall for Middle Tennessee, drought conditions quickly worsened throughout the area. At the beginning of October, only abnormally dry conditions were observed across portions of Middle Tennessee. However, by the end of the month, about 70 percent of the area was in at least a severe drought, with about 42 percent of that area in the extreme drought category. Areas across the northwest were still only in the abnormally dry category due in part to this area receiving about 1.5 to 3 inches of rain during the month. With this abnormally dry fall, Nashville's rainfall deficit for the year continued to worsen at 7.71 inches below normal for the year. Drought conditions across Williamson County quickly deteriorated through October with severe to extreme drought conditions observed across the entire county by the end of the month.

Heat Waves

Excessive Heat is when the heat index reaches at least 105ºF for at least three hours on two consecutive days, and the nighttime air temperature does not drop below 75ºF. The definition of Excessive Heat is a “rule of thumb” because the detrimental effects of high temperatures and humidity vary among segments of the population (old, young, etc.) and whether the population in general has built up a heat tolerance (residents in desert communities fair better than visitors). While some may better cope with excessive heat as defined, others may still be adversely affected by a lower heat index. A “rule of thumb” works for mitigation planning because the benefits of specific mitigation actions start accruing before conditions reach excessive heat levels. Exposure to extreme heat can pose health risks, including sunburn, dehydration, heat cramps, and heat stroke.

The National Weather Service Heat Index calculates how hot it feels when relative humidity is factored in with the actual air temperature using a 4-factor scale: caution, extreme caution, danger, extreme danger. The National Weather Service (NWS) also issues Heat Alerts.

- A Heat Advisory is issued 12-24 hours before the onset, at least 100ºF but less than 105ºF for at least 2 hours.
- An Excessive Heat Watch is issued when temperatures of 105ºF or greater are forecasted for the next 24 to 72 hours.
- An Excessive Heat Warning is issued when temperatures of 105°F last for more than 3 hours per day for two consecutive days or temperatures exceed 115°F for any period.

The following narratives were obtained via the NOAA Storm Event Database for Excessive Heat. A table containing all NOAA-recorded events between 2000-2024 for Williamson County is included in Appendix D.

Event Narrative 1: 08/04/2010

Afternoon heat index readings ranged from 110 to 115 degrees over much of Middle Tennessee on August 4th. Around the Nashville Metropolitan area, a couple dozen people were hospitalized suffering from heat exhaustion along with several others being hospitalized suffering from burnt feet. There were no known fatalities. There were also numerous reports of damage from the heat,

including exploding tires on automobiles. Afternoon temperatures around 100 degrees and unusually high humidity led to heat index values between 110 and 115 degrees on August 4th.

Event Narrative 2: 6/30/23

The first part of the day on June 30, 2023, was characterized by dangerous hot and humid conditions across most of Middle Tennessee as heat index values soared to 115 to 125 degrees. With these hot temperatures, an abundant amount of instability was in place across the area. With a mesoscale convective system (MCS) developing over Illinois and Indiana and diving southward, it moved into an environment that was favorable for severe thunderstorms. Damaging winds were the main hazards with this line of thunderstorms with several wind damage reports received through the evening hours. A weather station near Brentwood measured a maximum heat index value of 121 degrees.

Probability Future Events – Likely

The probability of Williamson County and its municipalities experiencing a drought/excessive heat event can easily be determined based on the historical record of 38 droughts per the NOAA since 2019. It can reasonably be assumed that these types of events have occurred consistently and will continue to occur each year.

2.9.3 Risk Assessment

Williamson County is vulnerable to drought; however, estimated potential losses are inherently difficult to calculate because drought tends to cause minor damage to the built environment. Therefore, it is assumed that all buildings and facilities in the planning area would technically be exposed to the drought hazard; however, there is no significant vulnerability to these buildings on a structural level.

Potential drought losses can be calculated in terms of the value of agriculture in the County, which is perhaps most vulnerable to drought. According to the USDA, the net income for agriculture is around $2.6 million. Population growth could contribute directly to this hazard, as more users pull from the available water supply within the region. Drought can also increase the County's vulnerability to wildfires. Dry, hot, and windy weather combined with dry vegetation and a spark through human intent, accident, or lightning can start a wildfire.

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for natural hazards. It was built and designed by FEMA in close collaboration with various stakeholders and partners in academia; local, state and federal government. The Risk Index leverages available source data for natural hazards and community risk factors to develop a baseline relative risk assessment for each county and census trace. Some of these community risk factors include social vulnerability which is determined by the data pulled from the Census preformed every ten years. A higher social vulnerability score is proportional to a higher risk score.

National Risk Index Score for Drought = Very Low

Although the National Risk Index is a well-valued tool it fails to properly show the feedback from the participating jurisdictions. Therefore, all identified hazards were evaluated in regard to risk by an established risk-scoring system provided by the Williamson County Emergency Management Agency and approved by the HMPC. Local jurisdictions evaluated the conditions using a mid-level impact scenario of the identified hazard. The results are below:

Drought/Excessive Heat Risk as Determined by the HMPC THIRA

To determine the overall risk of Drought/Excessive Heat in Williamson County, data was taken from the National Weather Service (NWS) as well as the National Centers for Environmental Information (NCEI) by the National Oceanic and Atmospheric Administration (NOAA).

Similar to the other natural hazards, data from these two sources were the primary resources used to determine how many days of drought and excessive heat were experienced in Williamson County.

The impact and probability numbers assigned to this hazard are as follows:

Human Impact	Property Impact	Business Impact	Operational Impact	Environmental Impact	Probability	Risk Score
1	3	1	1	2	5	6.6

Given the information above, it becomes vital that all participating jurisdictions are able to prioritize the necessity of mitigation actions so that they can become more resilient in the whole community that they serve.

2.9.4 Land Use and Development

According to the National Drought Mitigation Center, how we use land affects our vulnerability to drought. In general, land use patterns that maintain the integrity of watersheds and that have a smaller paved footprint result in greater resilience in the face of drought. The projected increase in population will possibly result in an increase in buildings and infrastructure, leading to increased impervious areas. An increase in population may also put increasing pressure on water and other natural resources, particularly during periods of drought. Therefore, future development could impact drought vulnerability in Williamson County.

2.9.5 Multi-Jurisdictional Differences

Due to the nature of drought, Williamson County and the incorporated jurisdictions are equally susceptible to drought conditions.

2.9.6 Summary

Williamson County and all incorporated jurisdictions are equally vulnerable to drought/excessive heat. With historical frequency considered, there is a significant chance of these events occurring each year. Drought/excessive heat can affect people’s health and safety. Examples of drought impacts on society include anxiety or depression about economic losses, conflicts when there is not enough water, reduced incomes, fewer recreational activities, higher incidents of heat stroke, and even loss of human life. Drought/excessive heat conditions can also provide a substantial increase in wildfire risk. As plants and trees wither and die from a lack of precipitation, increased insect infestations, and diseases—all associated with drought—they become fuel for wildfires. Williamson County periods of drought can equate to more wildfires and more intense wildfires, which affect the economy, the environment, and society in many ways, such as by destroying neighborhoods, crops, and habitats.

2.10 Severe Winter Weather

2.10.1 Hazard Overview

A freeze occurs when temperatures are below 32 degrees Fahrenheit for a period. These temperatures can damage crops, burst water pipes, and create layers of "black ice." Winter storms are events that can range from a few hours of moderate snow to blizzard-like circumstances that can affect driving conditions and impact communications, electricity, and other services. In Williamson County, all jurisdictions are vulnerable to freezes and moderate winter storms, but not to the severity level seen in much of the northern U.S. Based on previous occurrences, Williamson County can experience multiple winter weather events in one year affecting all jurisdictions equally. The severity of winter storms is commonly measured by inches of snowfall. It is possible for snowfall to accumulate up to 1 foot in Williamson County and/or ice accumulations to cause hazardous conditions. Much of these conditions are impacted by the numerous waterways present in middle Tennessee.

2.10.2 County Profile

The entirety of Williamson County is at risk of severe winter weather. Severe winter weather events can include large snow storms and ice storms. The NWS chose these severity measures as parameters more capable of producing considerable damage.

Event narratives were obtained via the NOAA Storm Event Database and are included below for each severe weather category. Tables containing all NOAA-recorded severe weather events between 1950- 2024 for Williamson County are contained in Appendix C.

Event Narrative 1: 02/16/2015

A major winter storm affected Middle Tennessee through much of the day on February 16, with a wintry mix of freezing rain, sleet, and snow. Freezing rain and sleet predominated along and south of I-40, with a mix of sleet and snow north of I-40. Combined ice and sleet accumulations ranged from 0.1" to 3" south of I-40, while combined sleet and snow accumulations north of I-40 ranged from 1" to over 7" near the Kentucky border. With temperatures well below freezing, widespread ice and snow covered all surfaces, resulting in numerous trees and power lines being knocked down and lengthy power outages lasting for a few days in some cases. Many roadways were impassable or closed, resulting in nearly all Middle Tennessee school systems shutting down for the entire week. Precipitation totals across Williamson County ranged from 0.5" to 2" of combined ice and sleet. A CoCoRaHS observer 3.8 miles SW of Fairview measured 2.0 of combined ice and sleet, while another CoCoRaHS observer 3.9 miles WSW of Eagleville measured 0.5" of combined ice and sleet. A photo from X showed 2" of ice and sleet in Franklin. Numerous trees and power lines were knocked down across the county, and many roads and schools were closed.

Event Narrative 2: 02/15/2021

An Arctic airmass spread across Middle Tennessee from Thursday, February 11 through Sunday, February 14, 2021, bringing very cold temperatures in the teens and 20s along with lengthy periods of freezing drizzle. This led to ice forming on elevated surfaces such as trees and power lines, as well as bridges, overpasses, and some roadways. As a major winter storm brought additional freezing rain, sleet, and snow to the area from Sunday evening February 14 into Monday, February 15, 2021, the previous ice combined with the new ice, sleet, and snow to

cause significant ice storm damage across parts of east-central Middle Tennessee, as well as create massive travel disruptions area wide. Locations from Giles and Lincoln Counties northeastward to Pickett and northern Fentress Counties received anywhere from 0.5” to over 1” of ice accretion from the combination of the weekend freezing drizzle plus new freezing rain. Numerous trees and power lines were downed in many counties, resulting in tens of thousands of power outages, with the worst damage affecting Lincoln, Bedford, Coffee, Cannon, Putnam, Overton, and northern Fentress Counties. Elsewhere, 2 to 3 inches of combined sleet and snow along with the frigid temperatures caked most surfaces in a thick layer of ice, with travel coming to a standstill across the northwestern half of Middle Tennessee - including the Nashville metro area. A wintry mix of snow and sleet brought snow accumulations up to 1/2 inch and sleet accumulations up to 2.5 inches across the county. Roads were ice covered and impassable, with most businesses and schools closed for the entire week.

Probability of Future Events - Likely

Data from the National Weather Service NOHRSC National Gridded Snowfall Analysis webpage covering the winters of 2008-2009 to 2022-2023 (the last 15-years) indicates that the average annual snowfall for Williamson County ranges from 4 to 6-inches per year. Using data from the NOAA Storm Events Database, trend analysis was performed on winter weather-related storms from 1996 to 2021 across the state of Tennessee. In this time period there was an increasing trend in the number of winter storms impacting Williamson County, this trend was significant to the 99% confidence level.

Figure 11: Average Annual Snowfall from the Winter of 2008/2009 to the Winter of 2022/2023, Williamson County Outlined in Bold.

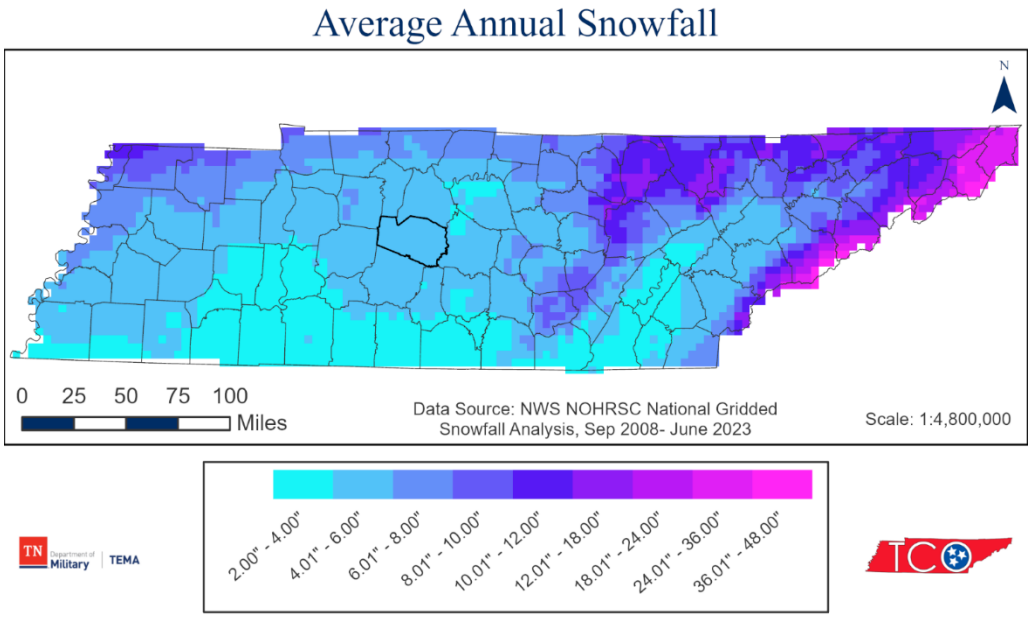
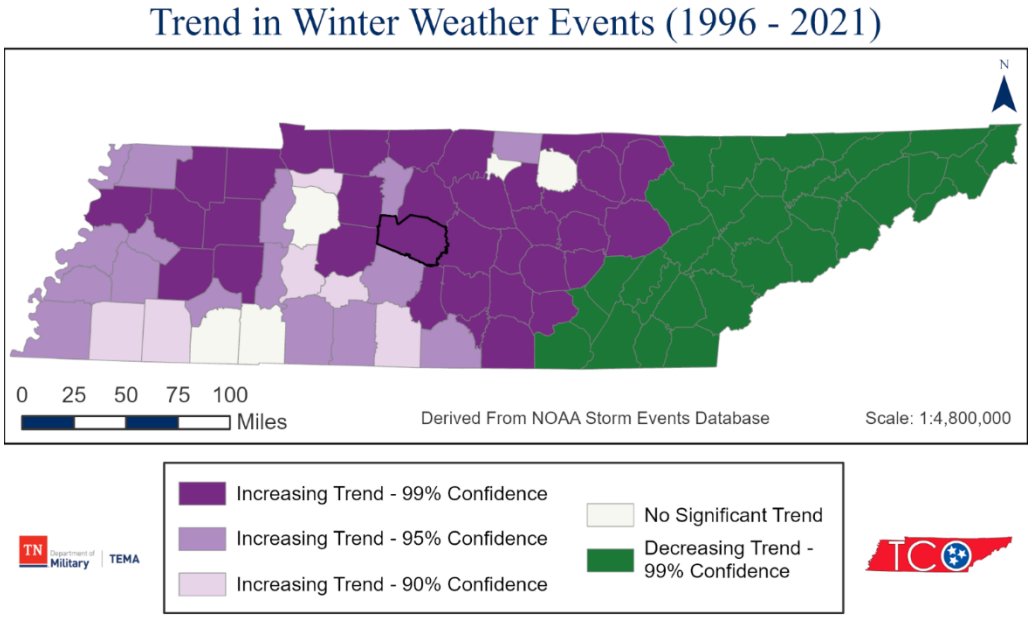


Figure 12: Trends in the Number of Winter Weather-Related Events Recorded in the NCEI Storm Events Database from 1996 to 2021, Williamson County Outlined in Bold.



Climate trends and variability will impact the future likelihood of winter weather events or severe winter storms in Tennessee, likely decreasing but not eliminating the overall risk. Average annual temperatures are expected to increase across the Southeast US, including temperatures during the winter season. Williamson County has an observed warming trend of +0.1°F per decade from 1896 to 2023 throughout the meteorological/climatological winter season (December – February). In the medium-term (1961 - 2023) the winter temperature trend shows greater warming at +0.8°F per decade, however, the short-term (1991 - 2023) trend shows slightly moderated warming of +0.6°F per decade during the winter season. The moderation was caused by the exclusion of the very cold winters of 1963 and 1977-1979.

2.10.3 Risk Assessment

Severe weather is not as spatially defined in any location in Williamson County; therefore, the entire County is equally at risk of severe weather. This includes the entire County population, all critical facilities, buildings (commercial and residential), and infrastructure. The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for natural hazards. It was built and designed by FEMA in close collaboration with various stakeholders and partners in academia; local, state and federal government. The Risk Index leverages available source data for natural hazards and community risk factors to develop a baseline relative risk assessment for each county and census trace. Some of these community risk factors include social vulnerability which is determined by the data pulled from the Census performed every ten years. A higher social vulnerability score is proportional to a higher risk score.

National Risk Index Score for Ice Storm = Relatively Low

National Risk Index Score for Winter Weather = Relatively Low

Although the National Risk Index is a well-valued tool it fails to properly show the feedback from the participating jurisdictions. Therefore, all identified hazards were evaluated in regard to risk by an established risk-scoring system provided by the Williamson County Emergency Management Agency and approved by the HMPC. Local jurisdictions evaluated the conditions using a mid-level impact scenario of the identified hazard.

To determine the overall risk of a severe Winter Weather/Snow and Ice event in Williamson County, data was pulled from the National Weather Service (NWS), the National Centers for Environmental Information (NCEI) by the National Oceanic and Atmospheric Administration (NOAA), WebEOC, and the Williamson County Computer Aided Dispatch (CAD) system.

When identifying Winter Weather/Snow and Ice event data, incidents that have an impact on life safety or pose a risk of damage to property and or the environment are included. Additionally, considerations must be given to transportation as it will be significantly impacted by the hazards associated with this type of event.

The impact and probability numbers assigned to this hazard are as follows:

Human Impact	Property Impact	Business Impact	Operational Impact	Environmental Impact	Probability	Risk Score
2	2	1	1	1	4	5.4

Given the information above it becomes vital that all participating jurisdictions are able to prioritize the necessity of mitigation actions so that they can become more resilient in the whole community that they serve.

2.10.4 Land Use & Development

Increased development and population growth can reasonably translate to increased damages resulting from severe winter weather events. The population in Williamson County is expected to rise similarly to its surrounding counties and Tennessee. An increase in population will lead to an increase in the number of residential and commercial structures, as well as new and improved infrastructure, which in turn means an increase in the number and value of assets at risk of damage caused by severe winter weather.

2.10.5 Multi-Jurisdictional Differences

The entirety of Williamson County and the incorporated jurisdictions, including all assets, can be considered equally at risk of severe winter weather events. This includes the entire population, all critical facilities, buildings (commercial and residential), and infrastructure.

2.10.6 Summary

Williamson County is subject to severe winter weather hazards. Associated damages include impacts to utilities, residential and commercial buildings/property, and agricultural losses. Large snowfalls or even the immediate start to snowfall may cause traffic collisions or lead to health concerns in the home as heating becomes more difficult and residents look to alternatives such as

generators and fireplaces. As such, severe winter weather poses a legitimate risk to Williamson County.

2.11 Earthquake/Seismic Activity

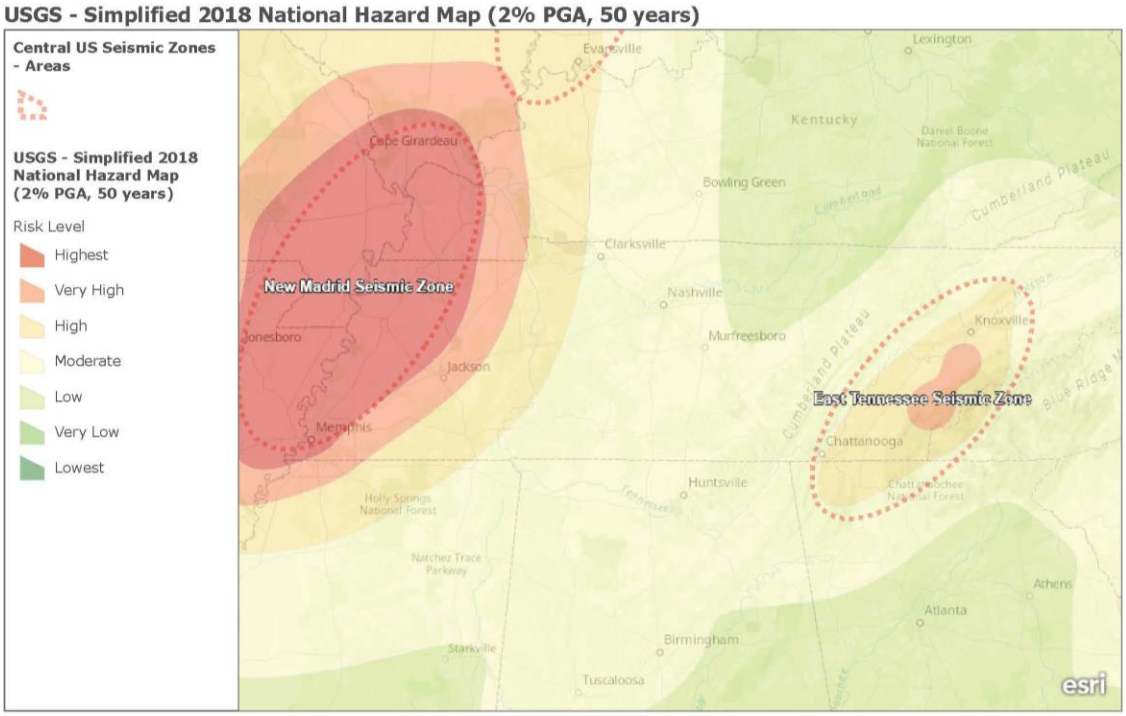
2.11.1 Hazard Overview

An earthquake results from a sudden release of energy in the Earth's crust that creates seismic waves. The energy originates from a subsurface fault. A fault is a fracture or discontinuity in a volume of rock along tectonic plates. In the most general sense, the word earthquake describes any event that generates seismic waves. Earthquakes are typically caused by the rupturing of geological faults. Occasionally, they are also caused by other events such as volcanic activity, landslides, mine blasts, and nuclear tests. An earthquake's point of initial rupture is called its focus or hypocenter. The epicenter is the point at ground level directly above the hypocenter.

2.11.2 County Profile

Williamson County is near the major intraplate (within a tectonic plate) seismic zone known as the New Madrid Seismic Zone. The New Madrid Seismic Zone (NMSZ) is an approximately 120-mile-long fault system that stretches across five states, including Western Tennessee. Williamson County is near the East Tennessee Seismic Zone (ETSZ) which stretches across three states. The figure below illustrates the risk level of the NMSZ/ETSZ within the state.

Figure 13: New Madrid Seismic Zone (Source: CUSEC)



Earthquake hazard map showing peak ground accelerations having a 2 percent probability of being exceeded in 50 years, for a firm rock site.

Esri, USGS | Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS

Williamson County has not experienced any recorded earthquakes in the last twenty years above a small magnitude (1.0 or greater), however, the NMSZ is known for producing four of the largest North American earthquakes in recorded history, all of which would have been felt in Williamson County. This includes the noted three-month period between December 1811 and February 1812 that had at least four earthquakes which are understood by scientists to be greater than a M7.0. During this period, there were dozens of strong earthquakes ranging between M6.0

and M7.5. Thousands of smaller shocks were documented. Similar to the 1811-12 New Madrid earthquake sequence which created Reelfoot Lake in Lake County, Tennessee, very large magnitude earthquake sequences are believed to have occurred in pre-historic times as well. Paleo-liquefaction and geologic evidence suggest large earthquake sequences occurred in the New Madrid Seismic Zone in 1450 AD and 900AD.

Based on geologic research on the paleo seismic record of past earthquakes, the USGS estimates that there is a 7 to 10 percent chance of a New Madrid earthquake the size of those in 1811-12 occurring in the next 50 years. However, the occurrence of even a moderate-sized earthquake located in close proximity to urban centers such as Memphis or St. Louis could be locally devastating. The last magnitude-6 earthquake struck near Charleston, Missouri, in 1895. The chance of such an earthquake occurring in the New Madrid region in the next 50 years is 25 to 40 percent.

These probabilities are derived from the USGS National Seismic Hazard Maps, which are developed from geologic information about faults, evidence of prehistoric earthquakes, instrumental and historical earthquake catalogs generated by seismic monitoring, and ground deformation measurements. The National Seismic Hazard Maps are used to estimate probabilities of large earthquakes and the ground shaking to be expected if those earthquakes occur.

The Eastern Tennessee Seismic Zone (ETSZ), a zone of small earthquakes stretching from northeastern Alabama to southwestern Virginia. The ETSZ is the second-most active natural seismic zone in the central and eastern United States, behind the New Madrid Seismic Zone in the Mississippi River region that produced the 1811-1812 magnitude 7+ earthquakes. In historic times, the ETSZ has not produced earthquakes larger than magnitude 4.8, however, scientists believe the ETSZ is capable of generating magnitude 6 or greater. The ETSZ region is home to several nuclear power plants and hydroelectric dams related to the Tennessee Valley Authority, along with major population centers such as Knoxville and Chattanooga.

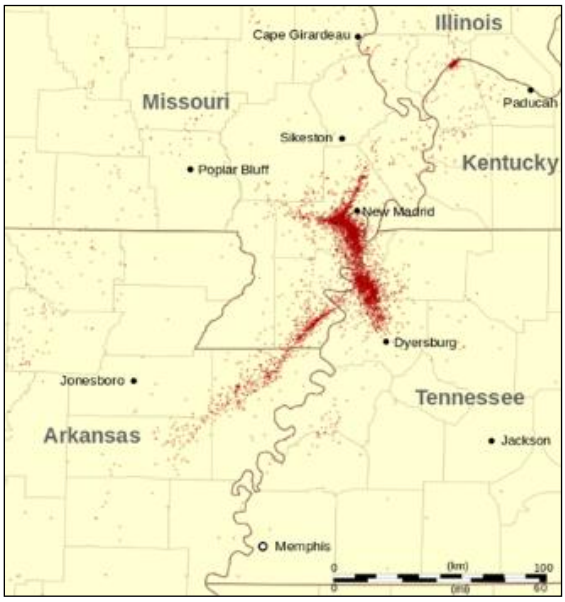
Table 24: Richter Scale Classification (Source: USGS)

Richter Scale for Earthquakes		
Magnitudes	**Description**	**Typical Impacts**
< 2.0	Micro	Not felt.
2.0-2.9	Slight	Generally, not felt but recorded.
3.0-3.9	Minor	Often felt, but rarely causes damage.
4.0-4.9	Light	Noticeable shaking of indoor items and rattling noises. Significant damage is likely.
5.0-5.9	Moderate	It can cause major damage to poorly constructed buildings in small regions. At most slight damage to well-designed buildings.

Richter Scale for Earthquakes		
Magnitudes	**Description**	**Typical Impacts**
6.0-6.9	Strong	It can be destructive in areas up to about 100 miles across populated areas.
7.0-7.9	Major	It can cause serious damage over larger areas.
8.0-8.9	Great	It can cause severe damage in areas several hundred miles across.
9.0-9.9	Epic	They are devastating in areas several thousand miles across.

Since 1812, the most significant recorded earthquakes from the New Madrid Zone were in 1895 and 1968. Since seismic measurement instruments were installed in and around the zone in the 1970s, more than 4,000 small earthquakes have been recorded, with the vast majority being too small to be felt.

Figure 14: NMSZ Earthquakes Recorded Since 1974 (Source: USGS)



According to a 2008 FEMA report, a severe earthquake in the NMSZ could result in the highest economic loss due to a natural disaster in U.S. history. Based on this report, a 7.7 magnitude quake in the NMSZ would result in thousands of fatalities, hundreds of billions of dollars in damage to structures, and total disruption of vital infrastructure in Western Tennessee, including Williamson County.

Probability of Future Events – Likely

A catastrophic earthquake at the NMSZ would result in $100-200 million in building damages. Furthermore, according to the HAZUS, Williamson County will experience the following in a catastrophic earthquake scenario:

Table 25: Catastrophic Earthquake Damages

Impact Overview		Numerical Value	
Fatalities		1	
Injuries		31	
Displaced Residents		37	
Residents Requiring Shelter		17	
Debris (tons)		43,000	
Residencies experiencing >moderate damage		557	
Day 1			
Households without power		0	
Households without potable water		0	
Resources Functioning on Day 1		**Infrastructure Functioning after Day 1**	
Resource	**Percentage Functioning**	**Resource**	**Percentage Functioning**
Hospitals	100	Highway Segments	100
Police Stations	100	Railway Segments	100
Fire Stations	100	Airport Segments	N/A
Schools	100	Bus facilities	N/A
Communications	100	Ports	N/A

Many buildings and the majority of infrastructure networks throughout the county could be vulnerable to earthquake impacts. HAZUS estimates that there are 63 thousand buildings in the region which have an aggregate total replacement value of $54,689 million. In terms of building construction types found in the region, wood frame construction makes up 77% of the building inventory. Throughout the county, all buildings and infrastructure are vulnerable to earthquake impacts.

Figure 15: National Seismic Hazard Map (Source: USGS) Ground Motions with a 2% Chance of Occurring in 50 Years

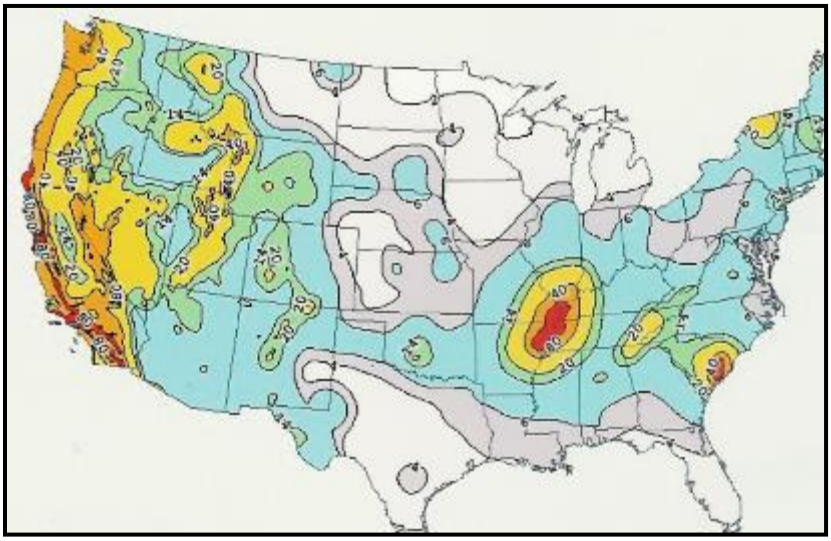
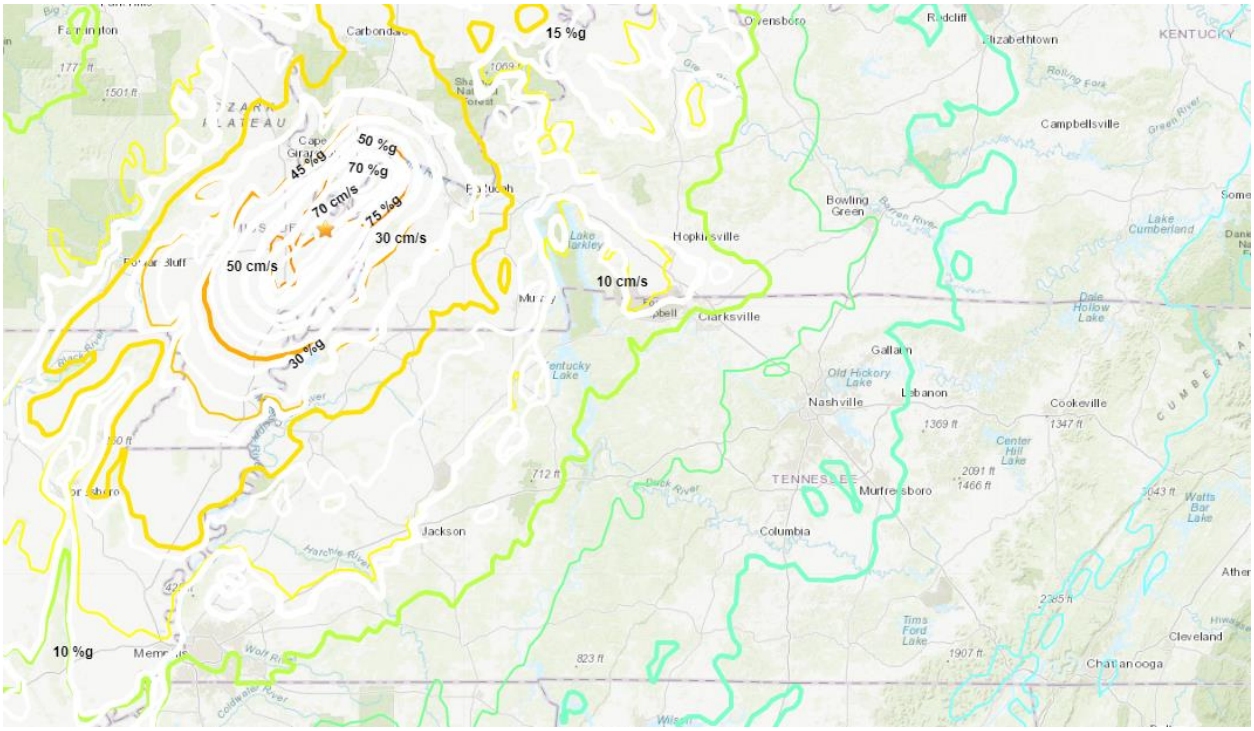


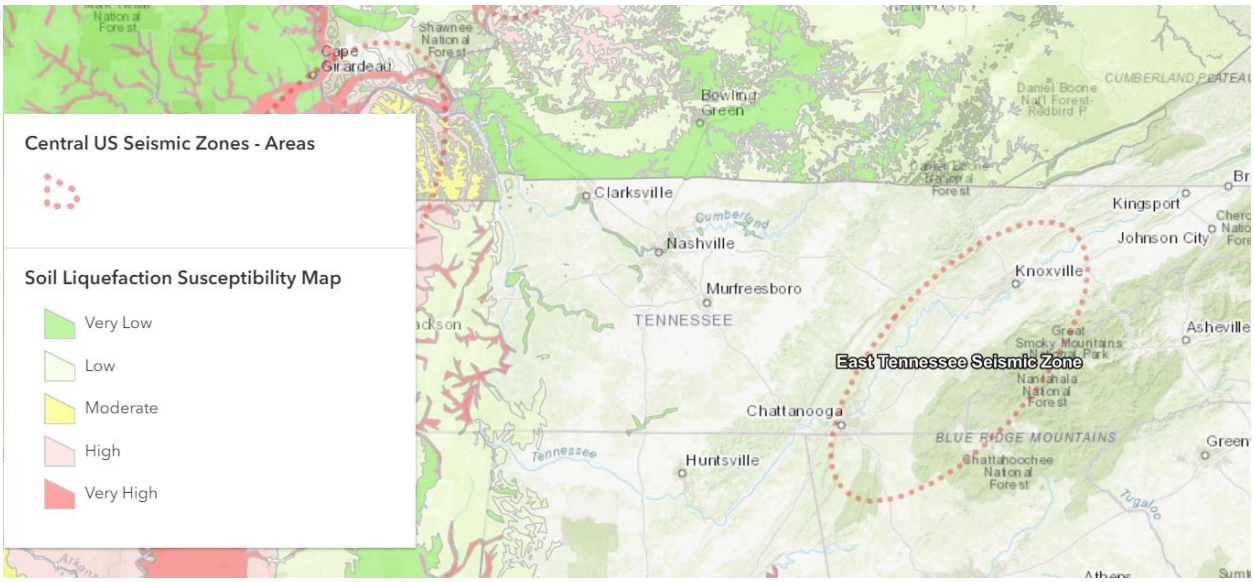
Figure 16: Mercalli Intensity Zones In Williamson County (Source: USGS)



As indicated in the above maps, all of Williamson County's jurisdictions and districts sit within intensity zones IV (light) to VI (strong) of the Modified Mercalli Intensity Scale due to its proximity to the NMSZ/ETSZ.

According to the Central United States Earthquake Consortium (CUSEC), Williamson county has a low level of risk for liquefaction following an earthquake.

Figure 17: Earthquake Induced Liquification (Source: CUSEC)



2.11.3 Risk Assessment

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for natural hazards. It was built and designed by FEMA in close collaboration with various stakeholders and partners in academia; local, state and federal government. The Risk Index leverages available source data for natural hazards and community risk factors to develop a baseline relative risk assessment for each county and census trace. Some of these community risk factors include social vulnerability which is determined by the data pulled from the Census preformed every ten years. A higher social vulnerability score is proportional to a higher risk score.

National Risk Index Score for Earthquake = Relatively Moderate

Although the National Risk Index is a well-valued tool it fails to properly show the feedback from the participating jurisdictions. Therefore, all identified hazards were evaluated in regard to risk by an established risk-scoring system provided by the Williamson County Emergency Management Agency and approved by the HMPC.

To determine the overall risk of earthquake/seismic incidents in Williamson County, data was taken from the National Weather Service (NWS) as well as the United States Geological Survey (USGS).

Similar to the other natural hazards, data from these two sources were the primary resources used to determine how many days seismic activity was experienced in Williamson County. However, knowledge and experience of local citizens and the HMPC was also incorporated to create a more accurate assessment.

The impact and probability numbers assigned to this hazard are as follows:

Human Impact	Property Impact	Business Impact	Operational Impact	Environmental Impact	Probability	Risk Score
4	5	4	4	4	1	5.2

Given the information above it becomes vital that all participating jurisdictions are able to prioritize the necessity of mitigation actions so that they can become more resilient in the whole community that they serve.

2.11.4 Land Use and Development Trends

Heavily populated or industrialized centers are at a higher risk for catastrophic earthquake damage. Williamson County, like much of Tennessee, is experiencing rapid growth increasing the likelihood of significant impacts to life and property from a significant earthquake.

2.11.5 Multi-Jurisdictional Differences

Counties predominantly in the West Portion of Tennessee will be more likely impacted by the New Madrid Zone. However, a significant magnitude earthquake can cause primary and secondary effects across the state.

2.11.6 Summary

Due to its proximity to the New Madrid Fault, the entirety of Williamson County could be subject to an earthquake. This includes the entire County population and all infrastructure. A significant earthquake event would result in a substantial loss of life and possibly a significant economic loss. Although the HAZUS report does not show a significant expectation of damage, the HMPC, with more direct knowledge of the county, recognizes the threat is greater than predicted.

2.12 Pandemic/Communicable Disease

2.12.1 Hazard Overview

Communicable disease (infectious disease) is defined as an illness caused by a specific infectious agent or its toxic product that results from transmission of that agent or its products from an infected person, animal, or reservoir to a susceptible host, directly or indirectly either through an intermediate plant or animal host, vector, or inanimate environment. Vector-borne diseases include bacterial and viral diseases transmitted by mosquitoes, ticks, and fleas. Pandemics are a widespread occurrence of a communicable disease that spans a whole country or the world at a particular time.

2.12.2 County Profile

Historically, examples of communicable disease outbreaks in Tennessee are West Nile Virus (mosquito-borne), bed bugs, and pertussis (whooping cough). The most recently declared worldwide communicable disease emergency that affected Tennessee was the COVID-19 (coronavirus) pandemic in 2020. Communicable disease cases are reported to the Tennessee Department of Health which provides reporting guidance and resources for communicable disease outbreaks within the state. Within Tennessee 12 diseases are categorized as immediate notification and 25 as next business day notification.

Event Narrative 1: 2009 H1N1 Pandemic

In the spring of 2009, a strain of H1N1 spread quickly across the U.S. and the globe. The U.S. government declared H1N1 (swine flu) a public health emergency in April 2006. By November 2009, 48 states reported cases of H1N1, mostly in children and young adults. The CDC estimates that 43 million to 89 million people had H1N1 between April 2009 and April 2010, resulting in an estimated 8,870 and 18,300 H1N1-related deaths.

Event Narrative 2: 2014 Ebola Outbreak

During the 2014 West African Ebola outbreak, 11 people were treated for Ebola Virus Disease (EVD) in the U.S., two of whom died. The majority were infected with the Ebola virus outside of the U.S. and either medically evacuated into the U.S. for treatment or entered the country as airline passengers.

Event Narrative 3: 2020 Coronavirus Pandemic

In December 2019, a coronavirus disease (COVID-19) outbreak was identified in Wuhan, China. In 2020, COVID-19 quickly spread to the United States, and in March 2020, the World Health Organization characterized COVID-19 as a pandemic. The United States declared a national emergency. Williamson County experienced the first case of COVID-19 in the state of Tennessee. It is estimated that 81,995 people were infected, resulting in 469 COVID19-related deaths in Williamson County.

