2025

TARRANT COUNTY

HAZARD MITIGATION ACTION PLAN

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Executive Summary

Hazard mitigation helps to reduce or eliminate potential losses from future disasters. Hazard mitigation planning is a process that leads to the implementation of hazard mitigation actions. Tarrant County is familiar with the impact of the hazard on its residents, visitors, infrastructure, environment, and economy. This 2025 update to Tarrant County's Hazard Mitigation Action Plan (HazMAP) reaffirms its commitment to continually improving its countywide mitigation strategy and program.

The 2025 hazard mitigation planning process began when Tarrant County assembled a Planning Committee representing a cross section of stakeholders that supported the County for this plan update. The composition of the group was designed to foster FEMA's Whole Community doctrine, which is based on the premise that both the government and its residents are responsible for implementing mitigation initiatives and activities to support the other phases of emergency management.

The first task of the Planning Committee was to identify the natural, technological, and human-caused hazards of concern that affect the county. In doing so, the committee assessed the following:

- Vulnerability of populations
- Vulnerability of community-owned and leased natural and built assets
- Risks presented by these hazards to the assets

The next step involved thoroughly evaluating the County's current mitigation capabilities and updating the mitigation strategy. The strategy identified five overarching mitigation goals and related objectives that underpin the HazMAP developed to implement hazard mitigation initiatives. The planning team added two goals, one related to High Hazard Potential Dams (HHPDs) and actions to address the Fire Management Assistance Grant for seven goals. These are fully discussed in Section 4: Mitigation Strategy. The goals and objectives provide the framework for the committee to review mitigation actions included in the 2020 Plan and to identify new mitigation actions developed by the county and the jurisdictions to further increase community resilience during the five-year period covered by this plan.

Mitigation should form the foundation of all emergency management agency's plans and procedures. Emergency management agencies should adopt mitigation practices to reduce, minimize, or eliminate hazards in their communities. The Tarrant County HazMAP identifies the hazards faced by participating jurisdictions, vulnerabilities to these hazards, and mitigation strategies for the future. The plan fulfills the requirements of the Federal Disaster Mitigation Act, as administered by the Texas Division of Emergency Management (TDEM) and the Federal Emergency Management Agency (FEMA).

The planning area for this plan is Tarrant County, Texas (see Figure 1), and it includes the following jurisdictions:

- City of Arlington
- City of Azle
- City of Bedford
- City of Benbrook
- City of Blue Mound*
- City of Colleyville
- City of Crowley
- City of Dalworthington Gardens*
- Town of Edgecliff Village
- City of Euless
- City of Everman
- City of Forest Hill*
- City of Fort Worth
- City of Grapevine
- City of Haltom City
- City of Haslet
- City of Hurst
- City of Keller
- City of Kennedale*
- City of Lake Worth
- Town of Lakeside
- City of Mansfield
- City of North Richland Hills
- Town of Pantego*
- City of Richland Hills
- City of River Oaks
- City of Saginaw
- City of Southlake
- Unincorporated Tarrant County
- University of North Texas Health and Science Center
- City of Watauga
- Town of Westlake
- City of Westworth Village
- City of White Settlement

*Jurisdictions that did not participate in the 2025 Tarrant County HazMAP. Although these jurisdictions were not fully profiled, any available data was incorporated into the Tarrant County analyses.

Figure 1 provides an overview of Tarrant County's location in the State of Texas.

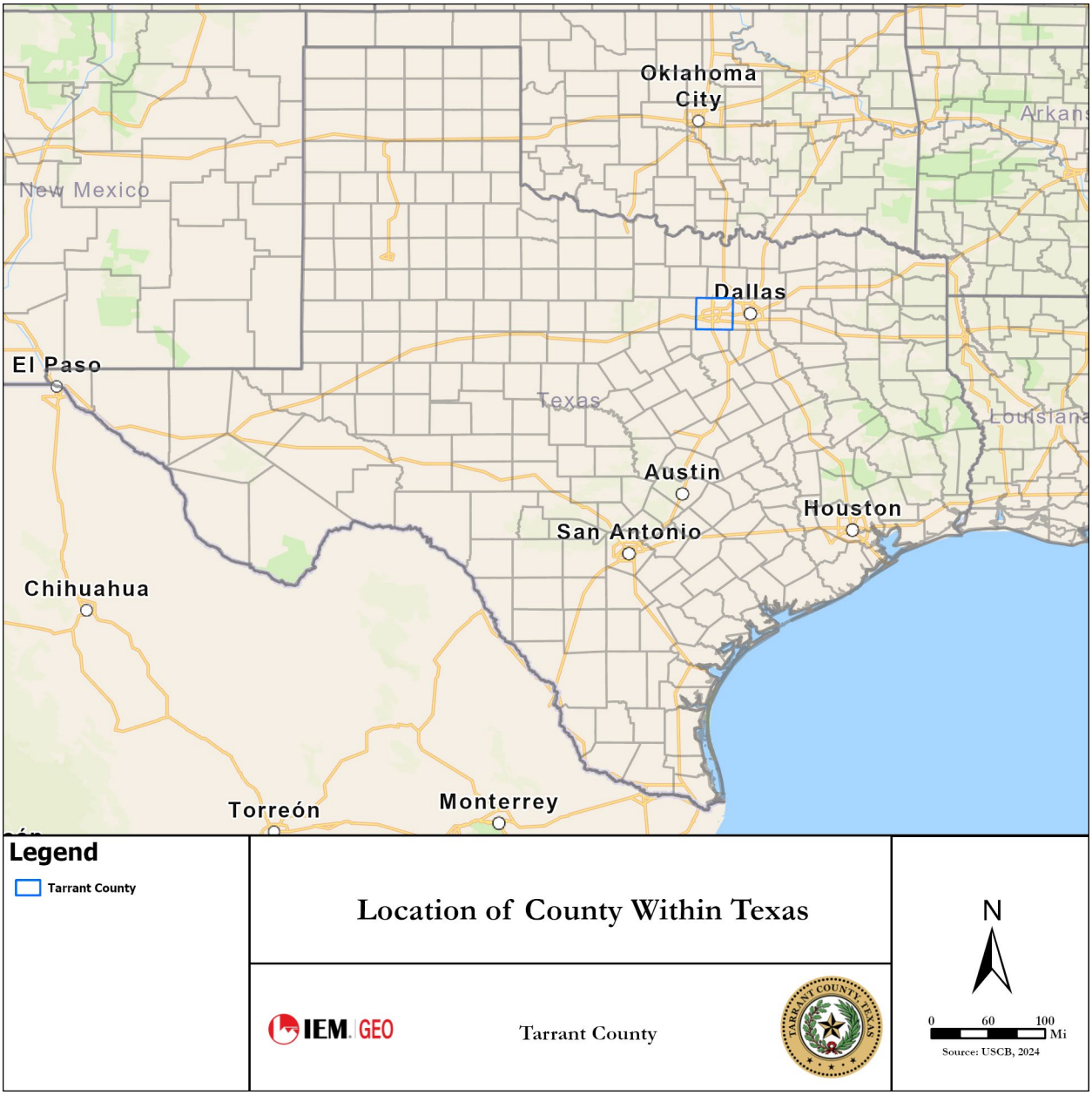

Figure 1: Location of Tarrant County in Texas

Figure 2 shows the locations of the jurisdictions, except the unincorporated areas of the county.

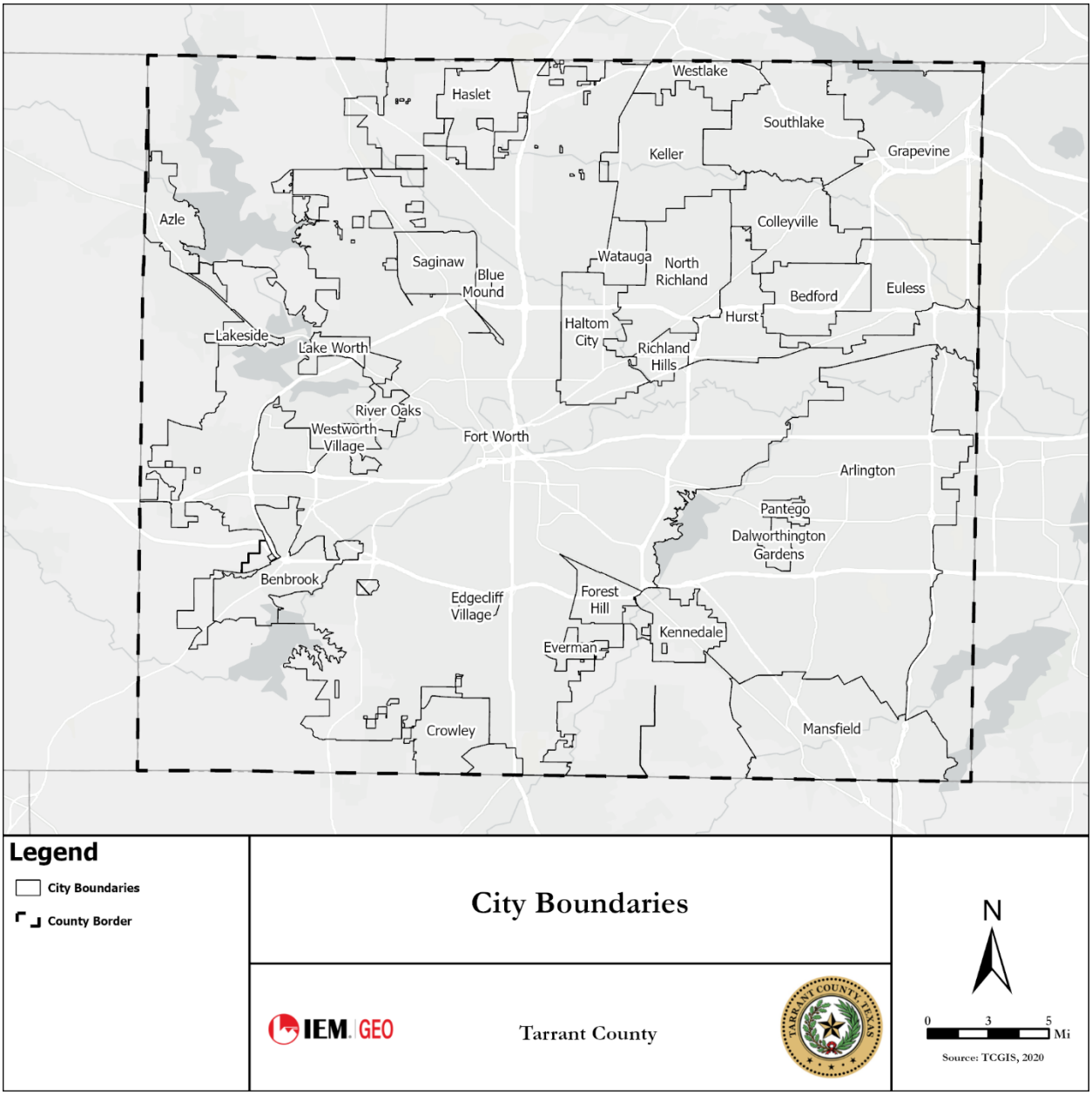

Figure 2: HazMAP Jurisdictions in Tarrant County

This HazMAP is the result of five years of updated studies, data collection, analysis, and community feedback. Representatives and citizens from participating jurisdictions provided feedback in public surveys to discuss the hazards their communities face and the vulnerabilities those hazards present. Representatives from each participating jurisdiction reviewed drafts of the HazMAP and added input to the mitigation strategies presented in the plan. Tarrant County citizens were also active participants in the development of the plan. Citizens participated in surveys that were advertised online on bulletin boards, and in newsletters to share their concerns about hazards faced in the community and how to mitigate the effects of these hazards.

All participants involved in this plan understand the benefits of developing and implementing mitigation plans and strategies. Elected officials, public safety organizations, planners, and many others have worked together to develop and implement this HazMAP, displaying that they have the vision to implement mitigation practices and therefore reduce the loss of life and property in their communities.

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Section 1: Introduction

The Tarrant County Hazard Mitigation Action Plan (HazMAP) fulfills the requirements of the Disaster Mitigation Act of 2000 (DMA 2000), which is administered by the Federal Emergency Management Agency (FEMA). DMA 2000 provides federal assistance to state and local emergency management entities to mitigate the effects of disasters. The HazMAP also encourages cooperation among various organizations across political subdivisions.

The 2025 HazMAP is an update of the 2020 FEMA-approved HazMAP. The title was changed from "Local Mitigation Action Plan" to "Hazard Mitigation Action Plan" to clearly specify the intent of the document. With each update, new challenges are identified and new strategies proposed, and when the plan is incorporated, it grows in complexity but without the loss of utility.

The content in this plan update is designed and organized to be as reader-friendly and functional as possible. The structure and format of this plan have changed significantly from the initial mitigation plan adopted in 2020. However, the quality of the information has been maintained.

This update fulfills the requirements of DMA 2000. The Tarrant County Hazard Mitigation Planning Team (HMPT) reviewed the evolution of the planning processes over the previous three years. This plan is the result of that effort.

The information in Section 3 reflects the impact of the hazards on all of Tarrant County, not solely on the participating jurisdictions. In addition, "Tarrant County" refers to the county as a whole and not solely to its unincorporated areas. The results of the vulnerability analysis and risk assessment, including historical events, are documented in the individual annexes of the participating jurisdictions.

Authority

The purpose of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended by DMA 2000, is "to reduce the loss of life and property, human suffering, economic disruption, and disaster assistance costs from natural disasters." Section 322 of the Act specifically addresses mitigation planning and requires state and local governments to prepare multi-hazard mitigation plans as a precondition for receiving FEMA mitigation grants.

Scope

The Tarrant County HazMAP encompasses all participating entities in Tarrant County, as noted in the Executive Summary. This plan identifies natural hazards that could threaten life and property in the communities. Some jurisdictions also address technological hazards, even though assessing them is not a requirement for this HazMAP. The scope of this plan includes both short- and long-term mitigation strategies, implementation actions, and possible sources of project funding to mitigate identified hazards.

Purpose

Tarrant County is susceptible to a number of natural hazards that can cause loss of life and property, economic hardship, and threats to public health and safety. Natural disasters cannot be prevented. However, their impact on people and property can be lessened through hazard mitigation measures. This HazMAP is intended to enhance and complement federal and state recommendations for the mitigation of natural and technological hazards in the following ways:

- Substantially reduce the risk of loss of life, injuries, and hardship from natural and technological disasters
- Improve public awareness of the need for individual preparedness and for building safer, more disaster-resilient communities
- Develop strategies for long-term community sustainability during community disasters
- Develop governmental and business continuity plans that will continue essential private sector and governmental operations during disasters

Mitigation planning is imperative to reduce the impact of disasters in Tarrant County. This plan is an excellent method for organizing Tarrant County's mitigation strategies. The implementation of the plan and its components is vital to preparing a community that is resilient to the effects of a disaster. The implementation of this HazMAP can reduce the loss of life and property and allow the participating communities to operate with minimal disruption of vital services to citizens. This HazMAP provides a risk assessment of the hazards to which Tarrant County is exposed, and it puts forth several mitigation goals and objectives based on that risk assessment.

This Tarrant County HazMAP was developed by the Tarrant County HMPT. It represents the collective efforts of citizens, elected and appointed government officials, business leaders, nonprofit organizations, and other stakeholders. This plan and timely updates of this plan will allow Tarrant County and participating jurisdictions to comply with DMA 2000 and its regulations, 44 CFR Part 201.6, thus establishing their eligibility to apply for federal aid for technical assistance and post-disaster hazard mitigation project funding. The update also prioritizes risks and vulnerabilities in an effort to minimize the effects of disasters in the participating communities.

Plan Organization

The 2025 Tarrant County HazMAP is organized into six sections to satisfy the mitigation requirements in 44 CFR Part 201.6. Four appendices provide the required supporting documentation. In addition, 27 cities and towns and the University of North Texas Health Science Center have prepared annexes. Tarrant County provided an annex that applies to County properties and the unincorporated areas of the county.

This HazMAP contains the following sections:

1. **Section 1: Introduction** – Describes the purpose of the Tarrant County HazMAP and introduces the mitigation planning process.

2. **Section 2: Planning Process** – Describes the planning process and organization for each participating jurisdiction, satisfying requirements 201.6(c)(1), 201.6(b)(2), 201.6(b)(1), 201.6(b)(3), 201.6(c)(4)(iii), and 201.6(c)(4)(i).
3. **Section 3: Hazard Identification and Risk Assessment** – Describes the hazards, their locations, previous occurrences, and jurisdictional profiles, satisfying requirements 201.6(c)(2)(i) and 201.6(c)(2)(ii).
4. **Section 4: Mitigation Strategy**– provides the jurisdiction's mitigation strategies and action items. It presents the mitigation goals and the action items associated with those goals for the prior HazMAP, if the jurisdiction was involved, and the goals and action items for this HazMAP. It fulfills requirements §201.6(c)(3)(ii)), §201.6(c)(3)(i)), §201.6(c)(3)(iv)), and §201.6(c)(3)(iii).
5. **Section 5: Plan Maintenance** – Describes plan monitoring, evaluating, and updating strategies, plan incorporation, and future public updates for each participating jurisdiction, satisfying requirements 201.6(c)(4)(i), 201.6(c)(4)(ii), and 201.6(c)(4)(iii).
6. **Section 6: Conclusion**
7. **Appendixes**
    - **Appendix A: Documentation from Planning and Public Meetings**
    - **Appendix B: Acronyms**
    - **Appendix C: Dam Profile Information (NOT PUBLIC)**
    - **Appendix D: Adoptions**
8. **Individual Jurisdictional Annexes**, as described below

To clarify terms, "section" refers to parts of the main body of this HazMAP, while "chapter" refers to parts of the jurisdictional annexes.

Structure of the Jurisdictional Annexes

The annexes were developed by the individual jurisdictions to provide a level of detail specific to the jurisdiction. Each annex contains five chapters.

- **Chapter 1** provides a brief introduction to the jurisdiction and contents of the annex.
- **Chapter 2** covers the planning process and those involved. It includes the plan development and adoption process and the organization of the planning effort, including Local Planning Team (LPT) members. This fulfills requirements §201.6(c)(1)), §201.6(b)(2)), §201.6(b)(1)), §201.6(b)(3)), §201.6(c)(4)(iii)), and §201.6(c)(4)(i).
- **Chapter 3** provides the hazard identification and risk assessment. The assessment includes the geographic area(s) affected, the probability of occurrence, the maximum probable extent, and vulnerability narratives, which identify points of vulnerability in each jurisdiction for each hazard.

In addition, Chapter 3 discusses the jurisdiction's compliance with the National Flood Insurance Program (NFIP). This fulfills requirements §201.6(c)(2)(i)), §201.6(c)(2)(ii)), §201.6(c)(2)(ii)(A)), §201.6(c)(2)(ii)(B)), §201.6(c)(2)(ii)(C)), and §201.6(c)(2)(iii).

- **Chapter 4** provides a summary of jurisdictional capabilities. It includes planning and regulatory capabilities, administrative and technical capabilities, financial capabilities, and education and outreach capabilities. It fulfills requirement §201.6(c)(3).
- **Chapter 5** provides the jurisdiction's mitigation strategies and action items. It presents the mitigation goals and the action items associated with those goals for the prior HazMAP, if the jurisdiction was involved, and the goals and action items for this HazMAP. It fulfills requirements §201.6(c)(3)(ii)), §201.6(c)(3)(i)), §201.6(c)(3)(iv)), and §201.6(c)(3)(iii).

Tarrant County Hazard Mitigation Strategy Maintenance Process

The Tarrant County HMPT, consisting of representatives from each participating jurisdiction, will continue to collaborate as a planning group. Primary contact will be through emails and conference calls, with strategy meetings occurring at least annually. The points of contact for the county and jurisdictions will jointly lead the plan maintenance and update process by:

- Assisting jurisdictional LPTs in updating their individual contributions to the county HazMAP
- Assisting LPTs that would like to begin their mitigation planning process
- Facilitating Tarrant County HazMAP meetings and disseminating information
- Collaborating in collecting and analyzing data for the countywide sections
- Requesting updates and status reports on planning mechanisms
- Requesting updates and status reports on mitigation action projects
- Assisting jurisdictions with mitigation grants
- Assisting jurisdictions with implementing mitigation goals and action projects
- Providing mitigation training opportunities
- Maintaining the documentation of local adoption resolutions for the Tarrant County HazMAP

Adopting the Tarrant County Hazard Mitigation Action Plan

Once the Tarrant County HazMAP has received FEMA "Approved Pending Local Adoption," each participating jurisdiction will take the Tarrant County HazMAP to its Commissioner's Court or City Council for final public comment and local adoption. A copy of the resolution will be inserted into the Tarrant County HazMAP and held on file at Tarrant County.

Section 2: Planning Process

Element A Requirements

FEMA	A1. Does the plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement 44 CFR § 201.6(c)(1)) A2. Does the plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process? (Requirement 44 CFR § 201.6(b)(2)) A3. Does the plan document how the public was involved in the planning process during the drafting stage and prior to plan approval? (Requirement 44 CFR § 201.6(b)(1)) A4. Does the plan describe the review and incorporation of existing plans, studies, reports and technical information? (Requirement 44 CFR § 201.6(b)(3)) E2. Was the plan revised to reflect changes in priorities and progress in local mitigation efforts? (Requirement 44 CFR § 201.6(d)(3)) HHPD1: Did the plan describe the incorporation of existing plans, studies, reports and technical information for HHPDs [High Hazard Potential Dams]?

Collaborative Process

During the planning process, jurisdictions were encouraged to work with neighboring jurisdictions within the county, local, and regional agencies and other mitigation partners to develop a unified approach to mitigation and address situations that could affect one another. Neighboring communities were outreached to via email and the evidence in located in Appendix A.

Bringing together mitigation strategies from the unincorporated area of the county and its 29 participating jurisdictions into a unified plan is a strategy that offers a model for countywide coordination. The Tarrant County HMPT comprised leaders from each participating jurisdiction's LPT and other relevant agencies. Each LPT provided local hazard information and capabilities. Each jurisdiction's vulnerabilities and mitigation needs were explicitly recognized in the strategy, along with those of the overall county.

Participating jurisdictions emailed the stakeholders listed in Table 1, inviting them to participate in the mitigation planning process and attend public meetings via their websites and public flyers. Stakeholders were encouraged to review the plan and provide relevant information and feedback.