For the most current data, visit: https://www.tn.gov/content/tn/health/cedep/ncov/data.html

2.12.3 Risk Assessment

The entirety of Williamson County including all assets located within the County can be considered at risk. Vulnerable and underserved populations have a higher risk of severe illness following disease infections. Historically, these populations include adults aged 65 or older,

infants under 2 years old, marginalized populations experiencing health or social inequities, and individuals with medical conditions. While a pandemic outbreak will not directly impact critical facilities and infrastructure, it could severely impact local healthcare services, with clinical systems and 911 becoming overwhelmed. A severe pandemic may result in an interruption of services and a shortage of supplies.

The Social Vulnerability Index (SVI) is a dataset that uses 16 census variables that help local officials identify communities that may need support before, during or after disasters. Unfortunately, the National Risk Index does not capture non-natural disaster impacts, therefore, using the SVI can help public health officials and local planners better prepare for and respond to emergency events such as disease outbreaks.

Social Vulnerability Index Score for Williamson County: 0.0213 (Low Level of Vulnerability)

Although the Social Vulnerability Index (SVI) is a well-valued resource it fails to properly show the feedback from the participating jurisdictions. Therefore, all identified hazards were evaluated in regard to risk by an established risk-scoring system provided by the Williamson County Emergency Management Agency and approved by the HMPC. Local jurisdictions evaluated the conditions using a mid-level impact scenario of the identified hazard.

To determine the overall risk of a Pandemic in Williamson County, data was taken from the Williamson County Computer Aided Dispatch (CAD) system, WebEOC, the Centers for Disease Control and Prevention (CDC), the Tennessee Department of Health and from news reports deemed reliable.

All data in this category includes any recognized pandemics or epidemics that have posed a risk to life safety or had a significant impact on the operations conducted within Williamson County.

The impact and probability numbers assigned to this hazard are as follows:

Human Impact	Property Impact	Business Impact	Operational Impact	Environmental Impact	Probability	Risk Score
4	1	4	3	1	1	3.6

Given the information above it becomes vital that all participating jurisdictions are able to prioritize the necessity of mitigation actions so that they can become more resilient in the whole community that they serve.

2.12.4 Land Use & Development

Considering that the entire County is at risk of communicable disease, increased development, and population growth can reasonably translate to increased impacts due to these events. The population in Williamson County is expected to rise similarly to its surrounding counties and Tennessee. An increase in population may lead to an increased risk of infection and new and improved business, which in turn means an increase in the number and value of assets at risk of economic disruption.

2.12.5 Multi-Jurisdictional Differences

The entirety of Williamson County and the incorporated jurisdictions, including all assets located within, can be considered equally at risk of communicable disease outbreaks. This includes the entire population, all critical facilities, buildings (commercial and residential), and infrastructure.

2.12.6 Summary

Williamson County is subject to communicable diseases through plant or animal host, vector, or inanimate environments. Communicable diseases can spread, leading to deaths, local business impacts and closures, and supply chain disruptions. Infections and hospitalizations due to communicable diseases can overwhelm local healthcare services.

2.13 Geological Incident

2.13.1 Hazard Overview

Geological incidents within Williamson County could include both landslides and sinkholes. According to the United States, Geological Survey (USGS), “A landslide is defined as the movement of a mass of rock, debris, or earth down a slope. Landslides are a type of "mass wasting," which denotes any down-slope movement of soil and rock under the direct influence of gravity. The term "landslide" encompasses five modes of slope movement: falls, topples, slides, spreads, and flows. These are further subdivided by the type of geologic material (bedrock, debris, or earth). Debris flows (commonly referred to as mudflows or mudslides) and rock falls are examples of common landslide types.

Almost every landslide has multiple causes. Slope movement occurs when forces acting down-slope (mainly due to gravity) exceed the strength of the earth materials that compose the slope. Causes include factors that increase the effects of down-slope forces and factors that contribute to low or reduced strength. Landslides can be initiated in slopes already on the verge of movement by rainfall, snowmelt, changes in water level, stream erosion, changes in ground water, earthquakes, volcanic activity, disturbance by human activities, or any combination of these factors.”

2.13.2 County Profile

Historically, the presence of sinkholes and landslides have not been a high risk for Williamson County. However, through various risk assessment meetings with the HMPC, members identified numerous occasions where landslides and sinkholes had occurred. Many of these members were part of emergency services within Williamson County and referred to instances where they responded to these hazards in nearby jurisdictions. Sinkholes are known to occur due to the karst topography that is not only common in Williamson County, but across middle Tennessee. Unfortunately, due to the low frequency of the hazard, the county and all participating municipalities have confirmed they do not actively map this hazard when they occur or consistently maintain a detailed narrative of these events.

The City of Brentwood was able to provide further context regarding their experiences with landslides, detailing the results of damage that occurred after the 2010 floods and subsequent landslide. Due to the flooding, the city experienced a large landslide that fortunately claimed no lives, but caused significant damage and required extensive recovery operations. The fiscal impacts of this event required nine contracts of more than $10,000 which resulted in a total impact of $247,983. Upon a thorough review and dedicated research effort, no further information could be found to provide a narrative of these events for the events described above or for the other municipalities included in this plan. As such, there is no available information other than the opinions of the subject matter experts involved in the planning process to provide an extent or detailed history of this risk occurring in Williamson County or any of its municipalities.

The National Risk Index (NRI) has recorded three occurrences of landslides in a 12-year span from 2010 to 2021. As such, we can expect a low probability of this event occurring per year in the future. We might expect that we may have one incident of this nature every 3-4 years. However, changes in climate and land use have begun to influence this risk in Williamson County. First, significant changes have occurred in land use and land cover caused by the

significant increase in the population of Williamson County. With the rapid growth of the county, changes in land use are heavily influencing the way that our natural environment responds to natural disasters. Recent studies of urban growth maps show that Williamson County is growing in a "hop-scotch" pattern including rural areas, especially in eastern parts of the county that were not intended for such development. Areas designed for urban growth in city areas around Fairview, Franklin, Brentwood, and Nolensville were not developed as heavily as expected in comparison to the rural areas which were developed more than expected. With the significant growth in population and new construction, Williamson County lost an estimated 260,000 acres of farmland from 2002 to 2020. This change not only leads to congestion, but also to stormwater issues, flooding, water quality issues, and new runoff patterns that contribute to an increased risk of geological hazards.

As Williamson County still has a significant agricultural industry, farmers may choose to switch to crops that have a higher economic return instead of their customary crops in an attempt to change with climate conditions. This change in crop production, or crop-switching, is commonplace across the United States as farmers look to adapt to climate change and maximize their yields and profits according to the London School of Economics and the City University of New York. This may influence the irrigation of rainfall and the amount of land cover present. Extreme weather events, warming temperatures, extreme cold weather, rising sea levels, and increased precipitation can contribute significantly to the frequency, severity, and intensity of geological incidents. As more heat and water is in the atmosphere with warmer ocean temperatures, it is likely storms will continue to increase in severity, and increase the probability of a geological incident occurring.

Event Narrative 1: 05/02/10

On May 2nd, 2010, after experiencing over 13" of rain in two days, the members of the Pleasant View Baptist Church released a notice that all members would have to use a different entry into the congregation due to a mudslide that had completely blocked the normal entrance to the church. Although the high elevation of the church property protected it from flood waters, the debris from the mudslide caused damage and blocked an entrance/exit. These same mudslides blocked roads and menaced houses on a scale most locals had never witnessed prior.

The Williamson County Highway Department crews were kept busy right after the rain event, clearing hillside debris off roadways. Some of the biggest slides happened on Highway 96 West, near the Natchez Trace Bridge, as well as on Holly Tree Gap, where a slide closed that roadway for about a week.

This flooding event in May of 2010 caused significant amounts of landslides to occur across middle Tennessee. The landslides damaged homes, businesses, and blocked travel on various roadways.

For the most current data, visit:
https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=ae120962f459434b8c904b456c82669d

2.13.3 Risk Assessment

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for natural hazards. It was built and designed by FEMA in close collaboration with various stakeholders and partners in academia; local, state and federal

government. The Risk Index leverages available source data for natural hazards and community risk factors to develop a baseline relative risk assessment for each county and census trace. Some of these community risk factors include social vulnerability which is determined by the data pulled from the Census preformed every ten years. A higher social vulnerability score is proportional to a higher risk score.

National Risk Index Score for Landslides = Relatively Moderate

Although the National Risk Index is a well-valued tool it fails to properly show the feedback from the participating jurisdictions. Therefore, all identified hazards were evaluated in regard to risk by an established risk-scoring system provided by the Williamson County Emergency Management Agency and approved by the HMPC. Local jurisdictions evaluated the conditions using a mid-level impact scenario of the identified hazard.

To determine the overall risk of Geological incidents in Williamson County, data was taken from the National Weather Service (NWS) as well as the United States Geological Survey (USGS).

Similar to the other natural hazards, data from these two sources were the primary resources used to determine how many days seismic activity was experienced in Williamson County. However, knowledge and experience of local citizens and the HMPC was also incorporated to create a more accurate assessment.

The impact and probability numbers assigned to this hazard are as follows:

Human Impact	Property Impact	Business Impact	Operational Impact	Environmental Impact	Probability	Risk Score
4	1	4	3	1	1	3.6

Given the information above it becomes vital that all participating jurisdictions are able to prioritize the necessity of mitigation actions so that they can become more resilient in the whole community that they serve.

2.13.4 Land Use & Development

Considering that the entire County is at risk of geological incidents; increased development, and population growth can reasonably translate to increased impacts due to these events. The population in Williamson County is expected to rise similarly to its surrounding counties and Tennessee. An increase in population may lead to an increased risk of incidents and increased risk.

2.13.5 Multi-Jurisdictional Differences

The entirety of Williamson County and the incorporated jurisdictions, including all assets located within, can be considered equally at risk of geological incidents. Although not all municipalities have experienced this risk, all land in Williamson County is susceptible to this hazard. The USDA classifies all of the landmass in Williamson County under the Ecological Region Name of Interior Plateau and tracks data as appropriate to soil including moisture class, landform and profile depth. This includes the entire population, all critical facilities, buildings (commercial and residential), and infrastructure.

2.13.6 Summary

Williamson County is at risk of geological incidents that can be initiated through a series of events, whether it be from seismic activity or due to significant rain and flooding. Sinkholes are not commonplace but they have caused damage in the past and have posed themselves as a risk to the well-being of the Williamson County citizenry.

Section Three: Mitigation Strategy

3.1 Mitigation Goals

Goals are general guidelines that explain what is to be achieved. They are usually broad-based policy-type statements, long-term, and represent global visions. Goals help define benefits the plan is trying to achieve.

3.1.1 Goal Setting Exercise

In 2023, and again in 2024, the HMPC agreed upon the goals for their hazard mitigation plan. It was decided that the goals from the 2017 plan should be carried over into the 2024 plan as they still reflected the current hazards and current conditions in the community.

3.1.2 Resulting 2024 Plan Update Goals

At the end of the meeting, the HMPC agreed upon three general goals for planning efforts. Those goals are as follows:

Goal 1: Protect the lives and health of citizens from the effects of natural hazards.

Goal 2: Emphasize mitigation planning to decrease vulnerability to new and existing structures.

Goal 3: Encourage public support and commitment to hazard mitigation by communicating mitigation benefits.

3.2 Expanding & Improving Mitigation Programs

Each municipality within Williamson County, including the unincorporated areas, are all experiencing rapid growth. As such, increased residences are being constructed, new roads are being built, and the size of the government infrastructure is working to grow with it.

Each municipal and county emergency management professional has been pursuing mitigation planning in unity and will continue to do so in future planning processes. Each emergency management professional for the unincorporated and incorporated municipalities of Williamson County has been given the authority to carry out mitigation planning efforts including application for grants, planning, and the execution of mitigation actions. Some mitigation actions will require consultation or approval by other representatives and as such, the municipal and county emergency management programs will be responsible for facilitating this process. Some communities in Williamson County are unable to dedicate a staff member full-time to the position of emergency management and as such, will rely on assistance from the county to help carry out mitigation efforts in their municipalities. These needs will be assessed throughout the continual planning process and will be addressed to local government leadership or public safety representatives as appropriate. In all mitigation planning efforts, members of the HMPC will be engaged to continue involving stakeholders from various fields and to build a more stable mitigation planning committee.

3.3 Compliance with NFIP

Williamson County and all municipalities therein participate in FEMA’s National Flood Insurance Program (NFIP). Each participating community enforces a flood damage prevention ordinance that regulates development within the Special Flood Hazard Area (SFHA).

Additionally, as members of FEMA's NFIP, each community requires Elevation Certificates on all new buildings and substantial improvements within the SFHA.

Given the flood hazards in the planning area, an emphasis will be placed on continued compliance with the NFIP. Currently mapped floodplains in the unincorporated county cover approximately 15,316 acres. Many of the structures were constructed prior to the county's first flood insurance study in 1981. Since 2008, the County has also participated in the NFIP's Community Rating System (CRS). The program provides flood insurance discounts to communities for exceptional floodplain management. The county is classified as a Class 8 community which allows for a 10% discount on certain flood insurance premiums.

Each jurisdiction participates in NFIP Webinars hosted by the State National Flood Insurance Program Office. Though not all jurisdictions have attended the same amount due to promotions and changes in staffing, each jurisdiction attends approximately three webinars per year at minimum. Each participating community will take the following steps to meet or exceed the following minimum requirements as set by the NFIP:

- Issuing or denying floodplain development/building permits;
- Inspecting all development to ensure compliance with the local ordinance;
- Maintaining records of floodplain development;
- Assisting in the preparation and revision of floodplain maps;
- Helping residents obtain information on flood hazards, floodplain map data, flood insurance, and proper construction measures.

As of May 31, 2024, the following are the designees appointed as the responsible individual for the NFIP in their municipality:

Municipality/Jurisdiction	Name:	Title:	Phone Number:
City of Brentwood	Todd Petrowski	City Planner	615-371-2232
City of Fairview	Micah Sullivan	Building Inspector	615-799-1585
City of Franklin	Shanna McCoy	Zoning Administrator	615-550-6631
City of Spring Hill	Dwayne Hicks	Codes Director	615-439-5606
Town of Nolensville	Don Swartz	Engineering Director	615-776-3323
Town of Thompson's Station	Micah Wood	Interim Town Administrator	615-794-4333
Williamson County School District	N/A	N/A	N/A
Williamson County Unincorporated	Floyd Heflin	County Engineer	615-790-5731

3.4 Substantial Damage (SD)/Substantial Improvement (SI)

Williamson County will ensure that SD/SI provisions are followed after each applicable incident. Officials in NFIP-participating communities are responsible for regulating all development in SFHAs by issuing permits and enforcing local floodplain requirements, including SD, for the repairs of damaged buildings. After an event, they must:

- Determine where the damage occurred within the community and if the damaged structures are in an SFHA.
- Determine what to use for "market value" and cost to repair consistently; uniformly applying regulations will protect against liability and promote equitable administration.

- Determine if repairing plus improving the damaged structure equals or exceeds 50% of the structure's pre-damage value.
- Require permits for floodplain development.

Following a disaster event, the floodplain manager should act quickly to move forward with the SI/SD process listed in *Figure 18.* Technical assistance may be available from FEMA and/or the state NFIP office. When there is a Presidentially Declared Disaster, communities may be reimbursed for these activities through FEMA Public Assistance.

Figure 18: Substantial Damage Assessment Process

State and federal officials do not make NFIP SD determinations. Local officials make these determinations based on their land use authority and locally adopted regulations.

The local emergency management representative in coordination with other effected municipalities or the county will be responsible for coordinating these efforts with the NFIP officials. Local government may be responsible for making determinations regarding SD/SI and/or may contract this responsibility out as appropriate and in accordance with law. Although local governments have trained staff, they may be overwhelmed in a large incident and may require assistance from the private sector.

The methodology for conducting these assessments will most likely rely on a GIS-based software product to guide assessors in the field and report back any information regarding SD/SI determinations. At a minimum, Williamson County and all municipalities will meet the minimum requirements of the NFIP by utilizing the Substantial Damage Estimator (SDE) as provided by FEMA. To ensure the public is aware of the requirements for SD/SI, the local external affairs officers or public information offices in coordination with all affected municipalities will be responsible for sharing requirements with the public.

3.5 Prioritization Process

The prioritization process was necessary as most mitigation projects represent a significant investment of financial and personal resources. By evaluating each project's degree of feasibility and the level of costs versus benefits, Williamson County could determine which projects should be included based on the available funding and time. The HMPC used the SAFE-T method to prioritize these projects. This approach was adopted from the successful methodology used by other counties in FEMA Region 4. This rating system uses five variables to evaluate each project's overall feasibility and appropriateness. *Figure 19* further explains this method.

Figure 19: SAFE-T Project Prioritization

Project Prioritization Method: SAFE-T			
Variable		Value	Description
S	**Societal:** The public must support the overall implementation strategy and specified mitigation actions. The projects will be evaluated in terms of community acceptance, social vulnerability and societal benefits	1	Low community acceptance/priority
		2	Moderate community acceptance/priority
		3	High community acceptance/priority
A	**Administrative:** The projects will be evaluated for anticipated staffing and maintenance requirements to determine if the jurisdiction has the personnel and administrative capabilities necessary to implement the project or whether outside help will be needed.	1	High staffing, outside help needed
		2	Some staffing, no outside help needed
		3	Low staffing, no outside help needed
F	**Financial:** The projects will be evaluated on their general cost-effectiveness and whether additional outside funding will be required.	1	Somewhat cost-effective
		2	Moderately cost effective
		3	Very cost-effective
E	**Environmental:** The projects will be evaluated for any immediate or long-term environmental impacts caused by their construction or operation.	1	Many environmental impacts
		2	Some environmental impacts
		3	Few environmental impacts
T	**Technical:** the projects will be evaluated on their ability to reduce losses in the short term or long term.	1	Short-term fix
		2	Medium-term fix
		3	Long-term fix

The identification and analysis process of mitigation alternatives allowed the HMPC to come to a consensus and prioritize recommended mitigation actions. The HMPC discussed the contribution of the effort to save lives or property first and foremost, with additional consideration given to the benefit-cost aspect of a project; however, this was not a quantitative analysis. The team agreed that prioritizing the actions collectively enabled the actions to be ranked in order of relative importance and helped steer the development of additional actions that meet the more essential objectives while eliminating some of the actions which did not garner much support. The cost-effectiveness of any mitigation alternative will be considered in greater detail by performing benefit-cost project analyses when seeking FEMA mitigation grant funding for eligible actions associated with this plan.

3.6 Mitigation Action Plan

The Mitigation Action Plan identified in Table 26 was developed to present the recommendations developed by the HMPC for how the communities can reduce the risk and vulnerability of people, property, infrastructure, and natural and cultural resources to future disaster losses. Emphasis was placed on both future and existing development. The action plan summarizes who is responsible for implementing each of the prioritized actions and when and how the actions will be implemented. Due to funding availability and other criteria, it should be clarified that the actions included in this mitigation strategy are subject to further review and refinement, alternatives analyses, and reprioritization. This document does not obligate Williamson County and the incorporated jurisdictions to implement any or all of these projects.

Rather this mitigation strategy represents the desires of the community to mitigate the risks and vulnerabilities from identified hazards.

Table 26: Williamson County New Mitigation Actions and Projects

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
All participating jurisdictions	All-hazards	Create a joint damage assessment tool that can be implemented within all agencies in Williamson County responsible for collecting damage assessment data.	GIS	Short-Term (0-3 years)	HMGP, Local Funds	2	2	3	3	1	11	$1,500	Both New and Existing
All participating jurisdictions	All-hazards	Obtain local data including tax parcels, building footprints, critical facility locations, and other information for use in risk analysis.	Emergency Management	Short-Term (0-3 years)	Local Funds	3	2	3	3	1	12	$0	Both New and Existing
All participating jurisdictions	All-hazards	Identify the most at-risk critical facilities and evaluate potential mitigation techniques. Each participating jurisdiction should attempt to identify their top five most vulnerable critical infrastructure facilities and detail this information with the county and Tennessee homeland security agent assigned to Williamson County.	Emergency Management	Short-Term (0-3 years)	Local Funds	3	2	3	3	1	12	$0	Both New and Existing
All	All-hazards	Obtain hazard data and use	Emergency	Short-	Local Funds	3	2	2	3	1	11	$0	Both New

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
participating jurisdictions		GIS to map risk for various hazards. The final product will result in an interactive series of maps that residents of each participating municipality can use to understand their risk.	Management, GIS	Term (0-3 years)									and Existing
All participating jurisdictions	All-hazards	Incorporate a stand-alone element for hazard mitigation into the applicable comprehensive (land use) plan.	Emergency Management, planning, codes enforcement	Short-Term (0-3 years)	Local Funds	2	3	3	3	1	12	$0	Both New and Existing
All participating jurisdictions	All-hazards	Form a plan implementation steering committee to monitor progress on local mitigation actions. Include a mix of representatives from neighborhoods, local businesses, and local government.	Emergency Management	Short-Term (0-3 years)	Local Funds	2	1	3	3	1	10	$0	Both New and Existing
All participating jurisdictions	All-hazards	Establish an interactive website for educating the public on hazard mitigation and preparedness measures. This website will also potentially serve as the future hazard mitigation plan as desired by the jurisdictions involved.	Emergency Management, GIS	Medium-Term (3-5 years)	Local Funds	3	1	2	3	2	11	$5,000	Both New and Existing

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
All participating jurisdictions	All-hazards	Purchase and install NOAA weather radios in schools, government buildings, parks, etc.	Emergency Management	Medium-Term (3-5 years)	HMGP, Local Funds	3	2	2	3	2	12	$3,000	Both New and Existing
City of Brentwood	Flood	Work with property owner of Ward Circle pond to increase water retention capabilities during heavy rains	Engineering	Short-Term (0-3 years)	Local Funds	3	3	3	1	3	13	$1,000	Existing
City of Brentwood	Tornado	Support Severe Weather Awareness Week	Community Relations	Ongoing	Local Funds	3	3	3	1	3	13	$1,000	Both New and Existing
City of Brentwood	Wildfire/Brush Fire	Join "Firewise Communities" program	Fire & Rescue	Short-Term (0-3 years)	Local Funds	3	3	3	1	3	13	$1,000	Both New and Existing
City of Brentwood	Wildfire/Brush Fire	Map vulnerable areas to reduce risk	GIS	Short-Term (0-3 years)	Local Funds	3	3	3	1	3	13	$2,500	Both New and Existing
City of Brentwood	Wildfire/Brush Fire	Inform the public about proper evacuation procedures and IPAWS.	Community Relations	Ongoing	Local Funds	3	3	3	1	3	13	$1,000	Both New and Existing
City of Brentwood	Drought/Excessive Heat	Develop drought communication plan	Community Relations	Ongoing	Local Funds	3	3	3	1	3	13	$1,000	Both New and Existing
City of Brentwood	Drought/Excessive Heat	Educate the public on water-saving techniques	Community Relations and Water Services	Ongoing	Local Funds	3	3	3	1	3	13	$1,000	Both New and Existing

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
City of Brentwood	Severe Winter Weather	Research and implement equipment advances and additions to provide more comprehensive snow removal efforts.	Public Works	Ongoing	Local Funds	3	3	3	1	3	13	$2,500	Both New and Existing
City of Brentwood	Severe Winter Weather	Research and implement improved technology for mixing anti-icing cocktails, improved de-icing, and reduced salt consumption	Public Works	Ongoing	Local Funds	3	3	3	1	3	13	$2,500	Both New and Existing
City of Brentwood	Severe Winter Weather	Maintain/update snow removal routes.	Public Works	Medium-Term (3-5 years)	Local Funds	3	3	3	3	2	14	$0.00	New
City of Brentwood	Severe Winter Weather	Deliver snow plow training to non-Public Works employees to increase staffing during winter storms.	Public Works	Ongoing	Local Funds	3	3	3	1	3	13	$50,000	Both New and Existing
City of Brentwood	Earthquake/Seismic Activity	Map and assess at-risk critical infrastructure and key resources.	GIS	Short-Term (0-3 years)	Local Funds	3	3	3	1	3	13	$5,000	Both New and Existing
City of Brentwood	Earthquake/Seismic Activity	Protect at-risk critical infrastructure and key resources.	Engineering	Medium-Term (3-5 years)	BRIC	3	1	3	1	3	13	$500,000	Both New and Existing
City of Brentwood	Earthquake/Seismic Activity	Educate the public on earthquake awareness.	Community Relations	Ongoing	Local Funds	3	3	3	1	3	13	$10,000	Both New and Existing

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
City of Brentwood	Geological Incident	Map vulnerable areas to reduce risk.	GIS	Short-Term (0-3 years)	Local Funds	3	3	3	1	3	13	$2,500	Both New and Existing
City of Brentwood	Geological Incident	Post landslide area signage.	Public Works	Short-Term (0-3 years)	BRIC	3	3	3	1	3	13	$5,000	Both New and Existing
City of Brentwood	Pandemic	Purchase and store PPE and supplies to avoid impacts on supply chain.	Finance	Short-Term (0-3 years)	HMGP, BRIC	3	3	3	1	3	13	$50,000	Both New and Existing
City of Brentwood	Pandemic	Exercise Continuity of Operations plan every four months	Fire & Rescue/Emergency Management	Ongoing	Local Funds	3	3	3	1	3	13	$2,500	Both New and Existing
City of Brentwood	Flood	Implement an "Adopt a Storm Drain" program	Public Works	Short-Term (0-3 years)	Local Funds	2	3	3	1	3	12	$2,500	Existing
City of Brentwood	Tornado	Encourage safe room construction in single-family residences and multi-family complexes.	Planning and Codes	Ongoing	Local Funds	2	3	3	1	3	12	$1,000	New
City of Brentwood	Tornado	Promote purchase and use of NOAA weather radios	Community Relations	Ongoing	Local Funds	2	3	3	1	3	12	$1,000	Both New and Existing
City of Brentwood	Drought/Excessive Heat	Develop and enforce irrigation restrictions during droughts.	Planning and Codes	Ongoing	Local Funds	2	3	3	1	3	12	$25,000	Both New and Existing

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
City of Brentwood	Geological Incident	Install catch-fall nets or berms for rocks at steep slopes near roadways.	Public Works	Short-Term (0-3 years)	BRIC	3	1	3	1	3	11	$100,000	Both New and Existing
City of Brentwood	Pandemic	Install air filtration (MERV13 filters and/or UV) at all city facilities.	City Administration	Short-Term (0-3 years)	BRIC	3	1	3	1	3	11	$250,000	Both New and Existing
City of Brentwood	Flood	Adopt policies for storm water runoff and implement a storm water utility fee	Engineering	Short-Term (0-3 years)	Local Funds	1	1	3	1	3	9	$5,000	Both New and Existing
City of Brentwood	Flood	Enforce maximum lot coverage requirement/encourage green space.	City Administration	Long-Term (5-10 years)	Local Funds	2	3	3	2	3	13	$0.00	New
City of Brentwood	Flood	Utilize GIS mapping to better determine floodplain and floodway.	City Administration	Long-Term (5-10 years)	Local Funds	3	1	3	3	3	13	$0.00	New
City of Brentwood	Flood	Enforce strict detention requirements.	City Administration	Medium-Term (3-5 years)	Local Funds	1	2	3	3	2	11	$0.00	New
City of Brentwood	Flood	Maintain dedicated emergency access ways.	Public Works	Short-Term (0-3 years)	Local Funds	3	2	2	2	1	10	$10,000	New
City of Brentwood	Severe Winter Weather	Stockpile 2,300-2,500 tons of salt at two weather protected strategic locations.	Public Works	Short-Term (0-3 years)	Local Funds	2	2	2	3	1	10	$100,000	New
City of Brentwood	Severe Winter Weather	Stage trucks pre-loaded with salt prior to expected winter weather events.	Public Works	Short-Term (0-3	Local Funds	3	2	1	3	1	10	$5,000	New

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
				years)									
City of Brentwood	Severe Winter Weather	Annually, prior to winter, check/prepare all snow removal equipment	Public Works	Short-Term (0-3 years)	Local Funds	2	2	3	3	1	11	$25,000	New
City of Brentwood	Severe Winter Weather	Replace aging/damaged snow removal equipment.	Public Works	Short-Term (0-3 years)	Local Funds	3	3	2	3	1	12	$50,000	New
City of Brentwood	Wildfire/ Brushfire	Enforcement of the State of Tennessee Forestry Department Burn permitting and Burn banning program.	City Administration	Long-Term (5-10 years)	Local Funds	2	2	3	3	3	13	$0.00	Both New and Existing
City of Brentwood/City of Franklin	Tornado	Annual service agreement for weather monitoring system and tornado sirens	City Administrations	Long-Term (5-10 years)	Local Funds	2	2	2	3	3	12	$4,000	Both New and Existing
City of Franklin	Flood	Clean and improve drainage ditches and retention areas within the park system, as well as protection of property from flood events.	Parks Department	Short-Term (0-3 years)	Local Funds	3	2	1	3	1	10	$3,000	Pre-Existing
City of Franklin	Wildfire/ Brushfire	Removal of dead trees, shrubbery, and stumps and evaluation, treatment and trimming of trees in area parks and other park properties.	Parks Department	Short-Term (0-3 years)	Local Funds	3	1	2	2	1	9	$4,000	New
City of Franklin	Severe Winter Weather	Clearing of ice and snow for emergency vehicles and citizens.	Streets Department	Short-Term (0-3 years)	Local Funds	3	1	2	2	1	9	$10,0000	Pre-Existing
City of	Tornado	Construct new city hall that	City	Long-	Local Funds	2	1	2	2	3	10	$5,000,000	New

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
Franklin		includes tornado sheltering for 200+ employees and visitors during the day and provides for some sheltering during downtown special events.	Administration	Term (5-10 years)									
City of Franklin	Flood	Ralston Creek at Liberty Hills Stream restoration	City of Franklin, Stormwater	Long-Term (5-10 years)	Local Funds	3	1	2	3	3	12	$50,000	New
City of Franklin	Flood	Procure AVL capabilities for all city vehicles enabling real time vehicle asset tracking for more accurate deployment of resources.	City Administration	Long-Term (5-10 years)	Local Funds	3	2	1	3	3	12	$10,000	New
City of Spring Hill	Flood	Continuous cleaning of drainage ditches and drainage way to help alleviate flooding.	Public Works	Short-Term (0-3 years)	Local Funds	3	1	1	2	1	8	$100,000	Pre-Existing
City of Spring Hill	Flood	Conduct inspections on stormwater detention ponds to ensure they are maintained and function properly.	Public Works	Short-Term (0-3 years)	Local Funds	2	2	2	3	3	12	$10,000	Pre-Existing
City of Spring Hill	Flood	Promote the use of social media, text messaging, X, etc. for public announcement of tornado warning and watches similar to amber alerts/Nixle.	Emergency Management	Short-Term (0-3 years)	Local Funds	3	2	3	3	1	12	$5,000	Pre-Existing
City of Spring Hill	Flood	Participation in NFIP.	City of Spring Hill	Long-Term (5-10 years)	Local Funds	2	2	3	3	3	12	$1,000	Pre-Existing
City of Spring	Severe Winter	Purchase of snow chains for patrol cars for the purpose of	Police	Short-	Local Funds	1	3	3	3	1	11	$1,500	New

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
Hill	Weather	increased mobility on snow- and ice-covered roads.	Department	Term (0-3 years)									
City of Spring Hill	Wildfire/ Brushfire	Specify and adopt native plants, shrubbery and trees for incorporation into the city's new uniform development code.	Planning Department	Long-Term (5-10 years)	Local Funds	1	2	2	3	3	11	$1,000	Pre-Existing
City of Spring Hill	Excessive Heat/Drought	In brown-out situations, provide fans to social service agencies for distribution to homeless shelters and locations designated by Spring Hill Social Services	Planning Department	Long-Term (5-10 years)	Local Funds	3	1	2	3	3	12	$15,000	Pre-Existing
City of Spring Hill	Excessive Heat/Drought	Impose water restrictions in drought conditions in accordance with the city's emergency response plan and drought management plan.	Water Department	Long-Term (5-10 years)	Local Funds	1	2	3	3	3	12	$1,000	Pre-Existing
Cumberland River Compact	Flood	Complete an additional stream restoration project assessment in Williamson County	Cumberland River Compact, environmental non-profit	Long-Term (5-10 years)	Local Funds	2	1	1	3	2	9	$2,000	Both New and Existing
Franklin Special School District	Flood, Severe Winter Weather, Excessive Heat/Drought, Earthquake	Add a 300-500 Kw Portable Generator with the ability to connect to multiple school facilities one being Franklin Elementary School, in order to provide emergency backup power to these sites. This will enable us to	FSSD Finance and Administration	Short-Term (0-3 years)	Local funds, HMGP, BRIC	3	2	2	3	3	13	$50,000	Existing

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
		operate the impacted facility as an emergency shelter as required.											
Franklin Special School District	Flood, Severe Winter Weather, Excessive Heat/Drought, Earthquake	Add a 300-500 Kw Portable Generator with the ability to connect to multiple school facilities one being Freedom Middle School, in order to provide emergency backup power to these sites. This will enable us to operate the impacted facility as an emergency shelter as required.	FSSD Finance and Administration	Short-Term (0-3 years)	Local funds, HMGP, BRIC	3	2	2	3	3	13	$78,000	Existing
Franklin Special School District	Flood, Severe Winter Weather, Excessive Heat/Drought, Earthquake	Add a 300-500 Kw Portable Generator with the ability to connect to multiple school facilities one being Popular Grove School, in order to provide emergency backup power to these sites. This will enable us to operate the impacted facility as an emergency shelter as required.	FSSD Finance and Administration	Short-Term (0-3 years)	Local funds, HMGP, BRIC	3	2	2	3	3	13	$55,000	Existing
Town of Nolensville	Flood	Acquisition of flood prone properties near mill creek.	Nolensville Fire and Rescue	Long-Term (5-10 years)	FMA, HMGP	2	1	2	3	3	11	$2,000,000	Existing
Town of	Flood	Flood wall construction	Nolensville Fire	Long-	FMA, Local	3	2	2	2	3	12	$300,000	Existing

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
Nolensville		along Bradfield Dr	and Rescue	Term (5-10 years)	Funds, HMGP								
Town of Nolensville	Flood	Enlargement and Replacement of drainage culverts along Rocky Fork Rd.	Nolensville Fire and Rescue	Long-Term (5-10 years)	FMA, Local Funds, HMGP	3	2	2	2	3	12	$125,000	Existing
Town of Nolensville	Flood	Continuous cleaning of drainage ditches to help alleviate flooding.	Public Works	Short-Term (0-3 years)	Local Funds	2	1	1	2	1	7	$35,000	Pre-Existing
Town of Nolensville	Tornado, Severe Winter Weather	Addition of a backup generator to Town Hall/Police station	Nolensville Fire and Rescue	Short-Term (0-3 years)	Local funds, HMGP, BRIC	3	2	2	3	3	13	$50,000	Existing
Town of Nolensville	Tornado	Community safe room addition to new fire station under construction	Nolensville Fire and Rescue	Short-Term (0-3 years)	Local funds, HMGP, BRIC	3	1	3	3	3	13	$250,000	Existing
Town of Nolensville	Flood	Purchase storm drain cleaning equipment.	Nolensville Fire and Rescue	Short-Term (0-3 years)	Local Funds, HMGP	1	3	2	3	2	11	$50,000	Existing
Town of Thompson's Station	Flood	Establish and maintain riparian buffers per Tennessee Department of Environmental Conservation (TDEC).	Town of Thompson's Station Planning and Zoning	Long-Term (5-10 years)	Local Funds, HMGP	2	2	2	3	3	12	$5,000	Both New and Existing
Town of Thompson's Station	Severe Winter Weather	Purchase new snow removal equipment (Truck, plow, salt spreader).	Maintenance Department	Short-Term (0-3 years)	Local funds, HMGP, BRIC	3	2	2	3	1	11	$100,000	New
Town of Thompson's	Severe Winter Weather	Establish salt inventory and storage areas.	Maintenance Department	Long-Term (5-	HMGP, Local Funds	2	2	2	3	3	12	$5,000	New

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
Station				10 years)									
Town of Thompson's Station	Severe Winter Weather	Purchase a 289 CAT Skid steer dedicated to snow removal.	Public Works	Short-Term (0-3 years)	HMGP, Local Funds	3	2	2	2	3	12	$140,000	New
Town of Thompson's Station	Wildfire/ Brushfire	Trimming of trees along roadway to protect Middle Tennessee Electric Membership Cooperation Power lines.	Town Administration and MTE	Short-Term (0-3 years)	Local Funds	3	2	2	2	1	10	$10,000	Both New and Existing
Town of Thompson's Station	Flood	Regular maintenance on ditches and culverts.	Town of Thompson's Station Maintenance Department	Short-Term (0-3 years)	HMGP, Local Funds	3	2	1	2	1	9	$10,000	Both New and Existing
Town of Thompson's Station	Flood	Enforcement of updated floodplain regulation.	Town of Thompson's Station Planning and Zoning	Long-Term (5-10 years)	HMGP, Local Funds	2	3	2	3	3	13	$5,000	Both New and Existing
Town of Thompson's Station	Tornado	Designate Community shelter location	Town Administration	Long-Term (5-10 years)	Local Funds	3	3	3	3	3	15	$0.00	New
Town of Thompson's Station	Wildfire/ Brushfire	Enforcement of the State of Tennessee Forestry Department Burn permitting and Burn banning program.	City Administration	Long-Term (5-10 years)	Local Funds	2	2	3	3	3	13	$0.00	Both New and Existing
Williamson County	Flood	Voluntary acquisition and removal of qualified properties as disaster declarations make	Emergency Management	Long-Term (5-10 years)	HMGP, FMA, Local Funds	2	1	1	3	3	10	$4,340,000	Both

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
		grant funding available. Current repetitive loss properties do not meet benefit cost requirements.											
Williamson County	Flood	Participation in the NFIP and CRS with initial FIRMS dated November 1981; Updates in 1989, 1993, 2003, 2006, and 2016.	Williamson County Engineering and Codes Enforcement	Short-Term (0-3 years)	Local Funds	2	2	3	3	2	12	$1,500	Existing
Williamson County	Flood	Continued application and enforcement of the Zoning ordinance (floodplain management) and Storm Water Management Regulations.	Williamson County Engineering and Codes Enforcement	Ongoing	HMGP, Local Funds	1	2	3	2	2	10	$25,000	Both New and Existing
Williamson County	Pandemic	Establish a pandemic response plan in coordination with the local department of health and the Williamson County Emergency Management Agency.	Williamson County Emergency Management Agency	Short-Term (0-3 years)	HMGP, Local Funds	3	2	3	3	3	14	$500	Existing
Williamson County	Drought/Excessive Heat	Develop an emergency action plan to provide cooling shelters to a population in need during excessive heat of about 300 people.	Williamson County Emergency Management Agency	Short-Term (0-3 years)	Local Funds	3	2	3	3	3	14	$1,000	New
Williamson County	Earthquake/Seismic Activity	Adopt new international building codes regarding	Williamson County	Ongoing	HMGP, Local Funds	2	3	3	3	3	14	$1,000	Both New and

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
		earthquake standard proofing for facilities at risk.	Engineering and Codes Enforcement										Existing
Williamson County	Flood, Severe Winter Weather, Excessive Heat/Drought, Earthquake	Portable emergency generator capable of supporting any number of critical facilities throughout the county.	Emergency Management Agency	Short-Term (0-3 years)	Local funds, HMGP, BRIC	3	2	3	3	3	14	$350,000	Existing
Williamson County	Geological Incident	Develop slope regulations, soil surveys, and require building pad certification letters of geotechnical reports for building envelops of concern.	Williamson County Engineering	Ongoing	HMGP, BRIC	2	3	3	3	3	14	$1,000	Existing
Williamson County	Flood, Severe Winter Weather, Excessive Heat/Drought, Earthquake	Add an emergency generator and related equipment at Fire Station 15.	Emergency Management Agency	Short-Term (0-3 years)	Local funds, HMGP, BRIC	3	2	2	3	3	13	$150,000	Existing
Williamson County	Flood, Severe Winter Weather, Excessive Heat/Drought, Earthquake	Add an emergency generator and related equipment at Fire Station 16.	Emergency Management Agency	Short-Term (0-3 years)	Local funds, HMGP, BRIC	3	2	2	3	3	13	$75,000	Existing
Williamson County	Flood, Severe Winter	Add an emergency generator and related	Emergency Management	Short-Term (0-3	Local funds, HMGP,	3	2	2	3	3	13	$100,000	Existing

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
	Weather, Excessive Heat/Drought, Earthquake	equipment at Fire Station 17.	Agency	years)	BRIC								
Williamson County	Flood, Severe Winter Weather, Excessive Heat/Drought, Earthquake	Add an emergency generator and related equipment at Fire Station 22.	Emergency Management Agency	Short-Term (0-3 years)	Local funds, HMGP, BRIC	3	2	2	3	3	13	$175,000	Existing
Williamson County	Flood, Severe Winter Weather, Excessive Heat/Drought, Earthquake	Add an emergency generator and related equipment at Fire Station 30.	Emergency Management Agency	Short-Term (0-3 years)	Local funds, HMGP, BRIC	3	2	2	3	3	13	$50,000	Existing
Williamson County	Tornado	Fortify new jail structure to withstand weather impacts from high winds/tornados	Sheriff's Office	Long-Term (5-10 years)	Local Funds	2	2	3	3	3	13	$280,000,000	New
Williamson County	Flood, Severe Winter Weather, Excessive Heat/Drought, Earthquake	Add an emergency generator and related equipment at Fire Station 35.	Emergency Management Agency	Short-Term (0-3 years)	Local funds, HMGP, BRIC	3	2	2	3	3	13	$150,000	Existing
Williamson County	Flood, Severe Winter Weather, Excessive	Add an appropriately sized emergency generator to adequately power the entirety of its Williamson	Emergency Management Agency	Short-Term (0-3 years)	Local funds, HMGP, BRIC	3	2	2	3	3	13	$1,050,000	Existing

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
	Heat/Drought, Earthquake	County Ag EXPO Park.											
Williamson County	Flood, Severe Winter Weather, Excessive Heat/Drought, Earthquake	Add an emergency generator for to WAKM AM-950's AM transmitter located in Williamson County.	Emergency Management Agency	Short-Term (0-3 years)	Local funds, HMGP, BRIC	3	2	2	3	3	13	$75,000	Existing
Williamson County	Flood	Implement a flood mitigation study to determine the most effective method for limiting flooding in the area around Lynwood Branch along Chapel Ct., Howell Dr., and Brookside Dr.	Williamson County Emergency Management Agency and Engineering	Medium-Term (3-5 years)	HMGP, FMA, Local Funds	3	2	3	2	3	13	$10,000	Both New and Existing
Williamson County	Earthquake/Seismic Activity	Install a generator or generator hookup to supply power to the secondary emergency operations center in case of a loss of power.	Williamson County Emergency Management Agency	Long-Term (5-10 years)	BRIC, Local Funds	2	3	2	3	3	13	$100,000	Existing
Williamson County	Wildfire/Brush Fire	Develop an educational program that informs the public of wildfire/brush fire risks. Additionally, incorporate advertisement of burn bans when appropriate.	Williamson County Emergency Management Agency	Medium-Term (3-5 years)	Local Funds	3	3	2	3	2	13	$1,000	Existing
Williamson County	Wildfire/Brush Fire	Develop land maintenance agreements for areas that are	Williamson County	Medium-Term (3-5	Local Funds	3	3	2	3	2	13	$1,000	Existing

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
		at higher risk for wildfire/brush fire.	Emergency Management Agency	years)									
Williamson County Schools	Flood, Severe Winter Weather, Excessive Heat/Drought, Earthquake	Add a Portable Generator at Independence High School to permit the facility to operate as a shelter location.	WCS Maintenance	Short-Term (0-3 years)	Local funds, HMGP, BRIC	3	2	2	3	3	13	$98,000	Existing
Williamson County Schools	Flood, Severe Winter Weather, Excessive Heat/Drought, Earthquake	Add a Portable Generator at Fairview High School to permit the facility to operate as a shelter location.	WCS Maintenance	Short-Term (0-3 years)	Local funds, HMGP, BRIC	3	2	2	3	3	13	$98,000	Existing
Williamson County Schools	Tornado	Fortify/harden existing school structures in order to withstand high winds/tornado impacts	Williamson County Schools	Long-Term (5-10 years)	Local Funds	2	2	2	3	3	12	$46,000	Both New and Existing
Williamson County Schools	Flood, Severe Winter Weather, Excessive Heat/Drought, Earthquake	Renovating an existing vestibule to hardened security measures at the main entry vestibule at Westwood Elementary to serve as a safe shelter location.	WCS Maintenance	Short-Term (0-3 years)	Local funds, HMGP, BRIC	3	2	2	3	3	13	$11,000	Existing
Williamson County	Flood	Develop storage areas and drainage ways for water to flow with the intent to protect structures and	Community Development Department	Ongoing	FMA	2	1	3	3	3	12	$10,000	Both New and Existing

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
		prevent soil erosion.											
Williamson County	Wildfire/Brush Fire	Create fire stops in large wooded areas to help prevent the spread of a wildfire.	TN Division of Forestry	Ongoing	Local Funds	2	3	2	3	2	12	$5,000	Both New and Existing
Williamson County	Flood	Coordinate with other county departments such as county highway and stormwater management to create a culvert reporting program for residents to report clogged or damaged culverts.	Williamson County Emergency Management Agency	Short-Term (0-3 years)	Local Funds	3	2	3	2	2	12	$1,000	Both New and Existing
Williamson County	Tornado	Develop educational programs that encourage the use or installation of storm shelters for protection against tornados.	Williamson County Emergency Management Agency	Medium-Term (3-5 years)	Local Funds	2	2	3	3	2	12	$0	Existing
Williamson County	Earthquake/Seismic Activity	Purchase and installation of five generator hook-ups to supply portable generator power to critical infrastructure facilities as recorded in the Critical2TN database.	Williamson County Emergency Management Agency	Medium-Term (3-5 years)	HMGP, BRIC, Local Funds	3	2	2	3	2	12	$300,000	Existing
Williamson County	Flood	Create a program to make consistent notifications to homeowners of repetitive	Williamson County Engineering	Ongoing	BRIC, FMA, Local Funds	2	3	3	1	2	11	$20,000	Both New and Existing

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
		loss properties to help inform them of insurance opportunities and other methods to prepare for flooding incidents.											
Williamson County	Flood	Develop floodplain management/use policy for Williamson County.	Williamson County Engineering	Ongoing	BRIC, FMA	2	3	3	1	2	11	$20,000	Both New and Existing
Williamson County	Flood	Development of stream buffer ordinances and policies to reduce stormwater runoff.	Williamson County Engineering	Ongoing	BRIC, FMA, Local Funds	2	3	3	1	2	11	$100,000	Both New and Existing
Williamson County	Flood	Develop maintenance agreements with owners of stormwater infrastructure.	Williamson County Engineering	Ongoing	BRIC, FMA, Local Funds	2	3	3	1	2	11	$100,000	Both New and Existing
Williamson County	Flood	Develop stream bank restoration programs for waterways across the county.	Williamson County Engineering	Ongoing	BRIC, FMA, Local Funds	2	3	3	1	2	11	$100,000	Both New and Existing
Williamson County	Drought/Excessive Heat	Implementation of an educational program that covers water conservation, encourages use of native vegetation, and encourages use of pervious surfaces to increase groundwater recharge.	Williamson County Emergency Management Agency and Engineering	Long-Term (5-10 years)	HMGP, Local Funds	3	2	3	1	2	11	$1,000	Existing
Williamson	Geological	Conduct a formal study to	Williamson	Medium-	Local Funds	2	2	2	3	2	11	$50,000	New

Name:	Hazards Mitigated:	Action Description:	Responsible Department:	Time Frame:	Funding Source:	Societal	Administrative	Financial	Environmental	Technical	Total SAFE-T Prioritization Score	Estimated Cost:	New or Existing Infrastructure
County	Incident	identify areas that pose the greatest risk of landslides in Williamson County. Upon completion of this study, create and install signage to notify the public of the risk as applicable.	County Emergency Management Agency	Term (3-5 years)									
Williamson County	Pandemic	Purchase and acquire new filters for portable ventilation system capable of cleaning contaminated air using MERV-13 filters or better.	Williamson County Emergency Management Agency	Medium-Term (3-5 years)	BRIC, Local Funds	2	2	2	3	2	11	$5,000	New
Williamson County	Severe Winter Weather	Create an annual plan for ensuring salt is pre-staged in the needed quantity prior to any severe winter weather.	Williamson County Highway	Short-Term (0-3 years)	Local Funds	1	2	2	3	2	10	$1,000	Both New and Existing
Williamson County	Severe Winter Weather	Stockpile salt for roadways at 1,500 tons annually.	Williamson County Highway	Short-Term (0-3 years)	Local Funds	2	2	2	3	1	10	$135,750	Pre-Existing
Williamson County	Severe Winter Weather	Investment in new severe winter weather activated signage to notify the public of dangerous winter-weather conditions.	Williamson County Highway	Short-Term (0-3 years)	Local Funds	1	2	2	3	2	10	$50,000	Both New and Existing
Williamson County	Tornado	Construction of storm shelters built into the footings of new roadway bridges.	Williamson County Highway Department	Ongoing	FMA, Local Funds	2	2	2	1	2	9	$10,000	New

Section Four: Implementation, Integration, and Maintenance

4.1. Plan Adoption, Implementation, Monitoring, and Evaluation

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

4.1.1 Plan Adoption

The purpose of formally adopting this plan is to secure buy-in, raise awareness of the plan, and formalize the plan's implementation. Plans will be adopted by the appropriate governing body for each participating community. Executed resolutions will be maintained and made available by the Williamson County Emergency Management Agency.

4.1.2 Implementation

Implementation and maintenance of the plan is critical to the overall success of hazard mitigation planning. This section provides an overview of the overall strategy for plan implementation and maintenance.

Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of the government. Implementation will be accomplished by adhering to the schedules identified for each action and through constant, pervasive, and energetic efforts to network and highlight the multi-objective benefits to each program and the community. This effort is achieved through the routine actions of monitoring agendas, attending meetings, and promoting a safe, sustainable community. Involvement of the HMPC through continued meetings and planning is essential and will serve as a key component to completing mitigation actions. Additional mitigation strategies could include consistent and ongoing enforcement of existing policies and vigilant review of programs for coordination and multi-objective opportunities.

Simultaneous to these efforts, it is important to maintain constant monitoring of funding opportunities that can be leveraged to implement some of the costlier actions. This will include creating and maintaining a list of ideas on how to meet local match or participation requirements. When funding does become available, the communities will be able to capitalize on the opportunity due to the diligence of the HMPC. Funding opportunities to be monitored include special pre- and post-disaster funds, state and federal funds, benefit assessments, and other grant programs, including those that can serve or support multi-objective applications.

Elected officials, officials appointed to head community departments, and community staff are charged with the implementation of various activities in the plan. Recommendations will be made to modify timeframes for the completion of activities, funding resources, and responsible entities. On an annual basis, the priority standing of various activities may also be changed. Some activities that are found unachievable may be removed from the plan entirely and activities addressing problems unforeseen during plan development may be added.

4.1.3 Integration into Local Planning Mechanism

A vital implementation mechanism that is highly effective and low-cost is the incorporation of the HMP recommendations and their underlying principles into other plans and tools. All plan

participants will use existing methods and programs to implement hazard mitigation actions where possible. As previously stated, mitigation is most successful when it is incorporated into government and public service's day-to-day functions and priorities. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include:

- Regularity Capabilities
- Administrative Capabilities
- Fiscal Capabilities

For further information regarding the different capabilities refer to Section 3 – Mitigation Strategy.

Implementation and incorporation into existing planning mechanisms will be conducted by respective planning authorities and will be done through the routine actions of:

- Monitoring other planning/program agendas;
- Attending other planning/program meetings;
- Participating in other planning processes; and
- Monitoring community budget meetings for other community program opportunities.

The successful implementation of this mitigation strategy will require constant and vigilant review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community. Efforts should continuously be made to monitor the progress of mitigation actions implemented through other planning mechanisms. Where appropriate, priority actions should be incorporated into Hazard Mitigation Plan updates.

4.1.4 Monitoring, Evaluating, Updating

For the HMP update review process, the WCEMA Director will be responsible for facilitating, coordinating, and scheduling reviews and maintenance of the plan. The Director may delegate this responsibility to anyone in the WCEMA. The review of the Hazard Mitigation Plan will be conducted as follows:

- WCEMA will be responsible for leading the meeting to review the plan.
- Notices will be emailed to the members of the HMPC, federal, state, and local agencies, non-profit groups, local planning agencies, and representatives of business interests, neighboring communities, and others advising them of the date, time, and place for the review.
- Local City officials will be notified by email or phone call.
- Before the review, department heads and others tasked with implementing various projects/actions will be queried concerning progress in their area of responsibility and asked to present a report at the review meeting.
- A copy of the current plan will be available for public comment.

- After the review meeting, a status report will be developed outlining the implementation of projects over the past year.
- After the review meeting, a status report will be developed identifying current repetitive loss properties for evaluation.

Criteria for Annual Reviews

The criteria recommended for annual reviews will include the following:

- Community growth or change in the past year to include residential, commercial, and industrial growth trends.
- The number of substantially damaged or improved structures by flood zone and review of jurisdictional NFIP membership.
- Renovations to public infrastructure, including water, sewer, drainage, roads, bridges, gas lines, and buildings.
- Natural hazard occurrences that required activation of the Emergency Operations Center (EOC) and whether the event resulted in a presidential disaster declaration.
- Natural hazard occurrences that were not of a magnitude to warrant activation of the EOC or a federal disaster declaration but were severe enough to cause damage in the community or closure of businesses, schools, or public services.
- The dates of hazardous events, narratives, and documented damages.
- Closures of places of employment or schools and the number of days closed.
- Road or bridge closures due to the hazard and the length of time closed.
- Assessment of the number of private and public buildings damaged due to the hazard and whether the damage was minor, substantial, major, or if buildings were destroyed. The assessment will include residences, mobile homes, commercial structures, industrial structures, and public buildings, such as schools and public safety buildings.
- Review of any changes in federal, state, and local policies to determine the impact of these policies on the community and how and if the policy changes can or should be incorporated into the Hazard Mitigation Plan.
- WCEMA will provide technical assistance in this meeting through staff or subject matter experts regarding the implementation of mitigation codes and ordinances.
- Review of the implementation status of projects/actions (mitigation strategies). The reason for delay will be discussed for any projects that are behind schedule or not yet started.

4.2 Continued Public Involvement

Continued public involvement is imperative to the overall success of the plan’s implementation. The update process provides an opportunity to solicit participation from new and existing stakeholders, publicize mitigation success stories, and seek additional public comment. The plan maintenance and update process will include continued public and stakeholder involvement and

input through attendance at designated committee meetings, web postings, press releases to local media, and public hearings.

4.3 Public Involvement Process for Annual Reviews

The public will be notified via the Williamson County website or any other form of a publicized social platform (i.e., local newspaper, Facebook, X) well in advance of any public meetings or comment periods.

4.4 Public Involvement for Five-year Update

When the HMPC reconvenes for the five-year update, they will coordinate with all stakeholders participating in the planning process—including those who joined the committee since the planning process began—to update and revise the plan. In reconvening, the HMPC will develop a plan for public involvement and will be responsible for disseminating information through various media channels detailing the plan update process. As part of this effort, public meetings will be held, and public comments will be solicited on the plan update draft.

Appendix A: Planning Documentation

HMP Planning Meeting 1:

Williamson County
Emergency Management Agency
Hazard Mitigation Planning Committee Meeting
03/30/2023

Name	Organization	Email	Cell Phone
Nicholas Sturgeon	WCEMA	nick.sturgeon@williamsoncountytn.gov	(629) 214-5015
Gino Fantoni	Franklin EM	ginofantoni@franklintn.gov	615-587-1885
GREG BOYD	SH. EMA	gboyd@springhilltn.org	615 924-9641
Todd Hoppenstedt	Brentwood PW	todd.hoppenstedt@brentwoodtn.gov	615-371-0080
JILL BURGIN	WCEMA	jill.burgin@williamsoncounty-tn.gov	615-934-CERT
Russell Peterson	City of Brentwood	russell.peterson@brentwoodtn.gov	615/405-7818
Scott Hughes	City of Fairview	firechief@fairview-tn.gov	615-420-8709
Bob Leeman	City of Brentwood	Bob.Leeman@Nashville.gov	615-[illegible]2260

HMP Planning Meeting 2:

Williamson County EOC
Sign-In

Event: HazMit Plan Meeting State Mission #_____ FEMA #_____ Date 4/26/23

Name	Address	E-Mail
Russell Peterson	On file	
Nicholas Sturgeon	on file	on file
Scott Villar	On file	On file
Kim Mellawhorn		
Todd Horton	on file	on file
Paul Tampien	WCARES - KM4PT	
Sam Killingsworth	on file	on file
Ashlar Simpson	on file	on file
Erin Jakrlooski	on file	on file
Jack Caner	—	michael.caner@tn.gov
Bill Jorgensen	—	—
GREG BOYD		
JOHN WALSH		
JILL BURGIN		

HMP Planning Meeting 3:

Williamson County
Emergency Management Agency
Hazard Mitigation Planning Committee Meeting
05/08/2023

Name	Organization	Email	Have a BOLDplanning Account (Y/N)?
Nicholas Sturgeon	WCEMA	nick.sturgeon@williamsoncounty-tn.gov	Yes
Mario Forgione	Wilco Engineering	mario.forgione@williamsoncounty-tn.gov	N
MAC NOLEN	WC Solid Waste	mac.nolen@williamsoncounty-tn.gov	Yes
Cathy Montgomery	Murfreesboro EMA	cdmontgomery@murfreesborotn.gov	N
Russell Peterson	On file		
JOHN WALSH	WCMC	john.j.walsh1@cmmc.org	No
GREG BOYD	SH. EMA		yes
Todd Horton	WCEMA	on file	yes

HMP Planning Meeting 4 (Virtual):

Meeting Name	Meeting Start Time	Display Name	Role	Attendee Email	Connection Type
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Bob Leeman	attendee	[redacted]	Desktop app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Brian Goss	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Cathy Montgomery	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Donny	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Gene Cheatham	attendee		Web app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Gino Fantoni	attendee		Mobile app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Hoop K9QJS	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Jessica	attendee		Web app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Jim Colvin	attendee		Web app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Joshua Walter	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Katy Clouse, LMSW	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Katy Clouse, LMSW	attendee		Mobile app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Mac Nolen	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Marc Waltz	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Mario Forgione	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Mark King	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Matthew Lupo	attendee		Web app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Moderator	host		Web app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Phil Sherrod	attendee		Mobile app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Russell Peterson	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	Sean Cothron	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-03 12:15:29	WCEMA EOC	coHost		Web app

HMP Planning Meeting 5 (Virtual):

Meeting Name	Meeting Start Time	Display Name	Role	Attendee Email	Connection Type
Hazard Mitigation Public Meeting	2024-01-04 16:59:55	Andrew Gossett	attendee	[redacted]	Mobile app
Hazard Mitigation Public Meeting	2024-01-04 16:59:55	Ashlae	attendee		Mobile app
Hazard Mitigation Public Meeting	2024-01-04 16:59:55	C Ferguson	attendee		Mobile app
Hazard Mitigation Public Meeting	2024-01-04 16:59:55	Call-in User_1	attendee		Other app
Hazard Mitigation Public Meeting	2024-01-04 16:59:55	Eoc Info	host		Desktop app
Hazard Mitigation Public Meeting	2024-01-04 16:59:55	JK Hooper	attendee		Mobile app
Hazard Mitigation Public Meeting	2024-01-04 16:59:55	James G	attendee		Web app
Hazard Mitigation Public Meeting	2024-01-04 16:59:55	Jill Burgin	attendee		Web app
Hazard Mitigation Public Meeting	2024-01-04 16:59:55	Joe	attendee		Desktop app
Hazard Mitigation Public Meeting	2024-01-04 16:59:55	Joshua Walter	attendee		Desktop app
Hazard Mitigation Public Meeting	2024-01-04 16:59:55	Moderator	coHost		Desktop app
Hazard Mitigation Public Meeting	2024-01-04 16:59:55	Ronnie Leftwich	attendee		Desktop app
Hazard Mitigation Public Meeting	2024-01-04 16:59:55	Tanya and Dan Scherr	attendee		Desktop app

HMP Planning Meeting 6 (Virtual):

Meeting Name	Meeting Start Time	Display Name	Role	Attendee Email	Connection Type
Hazard Mitigation Planning Committee	2024-01-05 12:29:05	Bob Leeman	attendee	[redacted]	Desktop app
Hazard Mitigation Planning Committee	2024-01-05 12:29:05	Call-in User_1	attendee		Other app
Hazard Mitigation Planning Committee	2024-01-05 12:29:05	Catherine Montgomery	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-05 12:29:05	Cathy Montgomery	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-05 12:29:05	Donny	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-05 12:29:05	Eoc Info	coHost		Desktop app
Hazard Mitigation Planning Committee	2024-01-05 12:29:05	Gene Cheatham	attendee		Mobile app
Hazard Mitigation Planning Committee	2024-01-05 12:29:05	Gino Fantoni	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-05 12:29:05	Jay.Bonson	attendee		Web app
Hazard Mitigation Planning Committee	2024-01-05 12:29:05	John Walsh	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-05 12:29:05	Katy Clouse, LMSW	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-05 12:29:05	Mac Nolen	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-05 12:29:05	Mario Forgione	attendee		Mobile app
Hazard Mitigation Planning Committee	2024-01-05 12:29:05	Moderator	host		Desktop app
Hazard Mitigation Planning Committee	2024-01-05 12:29:05	Phil Sherrod	attendee		Mobile app
Hazard Mitigation Planning Committee	2024-01-05 12:29:05	Russell Peterson	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-05 12:29:05	Russell Peterson	attendee		Desktop app

HMP Planning Meeting 7 (Virtual):

Meeting Name	Meeting Start Time	Display Name	Role	Attendee Email	Connection Type
Hazard Mitigation Planning Committee	2024-01-08 11:55:56	Catherine Montgomery	attendee	[redacted]	Desktop app
Hazard Mitigation Planning Committee	2024-01-08 11:55:56	Dallas Clements - WCEMA Reserves	attendee		Web app
Hazard Mitigation Planning Committee	2024-01-08 11:55:56	Donny	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-08 11:55:56	Eoc Info	host		Desktop app
Hazard Mitigation Planning Committee	2024-01-08 11:55:56	Gene Cheatham	attendee		Mobile app
Hazard Mitigation Planning Committee	2024-01-08 11:55:56	Gene Cheatham	attendee		Mobile app
Hazard Mitigation Planning Committee	2024-01-08 11:55:56	Gino Fantoni	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-08 11:55:56	Greg Boyd	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-08 11:55:56	Joshua Walter	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-08 11:55:56	Mac Nolen	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-08 11:55:56	Mario Forgione	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-08 11:55:56	Matthew Lupo	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-08 11:55:56	Mekayle Houghton	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-08 11:55:56	Moderator	coHost		Desktop app
Hazard Mitigation Planning Committee	2024-01-08 11:55:56	Russell Peterson	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-08 11:55:56	Sean Cothron	attendee		Desktop app
Hazard Mitigation Planning Committee	2024-01-08 11:55:56	Stark, Jeff OEM	attendee		Desktop app

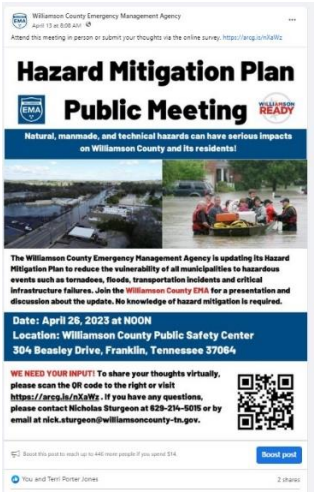
Those that were in attendance are recorded on the prior sign-in sheets are shown below with the jurisdiction in which they represented.

Name:	Jurisdiction:
Jessica Abrams	State of Tennessee
Jay Bonson	Williamson County
Greg Boyd	City of Spring Hill
Jill Burgin	Williamson County
Jack Casner	State of Tennessee
Gene Cheatham	Williamson County
Dallas Clements	Williamson County
Katy Clouse	Williamson County

Jim Colvin	City of Brentwood
Sean Cothron	Williamson County
Clint Derryberry	Maury County
Gino Fantoni	City of Franklin
C Ferguson	Williamson County
Mario Forgione	Williamson County
James G	Williamson County
Brian Goss	City of Brentwood
Andrew Gossett	Williamson County
James Hooper	Williamson County
Todd Hoppenstedt	City of Brentwood
Todd Horton	Williamson County
Mekayle Houghton	Williamson County
Scott Hughes	City of Fairview
Joe	Williamson County
Erin Jakuboski	Williamson County
Bill Jorgensen	Williamson County
Sam Killingsworth	Town of Nolensville
Mark King	Williamson County
Bob Leeman	City of Brentwood
Ronnie Leftwich	Williamson County
Matthew Lupo	Town of Nolensville
Ken McLawhon	Town of Thompson’s Station
Cathy Montgomery	Williamson County
Mac Nolen	Williamson County
Donny Parker	Williamson County
Russell Peterson	City of Brentwood
Tanya Scherr	Williamson County
Dan Scherr	Williamson County
Phil Sherrod	Williamson County
Jeff Stark	Metro Nashville – Davidson County

Nicholas Sturgeon	Williamson County
Ashlae Sympson	Williamson County
Paul Tampien	Williamson County
John Walsh	Williamson County
Joshua Walter	Williamson County
Marc Waltz	Williamson County
Scott Williar	City of Franklin

Social Media Publication 1:



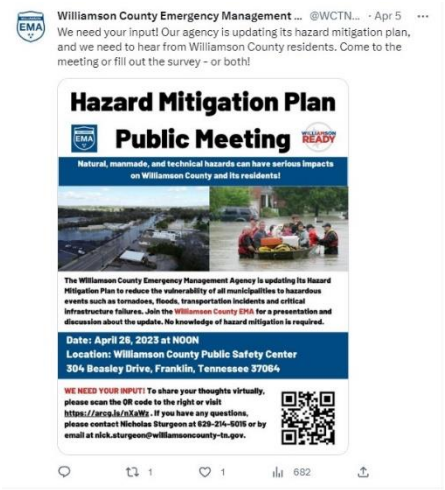
Social Media Publication 2:

Social Media Publication 3:

Social Media Publication 4:

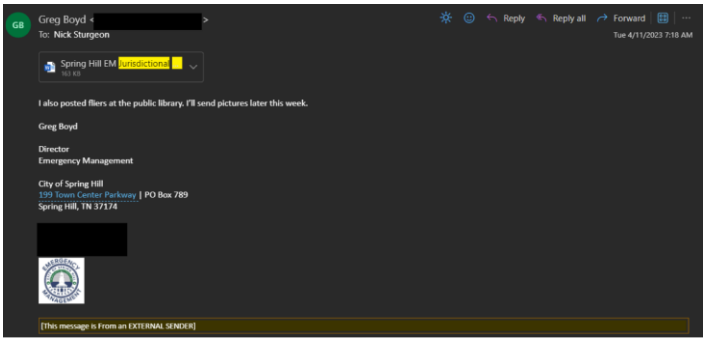
Social Media Publication 5:

Social Media Publication 6:



Social Media Publication 7:

Proof of Flyer 1:



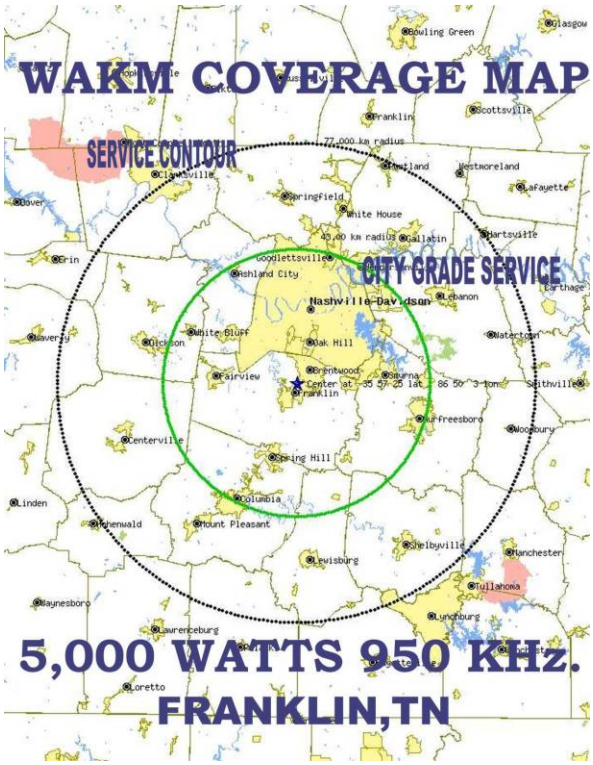
Appendix B: County Overview

CDC SVI Data:

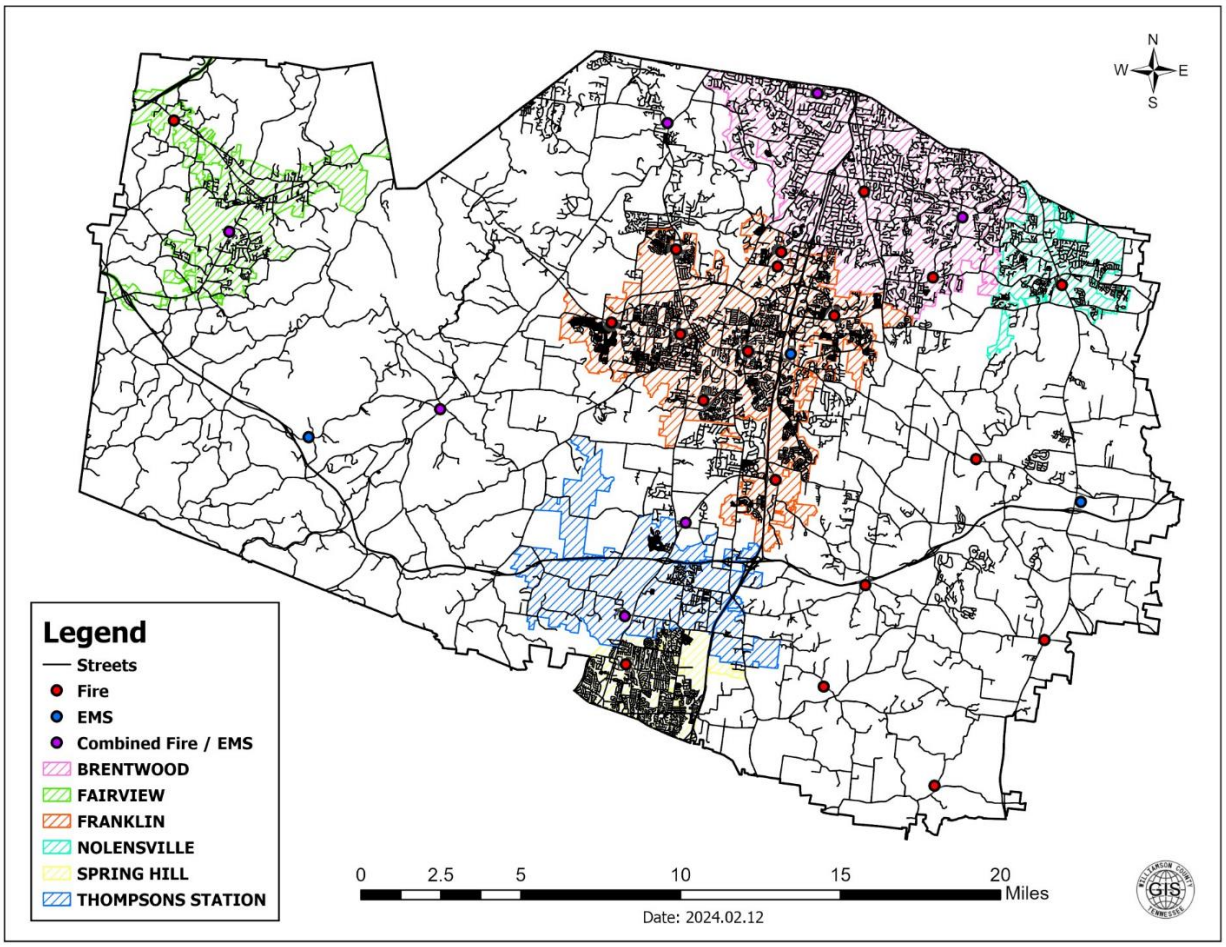
CDC SVI.xlsx

To view the data, please double click on the Excel icon above. If unable to view the data, please contact the WCEMA for assistance.

WAKM Coverage Map



Public Safety Facilities Map


N
W
E
S
Legend
Streets
Fire
EMS
Combined Fire / EMS
BRENTWOOD
FAIRVIEW
FRANKLIN
NOLENSVILLE
SPRING HILL
THOMPSONS STATION
0
2.5
5
10
15
20
Miles
Date: 2024.02.12
GIS

National Risk Index Summary:

National Risk Index

February 25, 2024

Williamson County, Tennessee

Summary

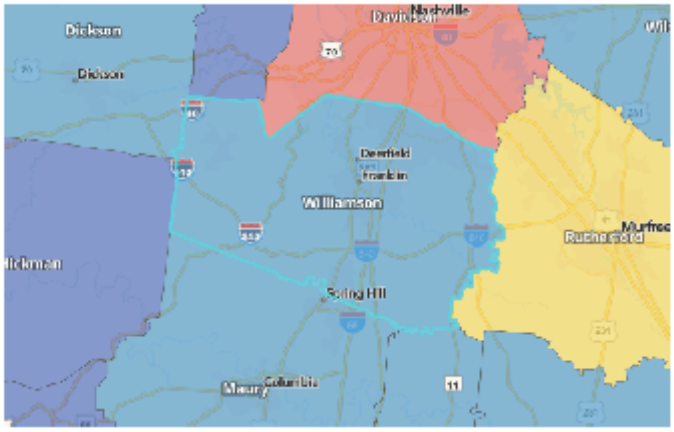
Risk Index is **Relatively Low**	Score **78.0** (0 – 100)
Expected Annual Loss is **Relatively Moderate**	Score **83.6** (0 – 100)
Social Vulnerability is **Very Low**	Score **2.1** (0 – 100)
Community Resilience is **Very High**	Score **86.2** (0 – 100)

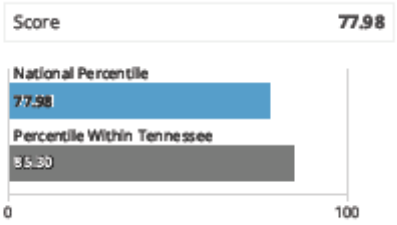
While reviewing this report, keep in mind that low risk is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience.

For more information about the National Risk Index, its data, and how to interpret the information it provides, please review the **About the National Risk Index** and **How to Take Action** sections at the end of this report. Or, visit the National Risk Index website at hazards.fema.gov/nri/learn-more to access supporting documentation and links.

Risk Index

The Risk Index rating is **Relatively Low** for **Williamson County, TN** when compared to the rest of the U.S.





78% of U.S. counties have a lower Risk Index

85% of counties in Tennessee have a lower Risk Index

Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value.

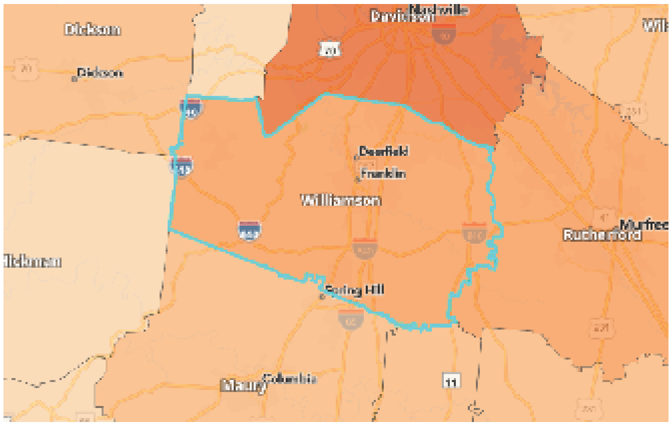
Hazard Type	Risk Index Rating	Risk Index Score	National Percentile
Avalanche	Not Applicable	–	
Coastal Flooding	Not Applicable	–	
Cold Wave	No Rating	0	0 100
Drought	Very Low	23.5	0 100
Earthquake	Relatively Moderate	93.6	0 100
Hail	Very Low	13.4	0 100
Heat Wave	Relatively Low	68.9	0 100
Hurricane	Very Low	49.6	0 100
Ice Storm	Relatively Low	38.5	0 100
Landslide	Relatively Moderate	88.7	0 100
Lightning	Relatively Moderate	70.1	0 100
Riverine Flooding	Relatively Low	59.4	0 100
Strong Wind	Relatively High	91.6	0 100
Tornado	Relatively Moderate	91.7	0 100
Tsunami	Not Applicable	–	
Volcanic Activity	Not Applicable	–	
Wildfire	Very Low	61.5	0 100
Winter Weather	Relatively Low	28.6	0 100

Risk Factor Breakdown

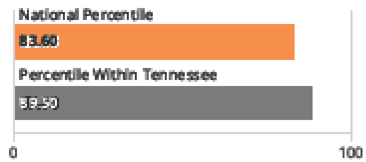
Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
Tornado	$10,277,838	Very Low	Very High	0.8	$8,124,847	91.7
Earthquake	$7,700,935	Very Low	Very High	0.8	$6,353,643	93.6
Strong Wind	$2,454,509	Very Low	Very High	0.8	$1,933,779	91.6
Riverine Flooding	$938,277	Very Low	Very High	0.8	$724,200	59.4
Heat Wave	$342,286	Very Low	Very High	0.8	$269,684	68.9
Lightning	$264,346	Very Low	Very High	0.8	$206,468	70.1
Hurricane	$251,986	Very Low	Very High	0.8	$198,134	49.6
Landslide	$214,227	Very Low	Very High	0.8	$159,934	88.7
Wildfire	$120,740	Very Low	Very High	0.8	$88,669	61.5
Ice Storm	$46,134	Very Low	Very High	0.8	$36,201	38.5
Winter Weather	$30,880	Very Low	Very High	0.8	$24,216	28.6
Hail	$17,983	Very Low	Very High	0.8	$14,186	13.4
Drought	$1,863	Very Low	Very High	0.8	$1,514	23.5
Cold Wave	$0	Very Low	Very High	0.8	$0	0
Avalanche	--	Very Low	Very High	0.8	--	--
Coastal Flooding	--	Very Low	Very High	0.8	--	--
Tsunami	--	Very Low	Very High	0.8	--	--
Volcanic Activity	--	Very Low	Very High	0.8	--	--

Expected Annual Loss

In **Williamson County, TN**, expected loss each year due to natural hazards is **Relatively Moderate** when compared to the rest of the U.S.



Score	83.6



84% of U.S. counties have a lower Expected Annual Loss

89% of counties in Tennessee have a lower Expected Annual Loss

Expected Annual Loss Legend

Very High, Relatively High, Relatively Moderate, Relatively Low, Very Low, No Expected Annual Losses, Not Applicable, Insufficient Data

Composite Expected Annual Loss	**$22,662,004.08**
Composite Expected Annual Loss Rate National Percentile	**13.9**

Building EAL	**$13,745,769.17**	Population EAL	**0.77 fatalities**
Building EAL Rate	**$1 per $3.98K of building value**	Population EAL Rate	**1 per 322.74K people**
Agriculture EAL	**$19,743.67**	Population Equivalence EAL	**$8,896,491.23**
Agriculture EAL Rate	**$1 per $1.80K of agriculture value**		

Expected Annual Loss for Hazard Types

Expected Annual Loss scores for hazard types are calculated using data for only a single hazard type, and reflect a community's relative expected annual loss for only that hazard type.

14 of 18 hazard types contribute to the expected annual loss for **Williamson County, TN**.