Table 1: Jurisdiction Stakeholders

Organization Represented	Position
City of Arlington	Emergency Management Administrator
City of Arlington	Emergency Management Coordinator (EMC)
City of Azle	EMC
City of Azle	Fire Chief/Fire Marshal
City of Bedford	Deputy Chief Fire Marshal
City of Benbrook Fire Department	Assistant Fire Chief/Emergency Operations Coordinator (EOC)
City of Blue Mound	Fire Chief
City of Burleson	EOC Manager
City of Colleyville	EMC
City of Crowley	Deputy Fire Chief/Fire Marshal
City of Crowley	Public Safety Chief
City of Euless	EMC
City of Everman	Fire Chief
City of Everman Fire Department	Assistant Fire Chief
City of Forest Hill Fire Department	Fire Chief, EMC, Fire Marshal
City of Fort Worth	EMC
City of Fort Worth	Fire Chief/EMC
City of Fort Worth	Emergency Management Coordinator
City of Fort Worth Fire Department – Office of Emergency Management	Emergency Management Officer 2
City of Grand Prairie	Assistant Director/EMC
City of Grand Prairie	EMC
City of Grapevine	Emergency Management Coordinator
City of Haltom City	Director of Community Preparedness and Outreach/ EMC
City of Haltom City	EM Analyst
City of Haslet	EMC
City of Holton City	Director of Community Preparedness and Outreach/EMC
City of Hurst	Assistant City Manager
City of Hurst	Assistant Fire Chief
City of Hurst	Assistant to the City Manager
City of Hurst	Director of Utilities
City of Hurst	EMC

Organization Represented	Position
City of Hurst	Fire Chief
City of Hurst	City Engineer
City of Hurst	Director of Information Technology (IT)
City of Hurst	Executive Director of Public Works
City of Hurst Fire Department	Assistant Fire Chief
City of Hurst Fire Department	Captain/Fire Inspector
City of Hurst Fire Department	Fire Marshal
City of Hurst Police Department	Assistant Police Chief
City of Keller	Fire Chief
City of Kennedale	Fire Chief/EMC
City of Lake Worth Fire Department	Fire Chief
City of Lake Worth Fire Department	Assistant Fire Chief
Town of Lakeside	EMC
City of Mansfield	EMC
City of Mansfield	Assistant EM
City of North Richland Hills	EMC
City of Richland Hills	Fire Chief
City of Richland Hills	Fire Marshal/EMC
City of River Oaks	EMC
City of Saginaw	Fire Chief
City of South Lake	Fire Chief
City of Samson Park	Fire Chief/EMC
City of Watauga	Fire Chief/EMC
City of Weatherford Fire Department	Administrative Assistant to the Fire Marshal
Town of Westlake	Fire Chief
City of Westworth Village	City Administrator/EMC
City of White Settlement	Police Chief
City of White Settlement Fire Department	Fire Chief
County of Denton	EM Director/Coordinator
County of Tarrant	Assistant EMC
County of Wise – Office of Emergency Management	Mitigation and Recovery Coordinator
Dallas – Fort Worth Airport	Senior IT Manager

Organization Represented	Position
Dallas – Fort Worth Airport	Sr. Emergency Manager
Dallas – Fort Worth Airport	Emergency Manager (EM)
Southlake Emergency Management	Emergency Manager Specialist
The North Central Texas Council of Governments (NCTCOG)	Director EM – Preparedness
Town of Edgecliff Village	Fire Chief/EMC
Town of Westover Hills	Chief of Police
University of North Texas Health Science Center	After Action Review (AAR) Manager

Hazard Mitigation Planning Team Points of Contact

Table 2 lists members of the Tarrant County HMPT. During this plan update, the HMPT members were also the point(s) of contact for their respective jurisdictions. LPT members for each jurisdiction are in their respective jurisdictional annexes.

Table 2: Tarrant County HMPT Members

Jurisdiction	Job Title	Role in the HMPT
Arlington	Emergency Management Administrator	Jurisdictional information
Arlington	Emergency Management Coordinator	Jurisdictional information
Azle	Emergency Management Coordinator	Jurisdictional information
Bedford	Deputy Chief of Emergency Operations	Jurisdictional information
Benbrook	Assistant Fire Chief/Emergency Management Coordinator	Jurisdictional Information
Colleyville	Emergency Management Coordinator	Jurisdictional information
Crowley	Emergency Management Coordinator	Jurisdictional information
Edgecliff Village	Fire Chief/Emergency Management Coordinator	Jurisdictional information
Euless	Emergency Management Coordinator	Jurisdictional information
Everman	Director of Emergency Services	Jurisdictional information
Fort Worth	Emergency Management Coordinator	Jurisdictional information
Grapevine	Emergency Management Coordinator	Jurisdictional information
Haltom City	Emergency Management Coordinator	Jurisdictional information
Haslet	Emergency Management Coordinator	Jurisdictional information

Jurisdiction	Job Title	Role in the HMPT
Hurst	Fire Chief/Emergency Management Coordinator	Jurisdictional information
Keller	Fire Chief/Emergency Management Coordinator	Jurisdictional information
Lake Worth	Fire Marshal/Emergency Management Coordinator	Jurisdictional information
Lakeside	Emergency Management Coordinator	Jurisdictional information
Mansfield	Emergency Management Coordinator	Jurisdictional information
North Richland Hills	Emergency Management Coordinator	Jurisdictional information
Richland Hills	Fire Chief/Emergency Management Coordinator	Jurisdictional information
River Oaks	Emergency Management Coordinator	Jurisdictional information
Saginaw	Fire Chief/Emergency Management Coordinator	Jurisdictional information
Southlake	Emergency Management Coordinator	Jurisdictional information
University of North Texas Health Science Center (UNTHSC)	Associate Director, Emergency Management and Business Continuity	Jurisdictional information
Unincorporated Tarrant County	Emergency Management Coordinator	Jurisdictional information
Watauga	Emergency Management Coordinator	Jurisdictional information
Westlake	Fire Chief/Emergency Management Coordinator	Jurisdictional information
Westworth Village	Emergency Management Coordinator	Jurisdictional information
White Settlement	Fire Chief/Emergency Management Coordinator	Jurisdictional information

Public Involvement

For Tarrant County, public involvement was a key priority, with a focus on ensuring accessibility and inclusivity. To gather feedback from residents on what matters most to them regarding hazard mitigation, a survey was posted by the County and all participating jurisdictions. The survey was made available in both English and Spanish to increase accessibility for non-English-speaking residents. Special emphasis was placed on reaching vulnerable and disadvantaged populations, who are often the most affected by hazards. Through targeted outreach efforts, including distributing the survey via social media, we ensured these groups had a voice in the process. The feedback gathered from this outreach will directly inform the development of mitigation strategies that address the unique needs and concerns of these populations.

Appendix A in this HazMAP documents the supporting documentation, advertisements, and details of this meeting and other meetings or outreach strategies.

Existing Data and Plans

Existing hazard mitigation information and other relevant HazMAPs were reviewed during the development of this plan. Data was gathered through many sources, including geographic information systems (GIS). The intent of reviewing existing material was to identify existing data and information, shared objectives, and past and ongoing activities that can help inform the mitigation plan. Review also helps identify the existing capabilities and planning mechanisms to implement the mitigation strategy. Table 3 outlines the sources used to collect data for the plan:

Table 3: Data Collection Sources

Data Source	Data Incorporated	Purpose
County appraisal data, census data, city land use data	Population and demographics	Population counts, parcel data, and land use data
National Centers for Environmental Information (NCEI)	Hazard occurrences	Previous event occurrences and mapping for hazards
Texas Forest Service/Texas Wildfire Risk Assessment Summary Report	Wildfire threat and urban interface	Mapping and wildfire vulnerability
National Dam Inventory	Dam information	High hazard dam list
Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Map (DFIRM) Flood Zones, National Flood Insurance Program (NFIP) studies	Flood zone maps and NFIP information	Geographic information systems (GIS) mapping of flood zones and NFIP data
October 2017 NFIP Flood Insurance Manual Change Package	NFIP Information	Repetitive Loss Properties and Community Rating System ratings
State of Texas Hazard Mitigation Plan, 2013, 2018, 2023	Hazards and mitigation strategy	Support the goals of the state
2020 Tarrant County Hazard Mitigation Action Plan (HazMAP)	All sections	This is an update of that plan
Hazard Mitigation: Integrating Best Practices into Planning	Planning Process	Use proven techniques in developing the HazMAP
Environmental Protection Agency (EPA) Superfund National Priority List	Protected sites	Risk assessment: identify critical areas
National Register of Historic Places	Historic districts	Risk assessment
Texas Parks and Wildlife List of Rare Species	Endangered or protected species	Risk assessment

Previous Plan Incorporation

The previous hazard mitigation action plan was integrated into various planning mechanisms across the jurisdictions, reinforcing its role in guiding resilience-building efforts. Most jurisdictions incorporated mitigation strategies into HMGP grant applications to ensure consistent alignment with broader community goals. Land use and zoning ordinances were updated to reflect hazard-specific

considerations, such as floodplain management and wildfire risk reduction. In addition, development review processes began including hazard vulnerability assessments, allowing jurisdictions to evaluate risks during permitting and project approval stages (see Table 4). This cross-integration ensured that mitigation actions were not siloed but embedded into daily governance and long-term planning.

Table 4: Methods of Integrating the Previous HazMAP into Jurisdictions' Plans

Jurisdiction	Grant Applica-tions	Permitting Process	Local Emergency Planning Committee	Emergency Operations Plans	Land Use/ Develop-ment Plans	No Plan Incorpora-tion
Arlington	Generator HMGP Grant Application					
Azle						X
Bedford						X
Benbrook						
Colleyville	Generator HMGP Grant Application					
Crowley	Generator HMGP Grant Application					
Edgecliff Village						X
Euless	Generator HMGP Grant Application					
Everman						X
Fort Worth	Generator HMGP Grant Application					
Grapevine						X
Haltom City	Generator HMGP Grant Application					
Haslet						X
Hurst	Generator HMGP					

Jurisdiction	Grant Applica-tions	Permitting Process	Local Emergency Planning Committee	Emergency Operations Plans	Land Use/ Develop-ment Plans	No Plan Incorpora-tion
	Grant Application					
Keller						X
Lake Worth						X
Lakeside						X
Mansfield						X
North Richland Hills	Generator HMGP Grant Application					
Richland Hills	Warning Systems HMGP Grant Application					
River Oaks						X
Saginaw						X
Southlake	Generator HMGP Grant Application					
University of North Texas Health Science Center (UNTHSC)						X
Unincorpo-rated Tarrant County	Updated Plan HMGP Grant Application					
Watauga						X
Westlake						X
Westworth Village						X
White Settlement						

Timeframe

The planning process for the update of the Tarrant County HazMAP was approximately 4 months. Table 5 shows the timeline followed.

Table 5: Timeframe for Update of Tarrant County Hazard Mitigation Action Plan

Activity	Time Period
Hazard Mitigation Planning Team Planning Meeting	August 23, 2024
Created planning teams	August–September
Capabilities assessment	August–September
Hazard identification and risk assessment	August–September
Public outreach completed	August–October
Mitigation strategy (goals and action items) reviewed	August–September
Reviewed Hazard Mitigation Action Plan (HazMAP) draft	October–November

Activities were either led or monitored by IEM and stakeholders for each jurisdiction in the plan, and public outreach strategies were conducted by the participating jurisdictions. The details of these activities are in the individual annexes of the jurisdictions.

Planning Meetings

During the planning process, each LPT met to discuss relevant information from the jurisdiction and to review the plan's objectives and progress. The goals of these meetings were to gather information and provide guidance for the jurisdictions throughout the planning stages.

Table 6 is a snapshot of the meeting facilitated by IEM and the HazMAP participants.

Table 6: Planning Meetings Snapshot

Date	Meeting	Location
August 23, 2024	Kickoff meeting	Tarrant County Northeast Courthouse

Section 3: Hazard Identification and Risk Assessment

The Tarrant County HazMAP is a tool to assist in the identification and documentation of natural hazards faced by the county and participating jurisdictions. Hazard profiles were created by compiling data from the previous federally declared disasters in Tarrant County, historical and potential events and damage assessments in Tarrant County, hazard data, and geographic information.

Assessing the risks posed by natural hazards is crucial in understanding their potential impact on life, property, and the economy. Risk assessment aims to identify, as much as possible, a community's qualitative and quantitative vulnerabilities based on available data. It provides a better understanding of the impacts of natural disasters on the community. It is a foundation for developing and prioritizing mitigation actions, as outlined in Section 4: Mitigation Strategy. The goal is to reduce damage and loss from natural disasters by improving preparedness and response times and allocating resources to the most vulnerable areas. This risk assessment followed the methodology described in FEMA's Local Mitigation Planning Handbook 2023, which outlines a five-step process:

1. *Identify hazards*: This step helps clarify hazards in the planning area.
2. *Describe hazards*: This step includes gathering more information about the hazards. It examines where they can occur, how impactful they have been, and how often and with what intensity they might occur.
3. *Identify community assets*: This step examines which assets are most vulnerable to loss during a disaster. It must include changes in development that have taken place since the previous plan was created.
4. *Analyze impacts*: This step describes how each hazard could affect the assets of each community.
5. *Summarize vulnerability*: This step brings all the analysis together. It uses risk assessment to draw conclusions. From these conclusions, the planning team can develop a strategy to increase the resilience of residents, businesses, the economy, and other vital assets.

The information gathered during the planning process for the *Tarrant County Multi-Jurisdiction Hazard Mitigation Action Plan* using the aforementioned five steps has been incorporated into this Risk Assessment section, which includes the following information:

Hazard Identification – identifies and prioritizes the natural hazards threatening Tarrant County and its jurisdictions and provides a discussion on vulnerability assessment.

Hazard Profiles – describe each natural hazard threatening Tarrant County and its jurisdictions. Information includes location; extent, magnitude, and/or severity; previous occurrences; and the probability of future occurrences. Each profile includes a discussion of the possible impacts of climate trends and variations.

Community Assets – identifies the resources in Tarrant County and its jurisdictions at risk of hazards. This includes people, structures, community lifelines, and other critical facilities; natural, historic, and cultural resources; the economy; and other activities that have value to the community.

Analysis of Impacts – identifies where assets are vulnerable and describes the potential impacts of the hazards.

Conclusions on Vulnerability – summarizes information from the hazard profiles, the vulnerability of assets, changes in development, and potential impacts and losses to help Tarrant County and its jurisdictions understand the most significant risks and vulnerabilities.

Hazard Identification

Of the 15 hazards identified in the State of Texas Hazard Mitigation Plan (SHMP), the HMPT identified 9 that could affect participating jurisdictions in Tarrant County. Coastal erosion, land subsidence, and hurricane/tropical storm were not profiled because of their extremely low risk to the participating jurisdictions.

Drought, earthquakes, expansive soils, extreme heat, thunderstorms, tornadoes, and winter storms have a countywide impact. Wildfires are most likely a threat to jurisdictions that are rural or have undeveloped land. Flooding can also occur anywhere in the county, but it is most likely a threat to jurisdictions containing 100-year floodplains or bodies of water.

The hazards identified by the Tarrant County HMPT are as follows:

- Civil Unrest
- Cyber Terrorism
- Dam Failure
- Drought
- Earthquake
- Expansive Soils
- Extreme Heat
- Flood
- Technological Hazard
- Thunderstorm
- Tornado
- Wildfire
- Winter Storms

According to the previous HazMAP, the definition of a thunderstorm includes hail, high winds, and lightning. These individual hazards in a thunderstorm are not considered separately.

Participating jurisdictions understand that identifying technological hazards is not required for a mitigation plan, but some jurisdictions chose to do so voluntarily. The ranking of natural hazards and technological hazards will remain separate in this HazMAP.

A detailed profile has been developed for each of the identified hazards in the remainder of Section 3. These profiles address the following details for each hazard:

- Location and Extent
- Previous Historical Occurrences
- Probability of Future Events
- Impacts of Climate Trends and Variation
- Vulnerability Assessment
- Development Trends

Ranking and Prioritizing Hazards

Each participating jurisdiction conducted a risk assessment and prioritized the hazards affecting its planning area, and it determined its best course of action. This information, along with historical events, climate change, development trends, vulnerabilities, probability, and impacts, is documented in the individual annexes. Each jurisdiction ranked potential hazards in order of risk, with 1 being the highest. When ranking hazards, the jurisdictions used the following guidance:

Geographic Area Affected

- **Negligible**: Less than 10 percent of the planning area (the entire [the University of North Texas Health Science Center]).
- **Limited:** 10 to 25 percent of the planning area.
- **Significant:** 25 to 75 percent of the planning area.
- **Extensive:** 75 to 100 percent of the planning area.

Probability of Future Occurrence

- **Unlikely:** Event possible in the next 10 years.
- **Occasional:** Event possible in the next 5 years.
- **Likely:** Event probable in the next 3 years.
- **Highly Likely:** Event probable in the next year.

MAXIMUM PROBABLE EXTENT

(Magnitude/Strength of Hazard using the extent scale in Table 7)

- **Minor:** Limited classification on scientific scale, slow speed of onset, or short duration of event.
- **Medium:** Moderate classification on scientific scale, moderate speed of onset, or moderate duration of event.
- **Major**: Severe classification on scientific scale, fast speed of/immediate onset, or long duration of event.

Table 7: Extent Scale for Natural Hazards

Hazard	Minor	Medium	Major
Drought	Presence-Sensing Device Initiation (PDSI) -1.99 to 1.99+	PDSI -2.00 to -2.99	PDSI -3.00 to -5.00
Earthquake	Mercalli Scale: I–V; Richter Scale: 0–4.8	Mercalli Scale: VI–VII; Richter Scale: 4.9–6.1	Mercalli Scale: VIII–XII; Richter Scale: 6.2–8.1+
Expansive Soils	EI Expansion Potential: 21–50 (Low); 0–21(Very Low)	EI Expansion Potential: 51–90 (Medium)	EI Expansion Potential: 91–130 (High) >130 (Very High)
Flooding	Outside of 100-yr and 500-yr flood zones, Zone A, AE, X	500-yr flood zone, Zone X	100-yr flood zone, Zone AE
Extreme Heat	Heat Index: 80 °F–105 °F	Heat Index: 105 °F–129 °F	Heat Index: >130 °F
Thunderstorm	Hail: H0–H4, 5–40mm; Wind Force: 0–3; Knots: <1–10 lightning activity level (LAL): 1–2	Hail: H5–H6, 30–60mm; Wind Force: 4–6; Knots: 11–27; LAL: 3–4	Hail: H7–H10, 50–>100mm; Wind Force: 8–12; Knots: 28–64+ LAL: 5–6;
Tornado	EF0	EF1–EF2	EF3–EF5
Wildfire	Keetch-Byram Drought Index (KBDI): 0–200	KBDI: 200–400	KBDI: 600–800
Winter Storms	Temperature: 40 °F to 35 °F Wind chill 36 °F to 17 °F	Temperature: 30 °F to 45 °F; Wind chill 25 °F to -4 °F	Temperature: 15 °F to -20 °F; Wind chill 7 °F to -98 °F

Table 8 shows the results of the hazard ranking by the jurisdictions.

Table 8: Hazard Risk Ranking by Jurisdiction

Jurisdiction	Drought	Earthquake	Expansive Soils	Extreme Heat	Flooding	Thunderstorms	Tornadoes	Wildfires	Winter Storms
Arlington	5	9	8	6	1	3	2	7	4
Azle	7	9	8	6	2	3	1	5	4
Bedford	6	8	2	5	4	1	3	N/A	7
Benbrook	4	10	9	8	5	1	2	7	3
Colleyville	8	9	5	6	2	1	3	7	4
Crowley	5	9	8	7	3	2	1	6	4
Edgecliff Village	8	9	7	4	5	1	2	3	6
Euless	6	9	5	4	3	1	2	8	7
Everman	7	9	5	4	1	3	2	8	6
Fort Worth	7	9	8	6	2	1	4	5	3
Grapevine	5	9	8	7	3	2	1	6	4
Haltom City	6	7	5	4	1	3	2	9	8
Haslet	7	9	4	6	5	1	2	8	3
Hurst	8	9	5	4	3	2	1	7	6
Keller	8	9	5	7	4	2	1	6	3
Kennedale	5	9	8	7	3	2	1	6	4
Lake Worth	7	8	4	2	5	1	3	N/A	6
Lakeside	4	9	5	3	7	1	2	6	8
Mansfield	6	9	3	7	2	1	4	8	5
North Richland Hills	2	3	4	5	1	6	7	8	9
Richland Hills	4	8	2	3	5	1	6	9	7
River Oaks	8	9	7	3	6	1	2	5	4
Saginaw	8	5	3	7	6	2	1	N/A	4
Southlake	5	9	8	4	2	3	1	7	6
Tarrant County	6	9	7	4	3	1	2	5	8
UNTHSC	6	8	5	4	7	1	2	9	3
Watauga	3	8	5	4	7	1	2	N/A	6
Westlake	7	8	9	6	5	1	2	3	4
Westworth Village	8	7	6	5	4	1	2	N/A	3
White Settlement	7	9	8	6	2	3	1	5	4

Major Disaster Declarations since the 2013 Hazard Mitigation Plan

Table 9 lists the major disaster declarations that have occurred since 2013.

Table 9: Tarrant County Major Disaster Declarations since 2013

Disaster Declaration Code	Incident Period	Date Declared	Description
DR-4159	October 30–31, 2013	December 29, 2013	Severe storms and flooding
DR-4136	April 17–20, 2013	August 2, 2013	West Fertilizer Co. explosion
DR-4223	May 4–June 23, 2015	May 29, 2015	Severe storms, tornadoes, straight-line winds, and flooding
DR-4245	October 22–31, 2015	November 25, 2015	Severe storms, tornadoes, straight-line winds, and flooding
DR-4255	December 26, 2015–January 21, 2016	February 9, 2016	Severe winter storms, tornadoes, straight-line winds, and flooding
DR-4266	March 7–29, 2016	March 19, 2016	Severe storms, tornadoes, and flooding
DR-4269	April 17–30, 2016	April 25, 2016	Severe storms and flooding
DR-4272	May 26–June 24, 2016	June 11, 2016	Severe storms and flooding
DR-4332	August 23–September 15, 2017	August 25, 2017	Hurricane Harvey
DR-4485	January 20–May 11, 2023	March 25, 2020	COVID-19 pandemic
DR-4586	February 11–21, 2021	February 19, 2021	Severe winter storms

Vulnerability Assessment

"Vulnerability" is defined as the conditions determined by physical, social, economic, and environmental factors or processes that increase the susceptibility of an individual, a community, assets, or systems to the impacts of hazards.[1] The participating jurisdictions have considered the possible effects on population, economy, existing and future structures, improved property, critical facilities and infrastructure, and the natural environment for each hazard.

A vulnerability assessment is a detailed analysis of a community's potential losses in a disaster. This assessment is particularly useful for decision makers, such as county and city personnel, who must choose how to balance mitigation costs against the potential harm to residents and property. The assessment provides a standardized approach to measuring a community's exposure to natural hazards.

[1] World Health Organization, "Vulnerability," Vulnerability and Vulnerable Populations (who.int).

It helps identify the hazards and regions that should be given priority for disaster resilience efforts. By evaluating the assets at risk, hazard mitigation resources can be allocated where they are most needed, using the information in the hazard profiles.

Hazard mitigation analysts require quantitative and qualitative information for each hazard to ensure a comprehensive vulnerability assessment. Quantitative data are obtained through an exposure analysis, which helps determine the number of assets at risk from a particular hazard. In cases where hazards cannot be measured quantitatively, qualitative data can help to describe how the hazard could impact the region. This allows analysts to gain valuable insights beyond the number of assets at risk. By combining quantitative and qualitative data, analysts can fully understand the risks associated with each hazard and develop appropriate mitigation strategies.

The hazard exposure analysis was created using the most reliable and current data, following the methodology outlined in the FEMA Local Mitigation Planning Handbook of May 2023. This handbook provides a comprehensive framework for identifying and evaluating hazards, estimating potential losses, and developing risk mitigation strategies. The analysis was conducted with great care and precision to ensure validity and accuracy.

A detailed vulnerability assessment was conducted to identify the potential effects of hazards in Tarrant County. The assessment covered various natural hazards, such as drought, flood, and dam failure, earthquakes, expansive soils, extreme heat, thunderstorm, tornado, wildfire, winter storms, and human-made or technological hazards, such as civil unrest, cyber terrorism, and technological hazards. Geospatial data were critical in determining the assets at risk in each hazard zone. By overlaying the natural hazard's spatial footprint on a map of population and assets, a geospatial analysis was conducted to identify the areas of exposure and vulnerability of the assets. It is essential to have spatial information on these hazards to accurately assess the level of risk and potential impacts on the assets.

National Risk Index

The National Risk Index (NRI) is an online tool that leverages available natural hazard data and community risk factors (CRFs) to provide a baseline risk measurement for each United States county and census tract. This plan incorporates NRI values to better understand the factors contributing to the natural hazard risk in Tarrant County. The NRI incorporates both percentiles ranking scores and a qualitative rating for 3 metrics:

- **Expected Annual Loss** (EAL) represents the average economic loss in dollars from natural hazards each year based on exposure, annualized frequency, and historic loss ratios.
- **Social Vulnerability** is a measure of the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood.
- **Community Resilience** is the ability of a community to prepare for, adapt to, and withstand and recover from natural hazards.

Each profiled hazard will provide details on the NRI scores for Tarrant County to provide insight into risk relative to other communities.

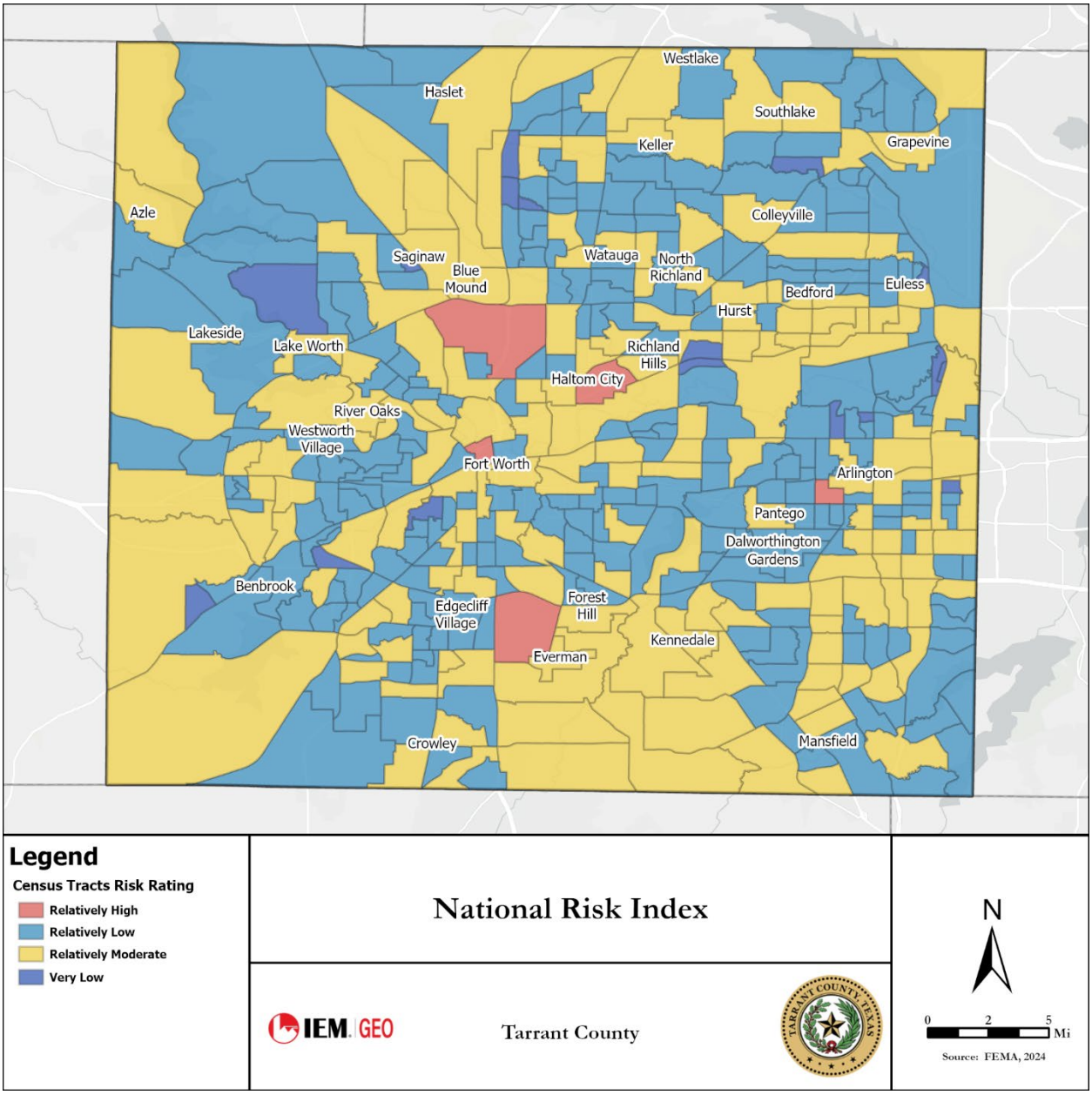


Figure 3: National Risk Index Score by Census Tract for Tarrant County

Critical Facilities

When evaluating the potential impacts of hazards on a community, it is important to identify what community assets could be affected by those hazards. Geospatial data were critical in determining the assets at risk in each jurisdiction in the planning area. This information included the vital infrastructure of the cities and county, such as utilities, government-owned facilities, schools, and other essential facilities that serve the community. A list of critical facilities was compiled, primarily using Homeland Infrastructure Foundation-Level Data. These facilities were identified based on the fundamental functions they provide to the community. Table 10 summarizes the types of facilities and the number of each type for each participating jurisdiction in this plan update. Figure 4 through Figure 11 are maps of Tarrant County displaying the locations of these critical facilities. Information regarding critical facilities and community assets is expanded upon in the jurisdictional annexes.

Table 10: Critical Facilities by Jurisdiction

Jurisdiction	Fire Stations	Law Enforcement	Hospitals	Emergency Operation Centers	Power Plants	Mobile Home/ RV	Nursing Homes	Urgent Care	Child Care	Airports	Schools	Jurisdiction Facility Total
Arlington	17	4	12	1	1	15	48	8	109	1	128	**344**
Azle	1	1	1	0	0	1	5	0	6	0	11	**26**
Bedford	3	1	3	1	0	0	12	0	13	0	14	**47**
Benbrook	1	1	0	0	0	0	2	0	6	0	2	**12**
Blue Mound	1	2	0	0	0	0	0	0	0	0	0	**3**
Colleyville	3	1	1	0	0	1	4	1	12	0	13	**36**
Crowley	2	1	0	0	0	1	2	0	10	0	9	**25**
Dalworthington Gardens	1	1	0	0	0	0	0	0	0	0	1	**3**
Edgecliff Village	1	0	0	0	0	0	0	0	0	0	1	**2**
Euless	3	1	0	1	0	1	2	0	8	0	17	**33**
Everman	1	1	0	0	0	0	0	0	2	0	8	**12**
Forest Hill	1	1	0	0	0	0	0	0	3	0	0	**5**
Fort Worth	38	14	26	1	6	58	98	10	253	5	327	**836**
Grapevine	6	1	2	0	0	6	8	2	11	1	14	**51**
Haltom City	3	1	0	2	0	1	2	0	10	0	17	**36**
Haslet	1	0	0	0	0	0	0	0	10	0	12	**23**
Hurst	3	1	2	1	0	4	2	1	11	0	10	**35**
Keller	3	1	2	0	0	5	25	1	22	0	31	**90**
Kennedale	1	1	0	0	0	2	1	0	3	0	5	**13**

Jurisdiction	Fire Stations	Law Enforcement	Hospitals	Emergency Operation Centers	Power Plants	Mobile Home/ RV	Nursing Homes	Urgent Care	Child Care	Airports	Schools	Jurisdiction Facility Total
Lake Worth	1	1	0	0	0	0	2	0	3	0	5	**12**
Mansfield	4	3	5	0	0	6	12	1	23	0	27	**81**
North Richland Hills	5	2	1	2	0	2	8	0	21	0	20	**61**
Richland Hills	1	2	0	0	0	0	3	0	5	0	2	**13**
River Oaks	1	1	0	0	0	0	0	0	3	0	0	**5**
Saginaw	2	1	0	0	0	0	2	0	13	1	6	**25**
Southlake	2	1	2	0	0	0	7	0	15	0	17	**44**
Watauga	1	1	0	0	0	0	2	0	7	0	4	**15**
Westworth Village	1	1	0	0	0	0	1	0	1	0	0	**4**
Dallas–Fort Worth International Airport	2	0	0	0	0	0	0	0	0	0	0	**2**
Lakeside	0	1	0	0	0	0	0	0	0	0	0	**1**
Westlake	1	2	0	0	0	0	0	0	1	0	2	**6**
Unincorporated County	3	9	0	0	0	4	0	0	0	1	0	**17**
University of North Texas	0	1	0	0	0	0	0	0	0	0	1	**2**
University of Texas at Arlington	0	1	0	0	0	0	0	0	0	0	1	**2**
White Settlement	1	3	0	2	0	5	2	0	3	0	16	**16**
Facility Type Total	**114**	**61**	**57**	**9**	**7**	**107**	**248**	**24**	**581**	**9**	**705**	**1922**

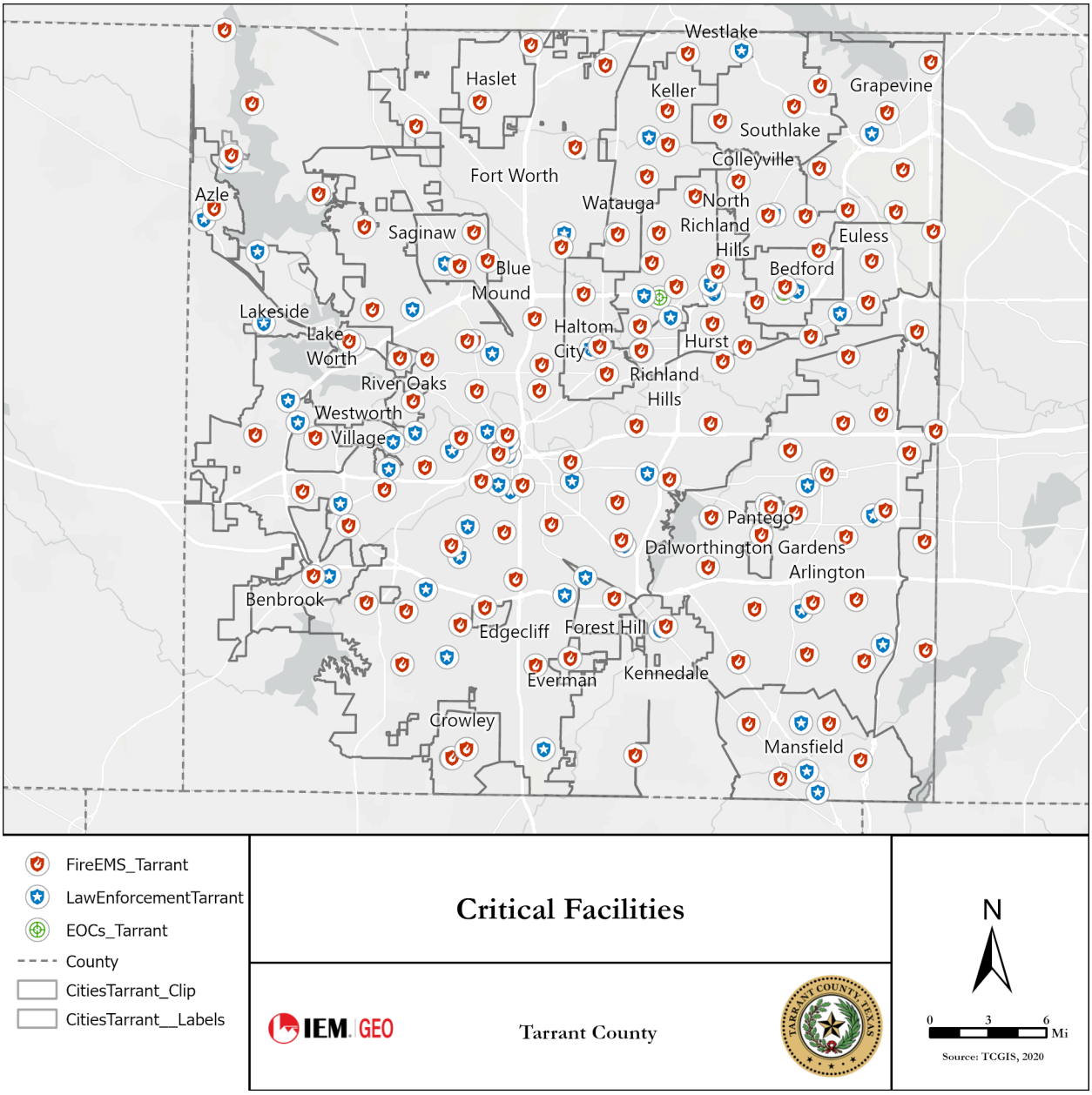


Figure 4: Locations of Fire Stations and Law Enforcement Facilities, Tarrant County