Hazard Type	Expected Annual Loss Rating	EAL Value	Score
Tornado	Relatively High	$10,277,838	94.7
Earthquake	Relatively Moderate	$7,700,935	94.2

Hazard Type	Expected Annual Loss Rating	EAL Value	Score
Strong Wind	Relatively High	$2,454,509	94.9
Riverine Flooding	Relatively Low	$938,277	69.2
Heat Wave	Relatively Moderate	$342,286	75.9
Lightning	Relatively Moderate	$264,346	78.8
Hurricane	Very Low	$251,986	52.5
Landslide	Relatively Moderate	$214,227	94.2
Wildfire	Relatively Low	$120,741	66.8
Ice Storm	Relatively Low	$46,135	46.1
Winter Weather	Relatively Low	$30,880	40.1
Hail	Very Low	$17,983	20.5
Drought	Very Low	$1,863	27.1
Cold Wave	No Expected Annual Losses	$0	0.0
Avalanche	Not Applicable	--	--
Coastal Flooding	Not Applicable	--	--
Tsunami	Not Applicable	--	--
Volcanic Activity	Not Applicable	--	--

Expected Annual Loss Values

Hazard Type	Total	Building Value	Population Equivalence	Population	Agriculture Value
Avalanche	--	--	--	--	--
Coastal Flooding	--	--	--	--	--
Cold Wave	$0	$0	$0	0.00	$0
Drought	$1,863	n/a	n/a	n/a	$1,863
Earthquake	$7,700,935	$5,732,549	$1,968,386	0.17	n/a
Hail	$17,983	$3,061	$14,378	0.00	$544
Heat Wave	$342,286	$3,684	$338,576	0.03	$26
Hurricane	$251,986	$248,386	$1,991	0.00	$1,610
Ice Storm	$46,134	$2,490	$43,644	0.00	n/a
Landslide	$214,227	$186,141	$28,086	0.00	n/a
Lightning	$264,346	$128,511	$135,835	0.01	n/a
Riverine Flooding	$938,277	$577,459	$359,701	0.03	$1,117

Hazard Type	Total	Building Value	Population Equivalence	Population	Agriculture Value
Strong Wind	$2,454,509	$329,791	$2,112,076	0.18	$12,641
Tornado	$10,277,838	$6,405,114	$3,870,787	0.33	$1,937
Tsunami	--	--	--	--	--
Volcanic Activity	--	--	--	--	--
Wildfire	$120,740	$111,144	$9,594	0.00	$3
Winter Weather	$30,880	$17,439	$13,437	0.00	$4

Exposure Values

Hazard Type	Total	Building Value	Population Equivalence	Population	Agriculture Value
Avalanche	--	--	--	--	--
Coastal Flooding	--	--	--	--	--
Cold Wave	$0	$0	$0	0.00	$0
Drought	$18,334,014	n/a	n/a	n/a	$18,334,014
Earthquake	$2,928,311,228,000	$54,689,628,000	$2,873,621,600,000	247,726.00	n/a
Hail	$2,925,992,402,385	$54,690,153,748	$2,871,266,800,000	247,523.00	$35,448,637
Heat Wave	$2,925,992,402,385	$54,690,153,748	$2,871,266,800,000	247,523.00	$35,448,637
Hurricane	$2,924,987,957,567	$54,672,983,997	$2,870,279,605,130	247,437.90	$35,368,440
Ice Storm	$2,925,041,212,564	$54,683,655,560	$2,870,357,557,004	247,444.62	n/a
Landslide	$1,125,211,552,939	$20,983,240,890	$1,104,228,312,049	95,192.10	n/a
Lightning	$2,925,956,953,748	$54,690,153,748	$2,871,266,800,000	247,523.00	n/a
Riverine Flooding	$67,934,556,133	$1,303,522,809	$66,624,960,029	5,743.53	$6,073,295
Strong Wind	$2,925,992,402,385	$54,690,153,748	$2,871,266,800,000	247,523.00	$35,448,637
Tornado	$2,925,992,402,385	$54,690,153,748	$2,871,266,800,000	247,523.00	$35,448,637
Tsunami	--	--	--	--	--
Volcanic Activity	--	--	--	--	--
Wildfire	$1,601,461,719,883	$27,542,795,954	$1,573,897,830,841	135,680.85	$21,093,087
Winter Weather	$2,925,992,402,385	$54,690,153,748	$2,871,266,800,000	247,523.00	$35,448,637

Annualized Frequency Values

Hazard Type	Annualized Frequency	Events on Record	Period of Record
Avalanche	--	--	--

Hazard Type	Annualized Frequency	Events on Record	Period of Record
Coastal Flooding	–	--	--
Cold Wave	0 events per year	0	2005-2021 (16 years)
Drought	8.5 events per year	294	2000-2021 (22 years)
Earthquake	0.117% chance per year	n/a	2021 dataset
Hail	3.7 events per year	128	1986-2021 (34 years)
Heat Wave	0.1 events per year	2	2005-2021 (16 years)
Hurricane	0 events per year	3	East 1851-2021 (171 years) / West 1949-2021 (73 years)
Ice Storm	0.6 events per year	42	1946-2014 (67 years)
Landslide	0 events per year	3	2010-2021 (12 years)
Lightning	80.9 events per year	1,780	1991-2012 (22 years)
Riverine Flooding	2.2 events per year	52	1996-2019 (24 years)
Strong Wind	6.2 events per year	211	1986-2021 (34 years)
Tornado	0.5 events per year	22	1950-2021 (72 years)
Tsunami	–	--	--
Volcanic Activity	–	--	--
Wildfire	0.001% chance per year	n/a	2021 dataset
Winter Weather	1 event per year	16	2005-2021 (16 years)

Historic Loss Ratios

Hazard Type	Overall Rating
Avalanche	--
Coastal Flooding	--
Cold Wave	No Rating
Drought	Very Low
Earthquake	Relatively High
Hail	Very Low
Heat Wave	Relatively Low
Hurricane	Very Low
Ice Storm	Very Low
Landslide	Very Low
Lightning	Very Low

Hazard Type	Overall Rating
Riverine Flooding	Very Low
Strong Wind	Very Low
Tornado	Relatively Low
Tsunami	--
Volcanic Activity	--
Wildfire	Relatively Low
Winter Weather	Very Low

Expected Annual Loss Rate

Hazard Type	Building EAL Rate (per building value)	Population EAL Rate (per population)	Agriculture EAL Rate (per agriculture value)
Avalanche	--	--	--
Coastal Flooding	--	--	--
Cold Wave	--	--	--
Drought	--	--	$1 per $19.03K
Earthquake	$1 per $9.54K	1 per 1.46M	--
Hail	$1 per $17.87M	1 per 199.70M	$1 per $65.17K
Heat Wave	$1 per $14.85M	1 per 8.48M	$1 per $1.34M
Hurricane	$1 per $220.18K	1 per 1.44B	$1 per $22.02K
Ice Storm	$1 per $21.96M	1 per 65.79M	--
Landslide	$1 per $293.81K	1 per 102.23M	--
Lightning	$1 per $425.57K	1 per 21.14M	--
Riverine Flooding	$1 per $94.71K	1 per 7.98M	$1 per $31.74K
Strong Wind	$1 per $165.83K	1 per 1.36M	$1 per $2.80K
Tornado	$1 per $8.54K	1 per 741.78K	$1 per $18.30K
Tsunami	--	--	--
Volcanic Activity	--	--	--
Wildfire	$1 per $492.07K	1 per 299.28M	$1 per $12.02M
Winter Weather	$1 per $3.14M	1 per 213.68M	$1 per $9.94M

Social Vulnerability

Social groups in **Williamson County, TN** have a **Very Low** susceptibility to the adverse impacts of natural hazards when compared to the rest of the U.S.

Score **2.13**

National Percentile
2.13

Percentile Within Tennessee
1.10

0 100

2% of U.S. counties have a lower Social Vulnerability

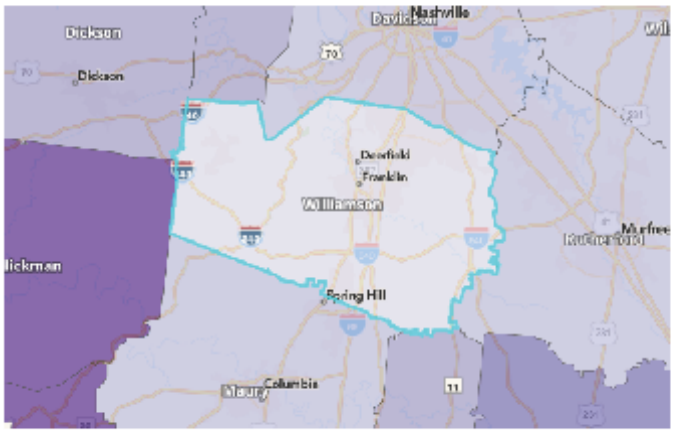
1% of counties in Tennessee have a lower Social Vulnerability

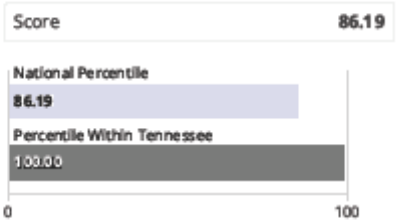
Social Vulnerability Legend

Very High | Relatively High | Relatively Moderate | Relatively Low | Very Low | Data Unavailable

Community Resilience

Communities in **Williamson County, TN** have a **Very High** ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the U.S.





14% of U.S. counties have a higher Community Resilience

0% of counties in Tennessee have a higher Community Resilience

Community Resilience Legend

Very High | Relatively High | Relatively Moderate | Relatively Low | Very Low | Data Unavailable

About the National Risk Index

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

The National Risk Index leverages available source data for Expected Annual Loss due to these 18 hazard types, Social Vulnerability, and Community Resilience to develop a baseline relative risk measurement for each United States county and Census tract. These measurements are calculated using average past conditions, but they cannot be used to predict future outcomes for a community. The National Risk Index is intended to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

Explore the National Risk Index Map at **hazards.fema.gov/nri/map**.

Visit the National Risk Index website at hazards.fema.gov/nri/learn-more to access supporting documentation and links.

Calculating the Risk Index

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:

Risk Index = Expected Annual Loss × Social Vulnerability + Community Resilience

Risk Index scores are presented as a composite score for all 18 hazard types, as well as individual scores for each hazard type.

For more information, visit hazards.fema.gov/nri/determining-risk.

Calculating Expected Annual Loss

Expected Annual Loss scores are calculated using an equation that combines values for exposure, annualized frequency, and historic loss ratios for 18 hazard types:

Expected Annual Loss = **Exposure** × **Annualized Frequency** × **Historic Loss Ratio**

Expected Annual Loss scores are presented as a composite score for all 18 hazard types, as well as individual scores for each hazard type.

For more information, visit hazards.fema.gov/nri/expected-annual-loss.

Calculating Social Vulnerability

Social Vulnerability is measured using the Social Vulnerability Index (SVI) published by the Centers for Disease Control and Prevention (CDC).

For more information, visit hazards.fema.gov/nri/social-vulnerability.

Calculating Community Resilience

Community Resilience is measured at the County level using the Baseline Resilience Indicators for Communities (HVRI BRIC) published by the University of South Carolina's Hazards and Vulnerability Research Institute (HVRI).

For more information, visit hazards.fema.gov/nri/community-resilience.

How to Take Action

There are many ways to reduce natural hazard risk through mitigation. Communities with high National Risk Index scores can take action to reduce risk by decreasing Expected Annual Loss due to natural hazards, decreasing Social Vulnerability, and increasing Community Resilience.

For information about how to take action and reduce your risk, visit hazards.fema.gov/nri/take-action.

Disclaimer

The National Risk Index (the Risk Index or the Index) and its associated data are meant for planning purposes only. This tool was created for broad nationwide comparisons and is not a substitute for localized risk assessment analysis. Nationwide datasets used as inputs for the National Risk Index are, in many cases, not as accurate as available local data. Users with access to local data for each National Risk Index risk factor should consider substituting

the Risk Index data with local data to recalculate a more accurate risk index. If you decide to download the National Risk Index data and substitute it with local data, you assume responsibility for the accuracy of the data and any resulting data index. Please visit the **Contact Us** page if you would like to discuss this process further.

The methodology used by the National Risk Index has been reviewed by subject matter experts in the fields of natural hazard risk research, risk analysis, mitigation planning, and emergency management. The processing methods used to create the National Risk Index have produced results similar to those from other natural hazard risk analyses conducted on a smaller scale. The breadth and combination of geographic information systems (GIS) and data processing techniques leveraged by the National Risk Index enable it to incorporate multiple hazard types and risk factors, manage its nationwide scope, and capture what might have been missed using other methods.

The National Risk Index does not consider the intricate economic and physical interdependencies that exist across geographic regions. Keep in mind that hazard impacts in surrounding counties or Census tracts can cause indirect losses in your community regardless of your community's risk profile.

Nationwide data available for some risk factors are rudimentary at this time. The National Risk Index will be continuously updated as new data become available and improved methodologies are identified.

The National Risk Index Contact Us page is available at **hazards.fema.gov/nri/contact-us**.

Appendix C: Historical Hazard Data

ETSU Climate Trend and Variations Report:

Williamson County Climate Trends and Variations

Flooding

The future risk of flooding in Williamson County is tied to predicted changes in the precipitation patterns. Tennessee and Williamson County have increasing trends in observed precipitation, and the Fourth National Climate Assessment (2018) reports that the broader Southeast region has seen an increase in the frequency and intensity of extreme rainfall events, there is high confidence that this trend will continue in the future. According to the Climate Mapping Risk Assessment (CMRA) Report, Williamson County is expected to experience a modest increase in various flood indicators by mid- and late-century. Both the increase in total precipitation and extreme rainfall events will increase the risk of flooding in Williamson County. The long-term (1895-2022) trend in annual precipitation shows an increase of +0.67” per decade, the medium-term (1961-2022) trend in precipitation shows an increase of +0.47” per decade, and the short-term (1991-2022) trend shows trend of 0.59” per decade. This indicates that precipitation has noticeably increased in Williamson County over the past several decades.

Figure 1: Climate Mapping Risk Assessment Report for Flooding in Williamson County.

(Source: US Climate Resilience Toolkit)

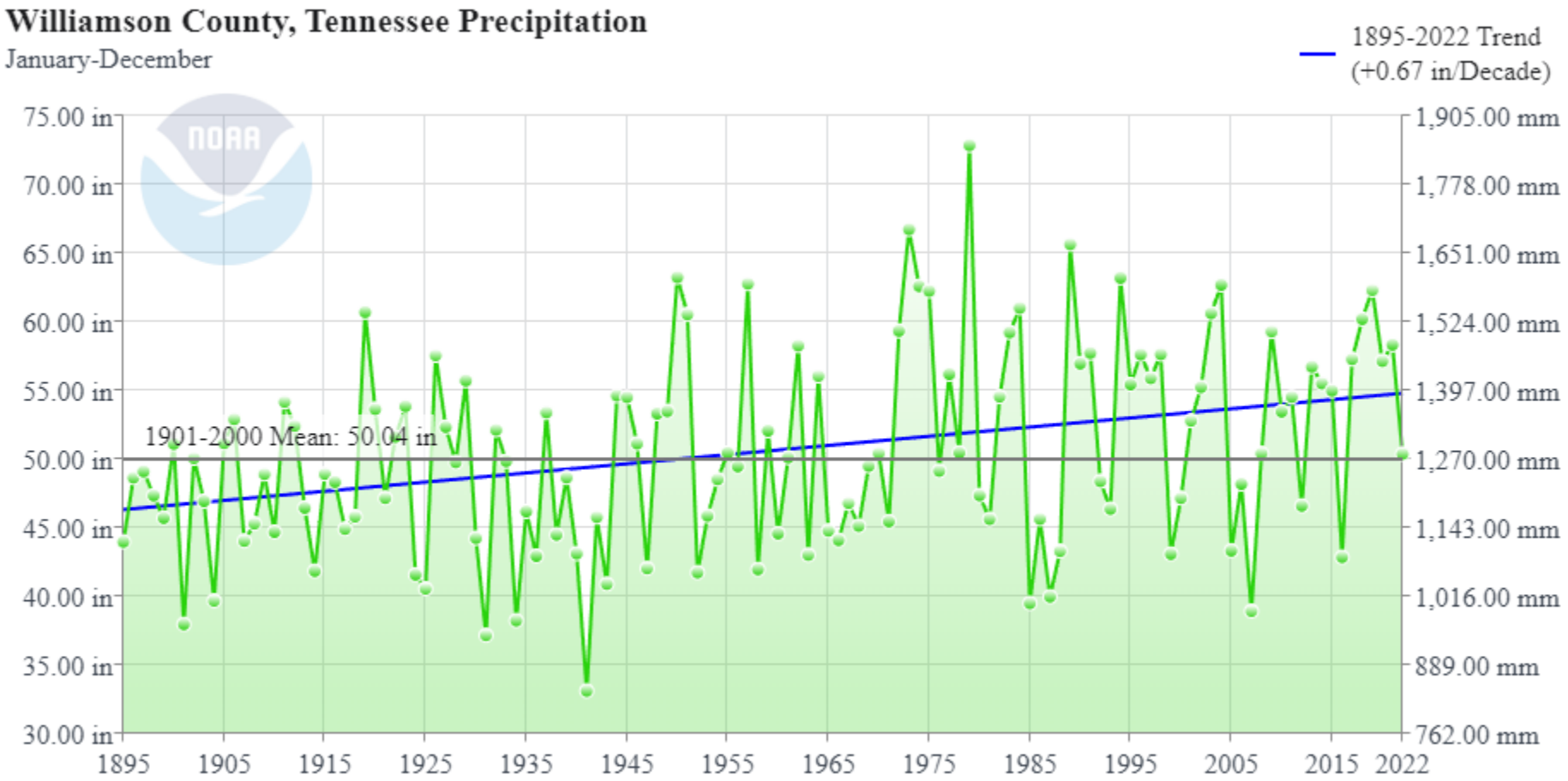


Figure 2: Total Annual Precipitation for Williamson County, Tennessee, Showing a +0.67-inch Increase per Decade Since 1895.

(Source: NOAA NCEI, Climate at a Glance: County Time Series)

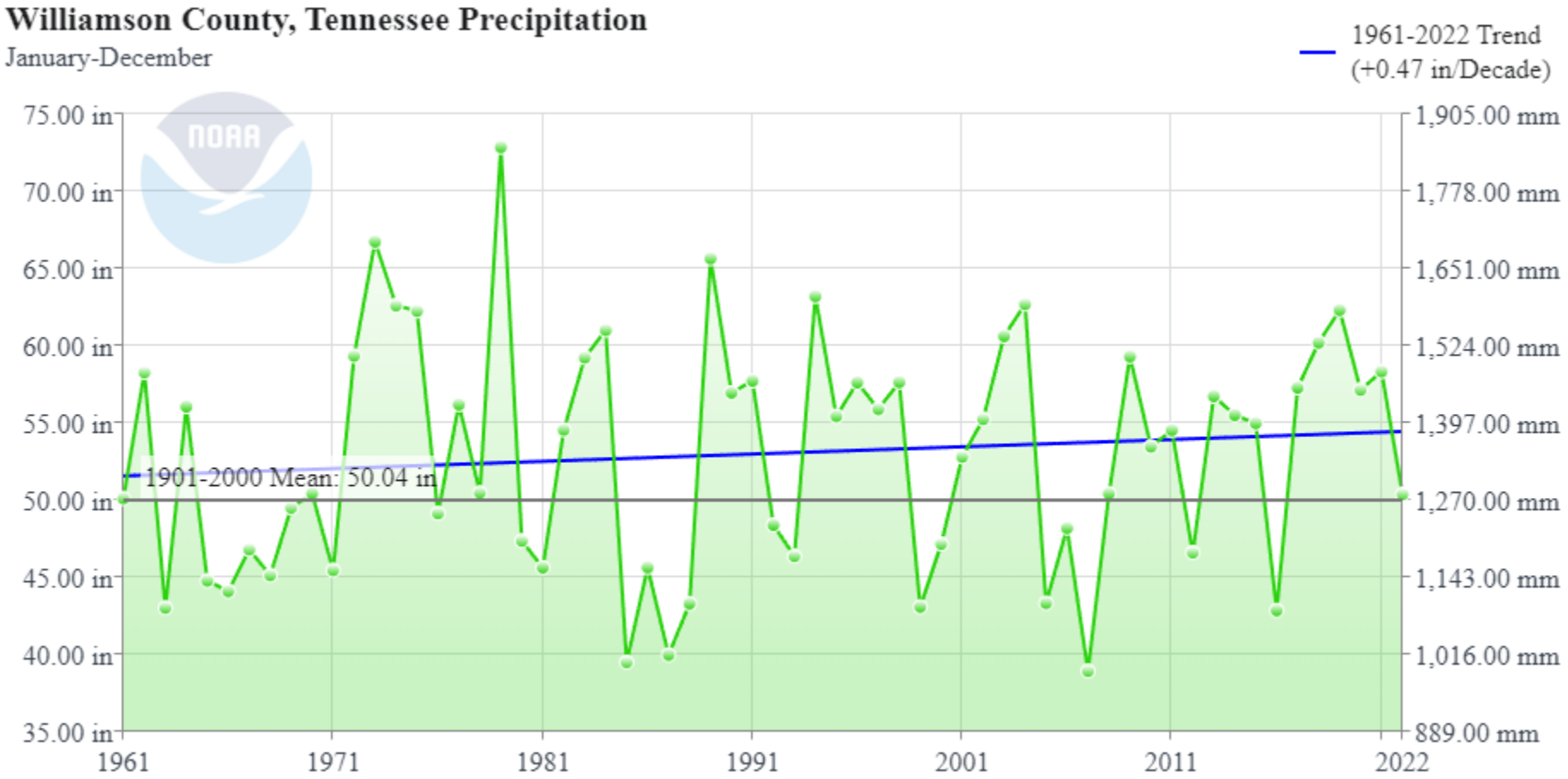


Figure 3: Total Annual Precipitation for Williamson County, Tennessee, Showing a +0.47-inch Increase per Decade Since 1961.

(Source: NOAA NCEI, Climate at a Glance: County Time Series)

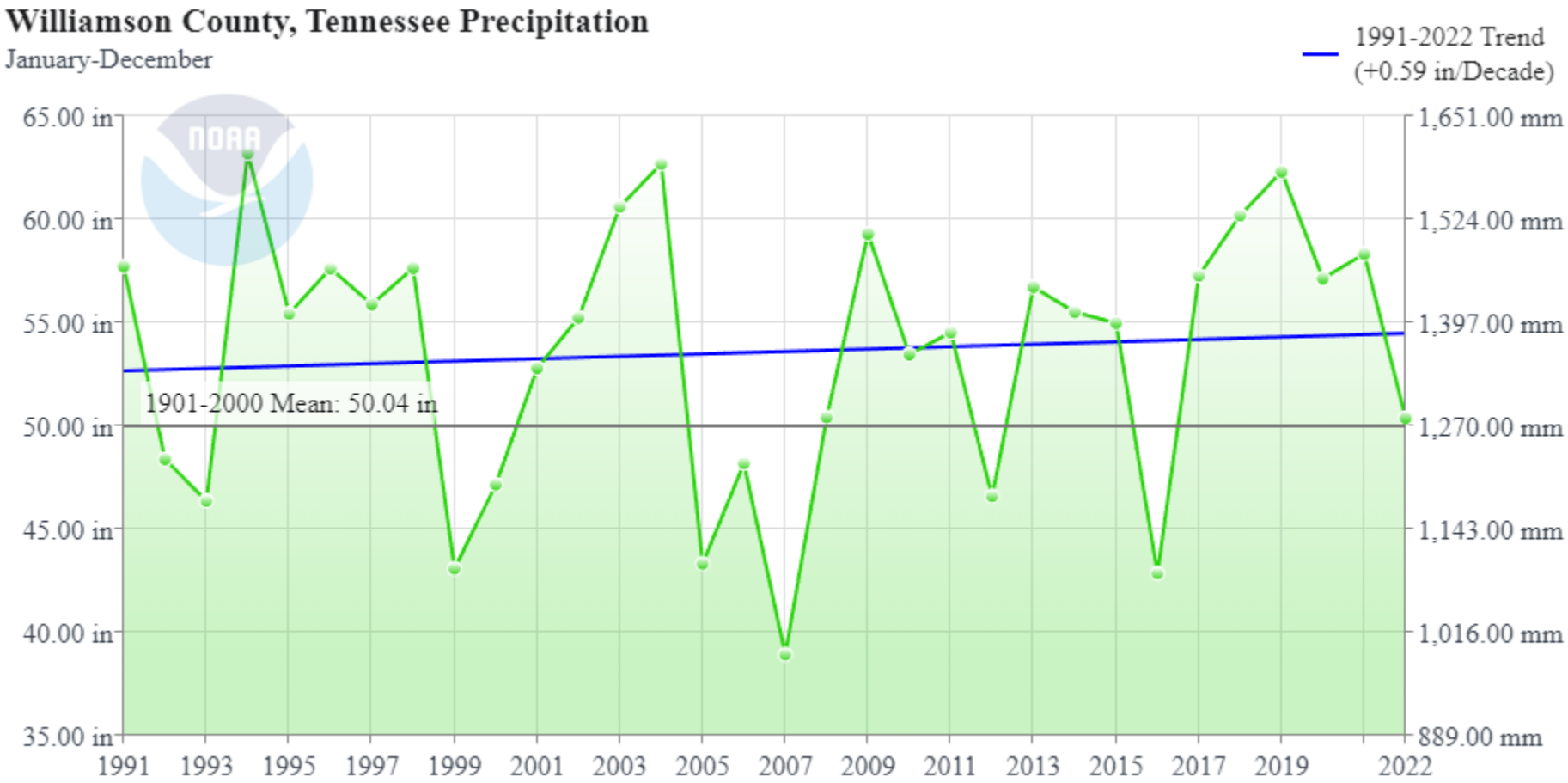


Figure 4: Total Annual Precipitation for Williamson County, Tennessee, Showing a +0.59-inch Increase per Decade Since 1991.

(Source: NOAA NCEI, Climate at a Glance: County Time Series)

Using the NOAA Storm Events Database, flood events and flood damages (dollars) were examined for trends between 1996 and 2021. While Williamson County did not show a significant trend in either the number of flood events or flood damages, several other nearby counties in Middle Tennessee did see increasing trends in the number of flood events in this time period.

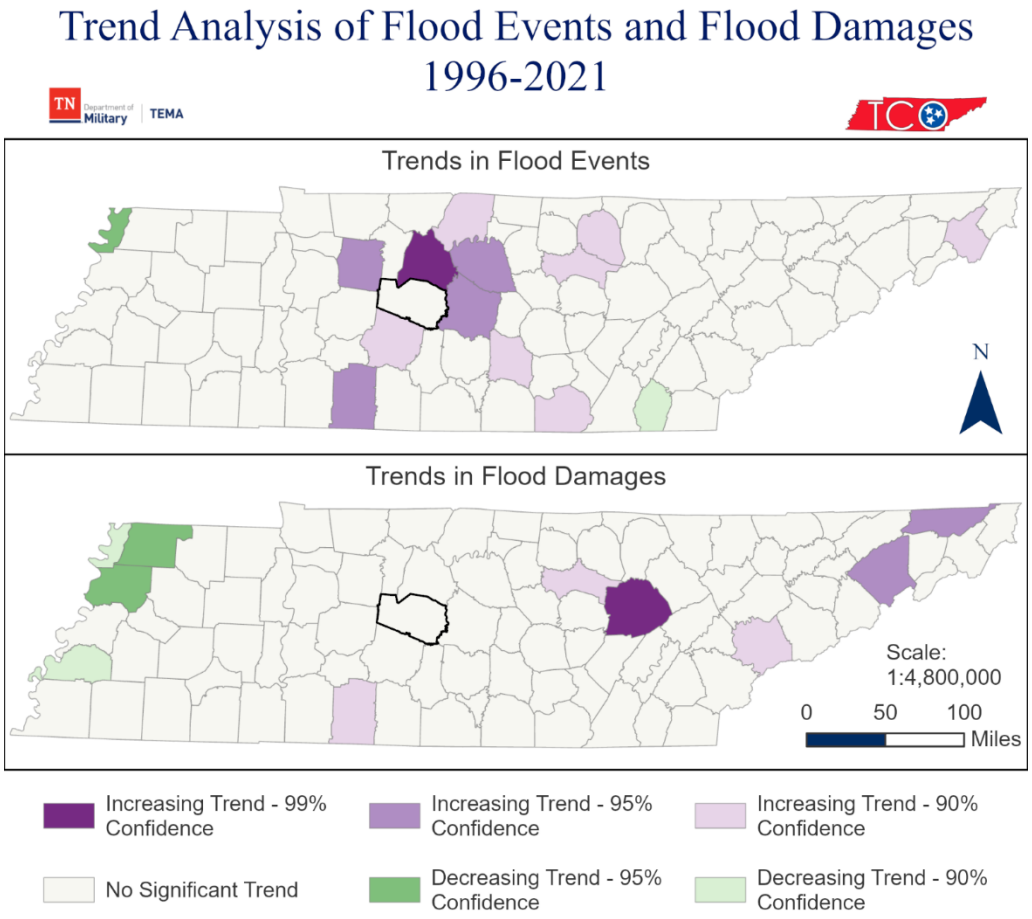


Figure 5: Trend in Flood Events and Flood Damages Reported in the NCEI Storm Events Database from 1996 to 2021, Williamson County Outlined in Bold.

The trends in flood events and flood damages presented above are for riverine flooding, but as overall rainfall increases and trends towards higher intensity precipitation events continue flash flooding may become a higher concern for parts of Tennessee, including Williamson County. The Tennessee Climate Office (TCO) analyzed trends in flash flood events and flash flood related damages from the NOAA Storm Events Database from 1996 to 2021. Williamson County showed no significant trend in these events, but some other nearby Middle Tennessee counties did show increasing trends in flash flood damage amounts.

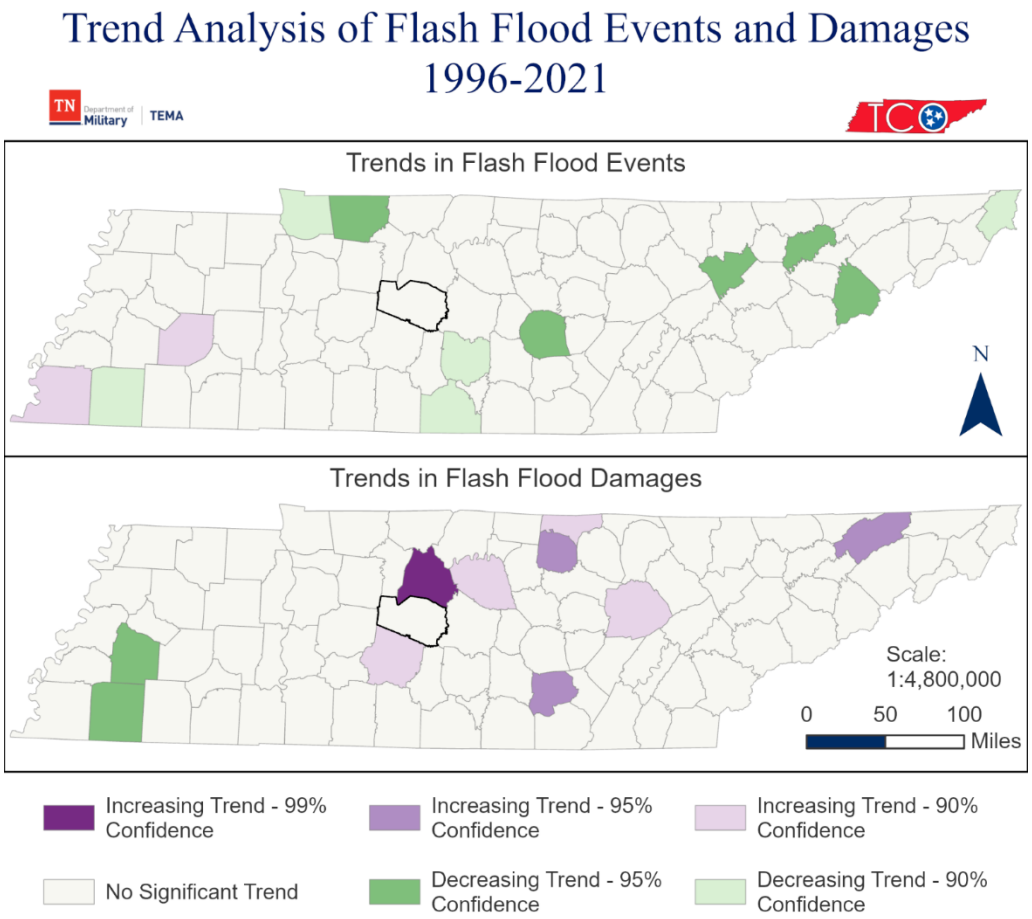


Figure 6: Trend in Flash Flood Events and Flash Flood Damages Reported in the NCEI Storm Events Database from 1996 to 2021, Williamson County Outlined in Bold.

Extreme rainfall events are often categorized based on how much above or below their amounts were compared to the 100-year, or 1% annual probability, rainfall amounts. For Williamson County, a 100-year 1-hour extreme rainfall total would be approximately 3.26-3.75 inches. For a 100-year 24-hour extreme rainfall event, Williamson County would experience 7.01-8.00 inches of rain.

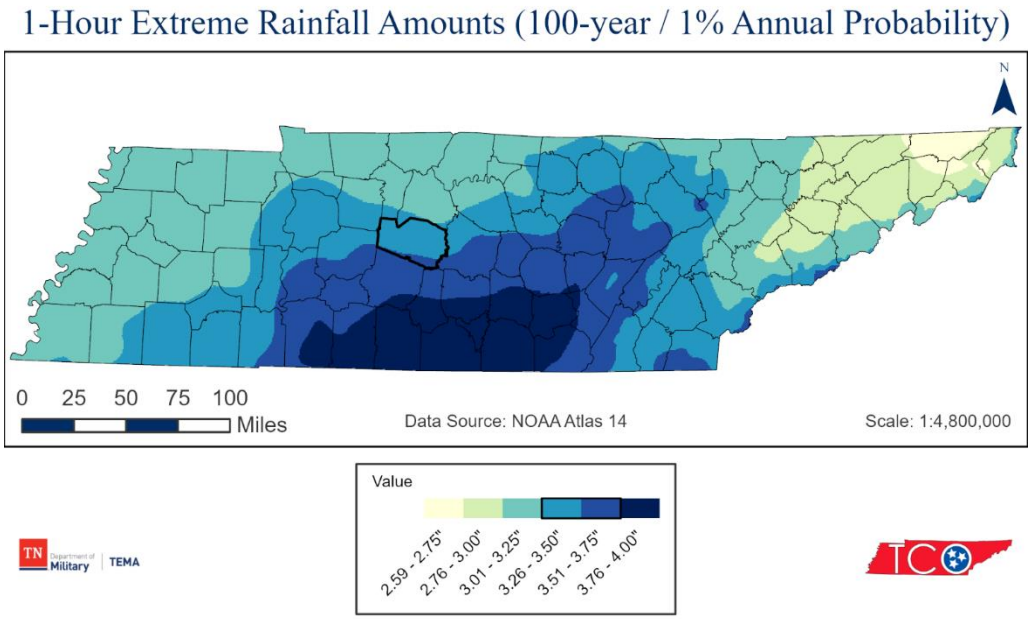


Figure 7: 1-hour Extreme Rainfall Estimates for 100-year Return Period (1% Annual Probability of Exceedance) using NOAA Atlas 14, Williamson County, Outlined in Bold.

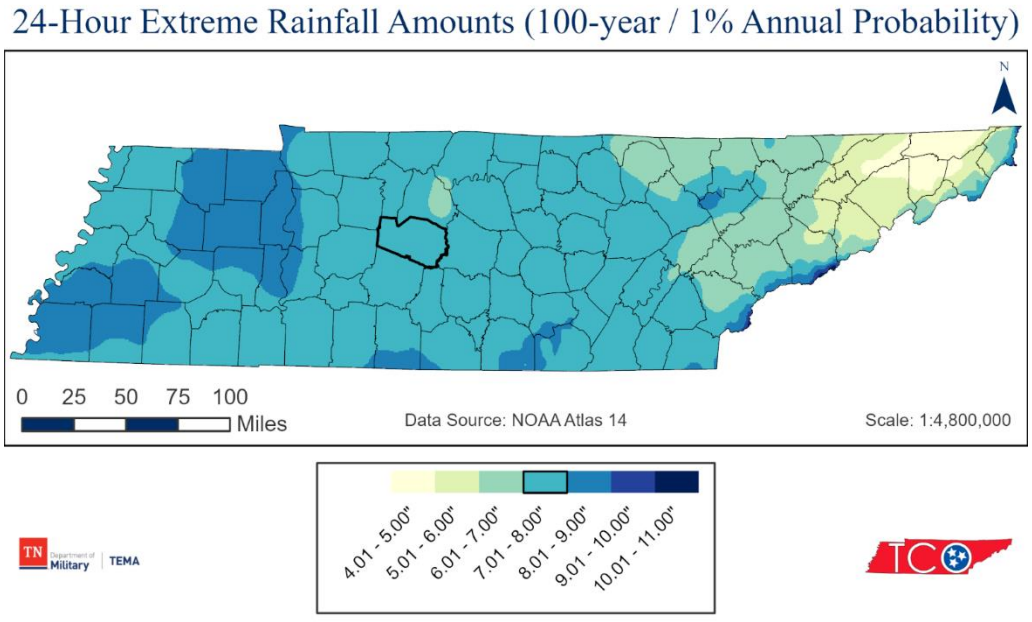


Figure 8: 24-hour Extreme Rainfall Estimates for 100-year Return Period (1% Annual Probability of Exceedance) using NOAA Atlas 14, Williamson County, Outlined in Bold.

The TCO analyzed trends in heavy precipitation days per year in counties across Tennessee, these were the number of days that daily rainfall totals exceeded a 1-year (100% chance of annual

probability), 2-year (50% chance of annual probability), or a 5-year (20% chance of annual probability) event. Williamson County showed no significant trend in these heavy rainfall events.

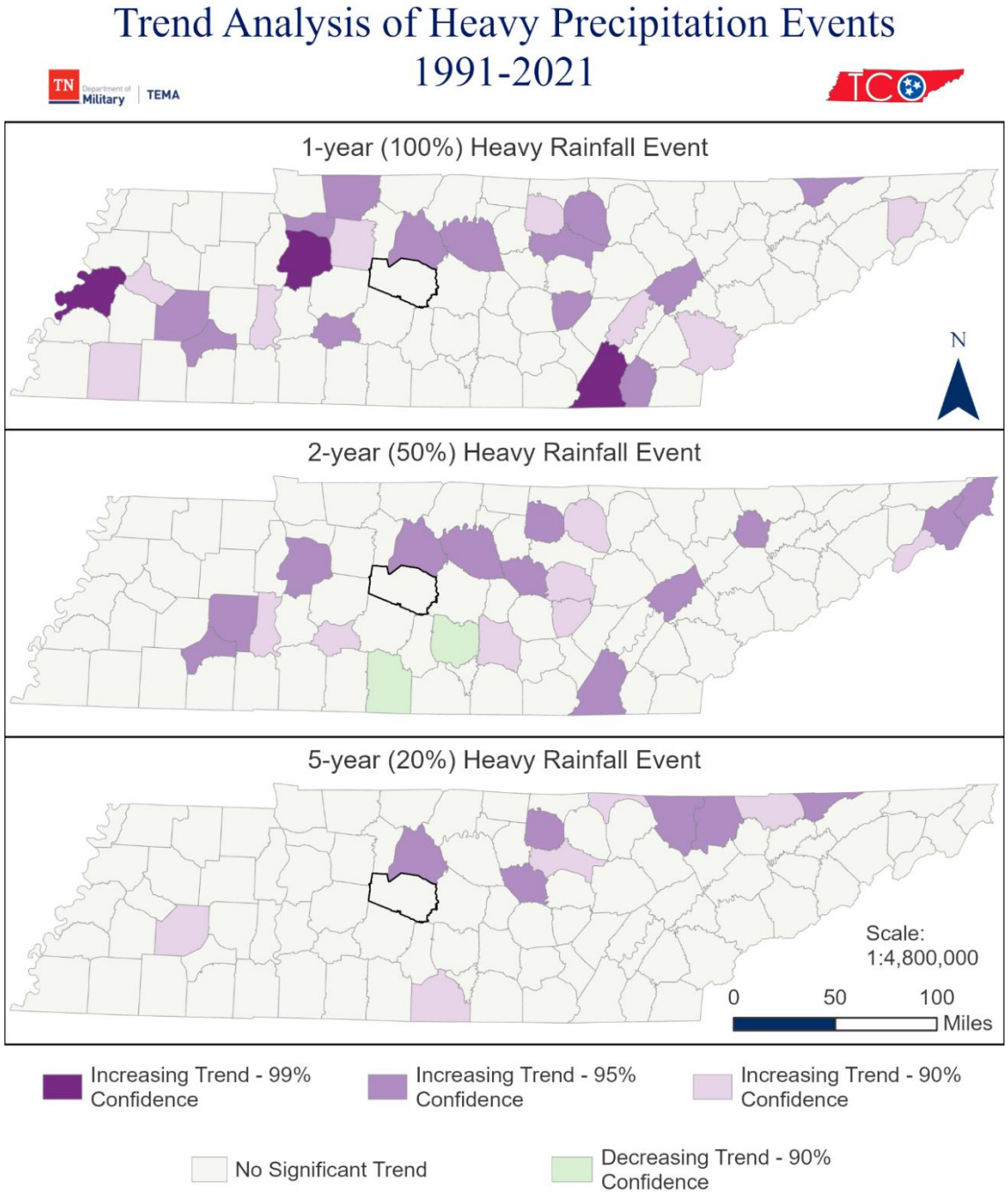


Figure 9: Trend in Heavy Precipitation Events (1-year, 2-year, and 5-year Return Period Exceedance Events), Williamson County Outlined in Bold.

Additional data from the CMRA report for Williamson County predicts an increase in the number of days per year with extreme precipitation for Williamson County throughout the 21st century. Based on analysis by the NCICS and NOAA, Franklin (the county seat of Williamson County) currently has a 100-year 24-hour extreme rainfall amount of 7.56 inches and that amount is predicted to rise by as much as 1.26 inches (to 8.82") by 2055.

Table 1: Possible Change in the Number of Days per Year with Precipitation Exceeding 99th Percentile (Extreme Precipitation Days).

High Emissions Scenario	Modeled History (1976-2005)	Early Century (2015-2044)	Mid Century (2035-2064)	Late Century (2070-2099)
Driest Projection	6.5	+1.1	+1.4	+2.8
Mean Projection	6.8	+1.2	+1.5	+2.9
Wettest Projection	7.2	+1.2	+1.6	+3.2
Low Emissions Scenario	**Modeled History (1976-2005)**	**Early Century (2015-2044)**	**Mid Century (2035-2064)**	**Late Century (2070-2099)**
Driest Projection	6.5	+0.7	+1.1	+1.6
Mean Projection	6.8	+0.8	+1.1	+1.7
Wettest Projection	7.2	+0.8	+1.2	+1.7

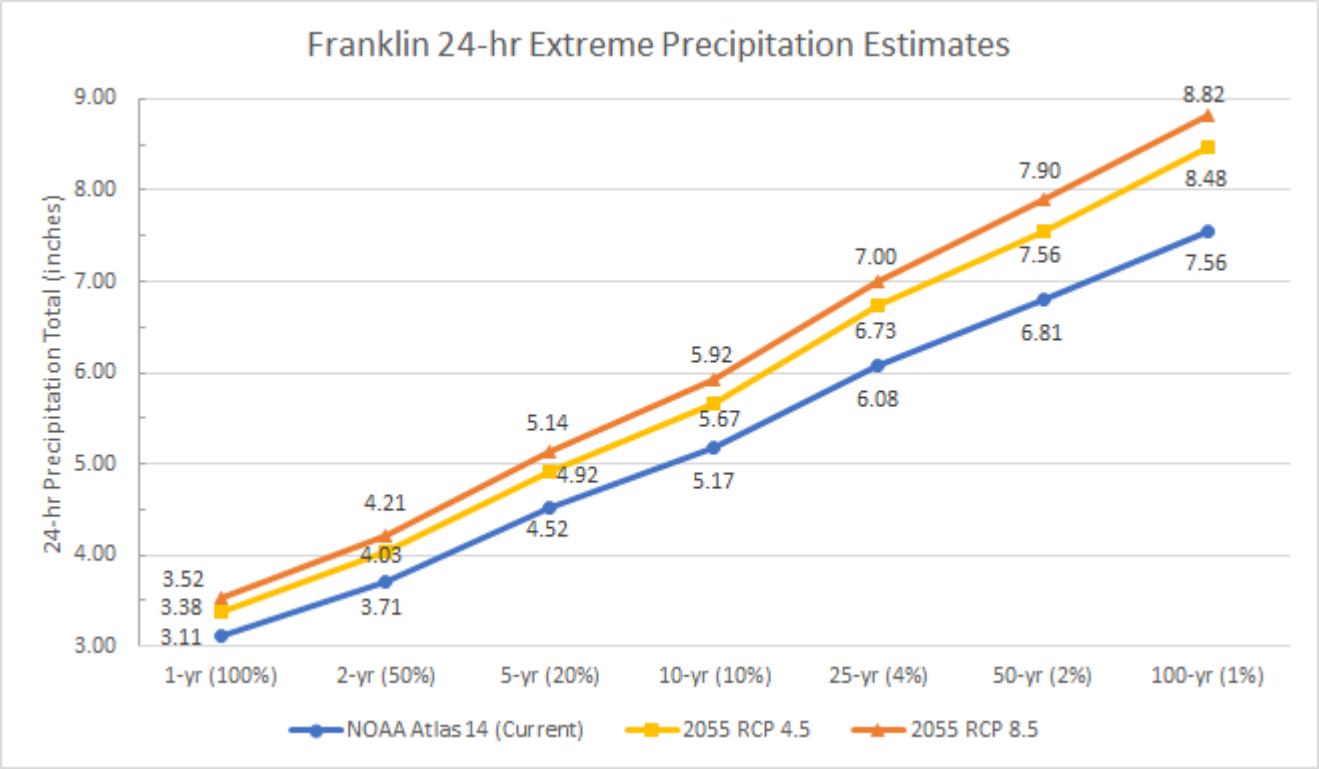


Figure 10: 24-hour Extreme Rainfall Estimates for 1-year, 2-year, 5-year, 10-year, 25-year, 50-

year, and 100-year Return Periods using NOAA Atlas 14 (historical data) and Mid-Century Values for 2055 using RCP4.5 and RCP8.5 Emission Scenarios.

The US Department of Agriculture and US Forest Service created a report based on models and projection data from Multivariate Adaptive Constructed Analogs (MACA), that show most of Tennessee is expected to see an increase in annual precipitation by the late 21st century. Williamson County is projected to see an increase of 2-4% in annual precipitation by the late 21st century. However, potential changes in precipitation are not expected to be spread equally across all four seasons. The largest change for Williamson County comes in spring precipitation totals, with a projected 6-8% increase over historical spring precipitation. Summer precipitation is projected to decrease 0.1-4% from the historical average, Fall is projected to see a 4-6% increase in precipitation, and Winter is projected to have a 2-4% increase in precipitation across Williamson County.

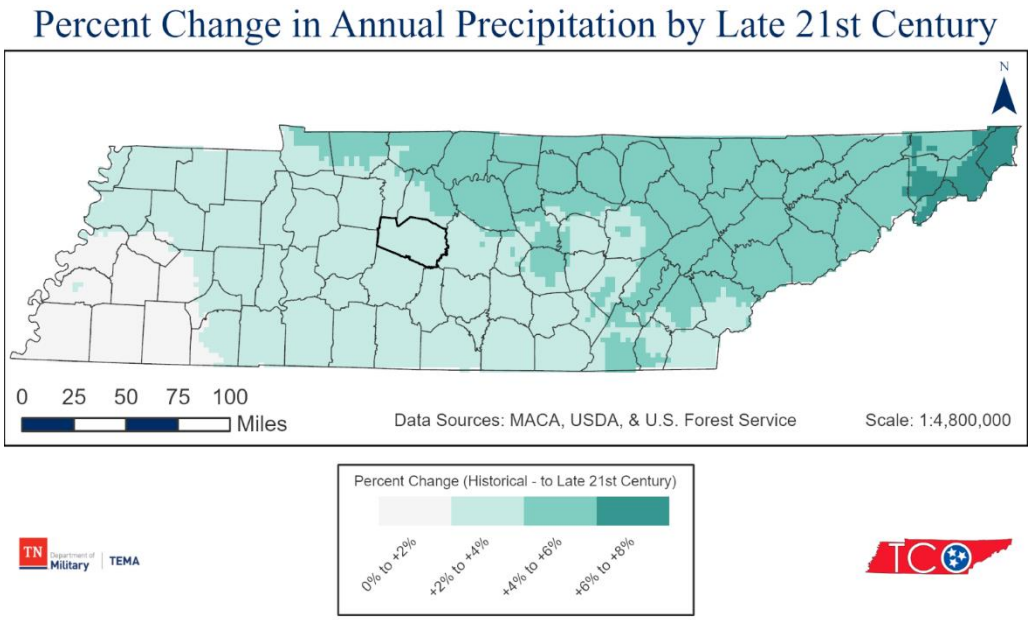


Figure 11: Projected Change in Annual Precipitation for Tennessee, Williamson County Outlined in Bold.

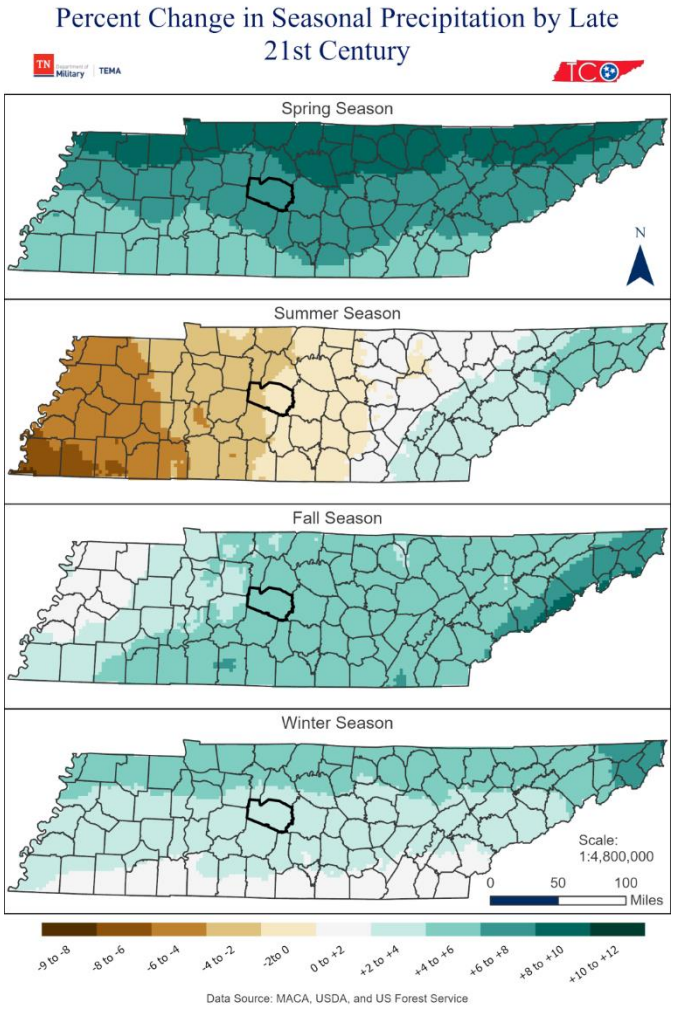


Figure 12: Projected Change in Seasonal Precipitation for Tennessee, Williamson County Outlined in Bold.

Tornado

It is uncertain how climate trends will impact the overall frequency of tornadoes, with convective storms (from which tornadoes form) being the least well understood extreme events when it comes to attributing future changes to climate trends and variations. However, some studies suggest that the number of days conducive to severe thunderstorms, which can spawn tornadoes, may increase in certain regions including West and Middle Tennessee. Additionally, warmer temperatures can provide more energy to storms, potentially leading to more intense tornadoes. Tornado formation depends on the interaction of multiple atmospheric factors, including temperature, humidity, wind shear, and instability. While climate trends may alter some of these factors, the precise impact on tornado formation remains uncertain. Warmer temperatures and increased moisture content in the atmosphere can contribute to more

favorable conditions for tornado formation, but other factors like wind shear patterns may also change and reduce the chances for tornado formation.

Using historical data from 1980 to 2021, Williamson County has a moderate density for tornadoes in Tennessee, with an average of 0.11 to 0.2 tornado tracks per square mile in most of the county, with extreme southern parts of the county with less than 0.1 tracks per square mile in this time period.

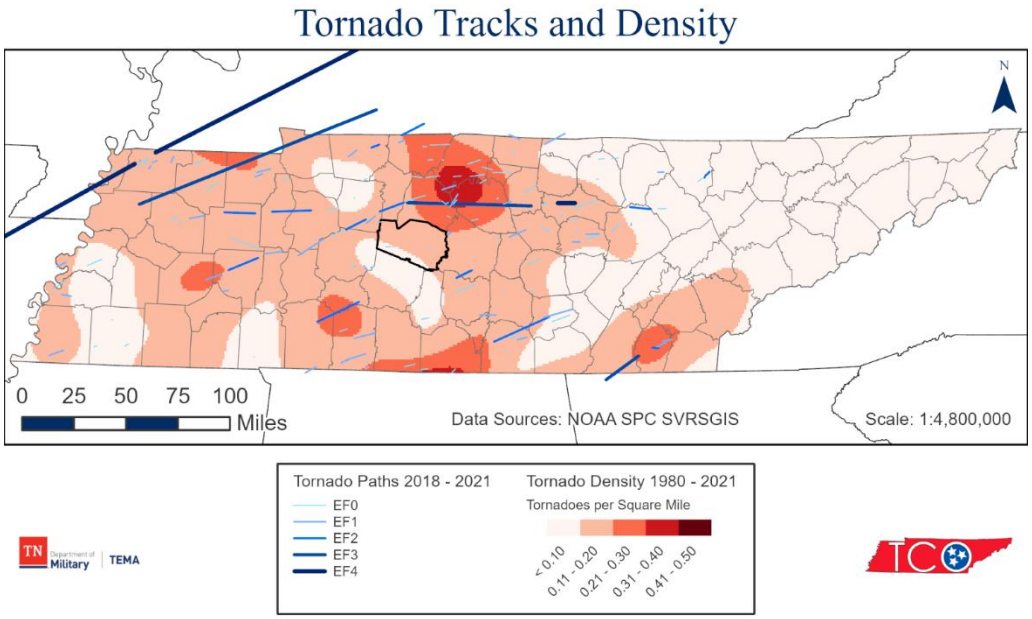


Figure 13: Tornado Tracks from 2018-2021 and the Density of Tornado Tracks across Tennessee from 1980 to 2021, Williamson County Outlined in Bold.

Using data from the NOAA Storm Events Database, trend analysis and emerging hotspot analysis were performed on the number of tornadoes reported in each county of Tennessee from 1996 to 2021. There was not a significant increasing or decreasing trend in the number of tornadoes observed in Williamson County. However, Williamson County and other neighboring counties to the north were identified as a sporadic hot spot for tornadoes, meaning the county was a hot spot for tornadoes in the final year in the analysis with a history of also being an on-again and off-again hot spot through the period, but less than 90 percent of the time-step intervals have been statistically significant hot spots. These results indicate that while there has been a moderate number of tornadoes occurring in Williamson County, there has not been a significant increase in the number of tornadoes observed per year over the past 26 years.

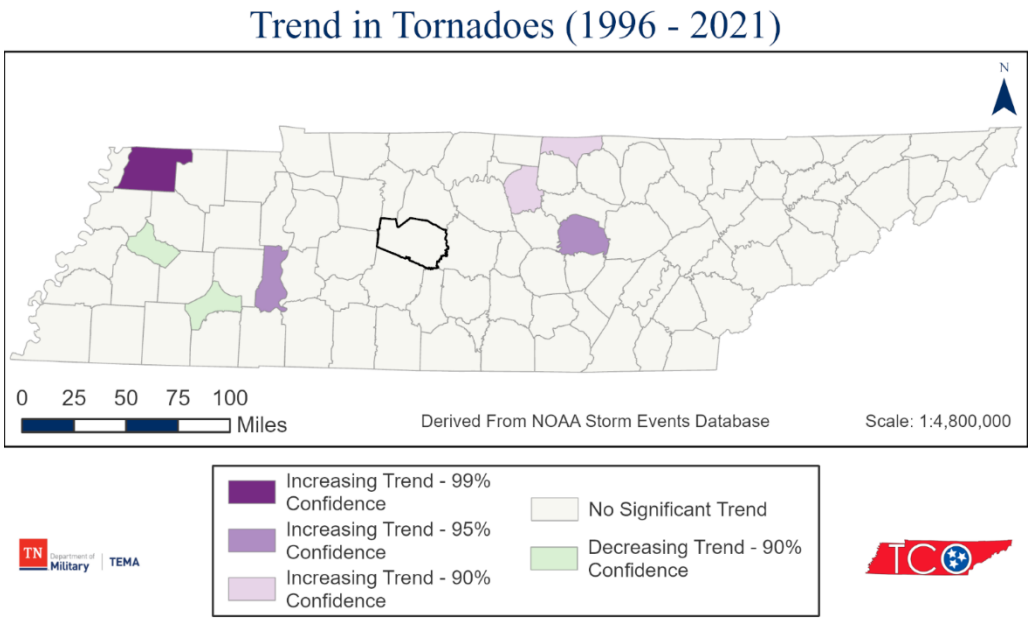


Figure 14: Trends in the Number of Tornadoes Recorded in the NCEI Storm Events Database from 1996 to 2021, Williamson County Outlined in Bold.

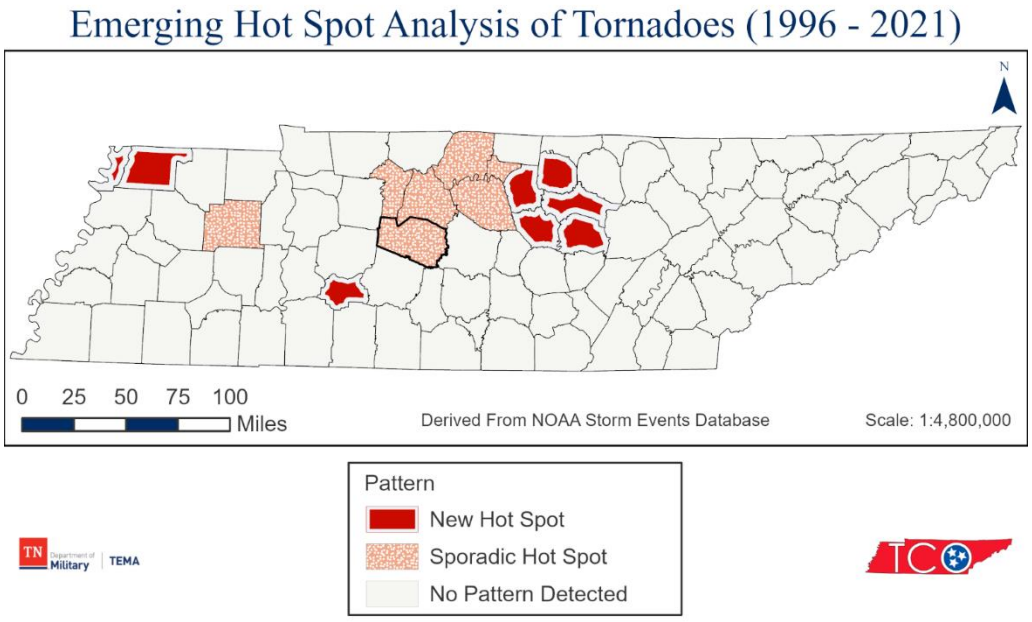


Figure 15: Emerging Hot Spot Analysis based on the Number of Tornadoes per Year Recorded in the NCEI Storm Events Database from 1996 to 2021, Williamson County Outlined in Bold.

Severe Weather

Climate trends and variations may lead to an increase in frequency and intensity of certain types of severe storms. Warmer air temperatures can contribute to more moisture in the atmosphere, providing fuel for stronger rainfall events and potentially more intense thunderstorms. The increased energy in the atmosphere can also contribute to the development of more powerful storms. Climate trends can also result in altered precipitation patterns influencing the distribution, timing, and intensity of rainfall during storms. Climate trends can influence the paths and tracks of severe storms too. Changes in atmospheric circulation patterns may lead to shifts in the regions where storms typically form or move, potentially affecting the areas that are historically vulnerable to specific types of storms. This can result in new areas being exposed to severe storms while other areas experience a decrease. Research by Ashley et al. (2023) into supercell thunderstorm formation compared historical data (1990-2005) and future climate models for the late 21st century (2085 – 2100), which indicate that the mid-South region of the U.S. (including West and Middle Tennessee) could see an increase in the number of supercell thunderstorms capable of producing severe thunderstorm hazards and tornadoes. These increases were mostly found in the late winter to early spring months of February, March, and April. Additionally, they found that an increasing number of supercell thunderstorms in this region could form in the late afternoon to overnight hours. Climate trends can contribute to compound events where multiple extreme weather events can occur simultaneously or in succession. These compound events can amplify the overall impacts on communities and ecosystems, making them more challenging to manage and recover from.

Severe Thunderstorms (Convective Wind, Hail and Lightning)

The Tennessee Climate Office (TCO) analyzed trends for thunderstorm winds (convective wind) and severe hail reports in counties across Tennessee using the NOAA Storm Events Database with data from 1996 to 2021, and lightning strikes per county from 1996 to 2021 from the NOAA Severe Weather Data Inventory (SWDI). The trend analysis for convective winds and severe hail showed a significant increasing trend in the number of events in Williamson County at the 95% confidence level. There was a decreasing trend in the number of lightning strikes per year in Williamson County at the 95% confidence interval.

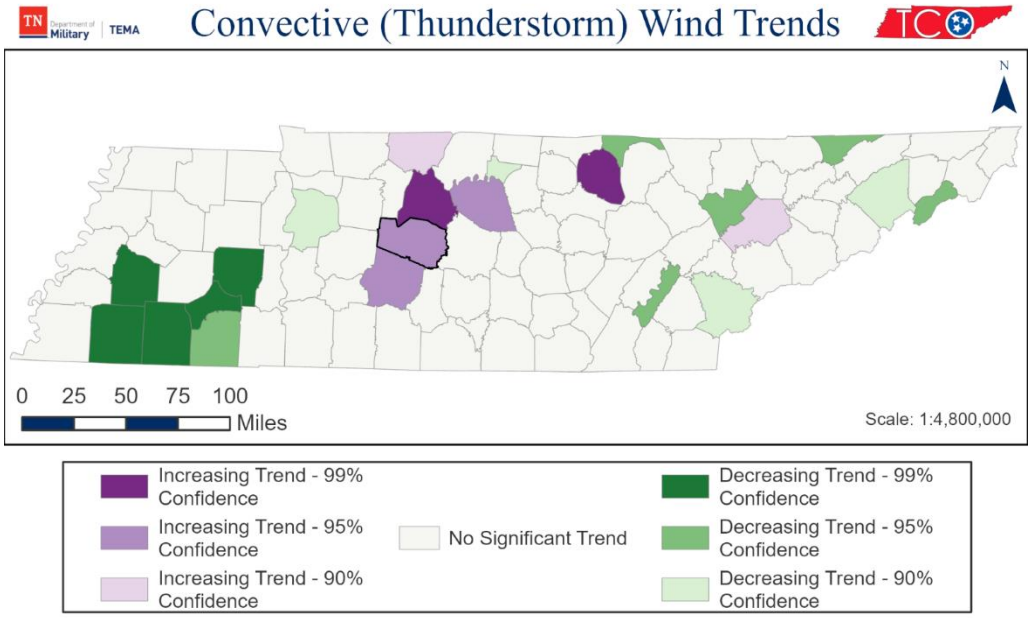


Figure 16: Trends in the Number of Thunderstorm Wind Events Recorded in the NCEI Storm Events Database from 1996 to 2021, Williamson County Outlined in Bold.

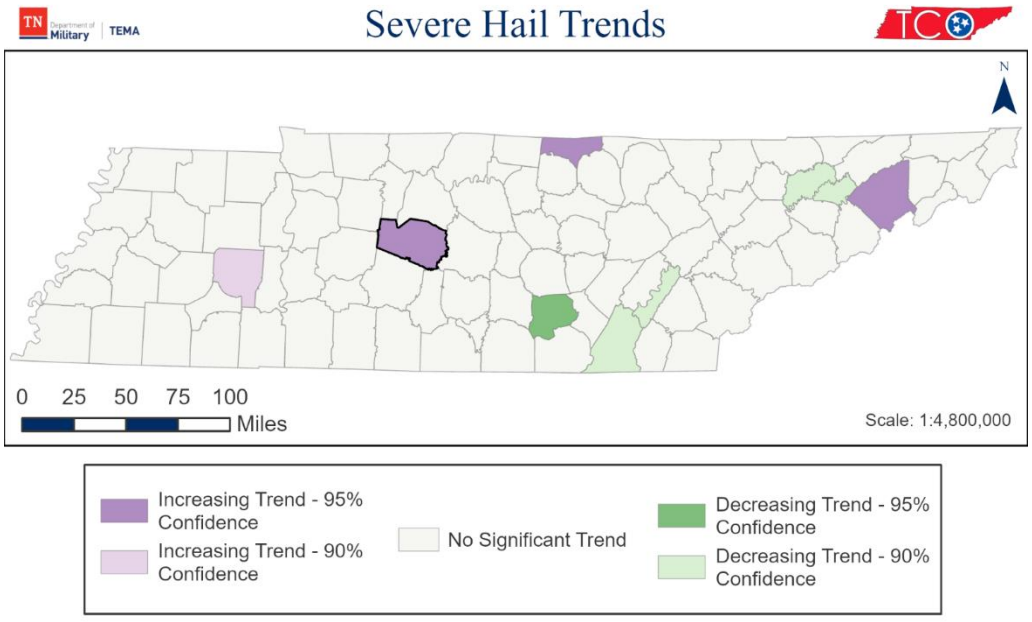


Figure 17: Trends in the Number of Severe Hail Events Recorded in the NCEI Storm Events Database from 1996 to 2021, Williamson County Outlined in Bold.

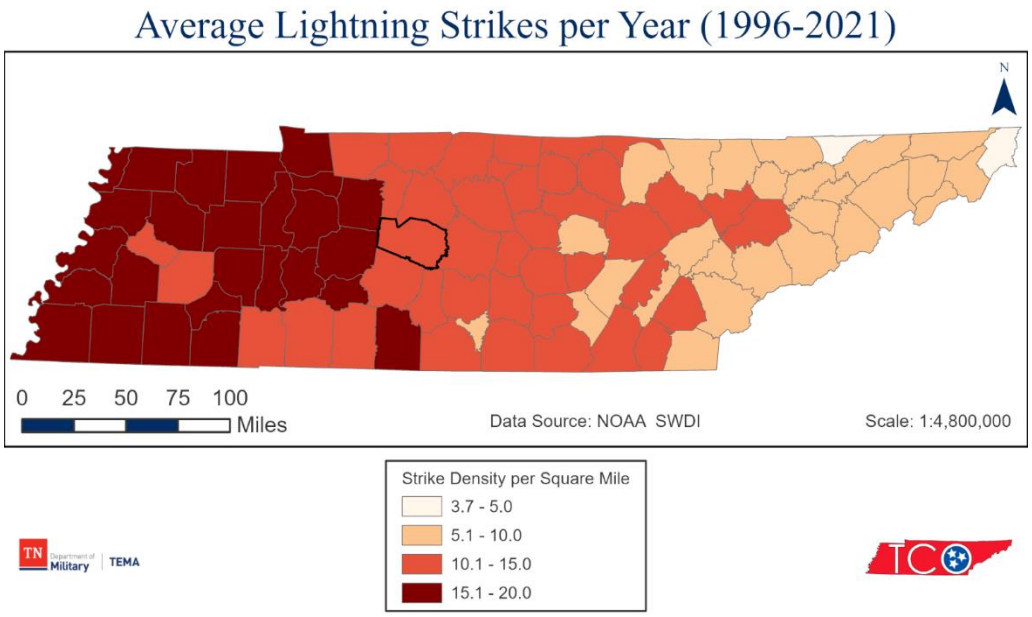


Figure 18: Average Annual Number of Lightning Strikes per Square Mile from 1996 to 2021, Williamson County Outlined in Bold.

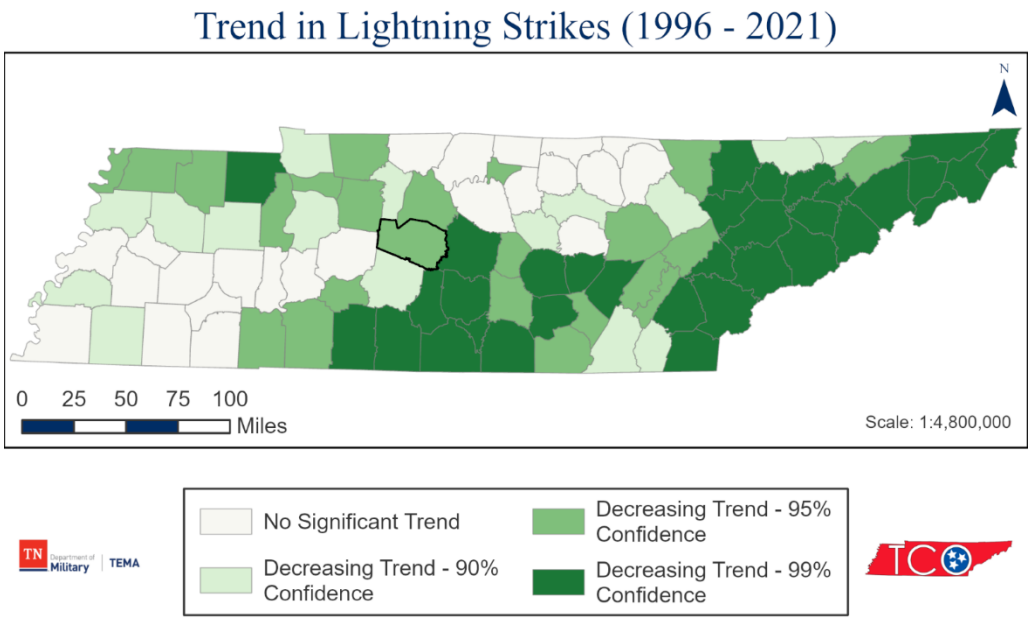


Figure 19: Trends in the Number of Lightning Strikes per County Recorded in the NOAA Severe Weather Data Inventory from 1996 to 2021, Williamson County Outlined in Bold.

Non-Thunderstorm Winds

The Tennessee Climate Office (TCO) also analyzed trends for non-convective (non-thunderstorm) wind reports in counties across Tennessee using the NOAA Storm Events Database with data from 1996 to 2021, and Williamson County showed a significant increasing trend at the 90% confidence level in non-convective wind events during this time along with several other counties in Middle Tennessee.

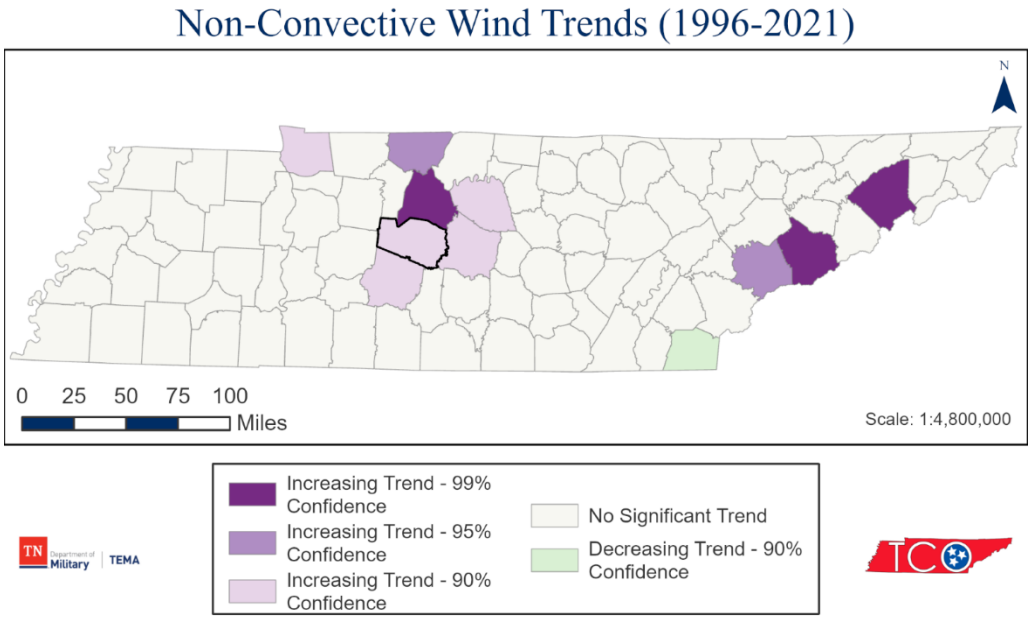


Figure 20: Trends in the Number of Non-Convective Wind Events Recorded in the NCEI Storm Events Database from 1996 to 2021, Williamson County Outlined in Bold.

Winter Weather

Data from the National Weather Service NOHRSC National Gridded Snowfall Analysis webpage covering the winters of 2008-2009 to 2022-2023 (the last 15-years) indicates that the average annual snowfall for Williamson County ranges from 4 to 6-inches per year. Using data from the NOAA Storm Events Database, trend analysis was performed on winter weather-related storms from 1996 to 2021 across the state of Tennessee. In this time period there was an increasing trend in the number of winter storms impacting Williamson County, this trend was significant to the 99% confidence level.

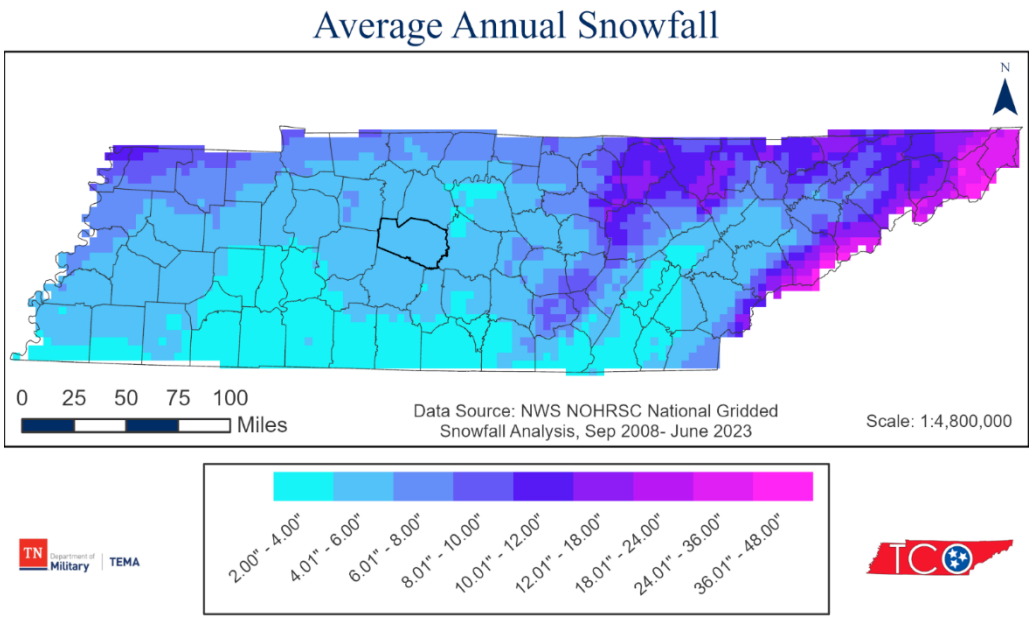


Figure 21: Average Annual Snowfall from the Winter of 2008/2009 to the Winter of 2022/2023, Williamson County Outlined in Bold.

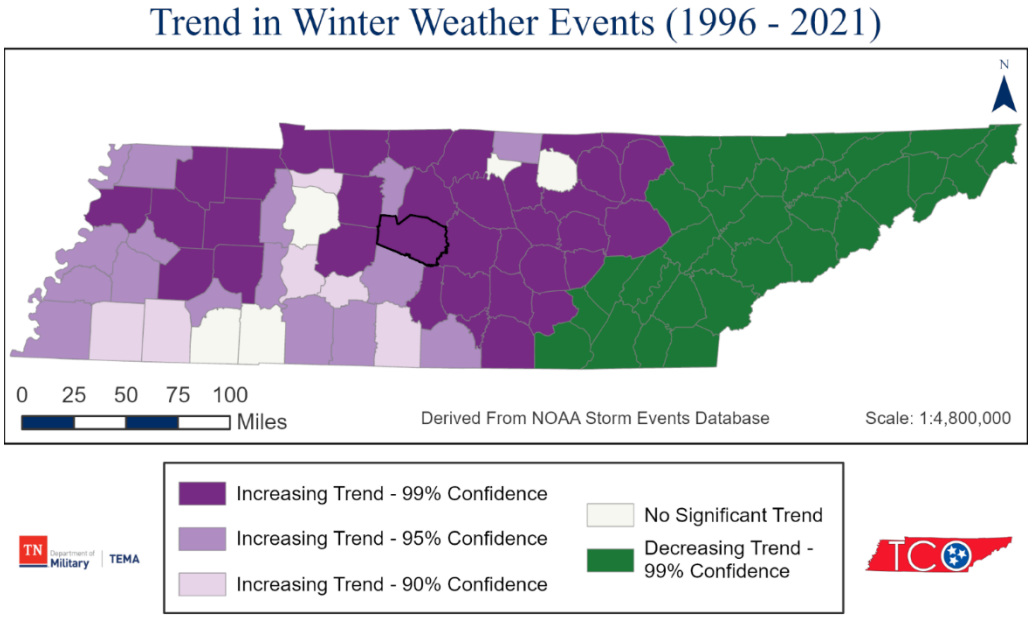


Figure 22: Trends in the Number of Winter Weather-Related Events Recorded in the NCEI Storm Events Database from 1996 to 2021, Williamson County Outlined in Bold.

Climate trends and variability will impact the future likelihood of winter weather events or severe winter storms in Tennessee, likely decreasing but not eliminating the overall risk. Average annual temperatures are expected to increase across the Southeast US, including temperatures during the winter season. Williamson County has an observed warming trend of +0.1°F per decade from

1896 to 2023 throughout the meteorological/climatological winter season (December – February). In the medium-term (1961 - 2023) the winter temperature trend shows greater warming at +0.8°F per decade, however the short-term (1991 - 2023) trend shows slightly moderated warming of +0.6°F per decade during the winter season. The moderation was caused by the exclusion of the very cold winters of 1963 and 1977-1979.

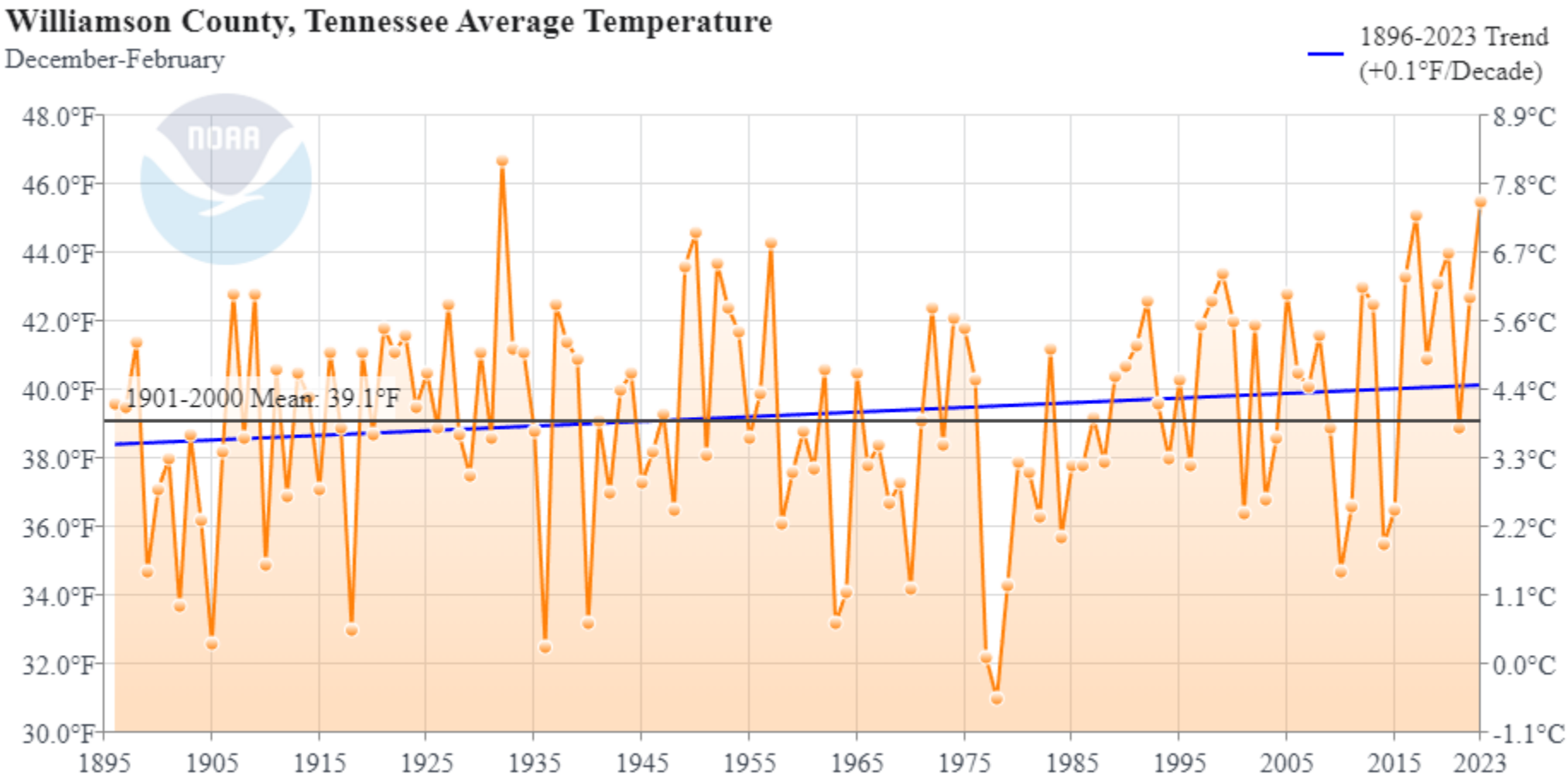


Figure 23: Winter (December to February) Mean Temperature for Williamson County, Tennessee, Showing a +0.1°F Increase per Decade Since 1895.