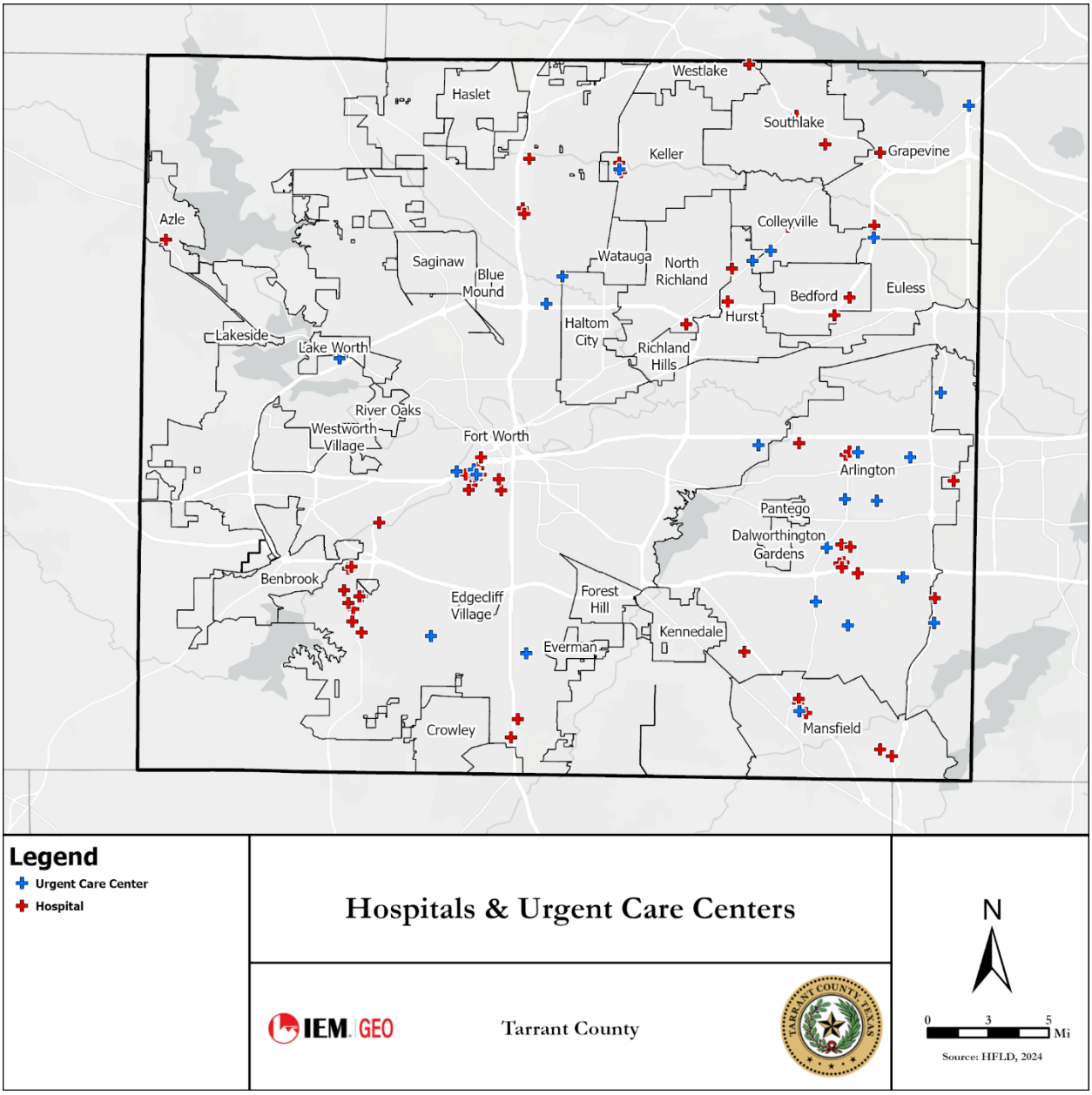


Figure 5: Locations of Hospitals and Urgent Care Centers in Tarrant County

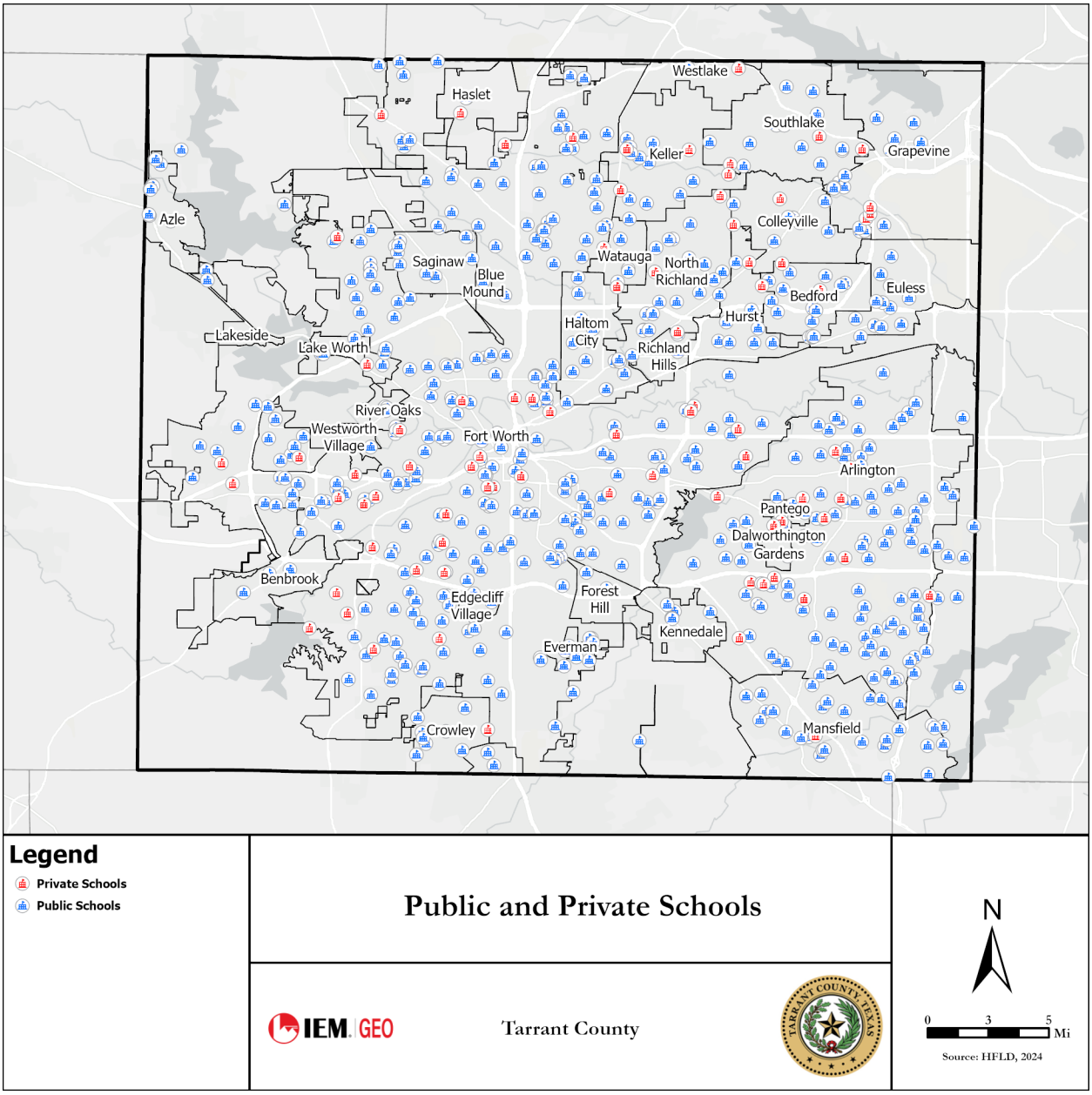


Figure 6: Locations of Schools in Tarrant County

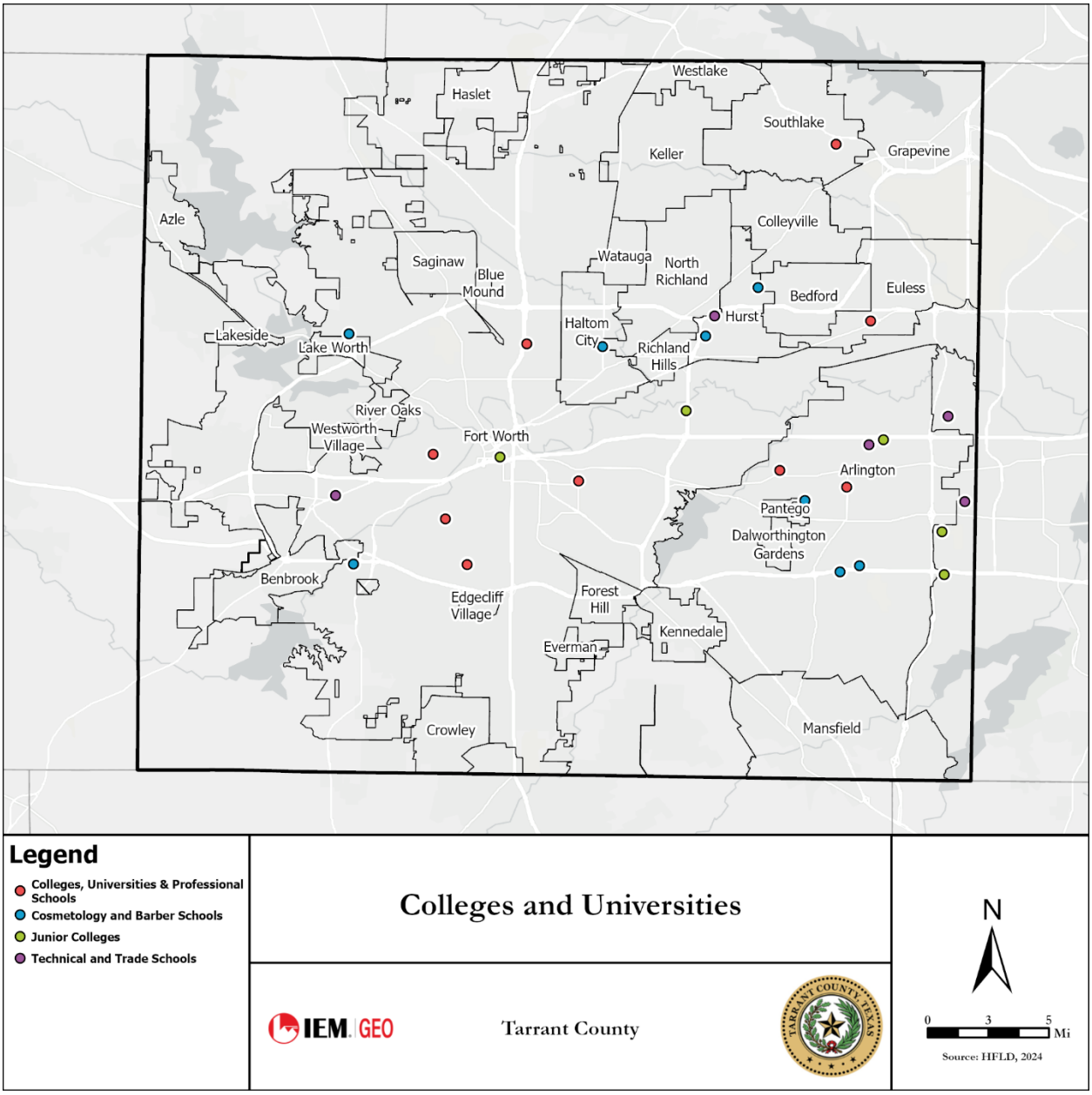


Figure 7: Locations of Colleges and Universities in Tarrant County

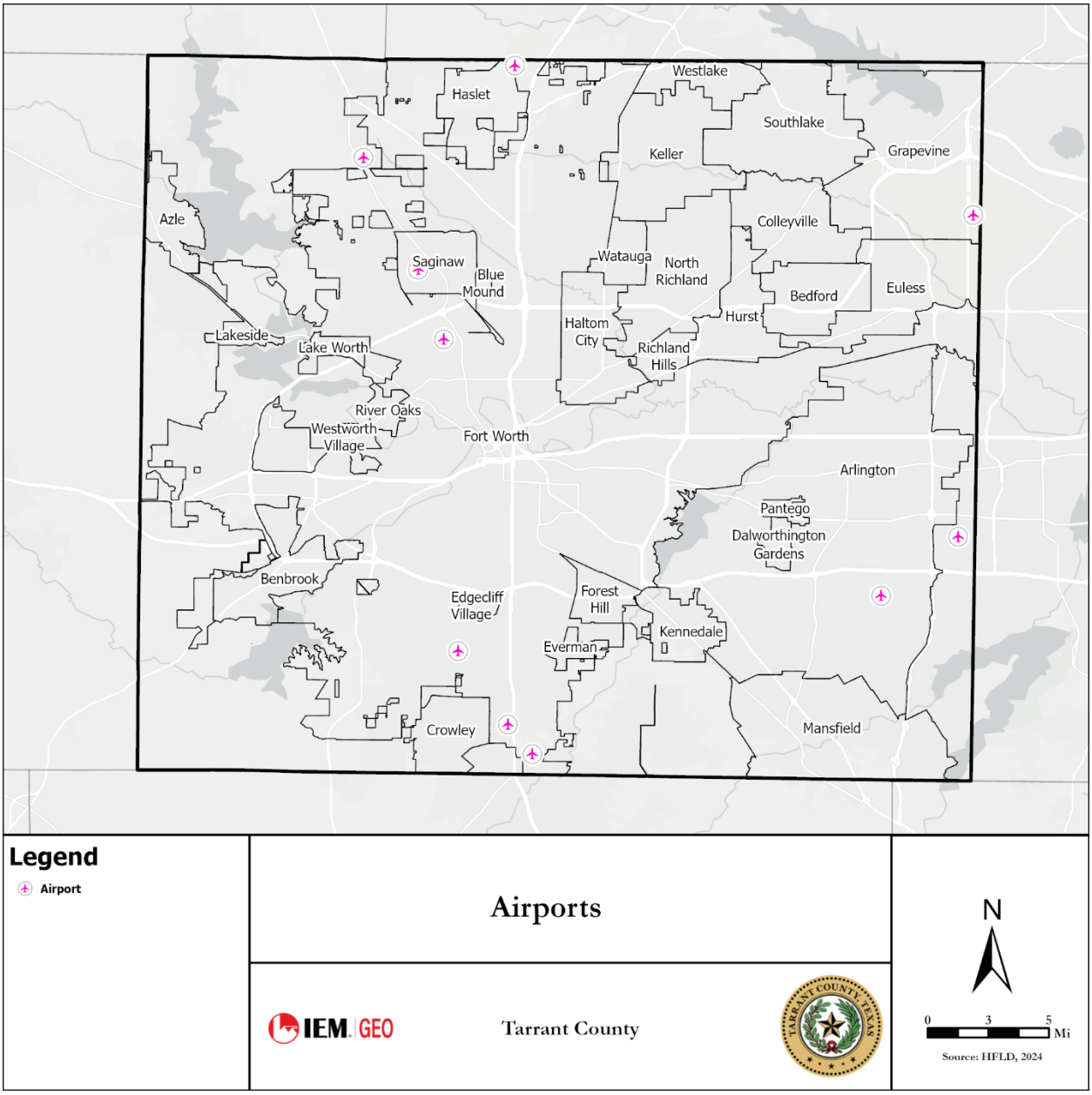


Figure 8: Locations of Airports in Tarrant County

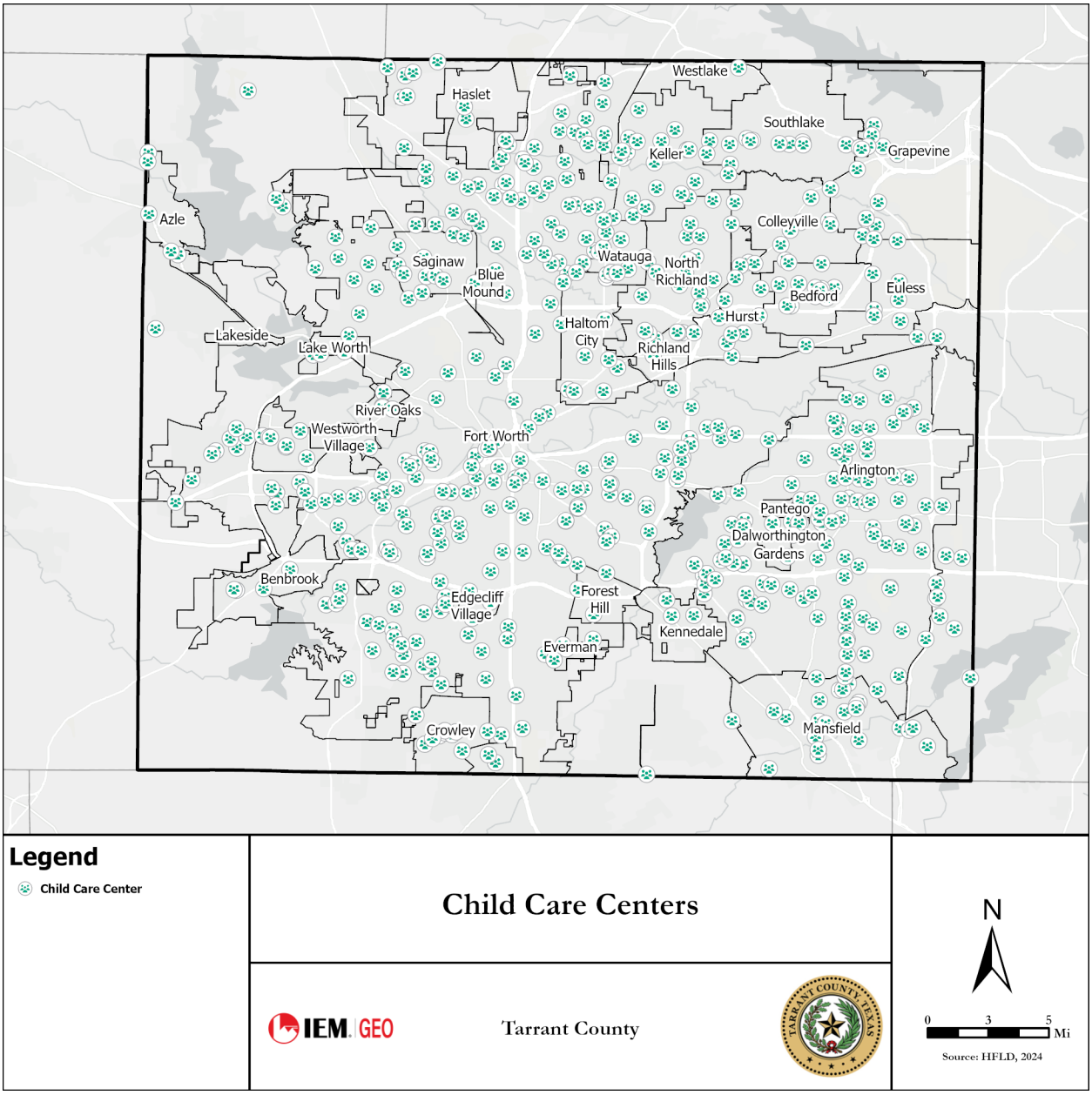


Figure 9: Locations of Child Care Centers in Tarrant County

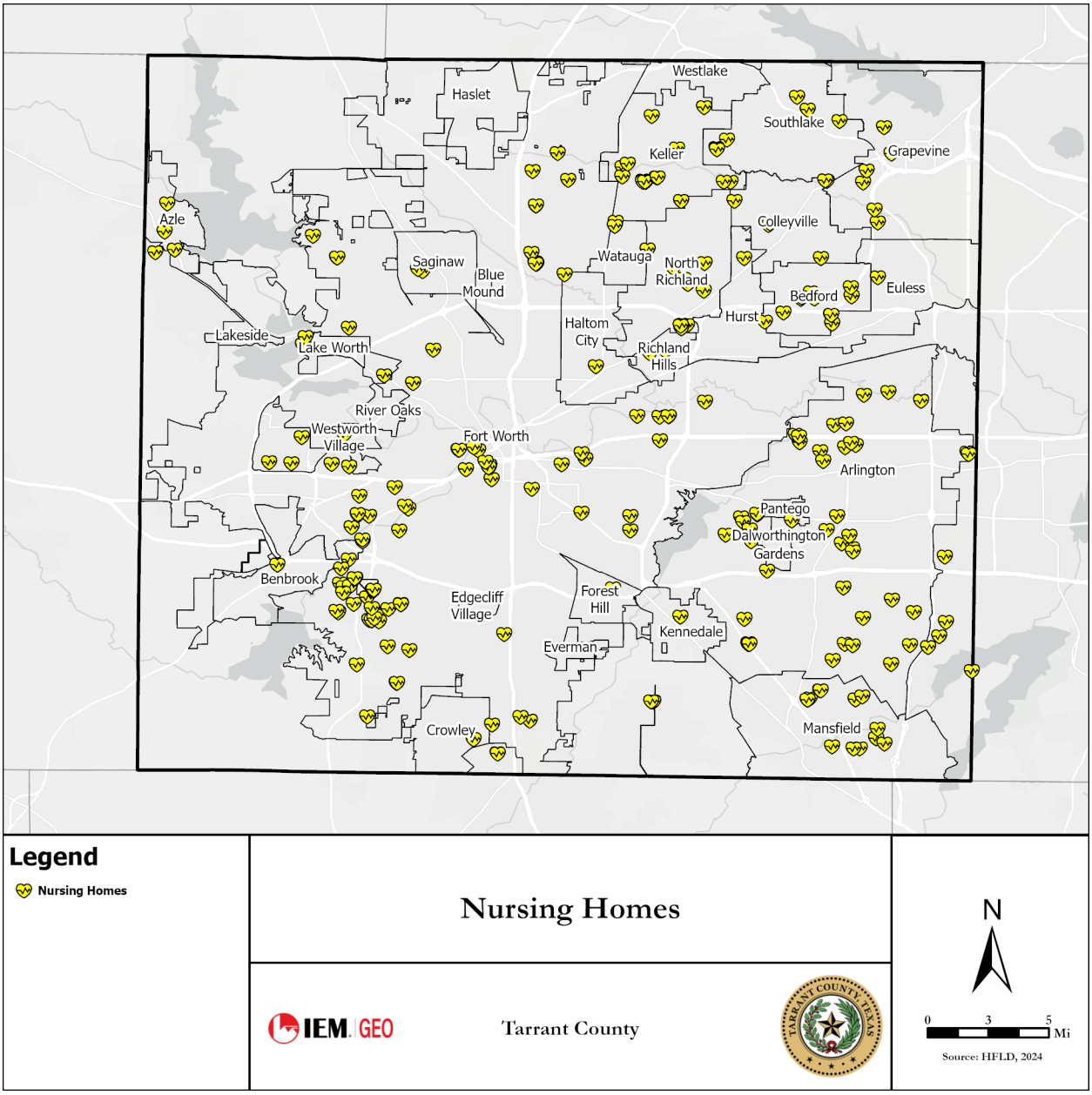


Figure 10: Locations of Nursing Homes in Tarrant County

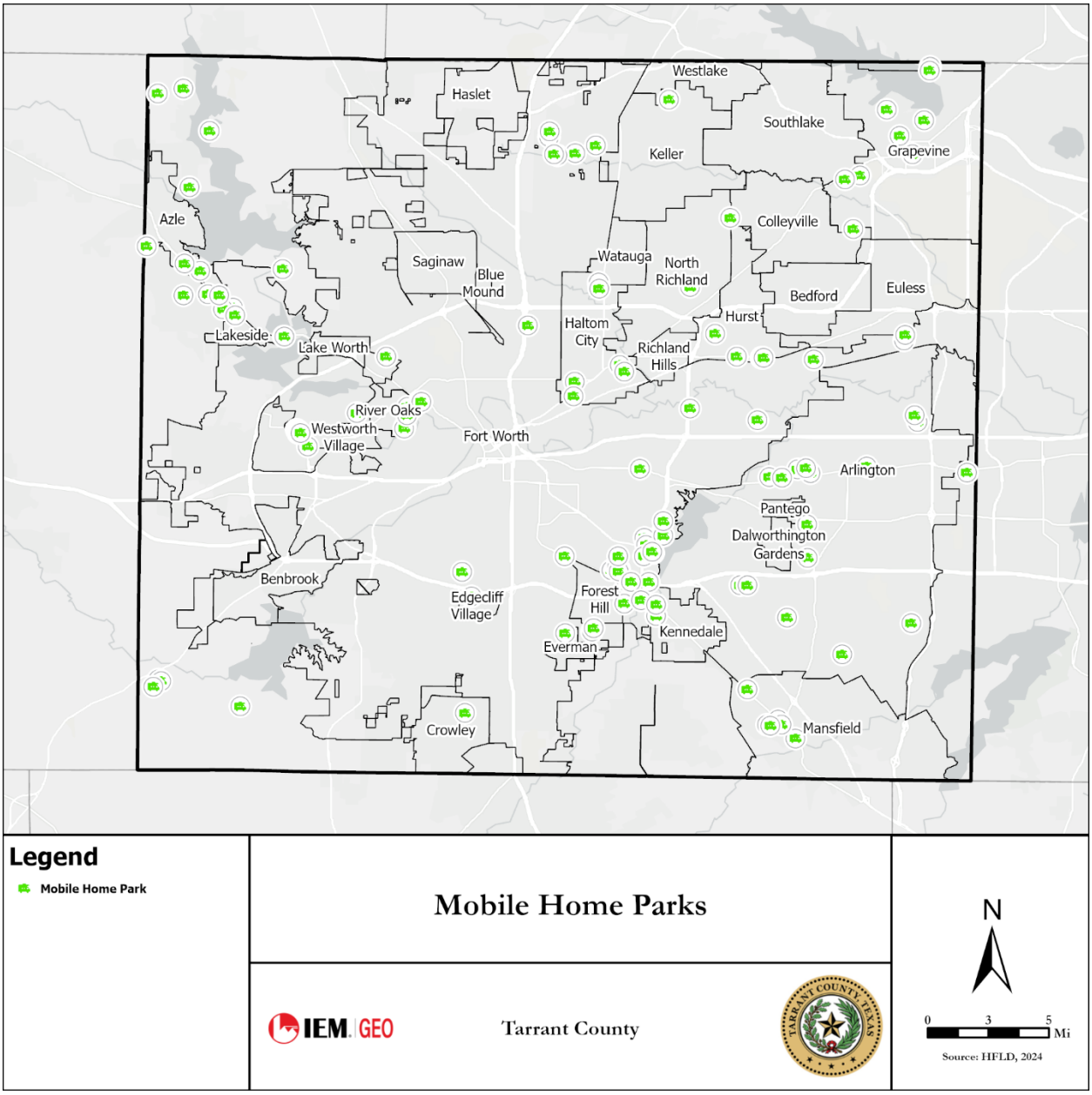


Figure 11: Locations of Mobile Home Parks in Tarrant County

Vulnerable Populations

Socioeconomic and demographic factors significantly impact how people are affected by disasters and their ability to access resources for recovery. These factors include age (children and the elderly), gender, income, disabilities, housing conditions, English proficiency, racial and ethnic background, and access to transportation. Individuals with one or more vulnerability characteristics tend to suffer more severe consequences from a disaster. Various tools and data were used to better understand the impacts of hazards on different demographic groups in Tarrant County.

An index that summarizes a series of variables into a simplified value can help us better understand vulnerability. The Social Vulnerability Index (SVI) summarizes 16 variables in four themes: Socioeconomic Status, Household Characteristics, Racial and Ethnic Minority Status, and Housing Type/Transportation. These data can be displayed in tabular form or by geographic distribution in a map, as shown in Figure 12.

Social Vulnerability Index Theme Maps, such as those in Figure 13, reveal that certain areas in the county have higher socioeconomic vulnerability than others. Much of Fort Worth, Arlington, and other areas toward the center of Tarrant County have the highest socioeconomic vulnerability. This suggests that residents in these areas may be more likely to experience social and economic stressors, such as poverty, limited access to insurance, and inadequate educational opportunities.

In addition, household characteristics are highly variable in the county. Residents in highly vulnerable areas are more likely to experience challenges related to their household characteristics, such as more elderly or young children, more single-parent households, more individuals with disabilities, or more people who do not speak English well. The variability of racial and ethnic minority is high in Fort Worth, Arlington, Haltom City, and other areas in the county, with Hispanic or Latino persons being the highest percentage minority group.

Specifically, areas of Fort Worth, Arlington, Kennedale, Mansfield, Hurst, Euless, Bedford, Haltom City, Richland Hills, and North Richland Hills have higher values in housing type and transportation vulnerability. These may include households without a personal vehicle or more people living in group housing or multi-unit structures.

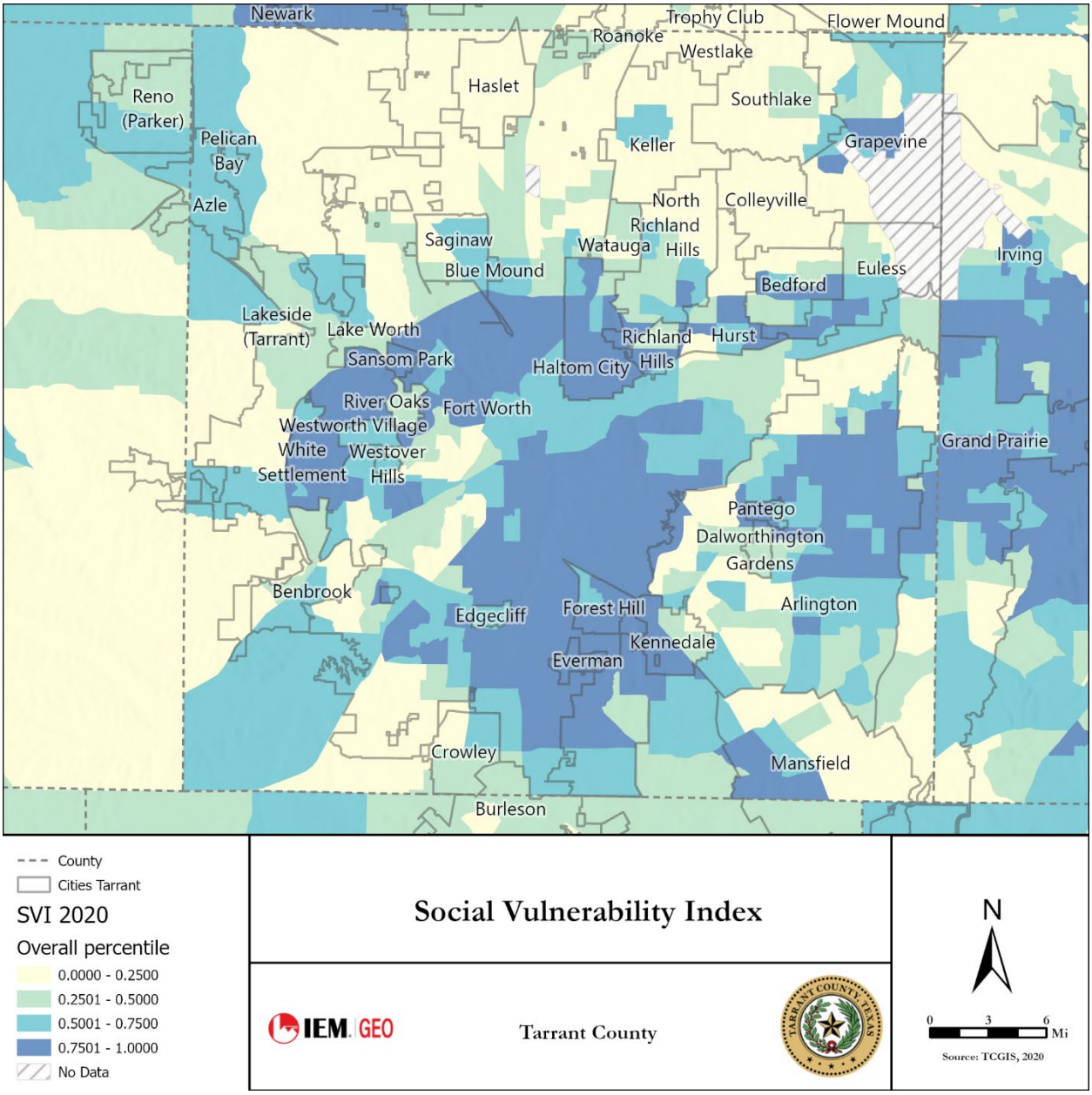


Figure 12: Social Vulnerability Index by Census Tract for Tarrant County

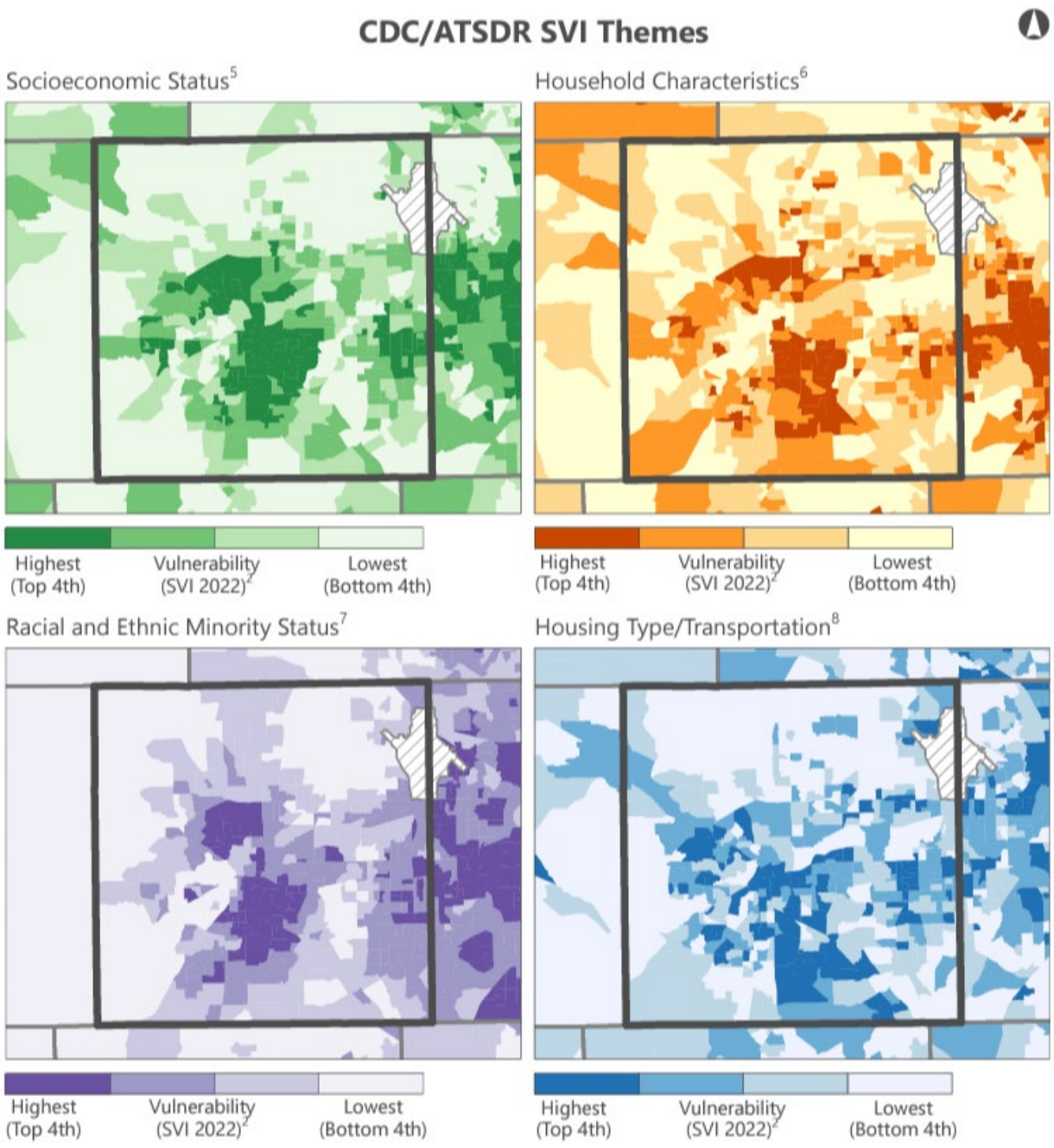


Figure 13: Social Vulnerability Index Themes for Tarrant County

Changes in Development

Tarrant County has a vibrant and diverse economy that attracts new and relocating businesses, retail development, and new housing construction. If business is to succeed, then economic development must flourish. A collaboration of public and private agencies, along with businesses and individuals, is always ready to step forward to promote an excellent quality of life that makes the community a great place to live, work, and raise families.

Changes in development include population variability, climate variability, and various mitigation actions implemented. Individual jurisdictions have identified specific changes in development, when applicable, in their annexes.

Increases in Vulnerability

CLIMATE VARIABILITY

A key factor in an increase in vulnerability is climate variability. According to the United States Environmental Protection Agency (EPA), Texas has warmed by an average of 3 °F in the past century. The atmosphere can hold more moisture at higher temperatures, which creates higher potential for extreme rainfall events.[2]

All participating jurisdictions are experiencing the effects of climate variability. The following information is part of the climatic impact vulnerability assessment conducted by the North Central Texas Council of Governments (NCTCOG) Department of Transportation and the University of Texas at Arlington (UTA). It is a compilation of historical climate data and projected future climate information for the Dallas–Fort Worth (DFW) Metropolitan Area:

- The UTA climate group gathered climate and weather data from 1900 to 2010 to interpret the historical trends in extremes and the variability of temperature and precipitation. Their findings suggest an increase in temperature, particularly in the summer season, and an increase in rainfall and rainfall intensity, primarily during the spring season.
- Historical disruption of transportation by weather is related mainly to extreme events like snow and ice storms and damage from severe supercell-type thunderstorms.
- Future climate prediction suggests extreme temperatures of up to 125 °F by the end of the 21st century, exceeding historical heat waves by 12 °F.
- By 2050, soil moisture is reduced by 10–15% in all seasons compared with historical values due to the increase in temperatures. This suggests a higher risk of infrastructure damage by cracking and, together with elevated temperatures, a higher-than-present risk of fires, particularly in wooded neighborhoods.
- A higher likelihood of drought will also amplify urban heat islands, particularly during the summer, which can make downtown Dallas as much as 10 °F hotter than adjacent rural locations.
- An increase in mean rainfall by up to 10% and severe thunderstorms by up to 40% in the spring will likely lead to a higher risk of flooding, which affects infrastructure.
- Extreme flooding events exceeding historic levels are expected because more tropical storm systems will occur in the fall.[3]

[2] Yale Climate Connections, A stark divide in Texas shows what climate change looks like » Yale Climate Connections.
[3] Climate Change/Extreme Weather Vulnerability and Risk Assessment for Transportation Infrastructure in Dallas and Tarrant Counties. March 24, 2015, Final Report - N. Central Texas Council of Governments - 2013-2015 Pilots.

The Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900–2036[4] published in 2021 by the Texas State Climatologist, provides extensive details on possible impacts of changing climate on future severe weather events. This report reviews historic records and climate models to identify the likely impacts of climate change specific to Texas. Increasing average temperatures are a driving force behind these changes. Average temperatures in Texas should be expected to be about 1.8 °F warmer in 2036 than the 1991–2020 average. Increased average temperature is not a weather extreme itself, but it affects many aspects of extreme weather and climate trends, such as the five examples below.

- **Extreme Heat:** Overall extreme heat has become more frequent and more severe. The number of 100 °F days has almost doubled over the past 45 years and is projected to continue to increase. Winter temperatures are also affected, with extreme cold being less frequent and less severe. Urban heat islands likely contribute to extreme heat events in urban areas.
- **Extreme Rainfall:** Precipitation is highly variable, which can make long-term projections of overall rainfall inconsistent. However, many localities in Texas have seen increases in extreme one-day precipitation events, which are strongly affected by increased temperatures because warmer air can produce more rainfall. Intense rainfall events combined with growth in urban areas in Texas may lead to an increase in precipitation runoff and urban flooding.
- **Drought:** Drought is largely driven by variations in multidecadal precipitation. Drought impacts may be sector-specific between agriculture and the surface water supply.
- **Severe Thunderstorms:** Models show complex and sometimes contradictory trends in thunderstorm activity. Higher temperatures are expected to lead to less hail overall, but they may increase the risk of very large hail earlier in the spring. Changes in severe storm environments may have made it less likely that thunderstorms will occur, but they may be more severe once they develop.
- **Wildfires:** Increased dryness will likely extend the wildfire season and may expand the areas affected by wildfires, as fuels become drier faster in a warmer climate.

POPULATION INCREASE

National forecasts of population and economic growth indicate that this region will continue to add residents and jobs well into the future. NCTCOG's predictions for 2030 use 2000 as a base year and project population and employment in five-year increments to 2030. Over the 30-year horizon, the 16-county North Texas region is expected to add 1.6 million households, with a corresponding 4.1 million people and 2.3 million non-construction jobs. This represents an average annual population growth rate of 2.6% for these 30 years, a magnitude of growth never experienced in the North Central Texas region. NCTCOG forecasts reflect only one set of growth assumptions. If circumstances change, real growth outcomes might be considerably different.[5]

[4] Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900–2036, Office of the Texas State Climatologist. Texas A&M University, 2021, https://climatexas.tamu.edu/files/ClimateReport-1900to2036-2021Update.
[5] North Texas to 2030: Extending the Trends. Vision North Texas. Prior Plan.

Table 11 lists the changes in the demographics of some participating jurisdictions since the 2015 HazMAP was adopted. An asterisk indicates information that has been elusive. Since 2015, the population has increased in all jurisdictions participating in the Tarrant County plan update, except Watauga, Everman, and River Oaks which lost 656, 219, and 125 people, respectively.

Table 11: Changes in Population for Certain Localities, 2015–2023

Jurisdiction	2015 Population Estimate	2023 Population Estimate	Difference
Arlington	379,370	398,431	19,061
Azle	11,140	14,562	3,422
Bedford	48,060	48,370	310
Benbrook	21,234 (2010 census)	24,336	3,102
Blue Mound	2,390	2,390*	0
Colleyville	23,760	25,736	1,976
Crowley	14,130	19,932	5,802
Euless	54,050	59,686	5,636
Forest Hill	12,380	14,157	1,777
Fort Worth	792,720	978,468	185,748
Grapevine	48,520	50,928	2,408
Haltom City	42,640	45,290	2,650
Haslet	1,660	1,720*	0
Hurst	38,340	39,304	964
Keller	42,890	46,316	3,426
Kennedale	7,130	10,052	2,922
Lake Worth	4,680	4,710	30
Lakeside	1,330	1,690	360
Mansfield	56,368 (2010 census)	78,542	22,174
North Richland Hills	66,300	70,658	4,358
Richland Hills	7,920	8,323	403
Saginaw	20,480	25,139	4,659
Southlake	27,710	31,137	3,427
Watauga	23,590	22,934	(656)
Westlake	1,120	1,310	190
Westworth Village	2,620	2,620*	0
White Settlement	16,733	18,119	1,386
Tarrant County	**1,922,470**	**2,182,947**	**260,477**

As of 2022, Fort Worth saw the greatest increase in population. In Tarrant County, the City of Haslet saw a 31% increase in population. According to Helen You, Associate Director of Senior Demography at the Texas Demographic Center, the growth is mainly due to growing economic opportunities.[6] Mansfield has a 2010 population estimate, and a city mitigation plan was approved in 2010. There are no data available for NCTCOG population changes from 2015 to 2017.

Changes in population for Edgecliff Village, River Oaks, NCTCOG and the University of North Texas Health Science Center (UNTHSC) are listed in Table 12 to reflect changes in population from 2017 to 2023. These jurisdictions were new in the last plan and will be included in the jurisdiction summary tables in the remainder of this plan.

Table 12: Changes in Population for Certain Localities, 2017–2023

Jurisdiction	2017 Population Estimate	2023 Population Estimate	Difference
Edgecliff Village	3,220	3,742	522
Everman	6,348	5,941	407
River Oaks	7,310	7,370	60
UNTHSC	5,000 (students, faculty, staff)	4,364 (students, employees)	(636)

Decreases in Vulnerability

Factors that decrease vulnerability to hazards include the mitigation actions addressed in jurisdictional annexes and the adoption of new codes and policies. The Environment & Development Department at NCTCOG plays a major role in regional coordination and management of reports and projects that improve regional resilience to natural hazards through the following programs:

- **The Corridor Development Certificate (CDC)** – The CDC process aims to stabilize flood risk along the Trinity River. The CDC process does not prohibit floodplain development; rather, it ensures that any development that does occur in the floodplain will not raise flood water levels or reduce flood storage capacity. A CDC permit is required to develop land in a specific area of the Trinity floodplain, called the Regulatory Zone, which is similar to the 100-year floodplain.
  - Under the CDC process, local governments retain ultimate control over floodplain permitting decisions, but other communities along the Trinity River Corridor are given the opportunity to review and comment on projects in their neighbor's jurisdiction. As the Metroplex economy continues to grow and develop, the CDC process will prevent increased flood risks.
- **The Trinity River COMMON VISION Program** – Local governments along the Trinity River have launched a regional initiative that has stimulated excitement and galvanized support for a new Trinity River **COMMON VISION**. It comprises these elements:

[6] Where is North Texas growth happening? Where is North Texas growth happening? New regional data shows smaller cities are leading the charge | Fort Worth Report.

  - A safe Trinity River, with stabilization and reduction of flooding risks
  - A clean Trinity River, with fishable and swimmable waters
  - An enjoyable Trinity River, with recreational opportunities linked by a trails system in a world-class greenway
  - A natural Trinity River, with preservation and restoration of riparian and cultural resources
  - A diverse Trinity River, with local and regional economic, transportation, and other public needs addressed
- **NCTCOG-OneRain Contrail Flood Warning Software –** Contrail software that delivers automated real-time data collection, processing, validation, analysis, archiving, and visualization of hydrometeorological and environmental sensor data.
- **The *integrated* Stormwater Management (iSWM) Program –** The iSWM™ Program for Construction and Development is a cooperative initiative that helps cities and counties achieve their goals of water quality protection, streambank protection, and flood mitigation, while helping communities meet their construction and post-construction obligations under state stormwater permits.
  - Development and redevelopment, by their nature, increase imperviousness in the surrounding environment. This increased imperviousness translates into the loss of natural areas, more sources for pollution in runoff, and heightened flooding risks. To help mitigate these impacts, more than 60 local governments are cooperating to proactively create sound stormwater management guidance for the region through the *integrated* Stormwater Management (iSWM) Program.
- **16-County Watershed Management Initiative –** Communities from across the region come together to collaborate on how to reduce the risks of flooding in their communities.
- **Texas SmartScape** – Texas SmartScape™ is a landscape program crafted to be “smart” for North Central Texas. Based on water-efficient landscape principles, it promotes the use of plants suited to the region’s soil, climate, and precipitation that do not require much—if any—additional irrigation, pesticides, fertilizers, or herbicides to thrive. The two main goals of the program are as follows:
  - Improve stormwater runoff quality
  - Conserve local water supplies

A Smart Approach to Land Development along the Trinity River

The Trinity River Vision Master Plan details a major project underway in Tarrant County that addresses smart development along the Trinity River. Typically, development in a hazard-prone area, such as a floodplain, is recognized as a factor that increases the vulnerability of an area, but this smart approach to design and development actually decreases vulnerability. The planning area encompasses 88 miles of the Trinity River and its greenbelts and tributaries throughout the Fort Worth area.

The plan focuses on eight segments of the Trinity River and its tributaries: Clear Fork North, Clear Fork South, Marine Creek, Mary's Creek, Sycamore Creek, West Fork East, West Fork West, and the Central City area, now called Trinity Uptown. It considers environmental quality, conservation, recreation facilities, trail developments, reforestation, beautification, and linkage to neighborhoods, downtown, and other special districts. The plan also addresses adjoining land uses, transportation, and how other facilities best complement and benefit from the greenways.[7]

In addition to recreational amenities, the park includes levees and other flood-protection systems. The Trinity River Vision Authority coordinates activities among local stakeholders and performs risk assessment planning for the effective delivery of the Central City Flood Control Project of the United States Army Corps of Engineers (USACE).[8]

[7] Tarrant County Government, "Trinity River Vision," https://www.tarrantcountytx.gov/en/county/supermenu-contents/residents/trinity-river-vision.html#:~:text=The%20Trinity%20River%20is%20a,convergence%20anchors%20our%20downtown%20today.
[8] Trinity River Vision Authority, https://www.trinityrivervision.org/.

Civil Unrest

Civil unrest is an umbrella term for a wide spectrum of phenomena (social unrest, civil disorder, civil disobedience, violent disorder, civil disturbance) and is defined as a term that includes limited political violence (such as acts of "terrorism," and individual assassinations), sporadic violent collective action (such as riots), and nonviolent and mildly violent collective action (such as protests and demonstrations)—all of which tend to take place in times of peace.[9]

Civil Unrest is defined, for the purposes of this plan, as any incident in which large groups of individuals gather with the purpose of causing damage or disruption to the community.

Location and Extent

Incidents of civil unrest can occur at any time in Tarrant County, but these incidents are more likely to be associated with a particular community activity or incident. Tarrant County has a history of significant incidents of civil unrest.[10] The threat of civil unrest poses a demonstrated threat to the safety and property of the citizens of Tarrant County. The possibility of civil unrest exists in all communities in Tarrant County. The communities at highest risk are the Cities of Arlington and Fort Worth. The urban nature of these cities lends itself to the possibility of future incidents.

Civil unrest may occur as a period of social upheaval during heightened community tension or at mass gatherings, such as sporting events, concerts, and political conventions. The safety risk of fire and emergency medical services (EMS) personnel responding to these fluid incidents may be elevated.

The following are assumptions for a large-scale incident of civil unrest in Tarrant County:

- A large-scale incident of civil unrest will require mutual aid from many local and state law enforcement agencies.
- The response to a large-scale incident of civil unrest could be several operational periods in duration.
- A large-scale incident could be a part of or cause civil unrest in multiple jurisdictions simultaneously and limit the availability of law enforcement assets.
- The Army National Guard may not be available to assist in a law enforcement capacity.
- The Chief Elected Official might have to declare a state of emergency.

Previous Historical Occurrences

- **June 2, 2020**: Hundreds of protesters led marches and demonstrations in the downtown areas of Fort Worth, for five consecutive days of protests over the death of George Floyd while he was in Minneapolis police custody. Leaders in North Texas called for peace ahead of the demonstrations.

[9] United Nations Office of Disaster Risk Reduction, 2024, https://www.undrr.org/understanding-disaster-risk/terminology/hips/so0003.
[10] WFAA.com, ABC Channel 8 News, June 2, 2020, Fifth day of protests in North Texas sees curfew zone extensions, more police and protester dialogue | wfaa.com.

Governor Greg Abbott deployed state troopers and National Guard troops to the Dallas–Fort Worth region as the state's response.[11]

- **October 12, 2023:** A former leader of Hamas in North Texas called for protests and displays of anger in response to Israel's response to Hamas attacks, causing concern for North Texas local authorities and the Texas Department of Public Safety (TDPS) and the Jewish community and institutions. TDPS expressed concern that the conflict could inspire homegrown violent extremists and foreign terrorist organizations operating in the United States to target the Jewish community. Jewish churches, schools, and other institutions place security on high alert after Hamas's violent attacks in Israel.[12]

Probability of Future Events

An incident of Civil Unrest can occur at any time with little or no warning and can vary from being peaceful disobedience to a large scale and highly destructive riot. A coordinated multiagency, multijurisdictional response may be required.

[11] WFAA.com, ABC Channel 8 News, June 2, 2020, Fifth day of protests in North Texas sees curfew zone extensions, more police and protester dialogue | wfaa.com.
[12] CBSNew.Com/Texas, J.D. Miles, October, 12, 2023, Call for protests, displays of anger from former Hamas leader has North Texas on edge - CBS Texas (cbsnews.com).

Cyber Terrorism

Cyber Terrorism or cyberattack is any intentional effort to steal, expose, alter, disable, or destroy data, applications, or other assets through unauthorized access to a network, computer system, or digital device.

For information technology systems, there are three terms related to cyber security that are sometimes used interchangeably but mean different things:

- An **event** is an innocuous action that happens frequently, such as creating a file, deleting a folder, or opening an email. On its own, an event typically is not an indication of a breach, but when paired with other events, it may signal a threat.
- An **alert** is a notification triggered by an event which may or may not be a threat.
- An **incident** is a group of correlated alerts that humans or automation tools have deemed likely to be a genuine threat. On its own, each alert might not appear to be a major threat, but when combined, they indicate a possible breach.

Location and Extent

Federal government officials have called ransomware a worsening problem. The United States Treasury Department reported that payments to ransomware gangs have increased, totaling an estimated $1.2 billion in 2021.[13]

Ecosystem has identified the evolving ways that attackers may use to try to access information systems and business operations.[14] Several of the most common are as follows (see Figure 14):

- **Phishing:** Phishing is a type of social engineering in which an attacker uses email, text, or a phone call to impersonate a reputable brand or person. A typical phishing attack tries to persuade a recipient to download malware or provide a password.

These attacks exploit people's trust and deploy psychological techniques, such as fear, to get people to act. Many attacks are untargeted, going out to thousands of people in the hope that just one responds. However, a more sophisticated version called spear phishing uses deep research to craft a message that is intended to be persuasive to a single individual.

- **Malware:** Malware refers to any software designed to harm a computer system or exfiltrate data. It comes in many forms, including viruses, ransomware, spyware, and trojan horses. Bad actors install malware by taking advantage of hardware and software vulnerabilities or by convincing an employee to do so using a social engineering technique.