(Source: NOAA NCEI, Climate at a Glance: County Time Series)

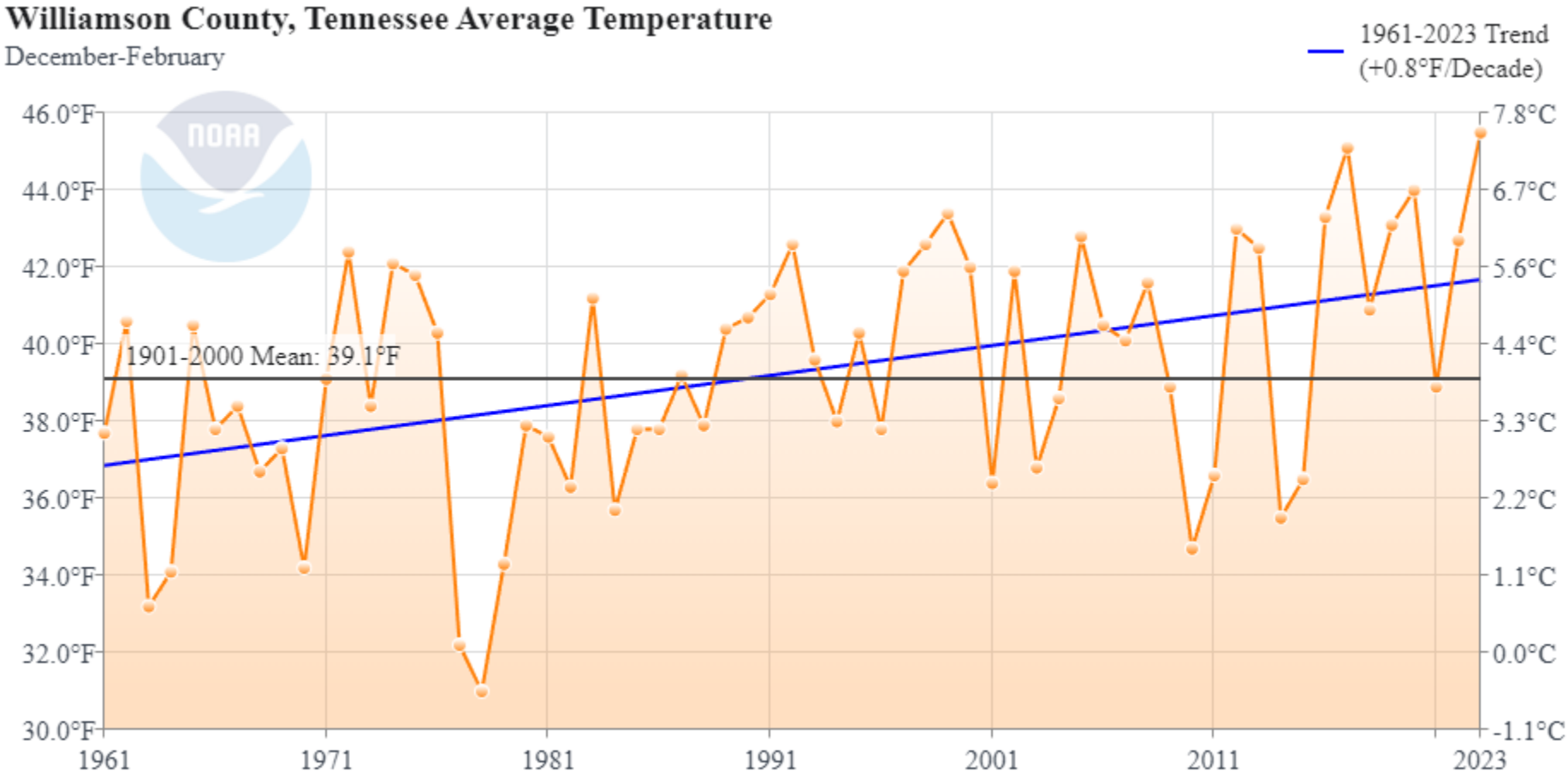


Figure 24: Winter (December to February) Mean Temperature for Williamson County, Tennessee, Showing a +0.8°F Increase per Decade Since 1961.

(Source: NOAA NCEI, Climate at a Glance: County Time Series)

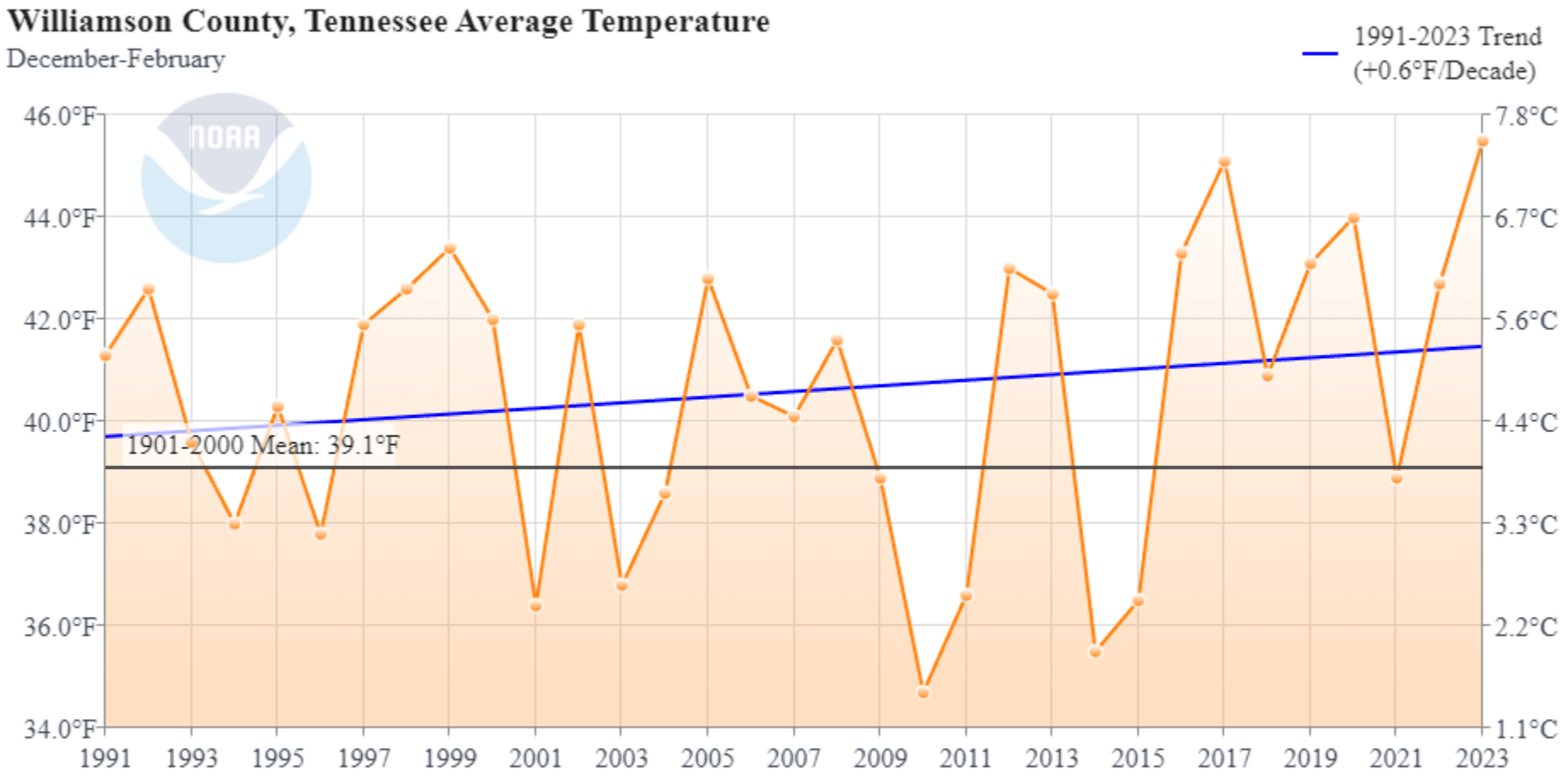


Figure 25: Winter (December to February) Mean Temperature for Williamson County, Tennessee, Showing a +0.6°F Increase per Decade Since 1991.

(Source: NOAA NCEI, Climate at a Glance: County Time Series)

In addition to the increasing average annual and winter temperatures, the USDA and U.S. Forest Service Office of Sustainability and Climate projects that the length of the frost-free season will increase by 50-55 days across Williamson County by the late 21st century. This means that the amount of time during the year where winter weather is possible will decrease. Currently, on average the frost season in Williamson County lasts for about five and a half months of the year (from Late October until early April), but by the late 21st century that is projected to decrease to just four months of the year. In the following two figures the historical and projected number of Frost Days (days with a minimum temperature below freezing) and Icing Days (days with a maximum temperature below freezing) are shown for Williamson County from the U.S. Climate Resilience Toolkit Climate Explorer. The mean projection for the low emissions scenario indicates that Williamson County could have approximately 32 fewer Frost Days per year by the end of the century, while the mean projection for the high emissions scenario indicates Williamson County could have 48 fewer Frost Days per year than the 1961-1990 observed average number of frost days. The mean projection for the low emissions scenario shows that Williamson County could observe approximately six fewer Icing Days per year, while the high emissions scenario shows that Williamson County could observe approximately eight fewer Icing Days per year by the end of the century compared to the 1961-1990 observed average.

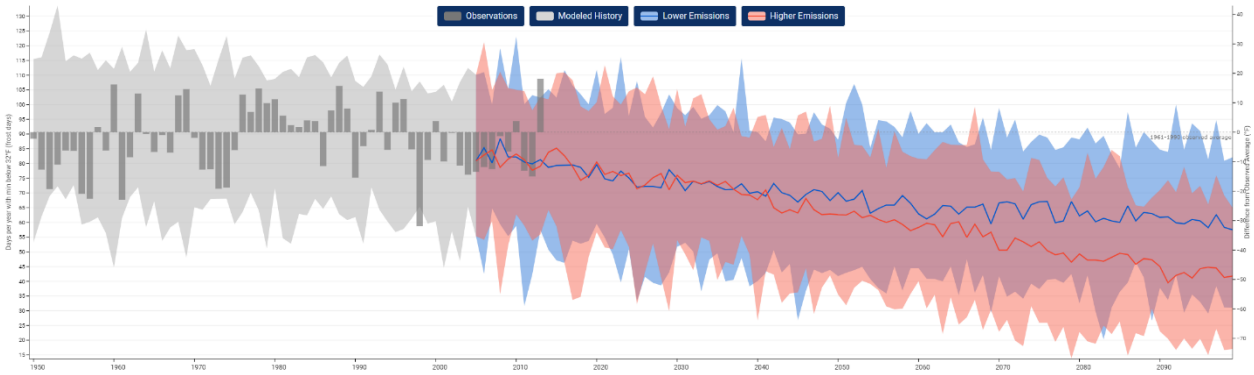


Figure 26: Days Per Year with Minimum Temperature Below 32°F (Frost Days) with Historical Observations from 1950 to 2013 and High (red) and Low (blue) Emission Scenarios Going to 2100 for Williamson County, Tennessee.

(Source: U.S. Climate Resilience Toolkit Climate Explorer)

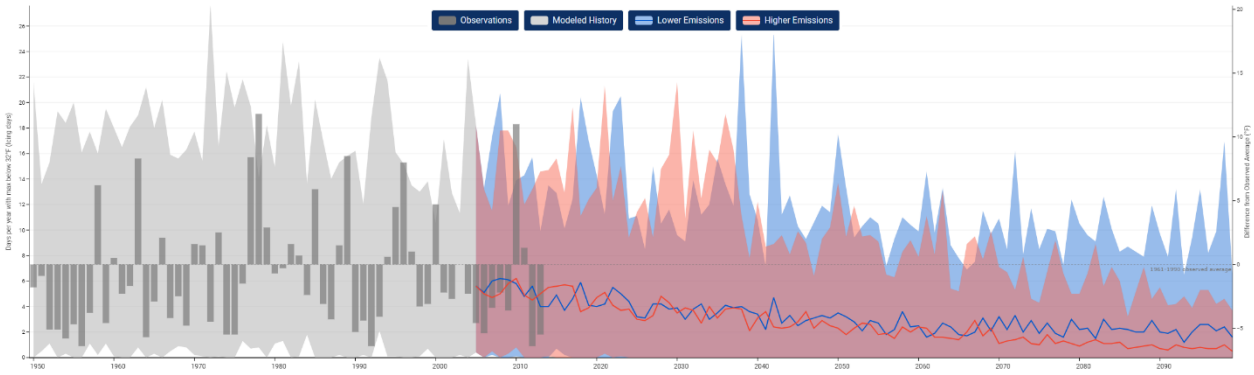


Figure 27: Days per Year with a Maximum Temperature Below 32°F (Icing Days) With Historical Observations from 1950 to 2013 and High (red) and Low (blue) Emission Scenarios Going to 2100 for Williamson County, Tennessee. (Source: U.S. Climate Resilience Toolkit Climate Explorer)

Additionally, the USDA forecasted changes in plant hardiness zones for the Southeast U.S. The following figure, from the Fourth National Climate Assessment (2018) indicates that Williamson County may transition from Plant Hardiness Zones 6b/7a (historical data, 1976-2005) to Plant Hardiness Zones 8a by 2070-2099, based on climate models using the RCP8.5 (higher emissions) greenhouse gas emissions scenario. That would correlate to a warming of approximately 15-20 degrees in the average coldest temperature expected in parts of the county, from historical values of -5°F to +5°F to future values of +10°F to +15°F.

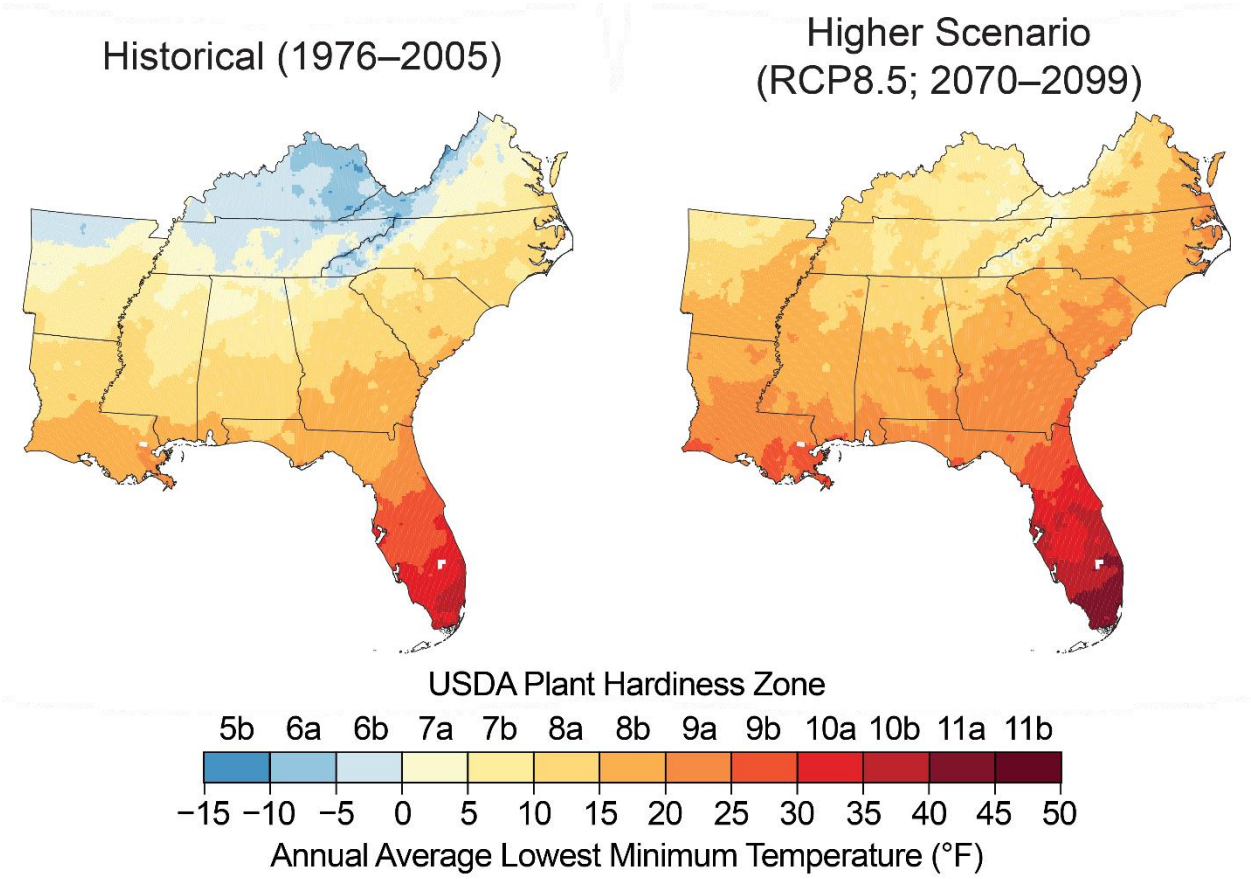


Figure 28: Comparison of Plant Hardiness Zones Across the Southeast U.S. from Historical Averages and Projected Values for Late Century using RCP8.5 (high emissions) Scenario Models.

(Source: Fourth National Climate Assessment (Southeast Chapter))

Drought

The future risk of drought in Williamson County is tied to changes in the precipitation and temperature patterns the county may experience due to climate trends and variations. The Fourth National Climate Assessment (2018, NCA4) states climate variability is expected to increase the average temperature and the number of high-heat days in the southeastern United States and intensify the hydrologic cycle, leading to an increase in both extreme precipitation events and periods of drought in the southeastern United States. The Climate Mapping Risk Assessment (CMRA) Report for Williamson County shows that while overall annual precipitation may increase, the number of dry days is expected to increase through the 21st century. Additionally, high-heat days are expected to increase as well, which could combine to favor short term periods of drought.

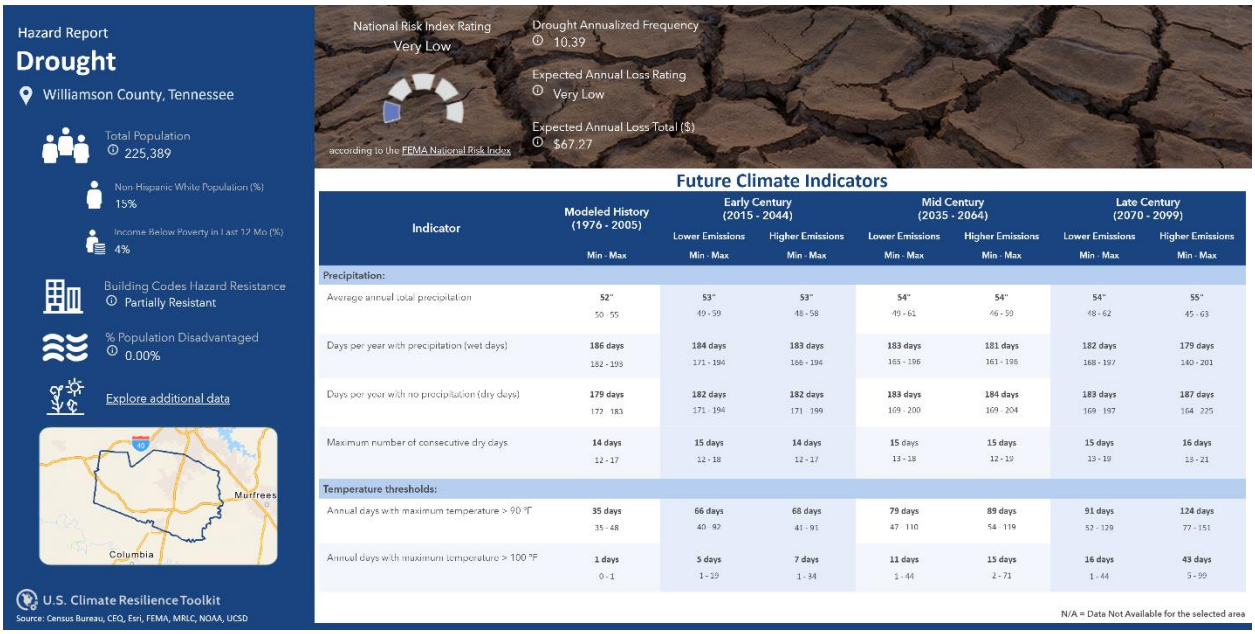


Figure 29: Climate Mapping Risk Assessment Report for Drought in Williamson County.

(Source: US Climate Resilience Toolkit)

The increasing trend in average temperature and total precipitation in Williamson County is also supported by observed historical data available from the NOAA National Centers for Environmental Information Climate at a Glance tool (refer to subsequent figures). The trend of increasing temperature and annual precipitation has been more pronounced over the past several decades compared to the longer-term (1895-2022) trend. The long-term trend in temperature is slightly positive at +0.1°F per decade due to several warm decades in the early 20th century followed by a cool period from the 1950's to the early 1980's, and then years that were mostly warmer than the 20th century average after 1985. The medium-term (1961-2022) shows an increased warming trend of +0.4°F per decade and the short-term (1991-2022) shows the most extreme trend of +0.6°F per decade. Additionally, the county's climate stripes graphics from NOAA show that aside from a few warmer than normal years early in the period, most of the above average temperature years have occurred in the past two decades. This indicates that warming has substantially increased in Williamson County and based on the NCA4, this trend is expected to continue in the future.

However, total precipitation has also been increasing in Williamson County, with the long-term (1895-2022) trend in precipitation having a +0.67" increase per decade, while the medium-term (1961-2022) shows an increased trend of +0.47" per decade, and the short-term (1991-2022) shows a trend of +0.59" per decade. This indicates that precipitation has increased in Williamson County and based on the NCA4, this trend is expected to continue in the future. Refer to Figures 2-4 in the Flood section for additional information. An increasing trend in precipitation may infer a decrease in drought potential; however, the observed pattern has been highly variable year-to-year and on shorter time periods. As temperatures increase, there can be more rapid

evapotranspiration, potentially leading to more rapid onset of drought occurrences (i.e., Flash Droughts).

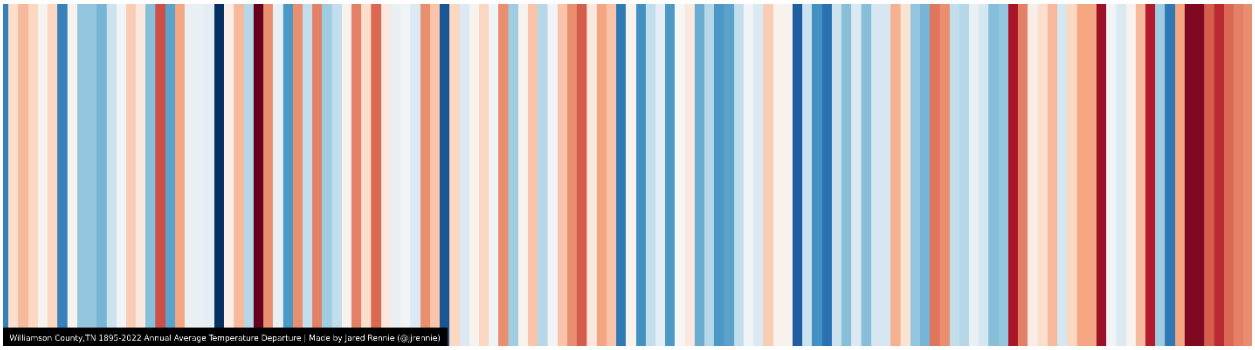


Figure 30: Observed (1895-2022) Annual Temperature for Williamson County, Tennessee, Compared to the 20th Century Average with Darkening Shades of Blue for Below Average Temperature and Darkening Shades of Red for Above Average Temperature.

(Source: NOAA NCEI)

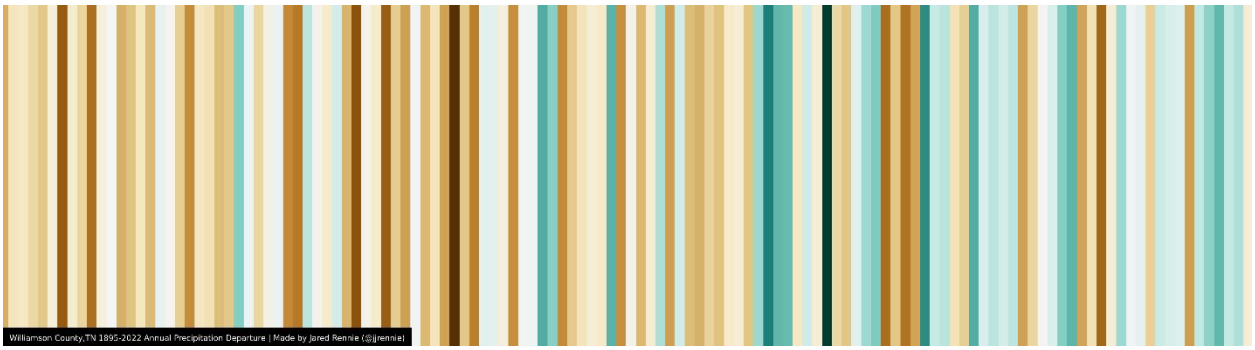


Figure 31: Observed (1895-2022) Annual Precipitation for Williamson County, Tennessee, Compared to the 20th Century Average with Darkening Shades of Brown for Below Average Precipitation and Darkening Shades of Green for Above Average.

(Source: NOAA NCEI)

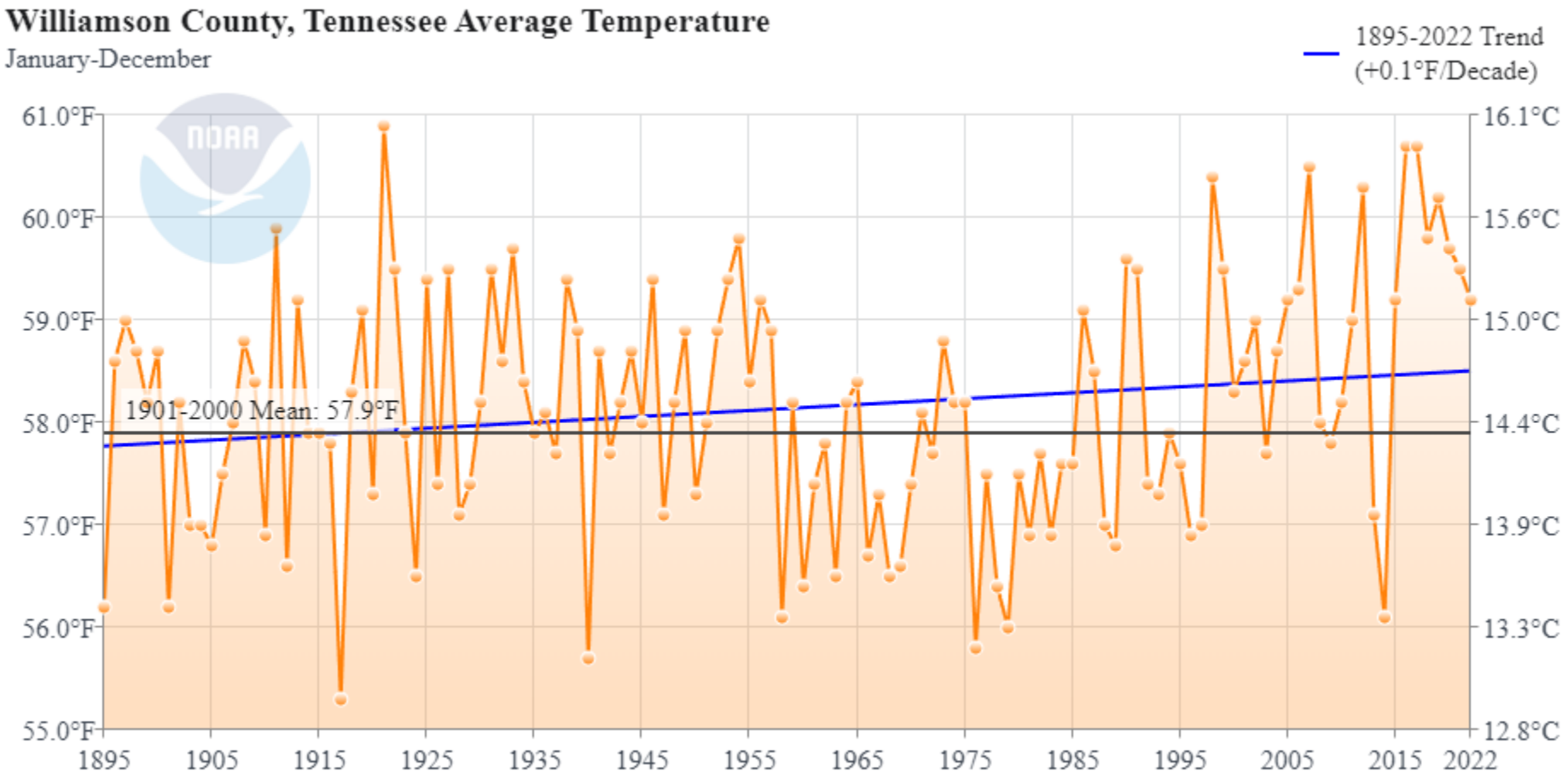


Figure 32: Annual Average Temperature for Williamson County Tennessee, Showing a +0.1°F Increase per Decade Since 1895.

(Source: NOAA NCEI, Climate at a Glance: County Time Series)

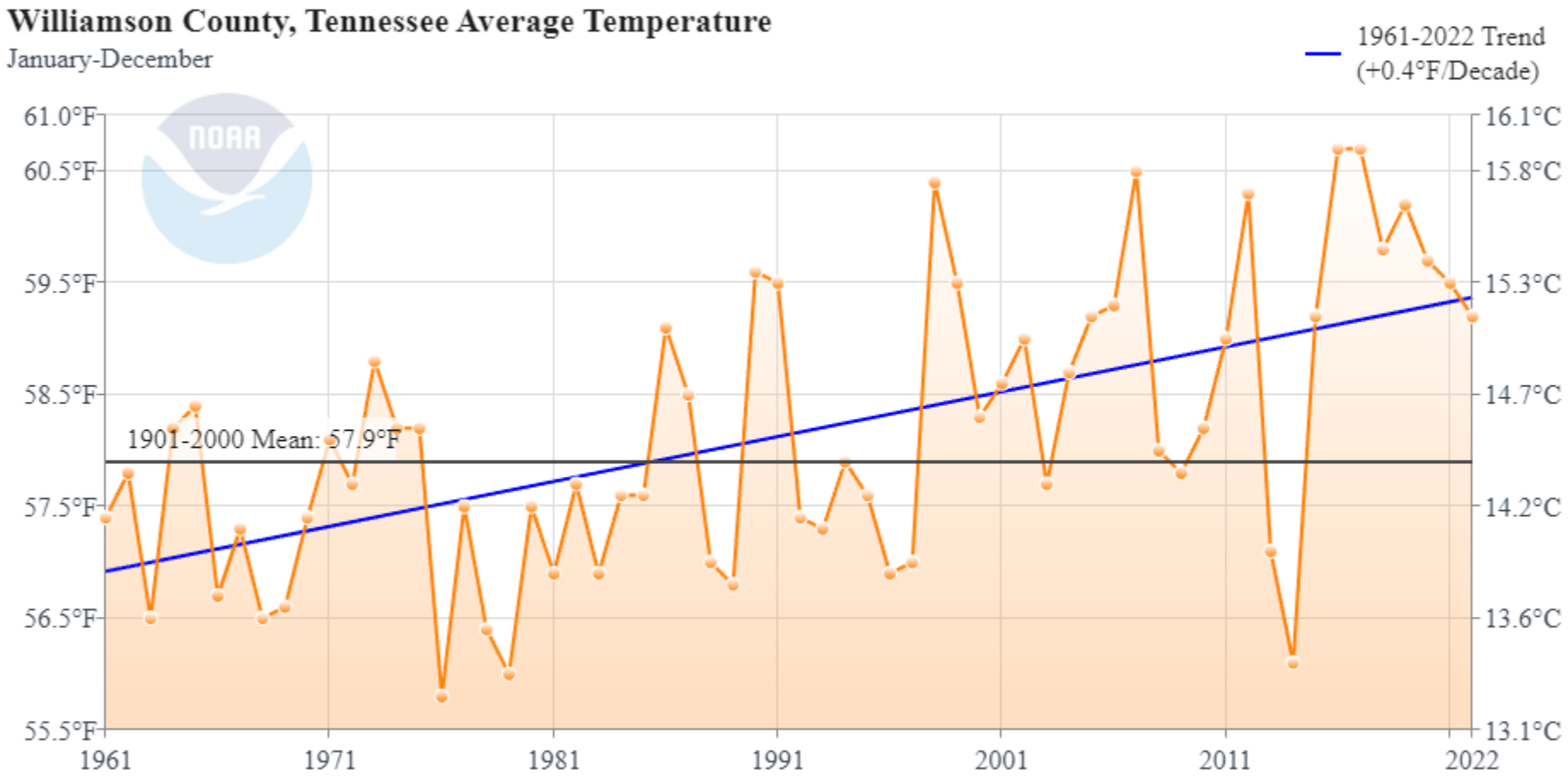


Figure 33: Annual Average Temperature for Williamson County, Tennessee, Showing a +0.4°F Increase per Decade Since 1961.

(Source: NOAA NCEI, Climate at a Glance: County Time Series)

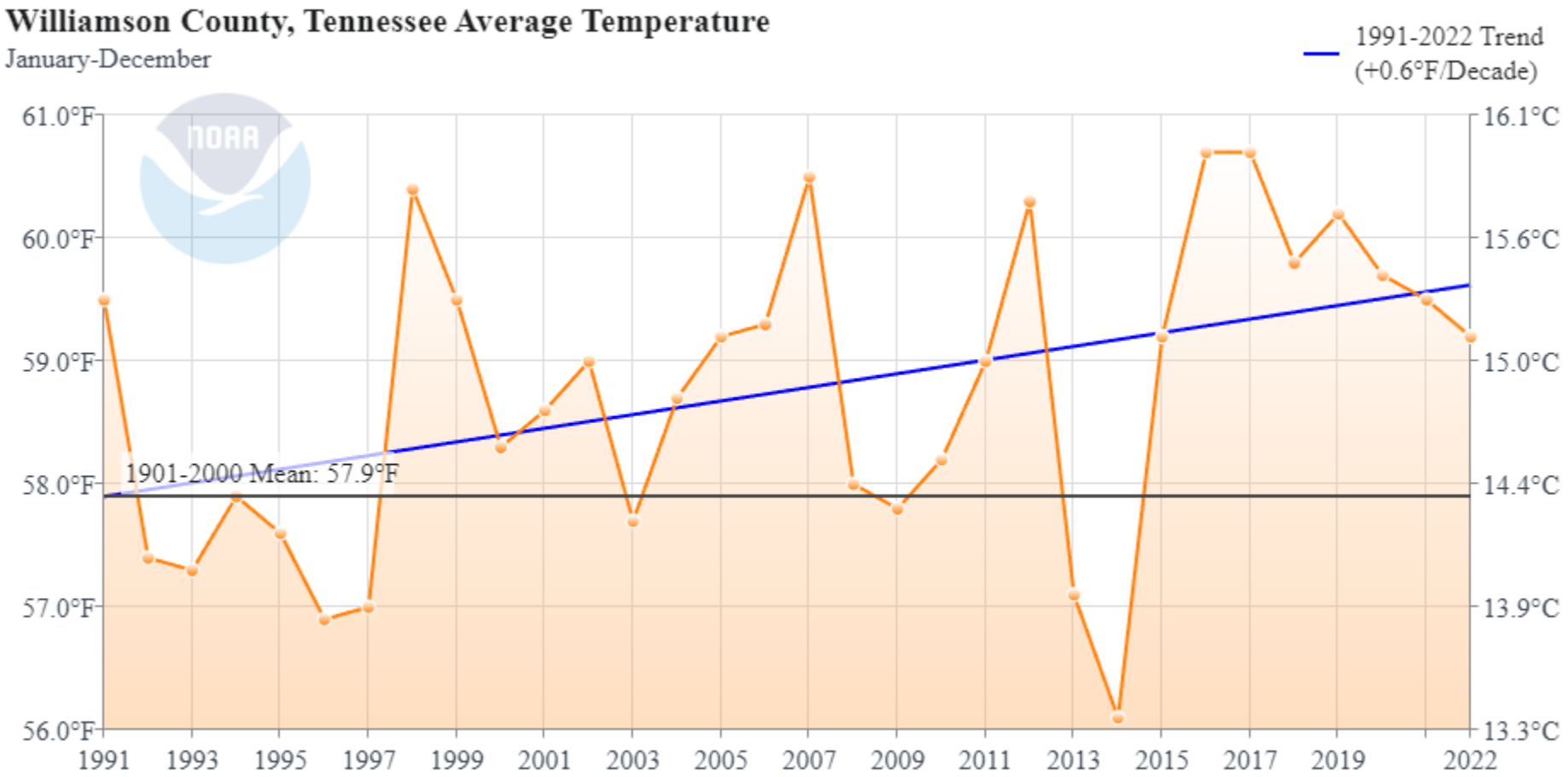


Figure 34: Annual Average Temperature for Williamson County, Tennessee, Showing a +0.6°F Increase per Decade Since 1991.

(Source: NOAA NCEI, Climate at a Glance: County Time Series)

The Tennessee Climate Office (TCO) analyzed trends in the U.S. Drought Monitor (USDM) throughout Tennessee from 2000 to 2021. County-level trends were developed based on the amount of each county that was covered in D0 (Abnormally Dry) conditions or worse, D1 (Moderate Drought) or worse, D2 (Severe Drought) or worse, D3 (Extreme Drought) or worse, and D4 (Exceptional Drought) each week. Trends were assessed using space-time cube analysis tools in ArcGIS Pro, with the results shown in the following figure. There was a significant decreasing trend in the amount of time that Williamson County spent in D1-D4 drought conditions over this period, but there was no significant trend in amount of time that Williamson County spent in the higher levels of drought D2 or worse, D3 or worse, or D4.

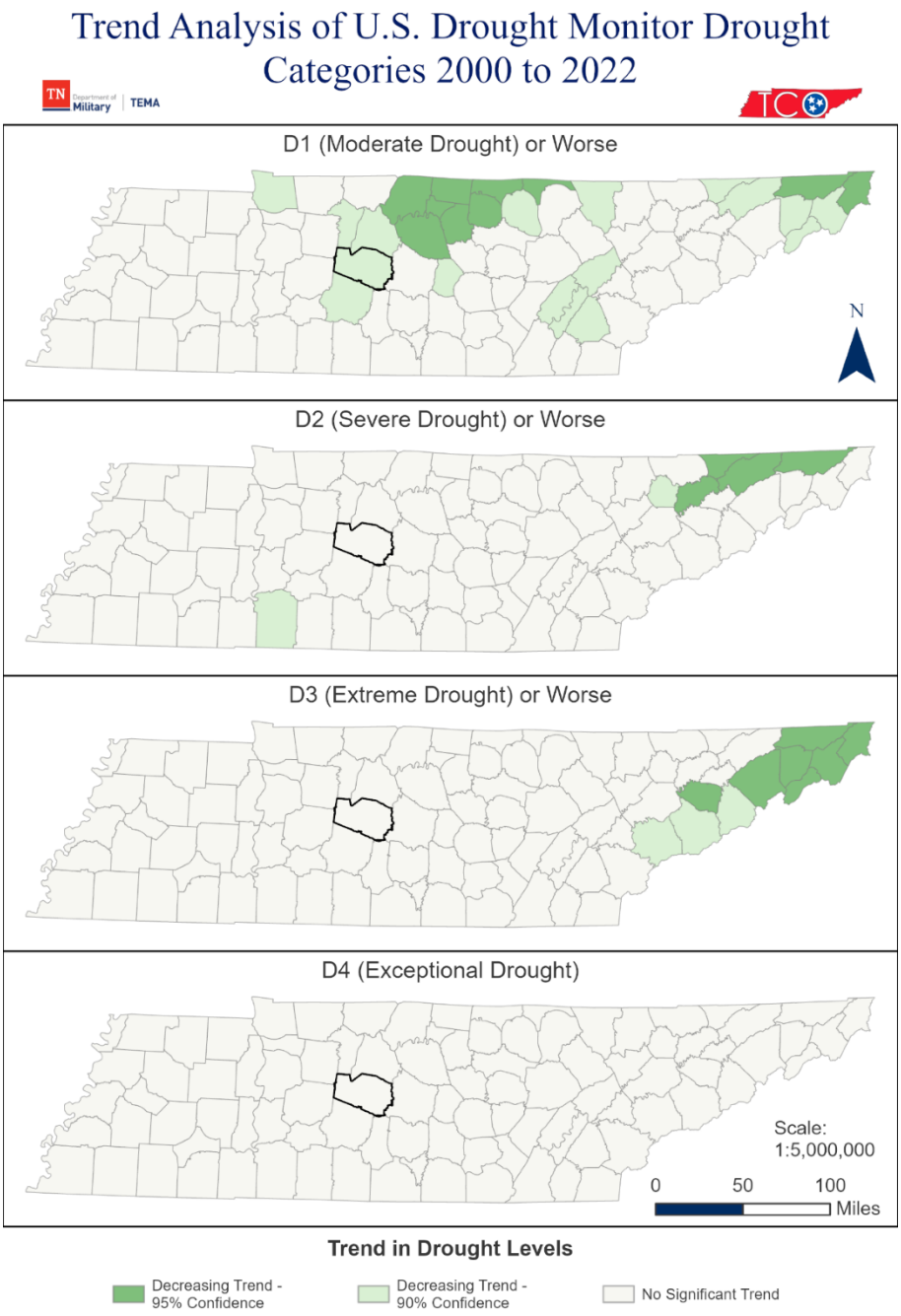


Figure 35: Trend Analysis of U.S. Drought Monitor from 2000 – 2021, Williamson County Outlined in Bold.