[13] Financial Crimes Enforcement Network, 11/01/2021, FinCEN Analysis Reveals Ransomware Reporting in BSA Filings Increased Significantly During the Second Half of 2021 | FinCEN.gov.
[14] Ibid.

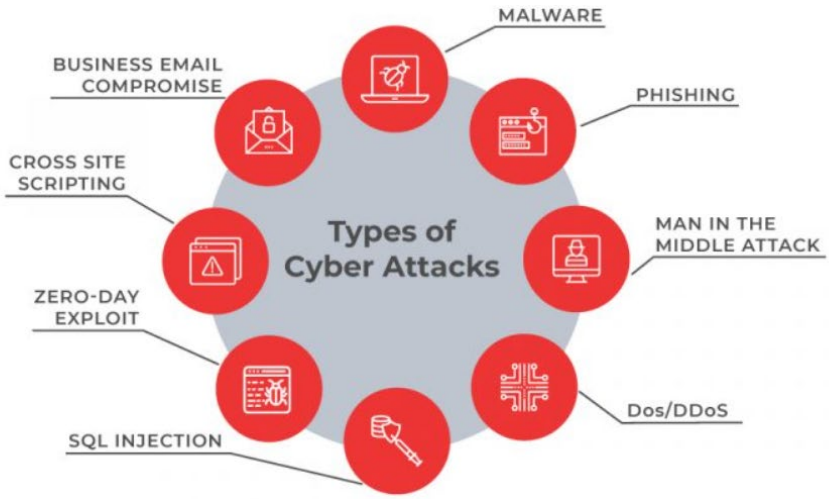


Figure 14:Types of Cyber Attacks[15]

- **Ransomware:** In a ransomware attack, bad actors use malware to encrypt critical data and systems and then threaten to make the data public or destroy it if the victim does not pay a ransom.
- **Denial of Service:** In a denial-of-service attack (DDoS attack), a threat actor overwhelms a network or system with traffic until it slows or crashes. Typically, attackers target high-profile companies such as banks or governments with the goal of costing them time and money, but organizations of all sizes can be victims of this type of attack.
- **Man in the Middle:** Another method that cybercriminals use to steal personal data is to insert themselves in the middle of an online conversation between people who believe they are communicating privately. By intercepting messages and copying them or changing them before sending them to the intended recipient, they try to manipulate the participants into giving them valuable data.
- **Insider Threat:** Although most attacks are conducted by people outside an organization, security teams must also be on the lookout for insider threats. Employees and other people who legitimately have access to restricted resources may inadvertently or in some cases intentionally leak sensitive data.
- **Unauthorized Access:** Many security breaches start with stolen account credentials. Whether bad actors acquire passwords through a phishing campaign or by guessing a common password, once they gain access to a system, they can install malware, do network reconnaissance, or escalate their privileges to allow them access to more sensitive systems and data.

Previous Historical Occurrences

- **March 14, 2024:** The Tarrant Appraisal District (TAD) reported Medusa, the hacking group, claimed responsibility for the March 14, 2024, ransomware attack on the TAD, posting sensitive personal data of 300 people obtained during the attack on the dark web. Medusa, located primarily in Romania,

[15] Ecosystm, 2024, "Things You Need to Know About Cyber Attacks, Threats and Risks," Things you need to know about Cyber Attacks, Threats & Risks - Ecosystm Insights.

demanded $700,000 during the March 14 attack. TAD opted not to pay the ransom but made cybersecurity upgrades instead, so Medusa leaked the sensitive data. The system used to manage property taxes continued to have issues with email and its website.[16]

- **June 24, 2023:** A hacker group called SiegedSec claimed responsibility for the leaked internal data from the City of Fort Worth's online systems, downloading information and posting it on a website called Telegram and on Twitter. The group posted pictures, spreadsheets, invoices, emails, and other internal information from View Works using stolen login information, the system that facilitates maintenance work orders for Fort Worth's transportation, public works, parks and recreation, and property management departments. However, no sensitive information from Fort Worth residents, businesses, or employees was leaked. Fort Worth officials worked with federal and local law enforcement to investigate the incident, as they believed the purpose of the hack was likely to embarrass the city and target the State of Texas on its position on gender-affirming care.[17] SiegedSec hackers did not demand a ransom from the City of Fort Worth.[18]

Probability of Future Events

The Federal Bureau of Investigation Annual Internet Crime Report provides statistical data on cybercrimes reported in the United States from complaints received in its internet crime complaint center. The following statistics show that there has been a significant increase in cybercrime in the State of Texas:

- 2022: 38,661 victims: the 3rd highest number of victims and in the top 10 states for victims' losses of $776.1M for cybercrime.
- 2023: 47,305 victims: the 2nd highest number of victims and in the top 10 states for victims' losses of $1.021 billion ($3.345M per capita) to cybercrime.

Vulnerability Assessment

Many aspects of our lives are now reliant on networked technology that is vulnerable to cyberattacks. Critical infrastructure refers to the systems and assets that are vital for the functioning of society, the economy, and national security. They comprise a vast network of assets, systems, and utilities that are needed to maintain normalcy in daily life and retain vast amounts of personal identifiable data. Any incapacitation could have debilitating effects on the county's security, local economy, public health and safety, and exposure of data could produce severe consequences for individuals.

[16] WFAA.com ABC Channel 8 News, Janel Forte, April 16, 2024, Tarrant County Appraisal District ransomware attack: latest | wfaa.com.
[17] Dark Reading, June 27, 2023, Trans-Rights Hacktivists Steal City of Ft. Worth's Data (darkreading.com).
[18] KERA News, NPR for North Texas, Toluwani Osibamowo, June 24, 2023, Hackers leak internal info from City of Fort Worth, targeting Texas over gender-affirming care ban | KERA News.

IMPACT ON ASSETS

Cyberattacks are a serious threat to America's critical infrastructure and can severely impact our day-to-day lives. The types of critical infrastructure sectors that might be vulnerable to cyberattacks are as follows:

- Chemical
- Commercial facilities
- Communications
- Critical manufacturing
- Dams
- Defense industrial base
- Emergency services
- Energy
- Financial services
- Food and agriculture
- Government facilities
- Healthcare and public health
- Information technology
- Nuclear reactors, materials, and waste
- Transportation
- Water and wastewater

The Texas Department of Homeland Security Strategic Plan 2021–2025 states that cyberattacks and intrusions can be used by criminals, terrorists, insiders, and hostile foreign nations to disrupt delivery of essential services, mask other attacks, or shake citizens' confidence in the government. Cyberattacks are rather easy to execute and challenging to disrupt and investigate, as demonstrated in the August 2019 ransomware attack that impacted 23 local government entities in Texas. The frequency of attacks and intrusions has increased significantly during the past five years. As the cyber threat continues to grow and evolve, a particular concern is the potentially severe consequence of an effective cyberattack against critical infrastructure facilities and systems. Cyber threats could also cause the denial or disruption of essential services, including utilities, public health, finance, or law enforcement networks.[19]

VULNERABLE POPULATIONS

The vulnerability of young and old adults is largely due to the surge of new customers going online during 2020. Although most young adults are tech-savvy, they are not immune from attacks, as they often have

[19] Office of the Texas Governor, 2021, Texas Homeland Security Strategic Plan 2021–2025.

a false sense of their capabilities, which leads to being caught off guard as they openly share personal information. In contrast, older adults are much less familiar with the latest technologies, increasing their susceptibility to various scams and phishing attacks that criminals target them with.[20]

[20] Cybernews.com, Adi Gaskell, October 14, 2021, Who is most vulnerable to cybercrime: new report reveals surprising insights | Cybernews.

Drought

Drought can be defined as a water shortage caused by a natural reduction in the amount of precipitation expected over an extended period, usually a season or more in length. It can be aggravated by other factors, such as high temperatures, high winds, and low relative humidity. Tarrant County experiences a cycle of wet and drought conditions that can extend over a period of months or even years. Extended periods of drought can have an enormous impact on an area by affecting the abundance of water supply, the agricultural economy, and the foundations of structures. Drought may affect the entire Tarrant County planning area equally.

Location and Extent

Figure 15 through Figure 19 show annual changes in drought conditions between 2018 and 2024. Tarrant County has experienced an increase in drought conditions over the years, with 2016 being the wettest year in this period.

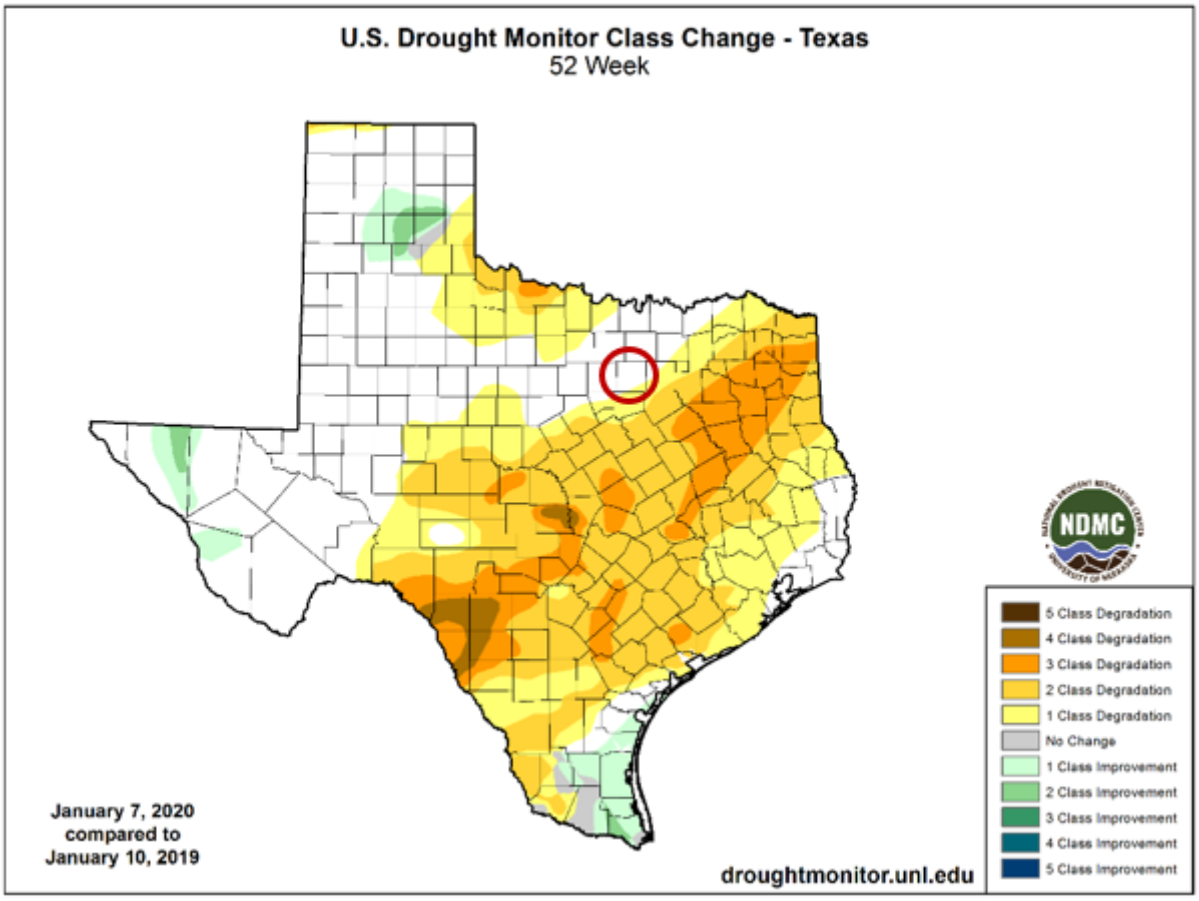


Figure 15: United States Drought Monitor Class Change, Texas, 2019–2020[21]

[21] United States Drought Monitor, "Class Change, Texas, 1 Year" 2020, http://droughtmonitor.unl.edu.

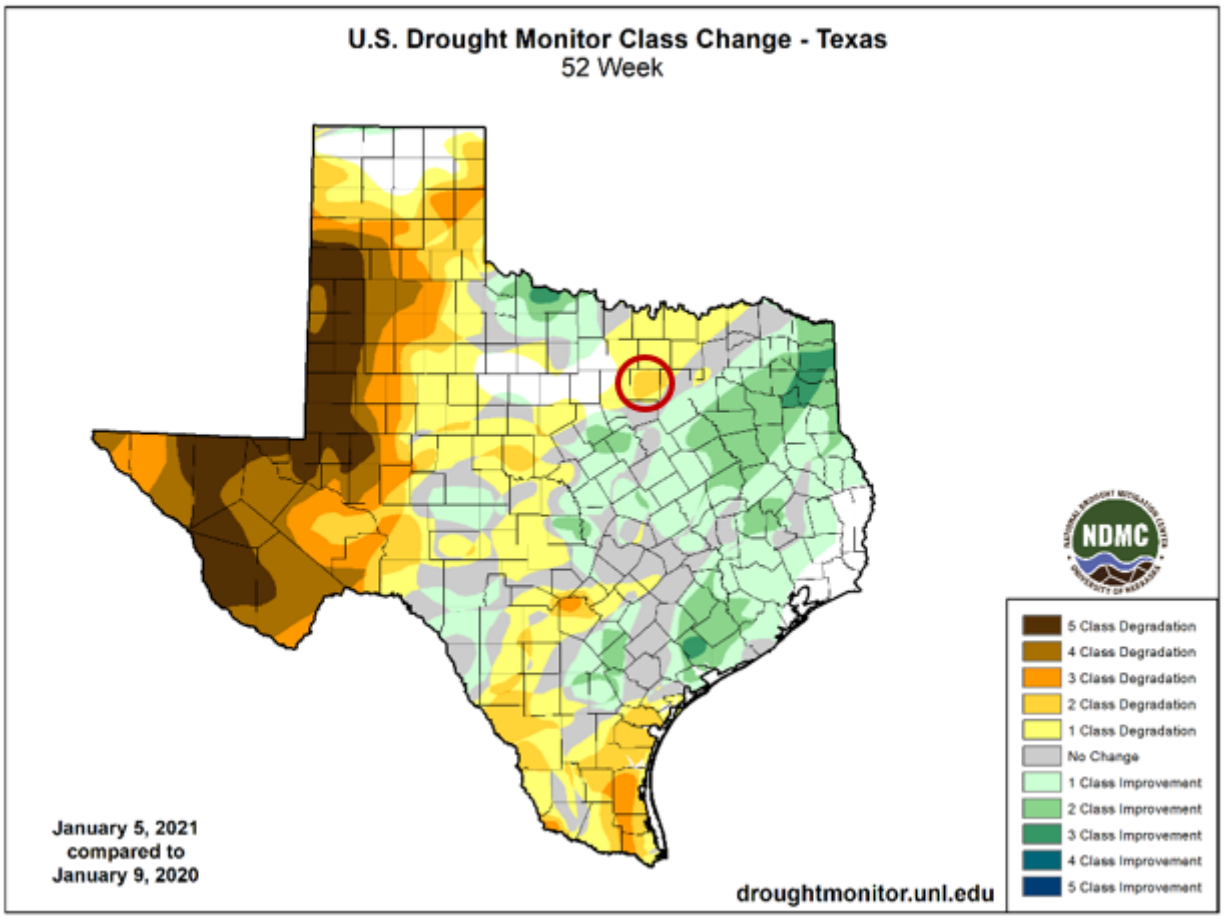


Figure 16: United States Drought Monitor Class Change, Texas, 2020–2021[22]

[22] United States Drought Monitor, "Class Change, Texas, 1 Year" 2021, http://droughtmonitor.unl.edu.

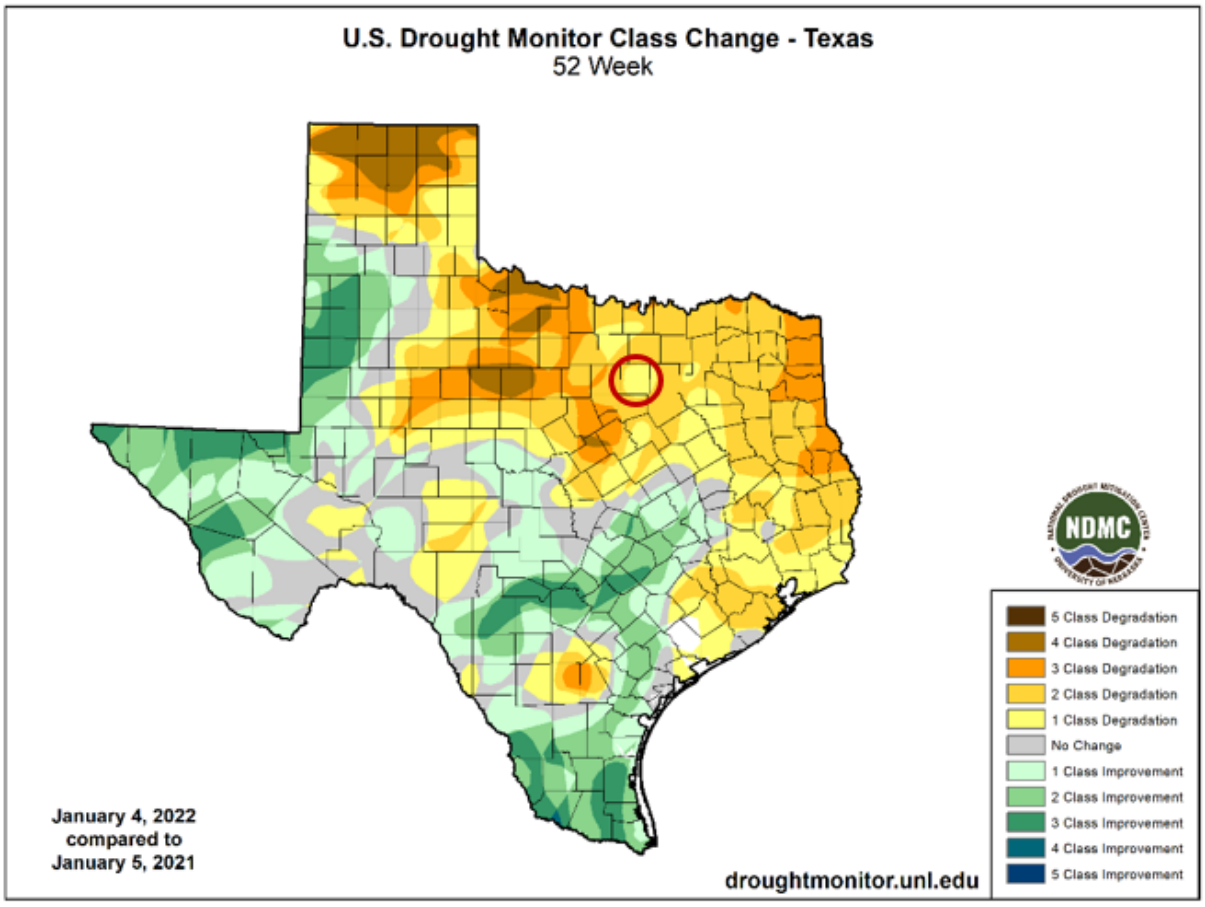


Figure 17: United States Drought Monitor Class Change, Texas, 2021–2022[23]

[23] United States Drought Monitor, "Class Change, Texas, 1 Year" 2022, http://droughtmonitor.unl.edu.

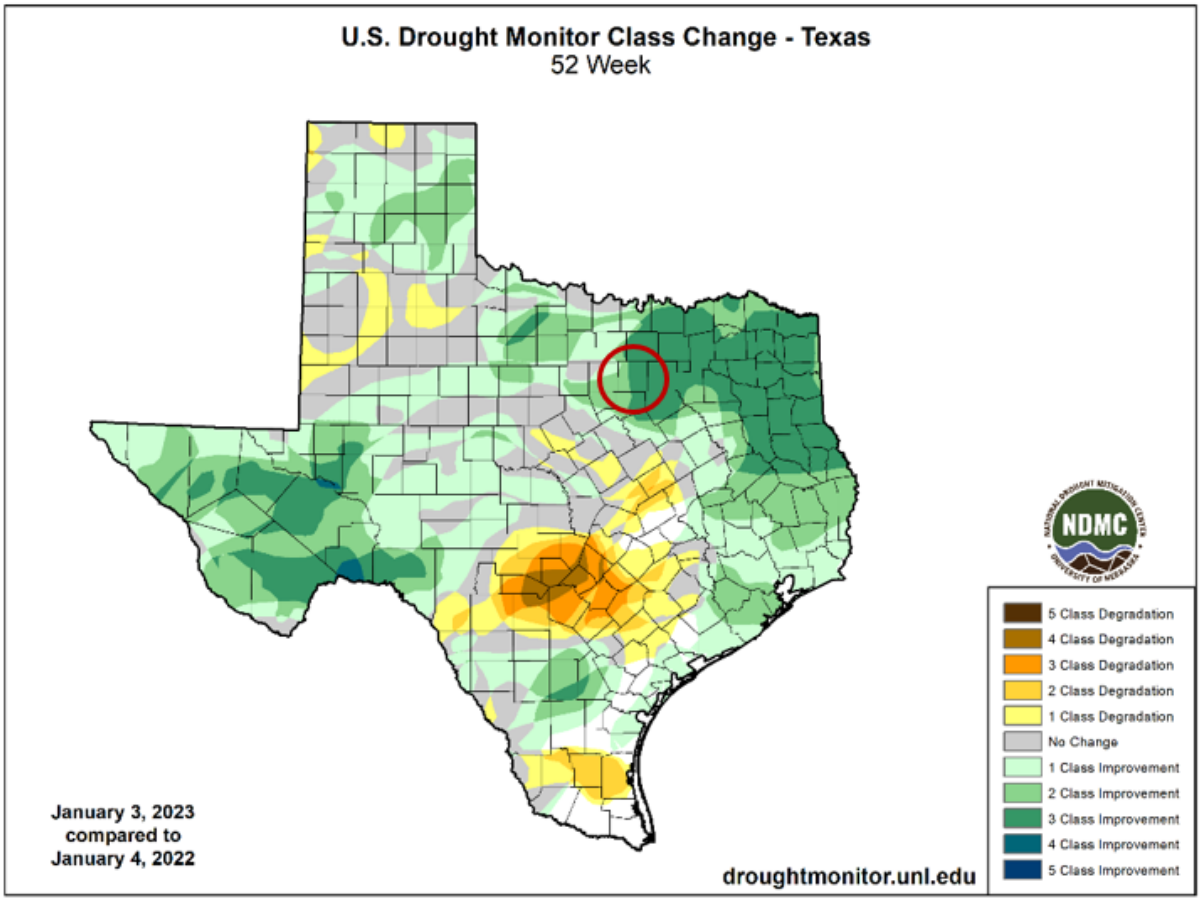


Figure 18: United States Drought Monitor Class Change, Texas 2022–2023[24]

[24] United States Drought Monitor, "Class Change, Texas, 1 Year" 2023, http://droughtmonitor.unl.edu.