Since the USDM only dates back to 2000, other metrics must be used to examine longer trends in drought occurrences. The Standardized Precipitation Index (SPI) is another metric that can be used to quantify drought and periods of wetness by capturing how observed precipitation deviates from the climatological average. Drought.gov provides a timeline of the SPI derived from

the Global Historical Climatology Network (GHCN), with data back to 1895 for the contiguous U.S. Red hues indicate drier conditions, while blue hues indicate wetter conditions. With this longer dataset the cyclical nature of dry and wet periods across Williamson County is even more apparent. It also shows that the shorter and less intense dry periods observed from 2008 to 2022 is one of the longer periods of time with minimal long-term drought impacts for the county.

Looking at the longer-term Standardized Precipitation Index (SPI) from the NCEI nClimGrid-monthly dataset (starting 1895) there is an increasing trend in the 3-month SPI value, indicating an increasing trend in precipitation (averaged over 3-months) across all of Tennessee with a moderate increase in values across Williamson County. A gridded SPI dataset is also available at a 5km resolution from NCEI. This gridded dataset with data from 1895 to 2022 was used to analyze the linear trend in 3-month SPI values (SPI value calculated from the dryness or wetness values of the previous 3 months), shown in the following figure. All areas of Tennessee had an increasing trend in SPI values over this time period, indicating an increasing trend in precipitation that is consistent with other observed records and climate models signifying that Tennessee is seeing a decrease in the risk for longer-term droughts. The overall trend in increasing wetness will not prevent future periods of drought, especially short-duration high-intensity Flash Droughts.

Table 2: SPI Category and Value Definitions.

SPI Category	SPI Value	Description
D4	≤ -2	Exceptionally Dry
D3	-1.6 to -1.9	Extremely Dry
D2	-1.3 to -1.5	Severely Dry
D1	-0.8 to -1.2	Moderately Dry
D0	-0.5 to –0.7	Abnormally Dry
W0	+0.5 to + 0.7	Abnormally Wet
W1	+0.8 to +1.2	Moderately Wet
W2	+1.3 to +1.5	Severely Wet
W3	+1.6 to +1.9	Extremely Wet
W4	≥ 2.0	Exceptionally Wet

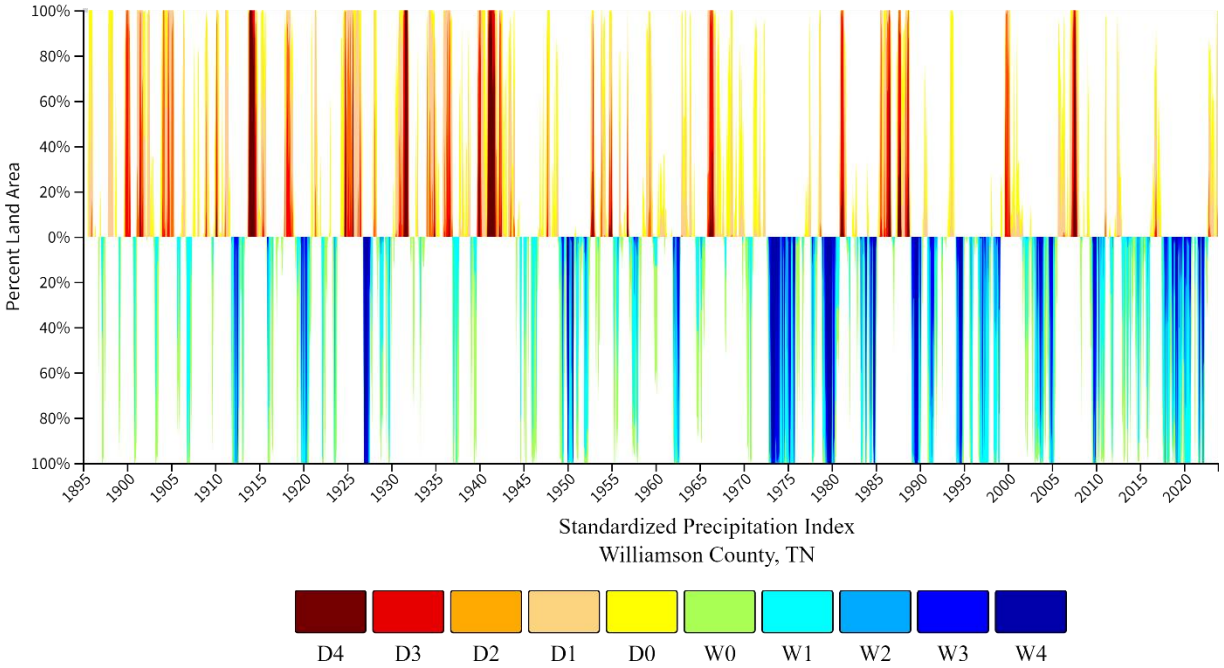


Figure 36: Periods of Drought and Wetness in Williamson County, Tennessee from 1895 to 2022.

(Source: Drought.gov)

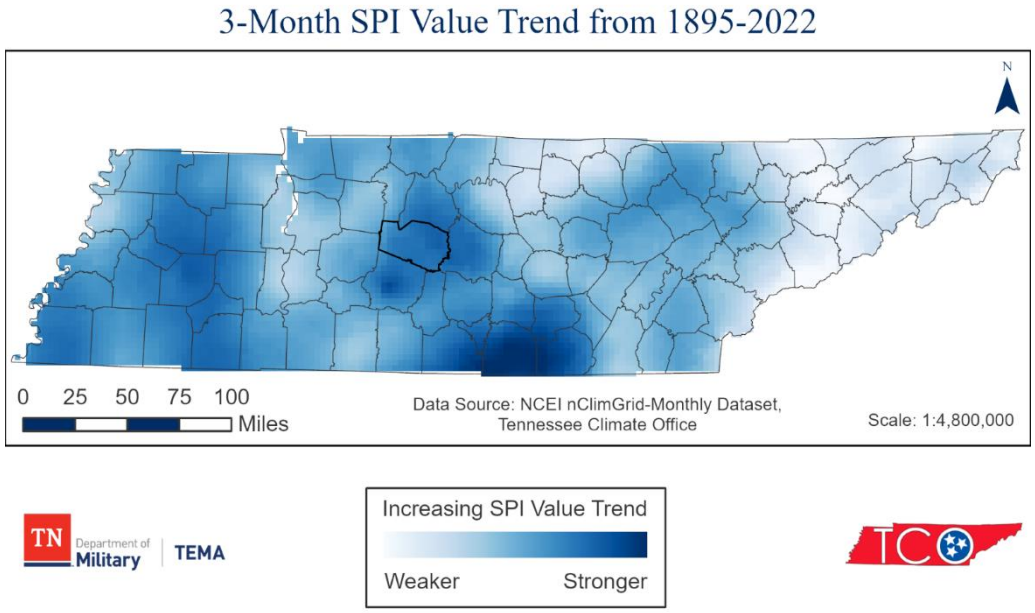


Figure 37: SPI Value Trend for 3-Months from 1895 to 2022, Williamson County Outlined in Bold.

The previous trends are based on observed historical data, but the Climate Mapping for Resilience and Adaptation (CMRA) Assessment tool provides county-level output from future climate projections. Data from this tool indicates Williamson County could expect an increase in the number of dry days per year due to climate variability. However, the tool provides a range of possible outcomes, with higher and lower greenhouse gas emission scenarios, for Early-Century (2015-2044), Mid-Century (2035-2064), and Late Century (2070-2099) time periods, and maximum, minimum, and mean projected values. The following table shows the projected change in the number of dry days per year for Williamson County. The Early-, Mid-, and Late-Century values represent the increase (positive values) or decrease (negative values) in dry days per year compared to the number of dry days per year from modeled history. In the mean projection, Williamson County could see an increase of 3.2 to 4.4 dry days per year by Mid-Century and an increase of 3.8 to 7.1 dry days per year by Late-Century.

Table 3: Possible Change in the Number of Dry Days per Year for Williamson County, Tennessee.

High Emissions Scenario	Modeled History (1976-2005)	Early Century (2015-2044)	Mid Century (2035-2064)	Late Century (2070-2099)
Driest Projection	183	+16	+21.3	+41.9
Mean Projection	179.4	+2.9	+4.4	+7.1
Wettest Projection	172.2	-1.0	-3.0	-7.7
Low Emissions Scenario	**Modeled History (1976-2005)**	**Early Century (2015-2044)**	**Mid Century (2035-2064)**	**Late Century (2070-2099)**
Driest Projection	183	+10.6	+16.7	+14.1
Mean Projection	179.4	+2.2	+3.2	+3.8
Wettest Projection	172.2	-1.3	-2.8	-3.6

The projected increase in high-heat days and the intensification of the hydrologic cycle will likely lead to an increasing number of Flash Droughts, which are defined by the rapid onset or intensification of drought conditions. Flash Droughts in the southeastern United States are often connected to short periods of time (a couple of weeks or months) with much higher-than-normal temperatures and much lower-than-normal precipitation leading to the rapid depletion of soil moisture and streamflow. September 2019 and October 2023 are prime examples of a Flash Drought in Tennessee, and more broadly across the Southeast. During the 2023 fall flash drought Williamson County went from 0% of the county in drought conditions (D1-4) on the October 3rd release of the U.S. Drought Monitor to 100% of the county being in at least Severe Drought (D2) conditions and about half of the county in Extreme Drought (D3) on the October 31st release of the US Drought Monitor.

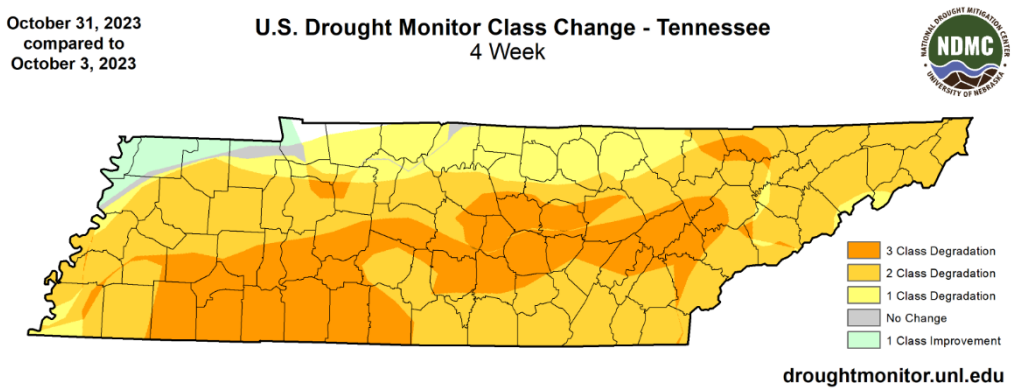


Figure 38: U.S. Drought Monitor Four Week Class Change in the State of Tennessee from October 3, 2023 to October 31, 2023.

(Source: National Drought Mitigation Center)

A study conducted by the U.S. Department of Agriculture (USDA) and U.S. Forest Service Office of Sustainability and Climate compared the length of a 10-year Drought, defined as a once in a decade drought as measured by the number of consecutive dry days (days with less than 0.1 inches of rain) during the summer season (May – September) between historical data and future climate models. For this study, the historical period was based on observed data from 1975 to 2005, and the future scenario was for the 2080's based on the RCP8.5 (higher emissions) ensemble mean of 20 global climate models from the CMIP5 experiment. The output of this study, shown in the following figure, indicates that most areas of Tennessee could expect a 10-year Drought (10% annual probability of occurrence) to maintain its current length or increase by as much as 6 days in the 2080's compared to a 1-year Drought from 1975-2005. In Williamson County, a 10-year drought could decrease in length by up to 1 day in the eastern part of the county and increase in length from 0.1 to 4 days in the central and western parts of the county compared to the modeled history. This demonstrates that although the average annual precipitation amount may increase in Tennessee, periods between precipitation events could get longer, leading to flash droughts or shorter-term drought periods.

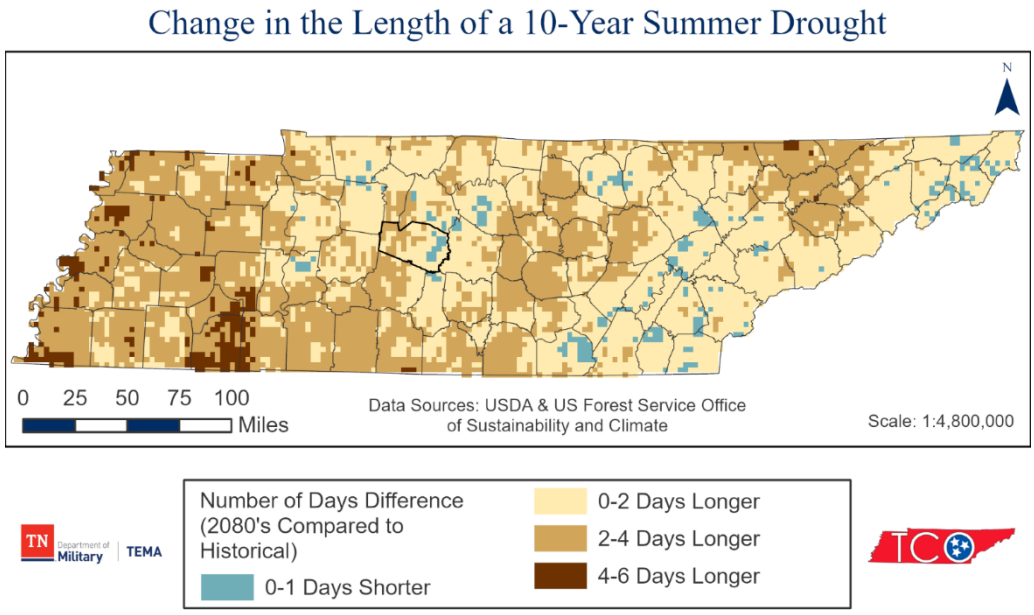


Figure 39: Change in the Length of a 10-Year (10% Annual Probability of Occurrence) Drought from Historical Data (1975-2005) to a 10-Year Drought in the 2080s (RCP8.5 Scenario), Williamson County Outlined in Bold.

In addition to the variable climate, population growth and development in Tennessee means that the state will be at a higher risk for hydrological and socioeconomic droughts in the future as water demand increases.

Local Threat and Hazard Data Collected During THIRA Process:

Local Hazard Data.xlsx

To view the additional hazard data as provided by NOAA, double click on the Excel icon above. If unable to view the data, please contact the WCEMA.

Appendix D: HAZUS/FIRM Panels

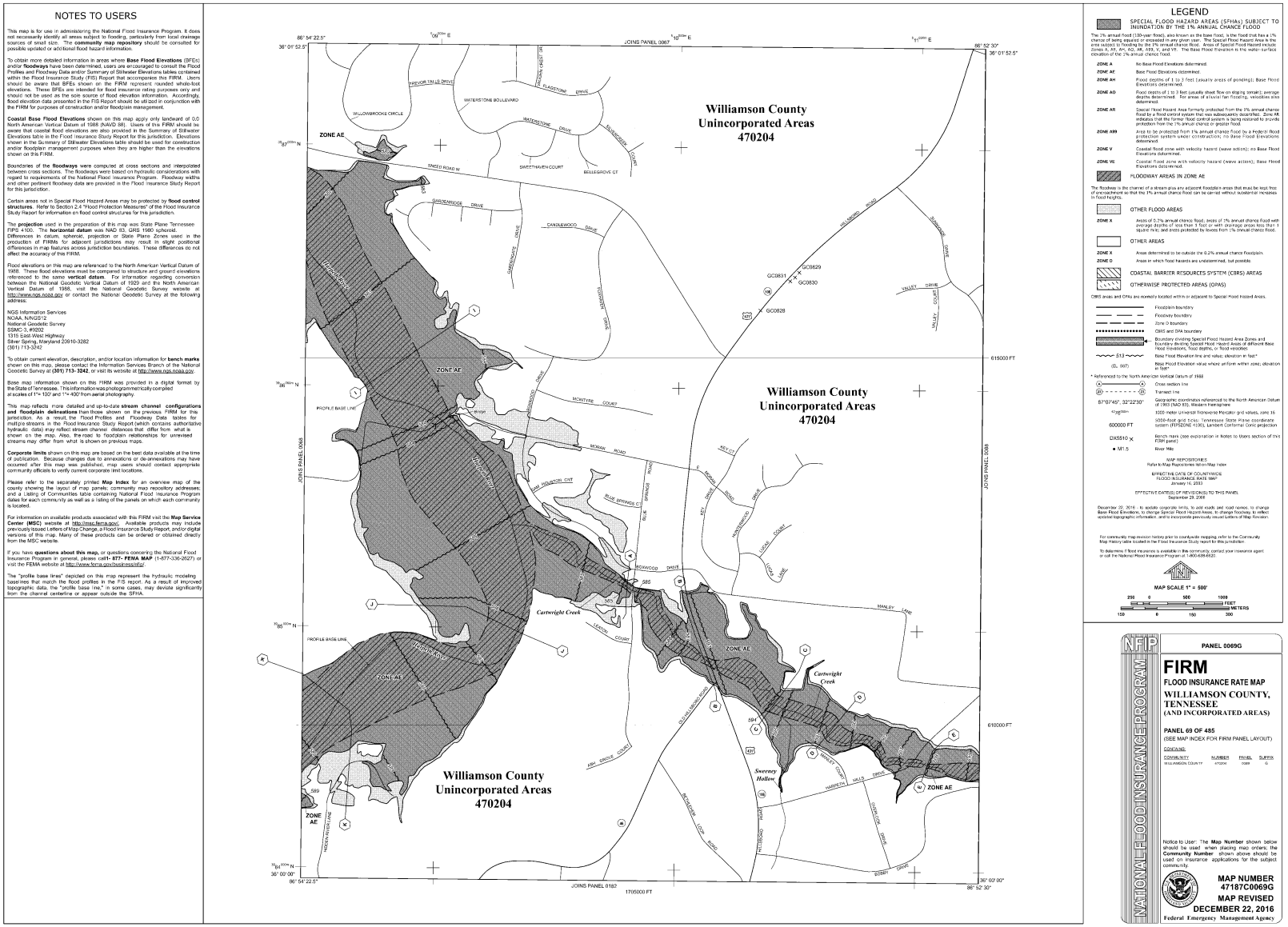
Sample FIRM Panels in Williamson County:

All FIRM panels attached in this appendix were obtained through the FEMA Flood Map Service Center and are consistently available. The attached images below are samples of FIRM panels for each of the participating municipalities.

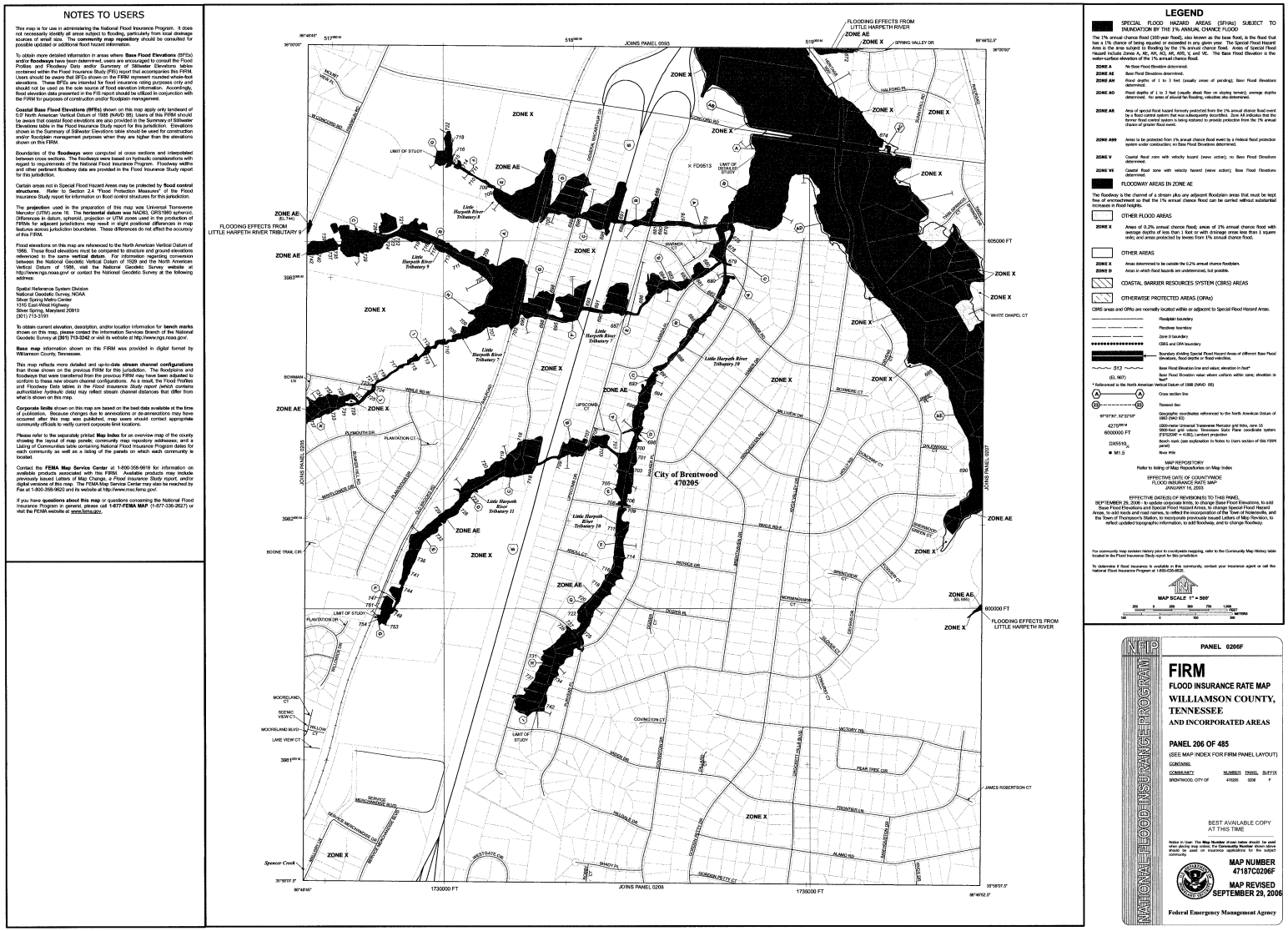
To access this site, go to: https://msc.fema.gov/portal/home

City of Franklin:

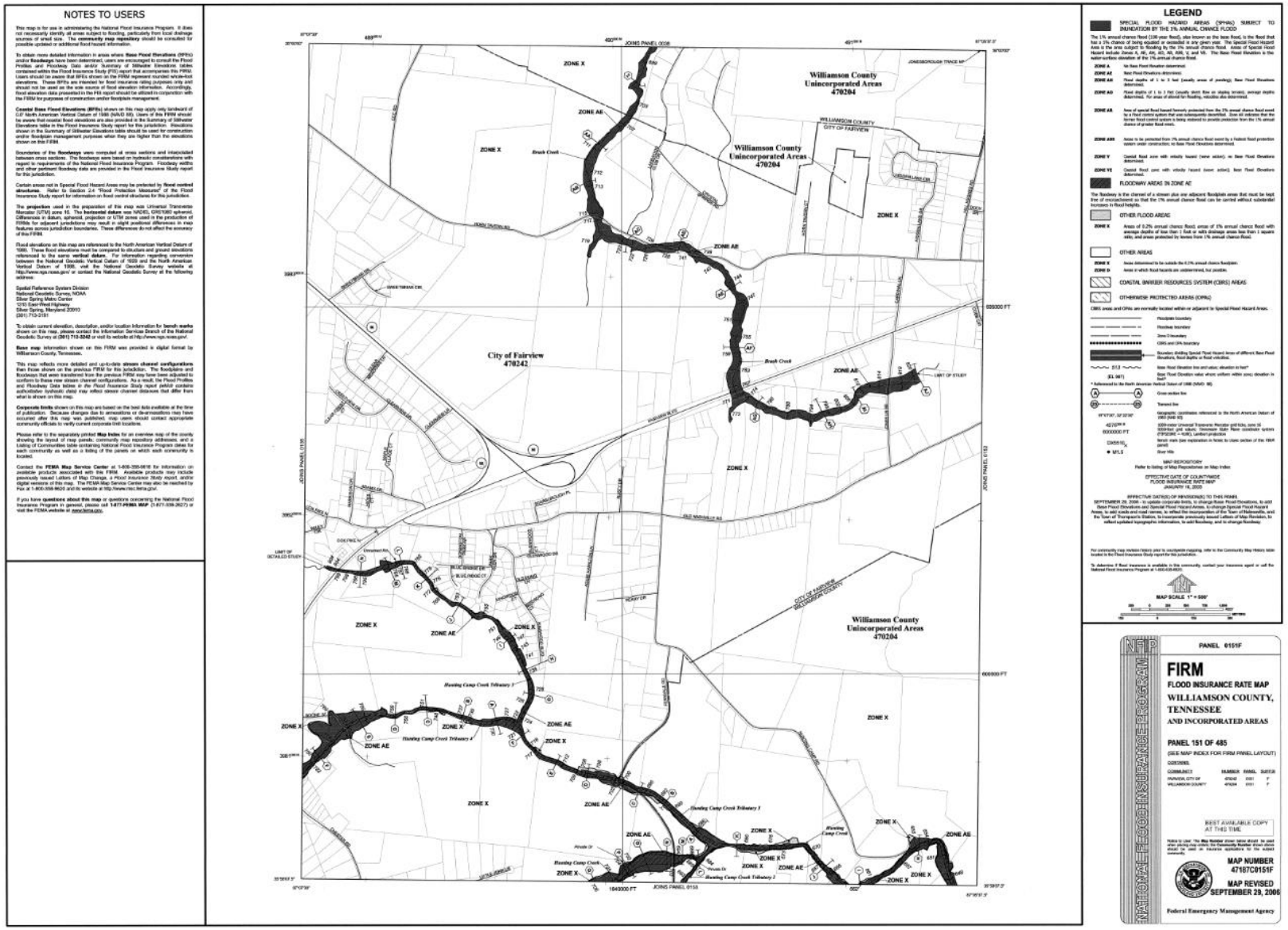
Williamson County Unincorporated:



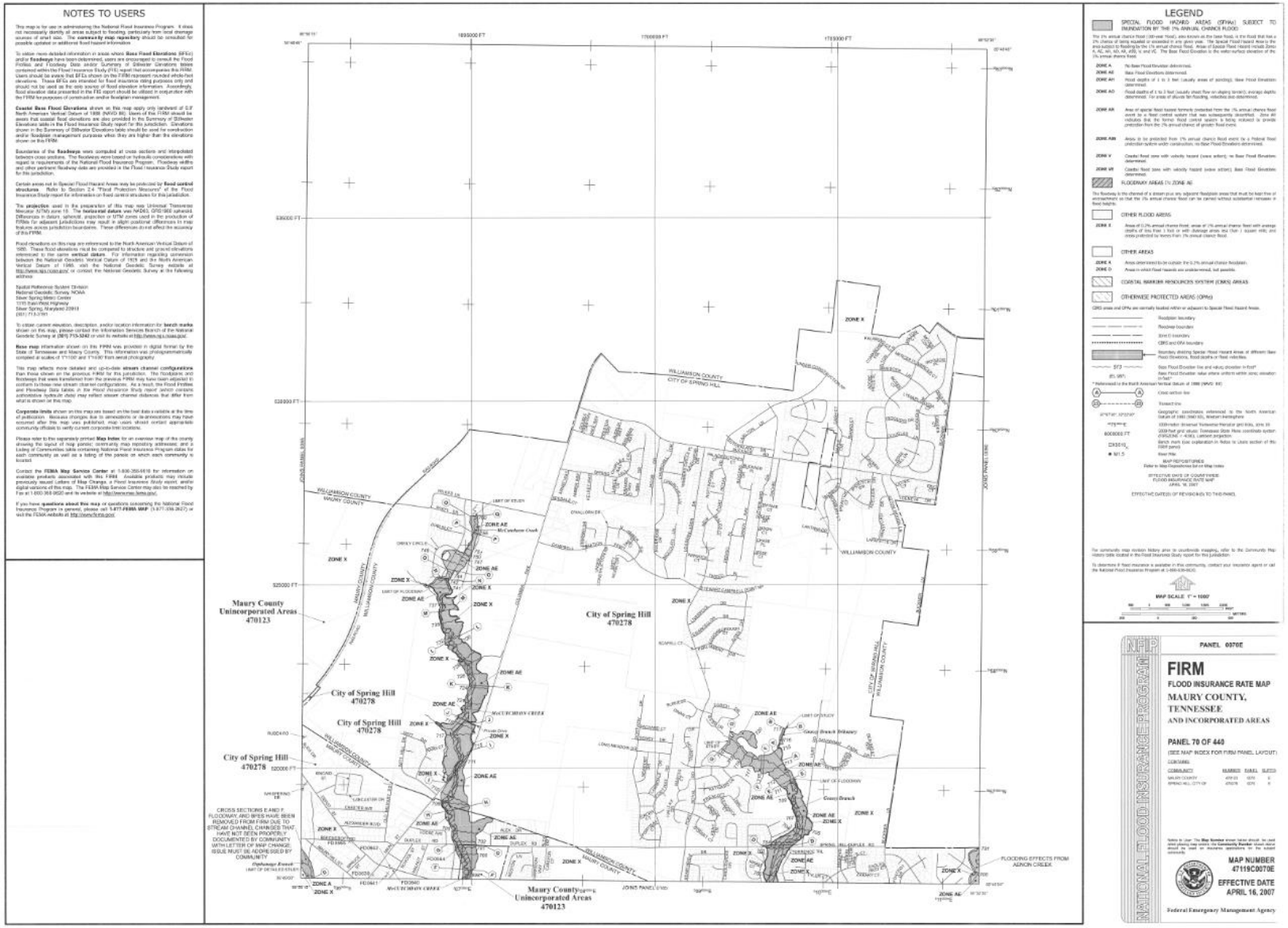
City of Brentwood:



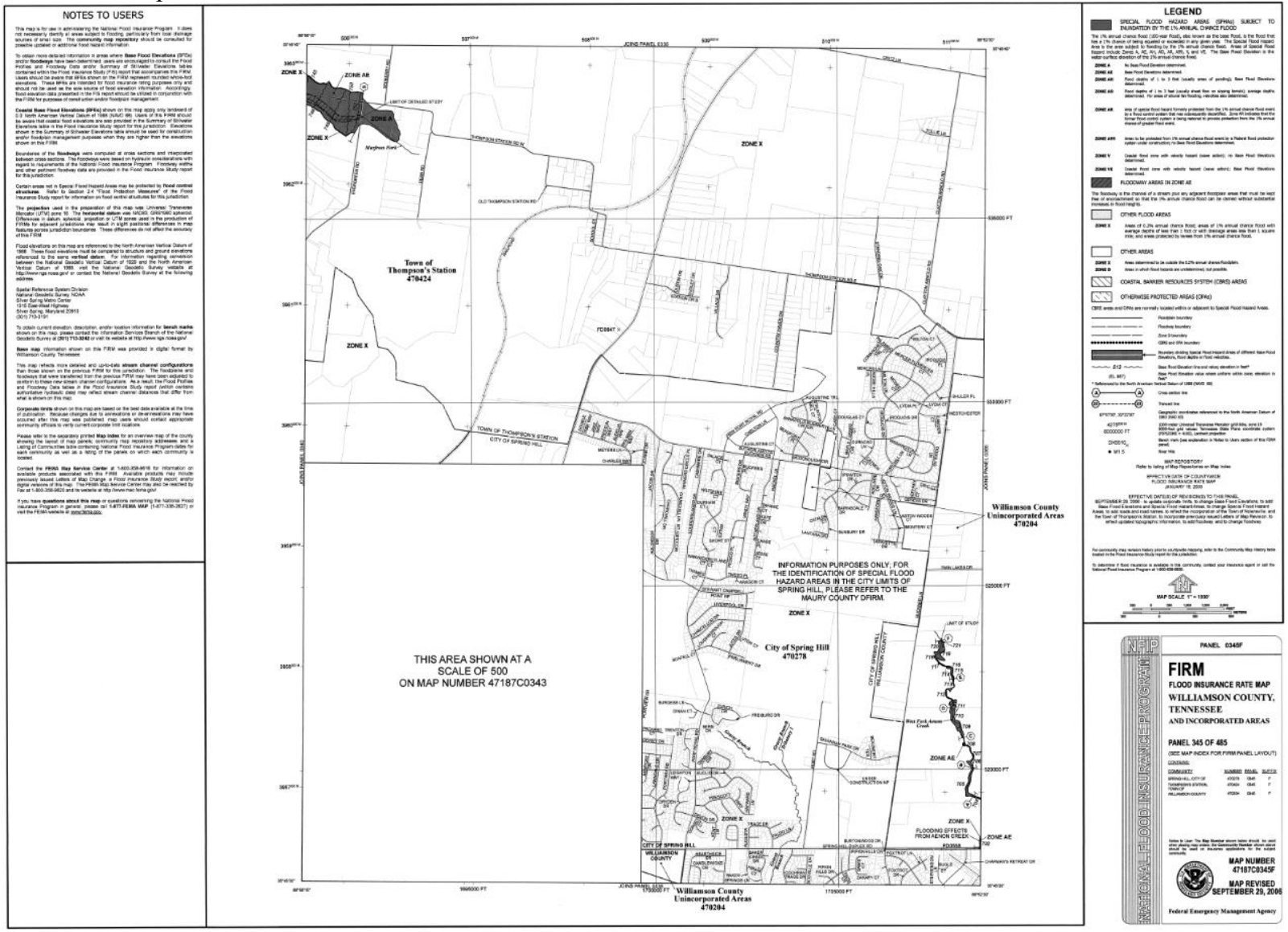
City of Fairview:



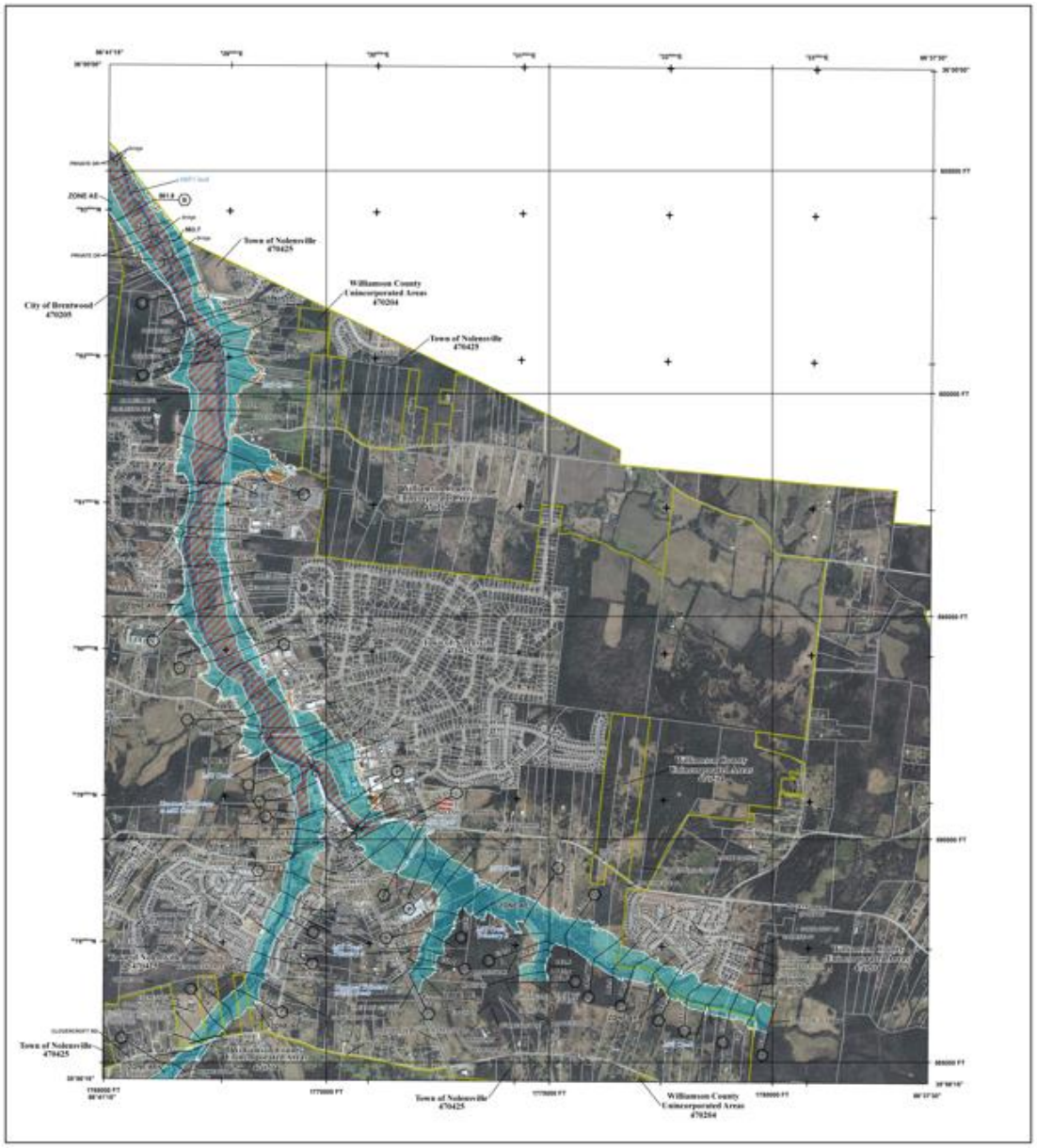
City of Spring Hill:



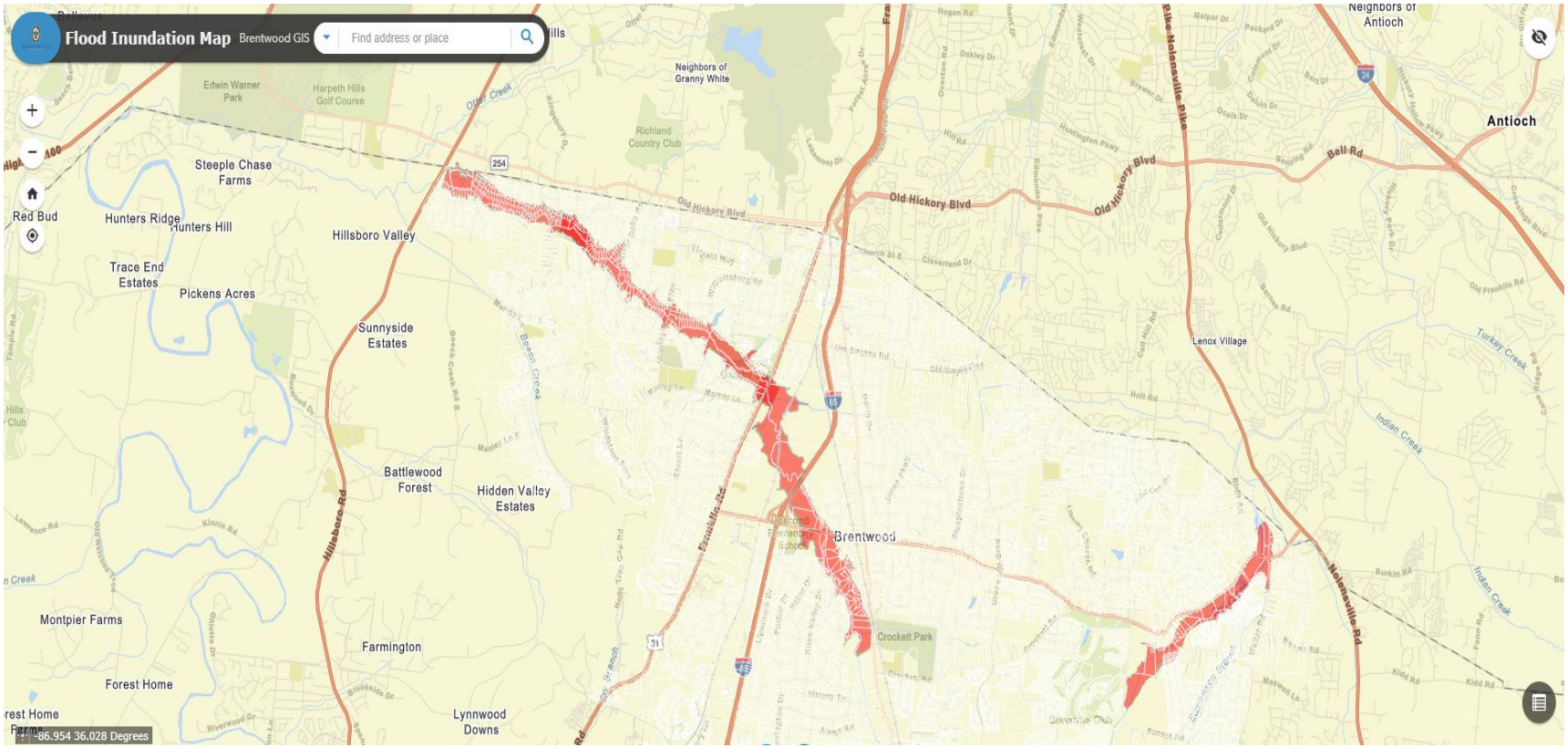
Town of Thompson's Station:



Town of Nolensville:



City of Brentwood Flood Inundation Map:



100-Year Flood Global Risk Report (HAZUS):

Hazus: Flood Global Risk Report

Region Name:	Williamson_100yr
Flood Scenario:	Williamson_100yr
Print Date:	Tuesday, March 7, 2023

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

HAZUS
EARTHQUAKE • WIND • FLOOD • TSUNAMI

Table of Contents

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Tennessee

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is approximately 68 square miles and contains 3,458 census blocks. The region contains over 87 thousand households and has a total population of 247,523 people. The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 63,263 buildings in the region with a total building replacement value (excluding contents) of 54,685 million dollars. Approximately 84.68% of the buildings (and 71.30% of the building value) are associated with residential housing.