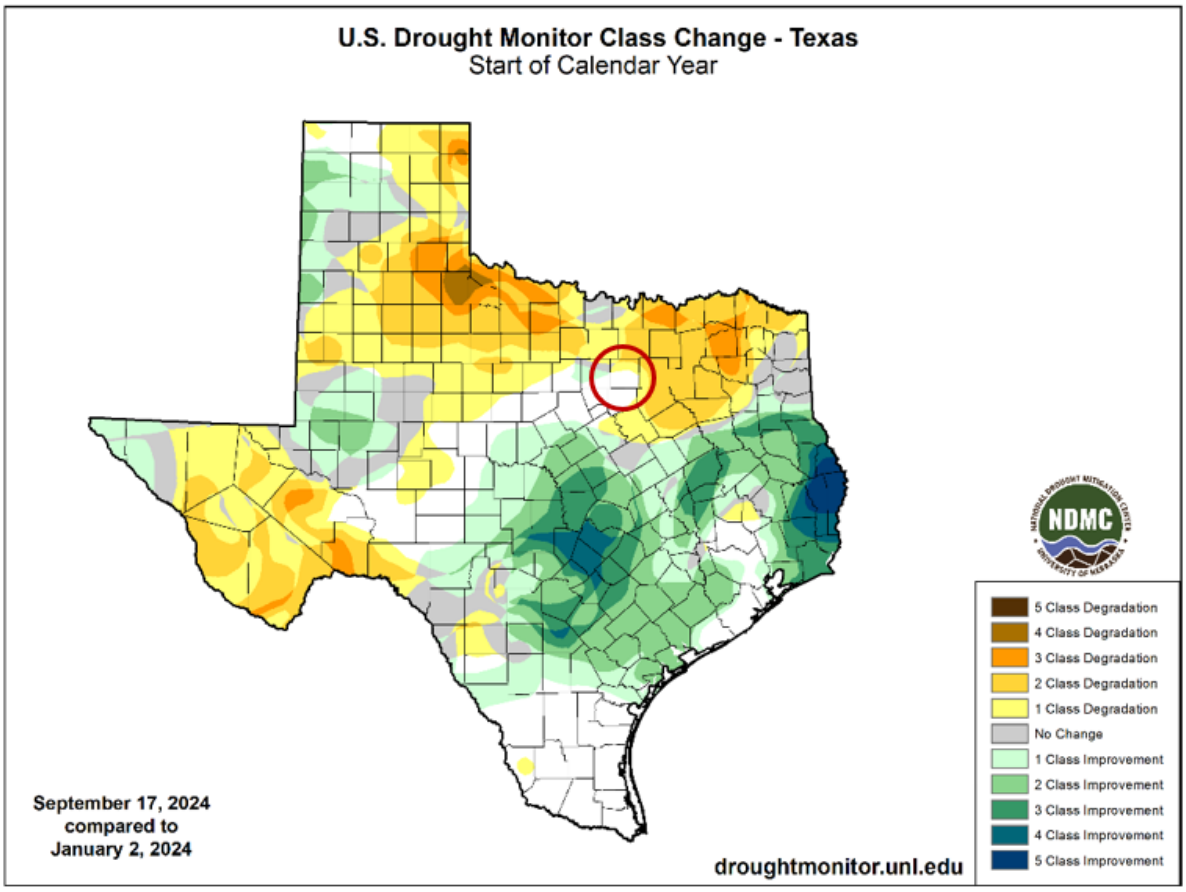
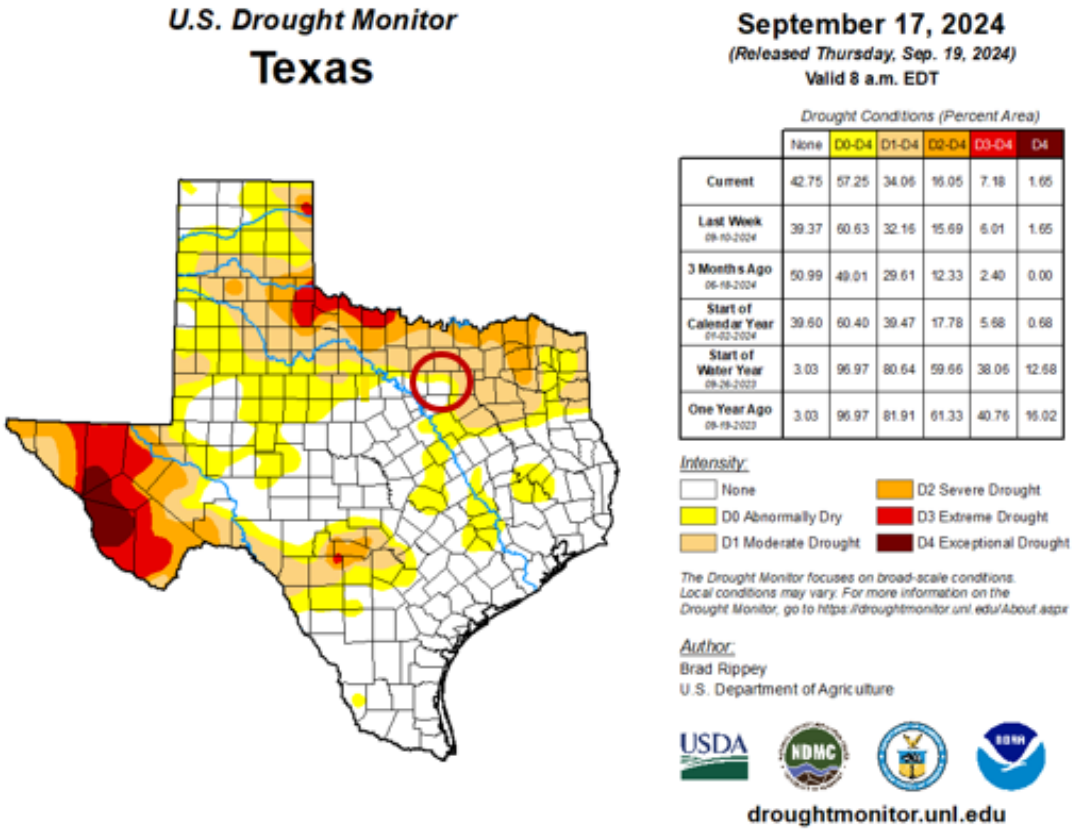


Figure 19: United States Drought Monitor Class Change, Texas, 2024[25]

[25] United States Drought Monitor, "Class Change, Texas, 1 Year" 2024, http://droughtmonitor.unl.edu.



Week	Date	None	D0-D4	D1-D4	D2-D4	D3-D4	D4	DSCI
Current	2024-09-17	53.80	46.20	13.91	0.00	0.00	0.00	60
Last Week to Current	2024-09-10	53.80	46.20	0.40	0.00	0.00	0.00	47
3 Months Ago to Current	2024-06-18	100.00	0.00	0.00	0.00	0.00	0.00	0
Start of Calendar Year to Current	2023-12-26	93.63	6.37	0.00	0.00	0.00	0.00	6
Start of Water Year to Current	2023-09-26	0.00	100.00	100.00	100.00	100.00	0.00	400
One Year Ago to Current	2023-09-19	0.00	100.00	100.00	100.00	100.00	0.00	400

Estimated Population in Drought Areas: **251,722**

Figure 20: Drought Conditions for Tarrant County as of September 17, 2024

Figure 21 shows that 2014–2015 had the greatest severity and longest time period of D3–D4 drought conditions. Besides major crop damage, these extreme drought conditions can put Tarrant County in extreme fire danger and could cause widespread water shortages and restrictions, creating a water emergency.

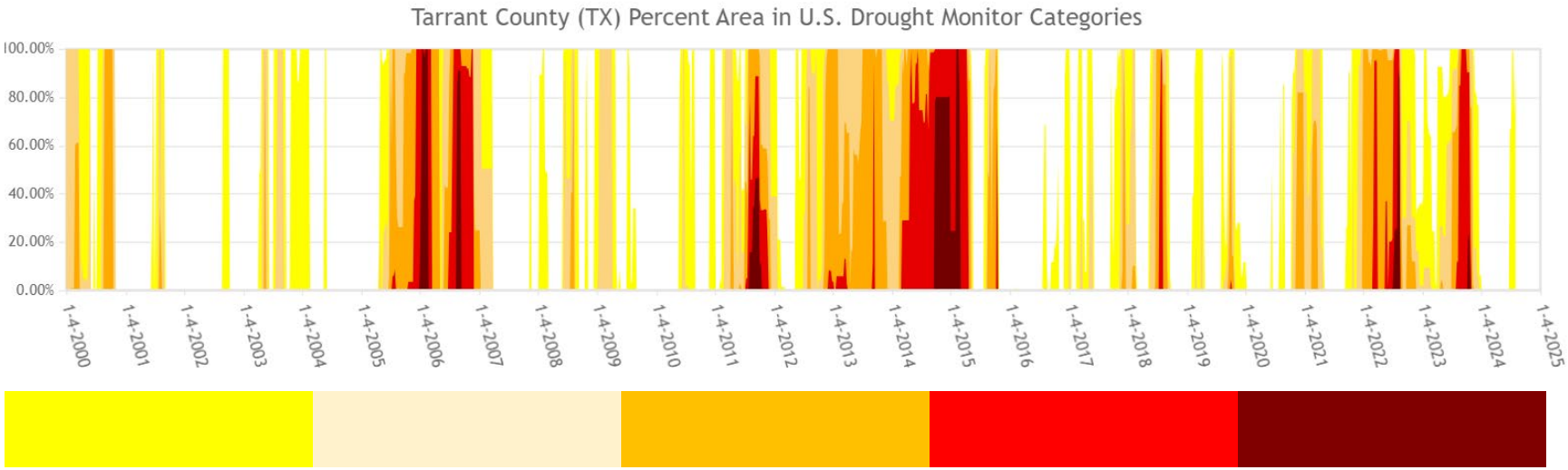


Figure 21: Drought Conditions, Tarrant County, Texas, 2000–2025[26]

[26] United States Drought Monitor, 2024, "Tarrant County Texas Drought Monitor, 2000–2025 Time Series Chart," Time Series | U.S. Drought Monitor (unl.edu)

Table 13 describes the drought monitoring indices, with drought severity, return period, and a description of the possible impacts of the severity of drought.

Table 13: National Drought Mitigation Center Drought Indices with Drought Severity

Drought Severity	Return Period (years)	Description of Possible Impacts	Drought Monitoring Indices		
			Standardized Precipitation Index (SPI)	NDMC* Drought Category	Palmer Drought Index
Minor Drought	3 to 4	Going into drought; short-term dryness slowing growth of crops or pastures; fire risk above average. Coming out of drought; some lingering water deficits; pastures or crops not fully recovered.	-0.5 to -0.7	D0	-1.0 to -1.9
Moderate Drought	5 to 9	Some damage to crops or pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing or imminent, voluntary water use restrictions requested.	-0.8 to -1.2	D1	-2.0 to -2.9
Severe Drought	10 to 17	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed.	-1.3 to -1.5	D2	-3.0 to -3.9
Extreme Drought	18 to 43	Major crop and pasture losses; extreme fire danger; widespread water shortages or restrictions.	-1.6 to -1.9	D3	-4.0 to -4.9
Exceptional Drought	44+	Exceptional and widespread crop and pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells creating water emergencies.	less than -2	D4	-5.0 or less

*NDMC - National Drought Mitigation Center

Figure 22 shows conditions based on the Keetch-Byram Drought Index (KBDI) for Tarrant County and the state of Texas. The KBDI, which is used to determine forest fire potential, is based on a daily water balance, where the drought factor is balanced with precipitation and soil moisture (assumed to have a maximum storage capacity of 8 inches) and is expressed in hundredths of an inch of depletion of soil moisture.

The drought index ranges from 0 to 800, where a drought index of 0 represents no moisture depletion, and an index of 800 represents absolutely dry conditions. At present, this index is derived from ground-based estimates of temperature and precipitation received from weather stations and interpolated manually by experts at the Texas Forest Service (TFS) for counties across the state. Researchers at Texas A&M University are working with TFS to derive this index from Advanced Very-High-Resolution Radiometer satellite data and Next-Generation Radar rainfall in GIS.

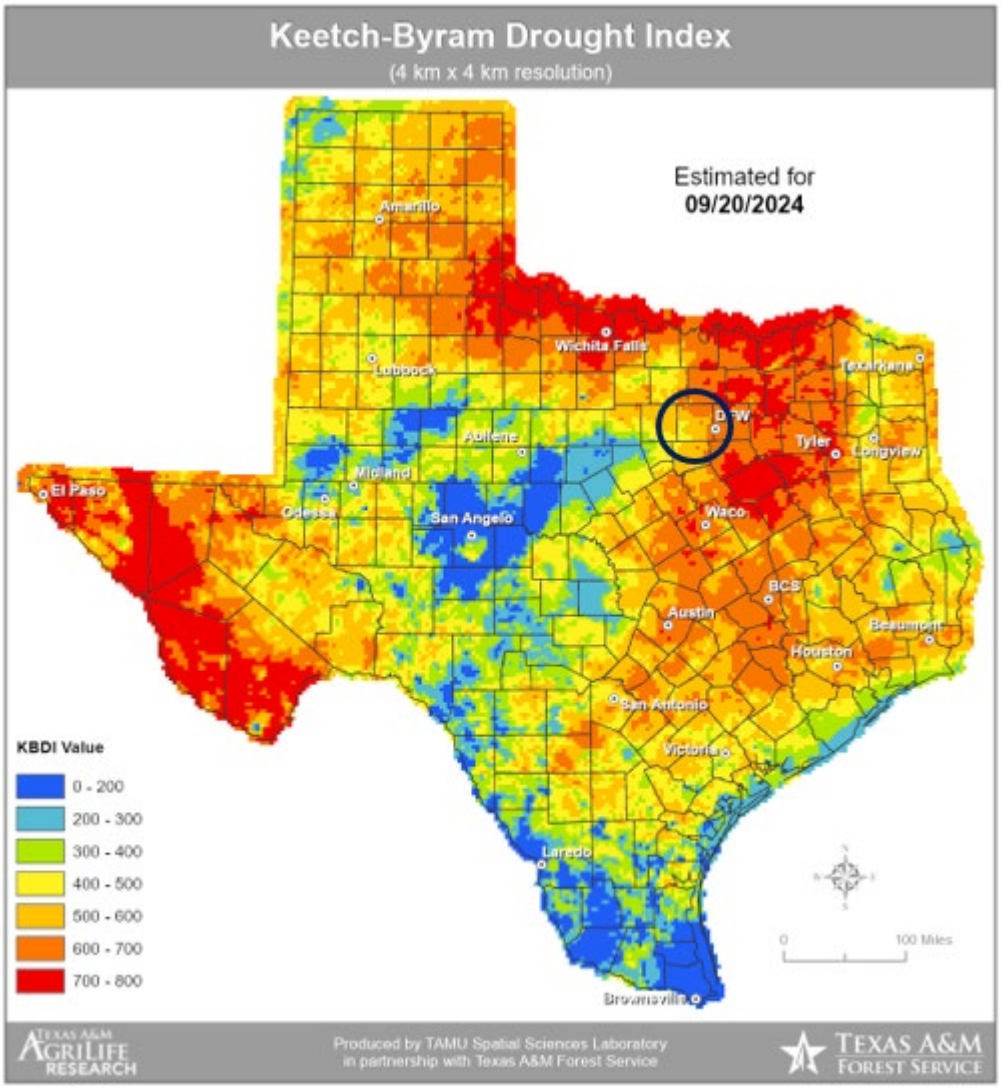


Figure 22: Keetch-Byram Drought Index for Texas, Circle Indicating Tarrant County[27]

Previous Historical Occurrences

Table 14 lists all historical droughts from February 2015 to 2023. Property damage from drought totals $2,000, and crop damage totals $19,000. Calculations of annualized losses due to drought events were conducted using historical data obtained from the National Centers for Environmental Information (NCEI).

[27] Texas A&M Forest Service. Keetch-Byram Drought Index, 09/20/2024. https://tfsweb.tamu.edu/DroughtStudy/.

Table 14: Historical Periods of Drought, Tarrant County, 2015–2024[28]

Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Tarrant (Zone)	08/25/2015	0	0	$0	$0
Tarrant (Zone)	09/01/2015	0	0	$0	$1,000
Tarrant (Zone)	10/01/2015	0	0	$2,000	$0
Tarrant (Zone)	12/01/2017	0	0	$0	$1,000
Tarrant (Zone)	07/01/2018	0	0	$0	$5,000
Tarrant (Zone)	08/01/2018	0	0	$0	$2,000
Tarrant (Zone)	10/01/2019	0	0	$0	$0
Tarrant (Zone)	11/17/2020	0	0	$0	$0
Tarrant (Zone)	12/01/2020	0	0	$0	$0
Tarrant (Zone)	02/23/2021	0	0	$0	$0
Tarrant (Zone)	03/01/2021	0	0	$0	$0
Tarrant (Zone)	01/01/2022	0	0	$0	$0
Tarrant (Zone)	02/01/2022	0	0	$0	$0
Tarrant (Zone)	03/01/2022	0	0	$0	$0
Tarrant (Zone)	04/01/2022	0	0	$0	$0
Tarrant (Zone)	05/01/2022	0	0	$0	$0
Tarrant (Zone)	06/01/2022	0	0	$0	$0
Tarrant (Zone)	07/01/2022	0	0	$0	$0
Tarrant (Zone)	08/01/2022	0	0	$0	$0
Tarrant (Zone)	09/01/2022	0	0	$0	$0
Tarrant (Zone)	10/04/2022	0	0	$0	$0
Tarrant (Zone)	11/01/2022	0	0	$0	$0
Tarrant (Zone)	07/11/2023	0	0	$0	$0
Tarrant (Zone)	08/01/2023	0	0	$0	$0
Tarrant (Zone)	09/01/2023	0	0	$0	$0
Tarrant (Zone)	10/01/2023	0	0	$0	$0
Tarrant (Zone)	11/01/2023	0	0	$0	$0
Totals:		**0**	**0**	**$2,000**	**$19,000**

[28] National Centers for Environmental Information, 2024, Storm Events Database - Search Page | National Centers for Environmental Information (noaa.gov).

Probability of Future Events

Rising temperatures, decreased precipitation, and higher emissions are expected to increase the probability of drought events in Tarrant County. As the number of days with maximum temperatures over 100 °F increases, the region will likely experience a higher evaporation rate, leading to lower soil moisture and water availability. In addition, with higher emissions, the frequency of hot days is expected to increase significantly, leading to a high probability of drought.[29]

Furthermore, climate models predict that the region could experience a decline in precipitation in the future. This could exacerbate the impact of rising temperatures and lead to more frequent and severe droughts. As a result, it is essential to take action to reduce greenhouse gas emissions and mitigate the impact of climate change to prevent the probability of droughts from increasing in Tarrant County and other regions. Figure 23 is a Seasonal Drought Outlook map showing the likely development for Tarrant County.[30] It shows that Tarrant County experienced moderate drought (D1 intensity) in August 2024.[31]

Effective measures to mitigate drought include promoting sustainable land use practices, encouraging renewable energy sources, reducing carbon emissions, and implementing water conservation strategies. These actions could help preserve soil moisture, ensure adequate water availability, and minimize the likelihood of droughts. Figure 24, Table 15, and Table 16 indicate there will be a gradual increase in the number of days each year with temperatures over 100 °F in Tarrant County and the effects of temperature created by lower and higher emissions.[32]

[29] Texas Department of Emergency Management (TDEM), 2023 State of Texas Hazard Mitigation Action Plan, "Drought Probability in Tarrant County," txdem.sharepoint.com/sites/TDEMWebsiteFiles/Shared Documents/Forms/AllItems.aspx?id=%2Fsites%2FTDEMWebsiteFiles%2FShared Documents%2FMitigation%2FState of Texas HMAP Update - 10%2E27%2E23%2Epdf&parent=%2Fsites%2FTDEMWebsiteFiles%2FShared Documents%2FMitigation&p=true&ga=1.
[30] National Oceanic and Atmospheric Agency, National Weather Service Climate Prediction Center, 2024, "United States Seasonal Drought Outlook," Climate Prediction Center: Seasonal Drought Outlook (noaa.gov).
[31] United States Drought Monitor, 2024, "State of Texas Intensity Map," Texas | U.S. Drought Monitor (unl.edu).
[32] Climate Mapping for Resilience and Adaption, 2024, https://livingatlas.arcgis.com/assessment-tool/explore/details.