HAZUS
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Building Inventory

General Building Stock

Hazus estimates that there are 63,263 buildings in the region which have an aggregate total replacement value of 54,685 million dollars. Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	38,988,257	71.3%
Commercial	10,443,597	19.1%
Industrial	1,899,509	3.5%
Agricultural	163,401	0.3%
Religion	1,009,276	1.8%
Government	231,344	0.4%
Education	1,949,883	3.6%
Total	**54,685,267**	**100%**

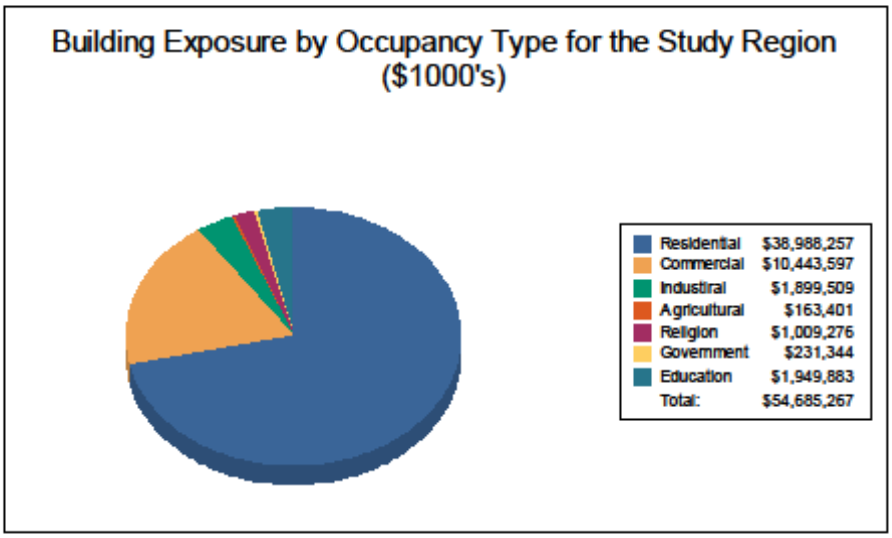
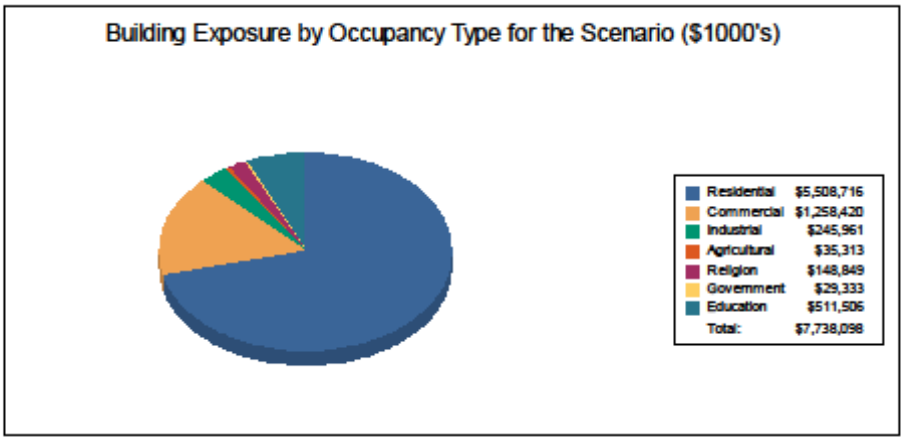


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	5,508,716	71.2%
Commercial	1,258,420	16.3%
Industrial	245,961	3.2%
Agricultural	35,313	0.5%
Religion	148,849	1.9%
Government	29,333	0.4%
Education	511,506	6.6%
Total	**7,738,098**	**100%**



Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 225 beds.
There are 77 schools, 21 fire stations, 5 police stations and 1 emergency operation center.

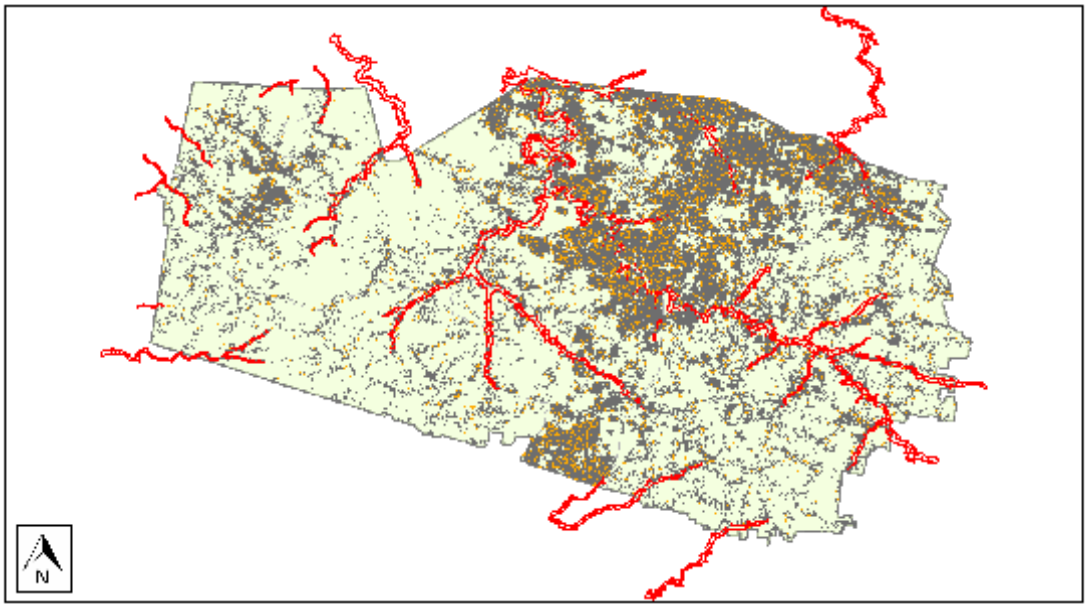
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Williamson_100yr
Scenario Name:	Williamson_100yr
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 314 buildings will be at least moderately damaged. This is over 47% of the total number of buildings in the scenario. There are an estimated 56 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

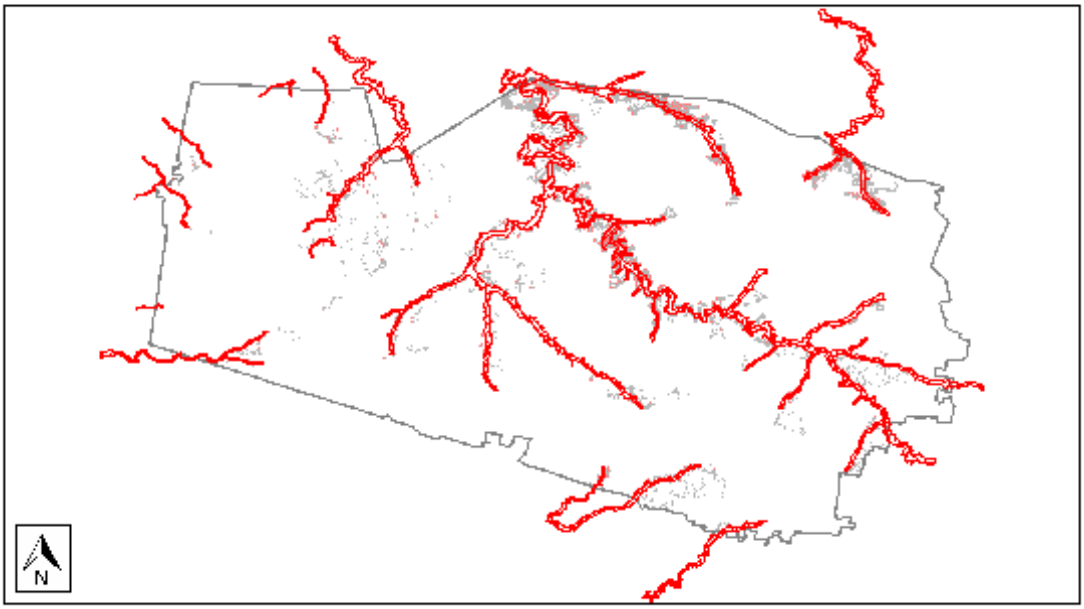


Table 3: Expected Building Damage by Occupancy

Occupancy	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	7	23	6	19	4	13	5	16	7	23	2	6
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Religion	0	0	1	100	0	0	0	0	0	0	0	0
Residential	35	11	77	24	60	19	52	16	46	14	54	17
Total	42		84		64		57		53		56	

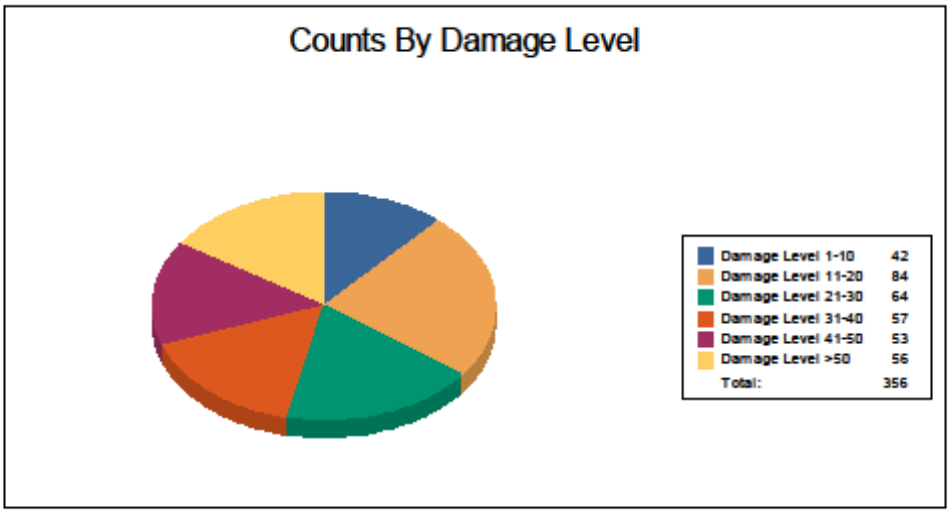


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	2	11	4	22	3	17	3	17	5	28	1	6
Steel	1	14	2	29	1	14	1	14	2	29	0	0
Wood	36	11	78	24	60	18	52	16	45	14	54	17

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 225 hospital beds available for use. On the day of the scenario flood event, the model estimates that 225 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Emergency Operation Centers	1	0	0	0
Fire Stations	21	0	0	0
Hospitals	2	0	0	0
Police Stations	5	0	0	0
Schools	77	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

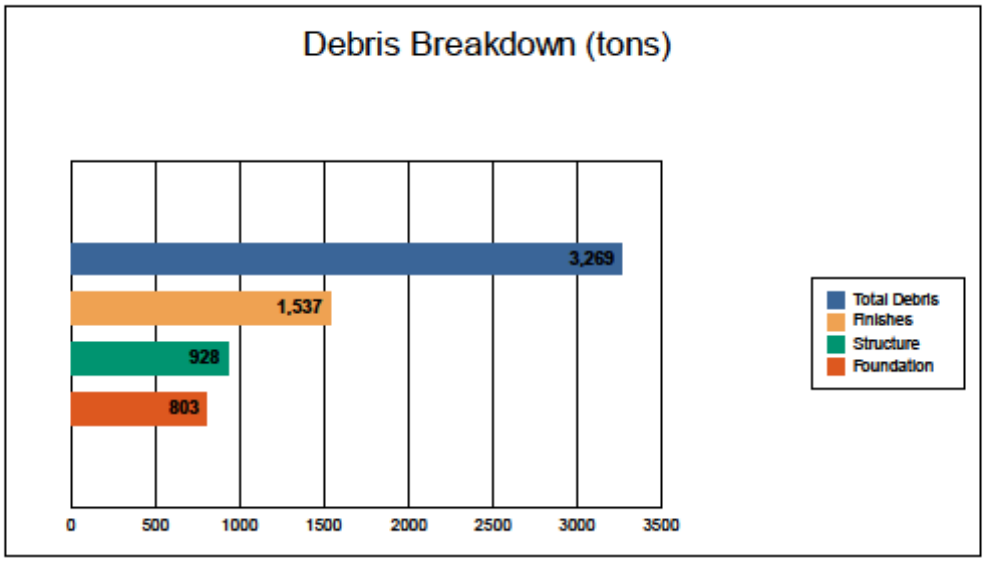
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

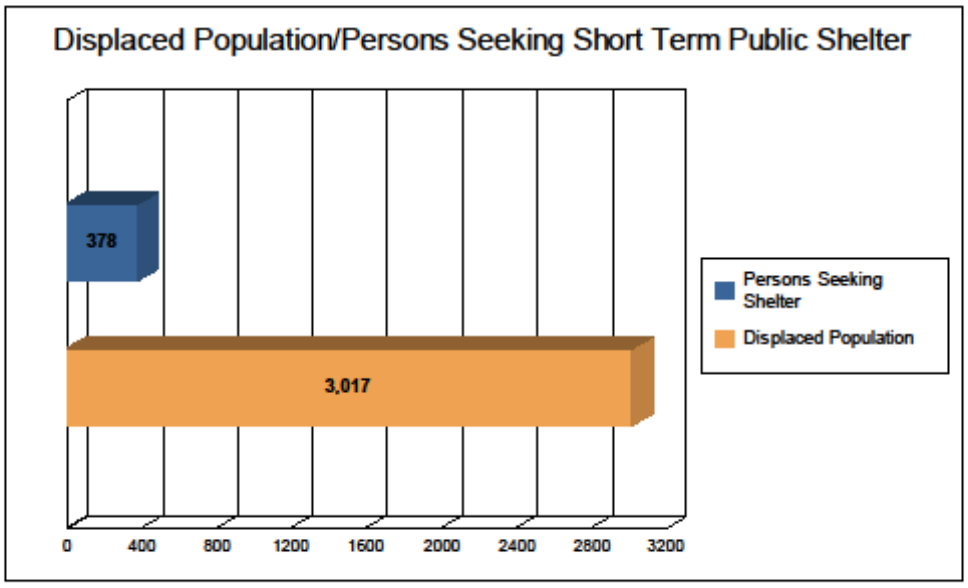


The model estimates that a total of 3,269 tons of debris will be generated. Of the total amount, Finishes comprises 47% of the total, Structure comprises 28% of the total, and Foundation comprises 25%. If the debris tonnage is converted into an estimated number of truckloads, it will require 131 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 1,006 households (or 3,017 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 378 people (out of a total population of 247,523) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 828.83 million dollars, which represents 10.71 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 503.78 million dollars. 39% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 41.60% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

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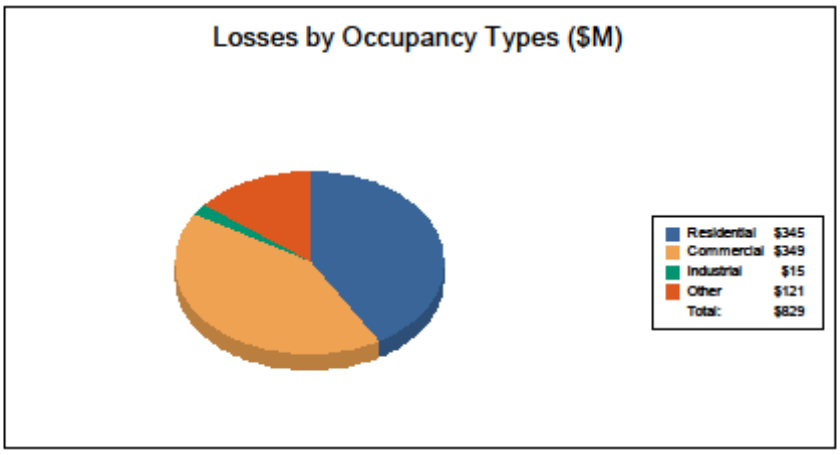
Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	189.84	38.06	3.57	7.34	238.81
	Content	97.02	106.56	8.67	32.35	244.59
	Inventory	0.00	15.39	1.54	3.45	20.38
	Subtotal	**286.86**	**160.00**	**13.77**	**43.16**	**503.78**
Business Interruption						
	Income	1.41	73.75	0.23	12.16	87.54
	Relocation	38.81	19.78	0.21	6.62	65.43
	Rental Income	14.36	13.76	0.04	0.51	28.68
	Wage	3.33	81.58	0.38	58.11	143.40
	Subtotal	**57.91**	**188.88**	**0.86**	**77.40**	**326.06**
ALL	**Total**	**344.77**	**348.88**	**14.63**	**120.64**	**828.83**



Appendix A: County Listing for the Region

Tennessee
- Williamson

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Tennessee				
Williamson	247,523	38,988,257	15,697,010	54,685,267
Total	**247,523**	**38,988,257**	**15,697,010**	**54,685,267**
Total Study Region	**247,523**	**38,988,257**	**15,697,010**	**54,685,267**

500-Year Flood Global Risk Report (HAZUS):

Hazus: Flood Global Risk Report

Region Name:	Williamson_500yr
Flood Scenario:	Williamson_500yr
Print Date:	Wednesday, March 8, 2023

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

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Table of Contents

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Tennessee

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is approximately 68 square miles and contains 3,458 census blocks. The region contains over 87 thousand households and has a total population of 247,523 people. The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 63,263 buildings in the region with a total building replacement value (excluding contents) of 54,685 million dollars. Approximately 84.68% of the buildings (and 71.30% of the building value) are associated with residential housing.

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Building Inventory

General Building Stock

Hazus estimates that there are 63,263 buildings in the region which have an aggregate total replacement value of 54,685 million dollars. Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	38,988,257	71.3%
Commercial	10,443,597	19.1%
Industrial	1,899,509	3.5%
Agricultural	163,401	0.3%
Religion	1,009,276	1.8%
Government	231,344	0.4%
Education	1,949,883	3.6%
Total	**54,685,267**	**100%**

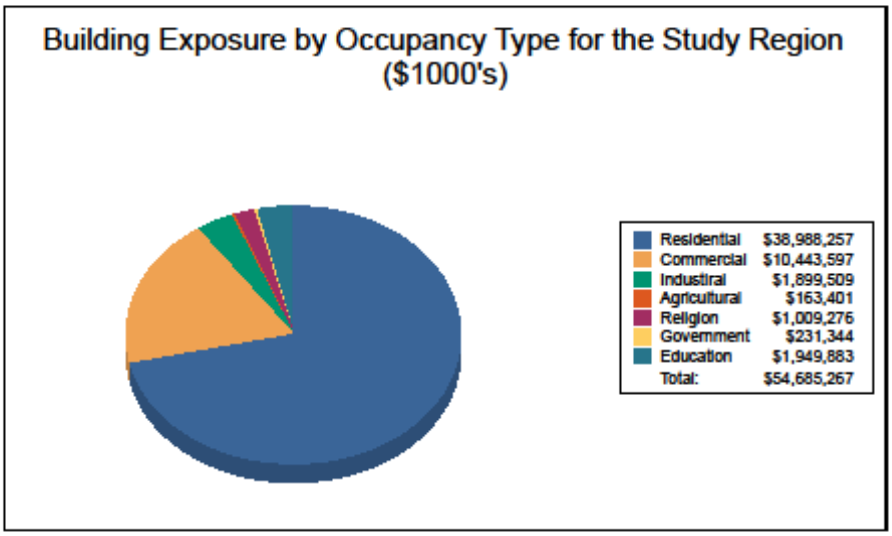

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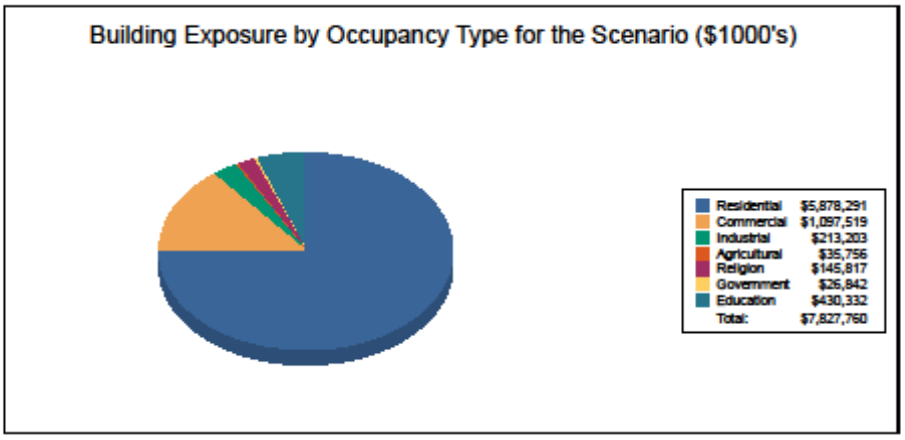
Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	5,878,291	75.1%
Commercial	1,097,519	14.0%
Industrial	213,203	2.7%
Agricultural	35,756	0.5%
Religion	145,817	1.9%
Government	26,842	0.3%
Education	430,332	5.5%
Total	**7,827,760**	**100%**



Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 225 beds.
There are 77 schools, 21 fire stations, 5 police stations and 1 emergency operation center.

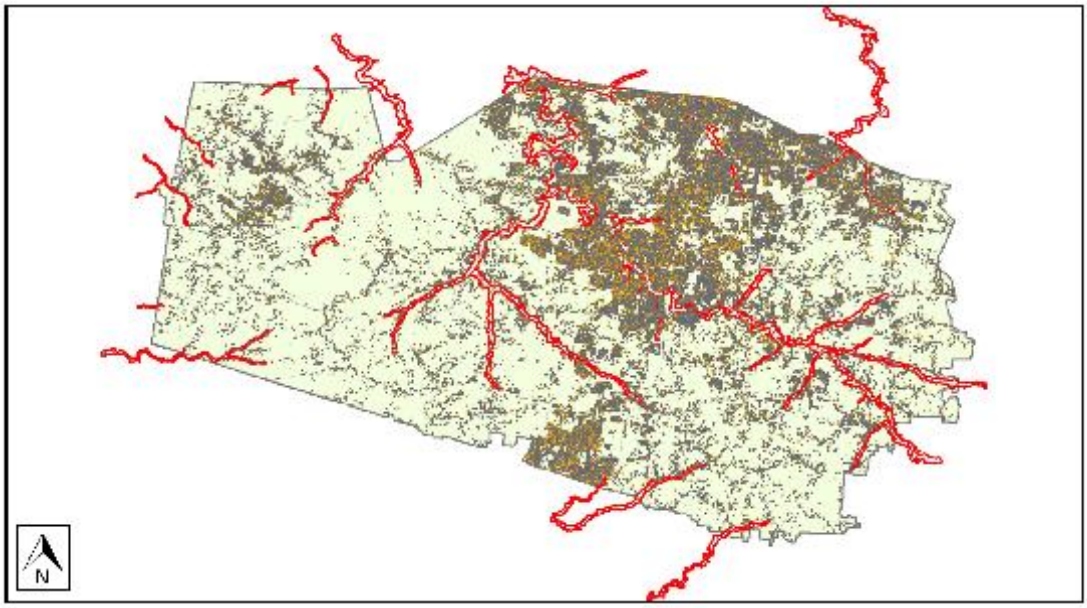
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Williamson_500yr
Scenario Name:	Williamson_500yr
Return Period Analyzed:	500
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 292 buildings will be at least moderately damaged. This is over 50% of the total number of buildings in the scenario. There are an estimated 50 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

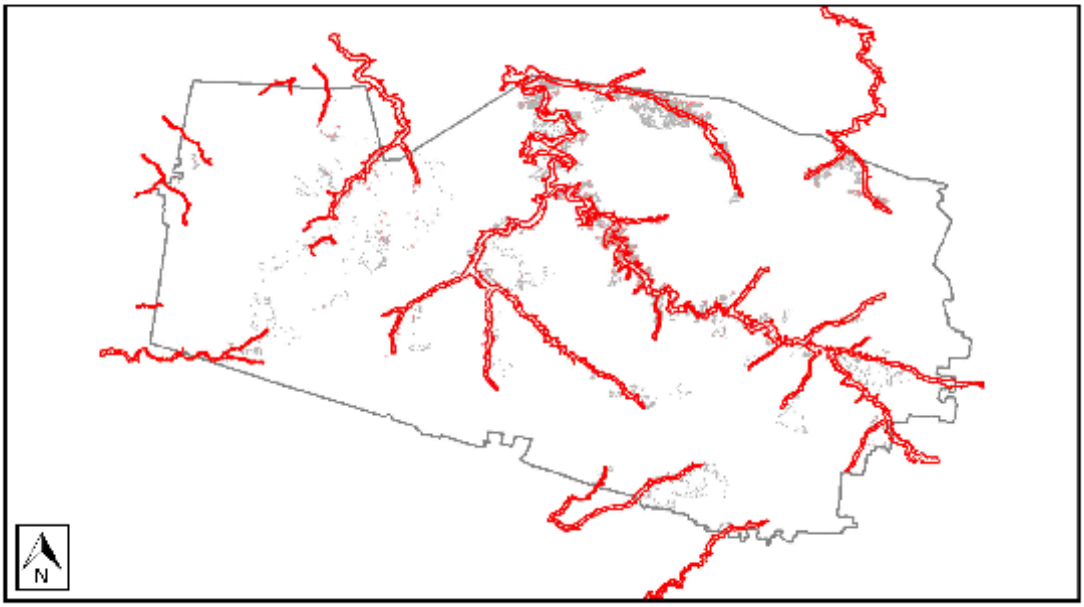


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Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		>50	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	6	18	9	27	3	9	5	15	5	15	5	15
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Religion	0	0	3	100	0	0	0	0	0	0	0	0
Residential	36	12	79	27	51	17	51	17	36	12	45	15
Total	**42**		**91**		**54**		**56**		**41**		**50**	

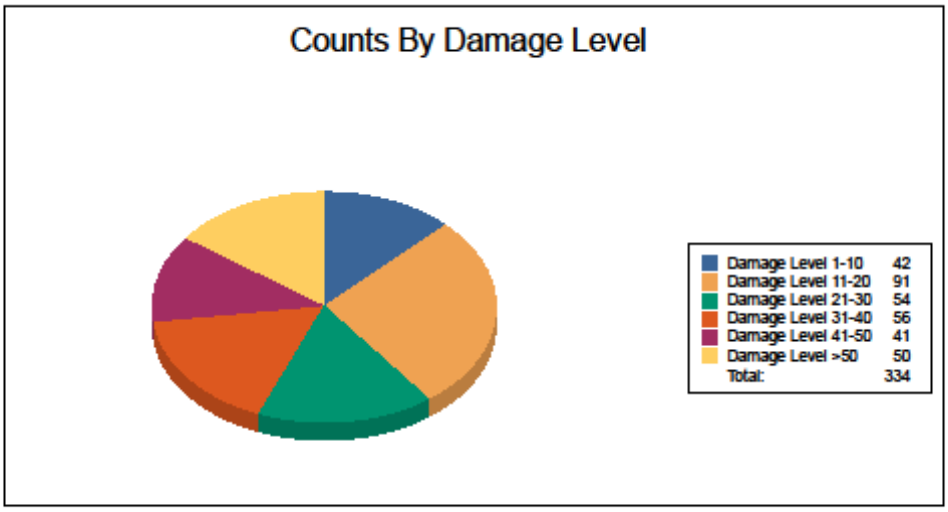


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	2	11	8	42	2	11	1	5	4	21	2	11
Steel	1	11	3	33	1	11	1	11	2	22	1	11
Wood	37	12	82	27	51	17	52	17	36	12	46	15

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 225 hospital beds available for use. On the day of the scenario flood event, the model estimates that 225 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Emergency Operation Centers	1	0	0	0
Fire Stations	21	0	0	0
Hospitals	2	0	0	0
Police Stations	5	0	0	0
Schools	77	0	0	0

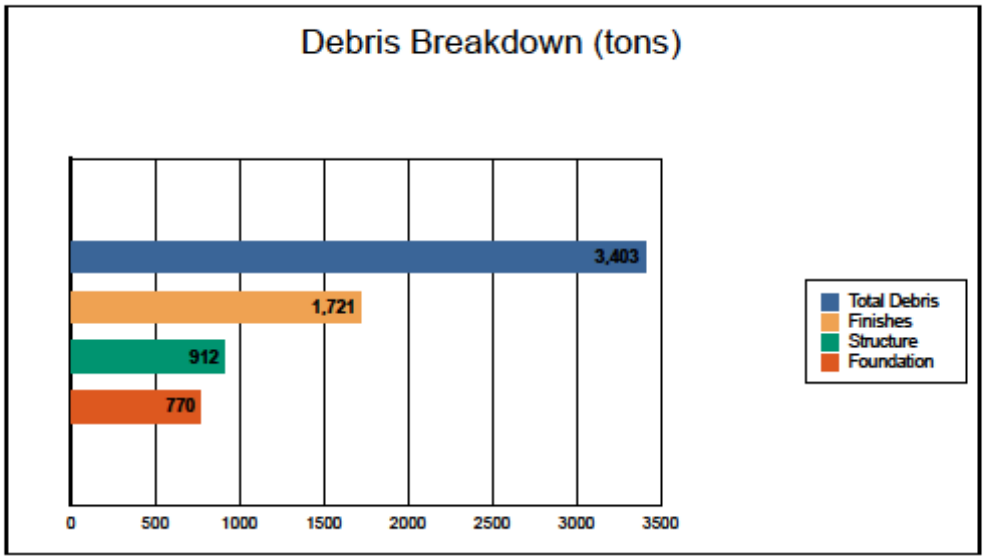
If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.
(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

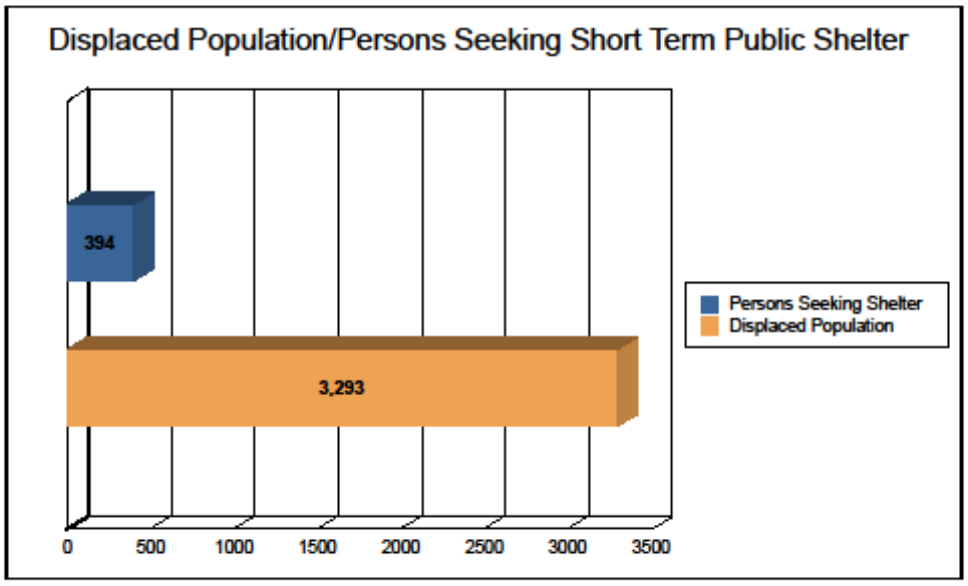


The model estimates that a total of 3,403 tons of debris will be generated. Of the total amount, Finishes comprises 51% of the total, Structure comprises 27% of the total, and Foundation comprises 23%. If the debris tonnage is converted into an estimated number of truckloads, it will require 137 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 1,098 households (or 3,293 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 394 people (out of a total population of 247,523) will seek temporary shelter in public shelters.



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Economic Loss

The total economic loss estimated for the flood is 880.86 million dollars, which represents 11.25 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 544.77 million dollars. 38% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 39.97% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

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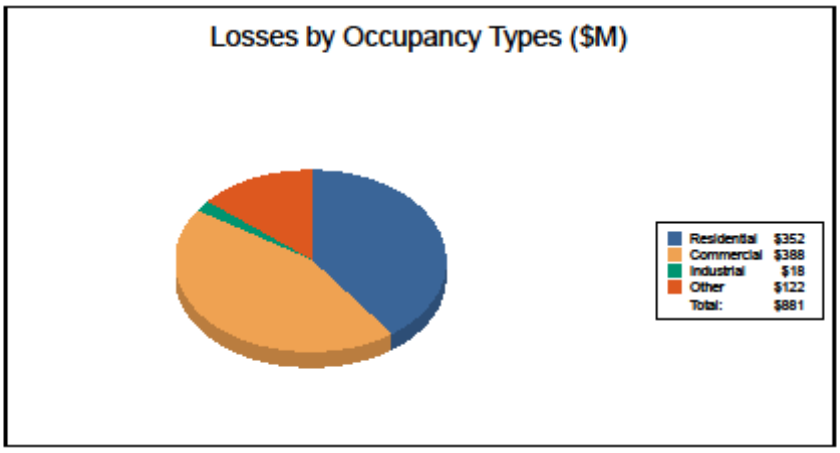
Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	192.82	42.62	4.22	8.51	248.17
	Content	98.88	125.39	10.79	40.20	275.26
	Inventory	0.00	16.19	2.02	3.13	21.34
	Subtotal	**291.69**	**184.20**	**17.03**	**51.84**	**544.77**
Business Interruption						
	Income	2.08	81.40	0.35	13.99	97.82
	Relocation	38.63	21.96	0.37	7.51	68.48
	Rental Income	14.82	14.88	0.09	0.61	30.39
	Wage	4.90	85.86	0.58	48.06	139.40
	Subtotal	**60.43**	**204.09**	**1.39**	**70.18**	**336.09**
ALL	**Total**	**352.12**	**388.29**	**18.43**	**122.02**	**880.86**



Appendix A: County Listing for the Region

Tennessee
- Williamson

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Tennessee				
Williamson	247,523	38,988,257	15,697,010	54,685,267
Total	**247,523**	**38,988,257**	**15,697,010**	**54,685,267**
Total Study Region	**247,523**	**38,988,257**	**15,697,010**	**54,685,267**

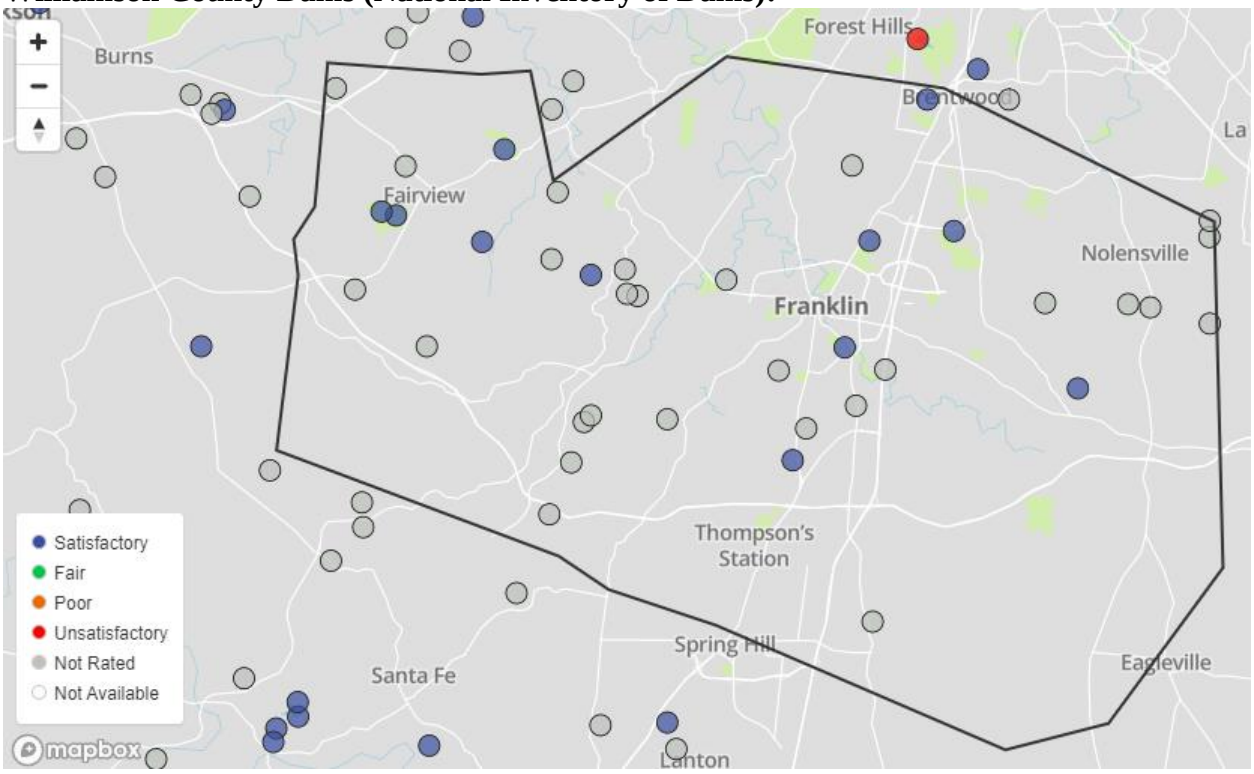
Appendix E: County Dam Data/Map

Williamson County Dam Data:

National Inventory of Dams.xlsx

To view the additional hazard data, double click on the Excel icon above. If unable to view the data, please contact the WCEMA.

Williamson County Dams (National Inventory of Dams):



Appendix F: References

- Centers for Disease Control
- Centers for Disease Control Social Vulnerability Index (CDC SVI)
- Central United States Earthquake Consortium (CUSEC)
- City University of New York
- Critical2TN Critical Infrastructure Database
- Comprehensive Preparedness Guide (CPG) 201
- Williamson County Computer Aided Dispatch (CAD)
- Emergency Management Accreditation Program (EMAP)
- East Tennessee State University Geoinformatics and Disaster Science Lab
- Federal Emergency Management Agency (FEMA)
- FEMA National Risk Index
- FEMA Resilience Analysis and Planning Tool (RAPT)
- Hazard Mitigation Planning Committee (HMPC)
- London School of Economics
- Mississippi State University
- National Centers for Environmental Information (NCEI)
- National Institute of Building Sciences (NIBS)
- National Integrated Drought Information System (NIDIS)
- National Oceanic and Atmospheric Administration (NOAA)
- National Weather Service (NWS)
- NWS National Operational Hydrologic Remote Sensing Center (NOHRSC)
- National Wildfire Coordinating Group (NWCG)
- Southern Group of State Foresters (SGSF)
- Tennessee Department of Health (TDOH)
- Tennessee Division of Forestry
- Tennessee Emergency Management Agency (TEMA)
- Tennessee Hazard Mitigation Plan
- United States Census Bureau
- United States Geological Survey (USGS)
- University of Wisconsin SILVIS Lab Wildland Urban Interface (WUI)
- WAKM Radio
- Williamson County Emergency Operations Plan (EOP)
- Williamson County Geographic Information Systems (GIS)
- Williamson County Threat and Hazard Identification and Risk Assessment (THIRA)
- Williamson County WebEOC
- WKRN News 2