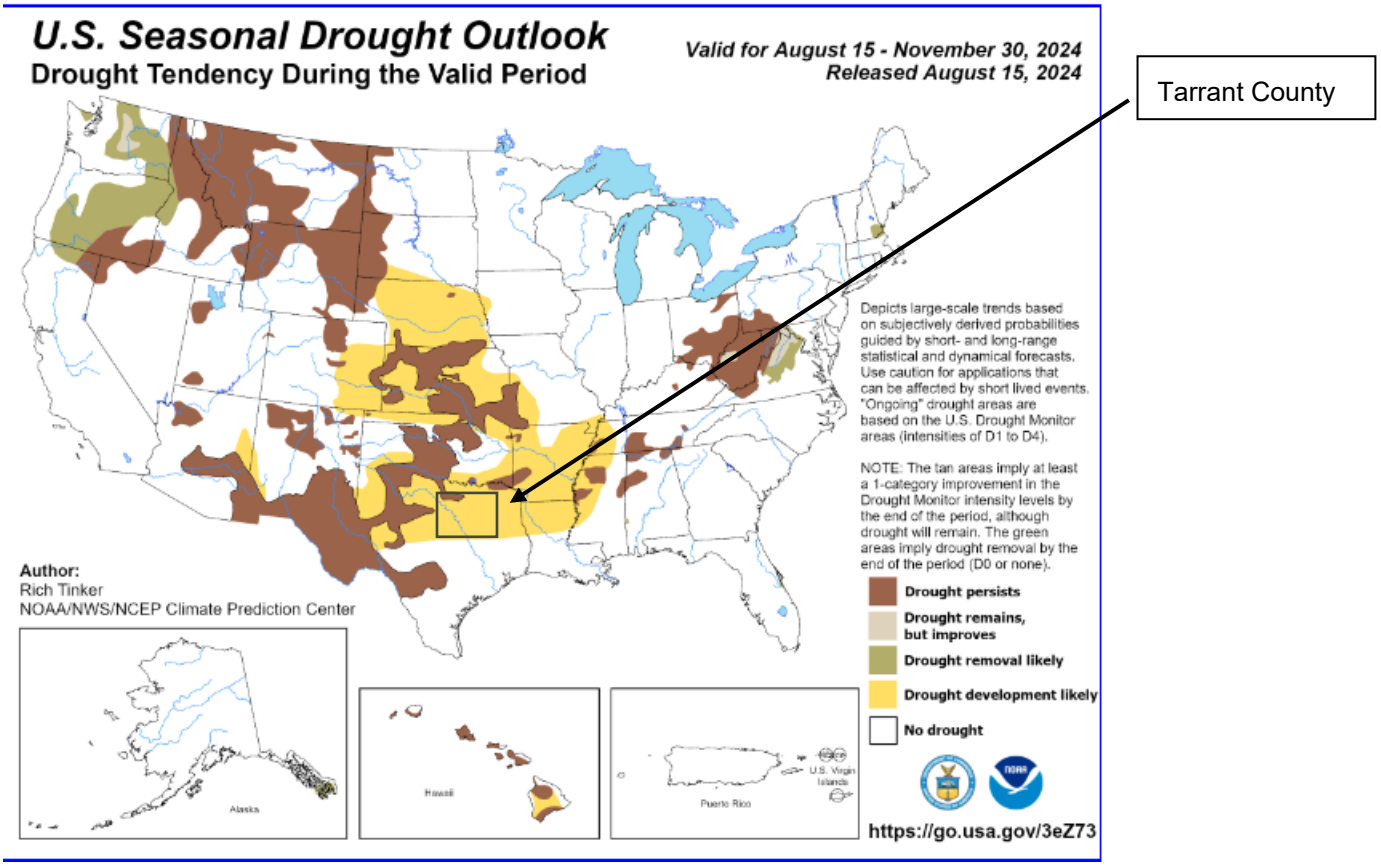


Figure 23: United States Seasonal Drought Outlook (August 15–November 30, 2024)

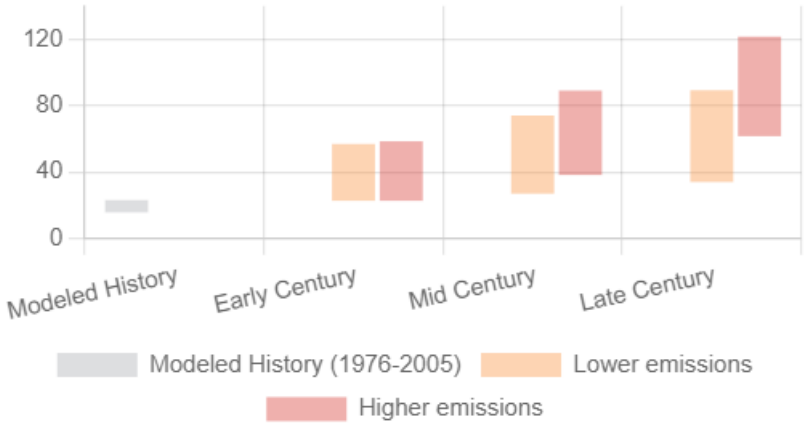


Figure 24: Effects of Higher and Lower Emissions on 100-Degree Days through 2100[33]

[33] Climate Mapping for Resilience and Adaption, 2024, https://livingatlas.arcgis.com/assessment.

Table 15: Days per Year in Tarrant County with Temperature above 100 °F with Lower Emissions[34]

Lower emissions	Minimum Projection	Mean (Days)	Maximum Projection
Modeled History (1976-2005)	15.8	18.6	23.2
Early Century (2015–2044)	22.8	38.8	57.0
Mid Century (2035–2064)	27.1	48.9	74.1

Table 16: Days per Year in Tarrant County with Temperature above 100 °F with Higher Emissions[35]

Higher emissions	Minimum Projection	Mean (Days)	Maximum Projection
Modeled History (1976-2005)	15.8	18.6	23.2
Early Century (2015–2044)	22.8	40.3	58.6
Mid Century (2035–2064)	38.3	57.1	89.1
Late Century (2070–2099)	61.7	92.5	121.6

Impact of Climate Trends and Variations

Climate change contributes to drought by altering weather patterns and increasing temperatures. As the climate continues to warm, more soil water evaporates, leading to drier conditions. In addition, changes in precipitation patterns can contribute to drought. In some regions in Texas, such as Tarrant County, there may be less rainfall overall, while in others, rainfall may be more sporadic and less predictable, making it difficult to plan and manage water resources. Drought will continue to be driven largely by precipitation variability over multiple decades, with long-term precipitation trends expected to be relatively small.[36] Figure 25, a climate change forecast, illustrates average, maximum, and minimum temperature change

[34] Ibid.
[35] Climate Mapping for Resilience and Adaption, 2024, https://livingatlas.arcgis.com/assessment-tool/explore/details.
[36] Texas Department of Emergency Management, 2023 State of Texas Hazard Mitigation Action Plan, "Drought Probability in Tarrant County," txdem.sharepoint.com/sites/TDEMWebsiteFiles/SharedDocuments/Forms/AllItems.aspx?id=%2Fsites%2FTDEMWebsiteFiles%2FSharedDocuments%2FMitigation%2FState of Texas HMAP Update - 10%2E27%2E23%2Epdf&parent=%2Fsites%2FTDEMWebsiteFiles%2FSharedDocuments%2FMitigation&p=true&ga=1.

predictions for Tarrant County from 2022 to 2040. It also shows projected climate in that period, considering a median scenario, neither particularly optimistic nor pessimistic.

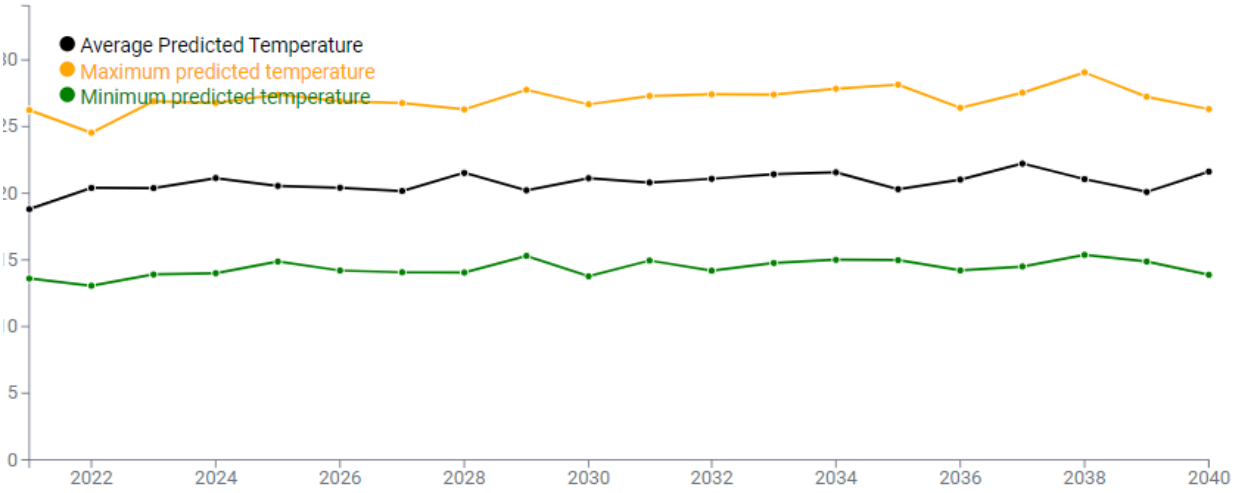


Figure 25: Climate Change Forecast, Future Climate Trends for Tarrant County, Texas[37]

Vulnerability Assessment

Droughts can have wide-ranging impacts that cross jurisdictional boundaries and affect large areas. Although all existing and future buildings, facilities, and populations are at risk of this hazard, droughts usually cause water shortages and crop/livestock losses on agricultural lands. The effects of dry soil on buildings can also be quite damaging. As the ground dries out, it contracts, causing or worsening cracks in foundations, walls, and driveways. Other symptoms of foundation damage include uneven floors, doors and windows out of alignment, and broken sewer pipes.

The economic consequences of droughts can be extensive, as they create a complex interconnection of impacts on various sectors of the economy and extend far beyond the geographic region affected by the drought. This complexity arises because water is crucial in producing goods and delivering services. If droughts persist for many years, the direct and indirect economic consequences can be significant.

Drought is also closely related to wildfire risk. Prolonged periods of drought lead to decreased soil moisture and increased plan mortality and stressed vegetation, which creates more fuel for fires.

Ground and surface water quality can also be affected during drought. Lower water levels in water bodies may increase the concentration of waterborne pollutants and may also result in higher water temperature which can affect aquatic ecosystems.

[37] Augurisk, Mearns, L.O., et al., 2017: The NA-CORDEX dataset, version 1.0. NCAR Climate Data Gateway, Boulder CO, accessed [November 2020]. Scenario RCP4.5 (median scenario), Model: CanESM2.CanRCM4. “Tarrant County Climate Change Forecast.” Tarrant County Texas natural disaster risk assessment on Augurisk. RCP = Representative Concentration Pathway (of temperature change).

ESTIMATED IMPACT AND POTENTIAL LOSSES

Annualized loss value can be interpreted as the impact expected from drought in terms of human losses and injuries and property losses. Data from the NRI (see Figure 26) show an EAL from drought in Tarrant County of $32,000, a relatively low percentile rating compared with the rest of the United States, and a score of 55.1.[38]

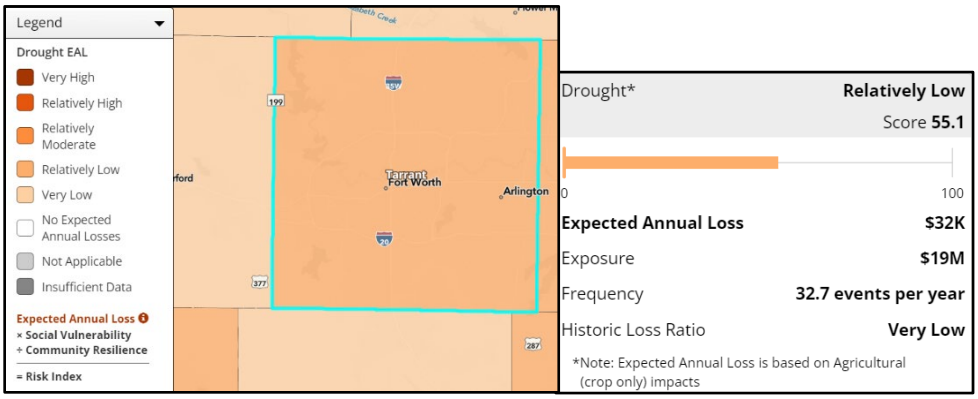


Figure 26: National Risk Index Data on Estimated Annual Loss from Drought, Tarrant County, Texas[39]

IMPACT ON COUNTY ASSETS

Community lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function. Community lifelines are essential for the well-being of any community. They provide support and assistance to individuals who require help, especially during times of crisis. FEMA community lifelines are a critical component of emergency management in the United States. These lifelines are designed to address the essential needs of a community during and after a disaster. There are eight lifelines, each with its own focus and purpose (see Figure 27).

Figure 27: FEMA Community Lifelines

[38] FEMA, National Risk Index, 2024, Tarrant County Drought Expected Annual Loss, Map | National Risk Index (fema.gov).
[39] FEMA, National Risk Index, 2024, "Tarrant County Drought Expected Annual Loss Map, Legend and Score," Map | National Risk Index (fema.gov).

Community lifelines help create a sense of safety and security in a community. They provide a safety net for individuals who may be struggling and offer comfort and reassurance that help is available when needed. Without these lifelines, communities would be much more vulnerable to crises and emergencies. The main lifelines for drought are food, hydration, shelter, and water systems; most crops and animals require water to thrive and grow, without which they stress and ultimately die. Shelter also is affected, as drought can severely damage structural integrity as the soil pulls away from beams, buildings, and bridges.

VULNERABLE POPULATIONS

All populations, agriculture, property, and the environment in Tarrant County are vulnerable to drought. During extreme drought conditions, typical demand can deplete water resources, leading to a scarcity of potable water and a decline in overall water quality. This can raise health concerns for all residents, especially for vulnerable populations, such as children, the elderly, and the immunocompromised. In addition, potable water is crucial for drinking, sanitation, patient care, sterilization, equipment, and heating and cooling systems in medical facilities.[40]

The Community Resilience for Equity reports United States Census Bureau statistics for Tarrant County on social vulnerability factors and Hispanic origin and race (see Figure 28 and Figure 29).

[40] Texas Department of Emergency Management, 2023 State of Texas Hazard Mitigation Action Plan, "Drought Impact on Vulnerable Populations," txdem.sharepoint.com/sites/TDEMWebsiteFiles/SharedDocuments/Forms/AllItems.aspx?id=%2Fsites%2FTDEMWebsiteFiles%2FSharedDocuments%2FMitigation%2FState of Texas HMAP Update - 10%2E27%2E23%2Epdf&parent=%2Fsites%2FTDEMWebsiteFiles%2FSharedDocuments%2FMitigation&p=true&ga=1.

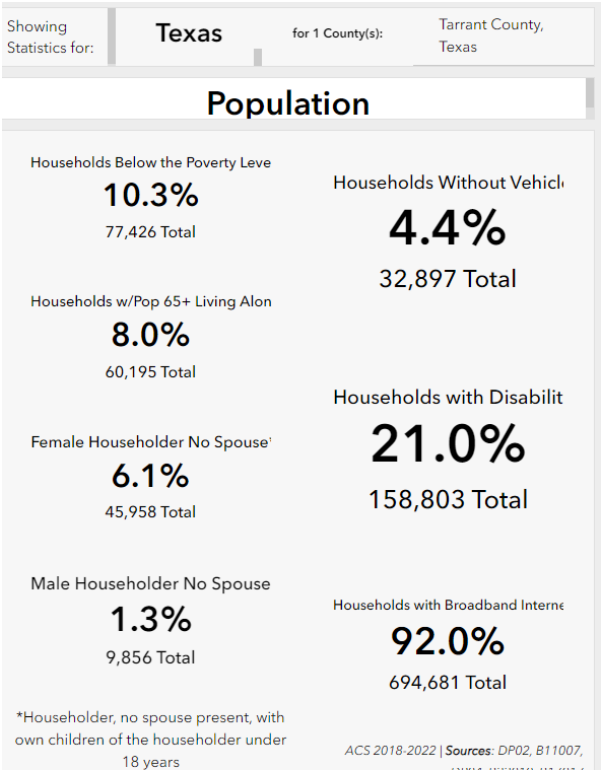


Figure 28: Community Resilience Estimates, Tarrant County, 2022[41]

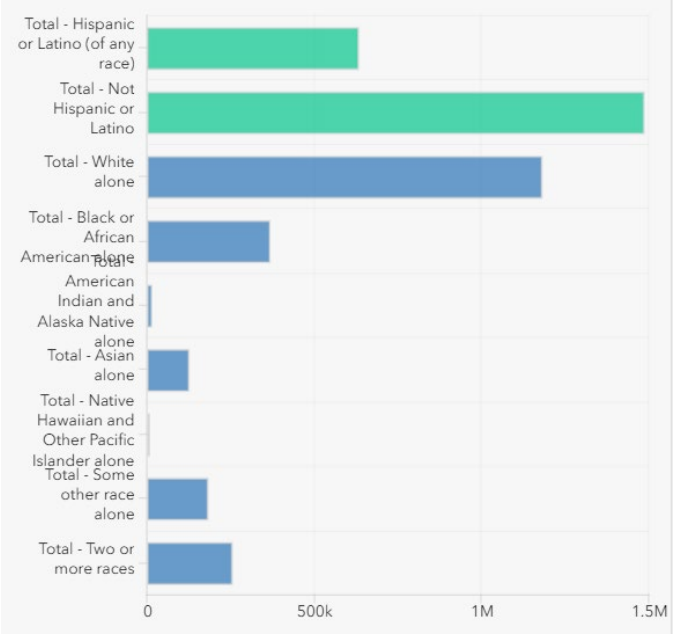


Figure 29: Hispanic Origin and Race, Tarrant County, 2022[42]

[41] Community Resilience Estimates (CRE) for Equity, 2022, "Tarrant County Population Social Vulnerability Statistics," CRE for Equity (arcgis.com).
[42] Community Resilience Estimates (CRE) for Equity, 2022, "Tarrant County Population Hispanic Origin and Race Statistics," CRE for Equity (arcgis.com).

The Climate and Economic Justice Screening Tool can be used to illustrate census tracts in Tarrant County that are reported as overburdened and underserved. They are highlighted in gray in Figure 30. This tool ranks most of the burdens using percentiles and shows how much burden each census tract experiences when compared with other tracts. Communities are considered disadvantaged if their census tract meets the threshold for at least one of the tool's categories of burden: climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development.[43]

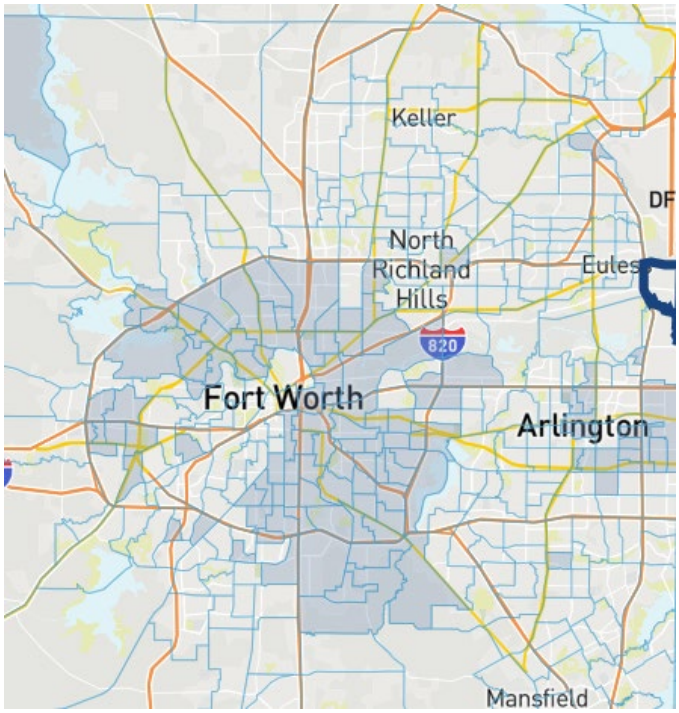


Figure 30: Climate and Economic Justice Areas (in Gray), Tarrant County[44]

Development Trends

The Tarrant Regional Water District Strategic Water Conservation Plan indicates that water demands are projected to double over the next fifty years, primarily due to projected growth in population in the area. The Conservation Plan addresses possible needs for water conservation, water reuse, and acquisition of additional water supply.[45]

On October 1, 2021, Tarrant County issued a ban on outdoor burning for 90 days, as unincorporated areas were under drought conditions due to a lack of rainfall for several weeks.[46] A press release on August 20, 2024, stated that severe drought conditions in unincorporated areas of Tarrant County prompted the Fire Marshal to request the ban on outdoor burning, based on an order from the Tarrant

[43] Climate and Economic Justice Screening Tool, 2024 (https://www.geoplatform.gov/).
[44] Climate and Economic Justice Screening Tool, 2024 (https://www.geoplatform.gov/).
[45] Tarrant Regional Water District Strategic Water Conservation Plan, 2013. https://savetarrantwater.com/wp-content/uploads/2020/09/strategic_water_conservation_plan.pdf.
[46] Fort Worth Star-Telegram, Haley Samsel, October 1, 2021, "As Severe Drought Conditions Hit North Texas, Tarrant County Issues 90-Day Burn Ban," Tarrant County bans outdoor burning to prevent wildfires | Fort Worth Star-Telegram.

County commissioners court, to protect the lives and properties of Tarrant County residents. The Texas A&M Forest Service supported the request for an outdoor burning ban. In Texas, local governments are empowered to take action on behalf of those they serve. When drought conditions exist, a burn ban can be put in place by a county judge or county commissioners court, prohibiting or restricting outdoor burning for public safety.[47] Drought conditions in Tarrant County have been persistent since the last plan update in 2020, indicating increasing vulnerability to drought. Figure 31 shows a fire in dried vegetation in neighboring Parker County.

Figure 31: Grass and Weeds on Fire, Parker County, 2018

VULNERABILITY SCORE

The NRI includes data on the EALs to individual natural hazards, historical loss, and overall risk at the county and census tract levels. Based on the NRI, Tarrant County has a rating for drought of relatively low and a score of 53.6, which is lower than the national percentile.

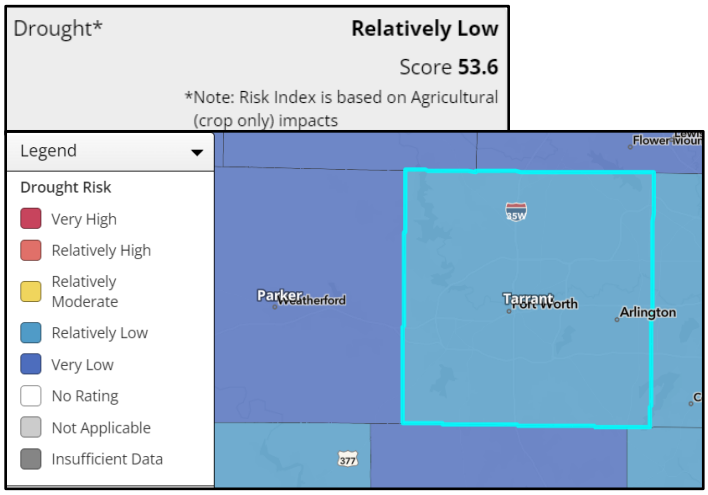


Figure 32: National Risk Index Data for Drought Risk, Tarrant County[48]

[47] Tarrant County Texas Government, 2024, PRESS RELEASE (tarrantcountytx.gov).
[48] FEMA, National Risk Index, "Tarrant County Drought Score, Map, and Legend." Map | National Risk Index (fema.gov).

Earthquake

An earthquake is a sudden motion or trembling caused by an abrupt release of accumulated strain on the tectonic plates that constitute the Earth's crust. The theory of plate tectonics holds that the Earth's crust is broken into several major plates. These rigid, 50- to 60-mile-thick plates move slowly and continuously over the interior of the Earth, meeting in some areas and separating in others. As the tectonic plates move together, they bump, slide, catch, and hold. Eventually, faults along or near plate boundaries slip abruptly when the stress exceeds the elastic limit of the rock, and an earthquake occurs.

Location and Extent

Table 17 describes the levels of shaking possible from earthquakes, with reference to the Modified Mercalli Intensity Chart. Figure 33 shows the levels of ground shaking from earthquakes in 2023.[49] Tarrant County is at a Level V or VI on the Modified Mercalli (MMI) Intensity Chart, with moderate to strong shaking.

Table 17: Magnitude/Intensity Comparison for Earthquakes[50]

Magnitude	Typical Maximum MMI	Abbreviated Modified Mercalli Intensity Scale
1.0–3.0	I	I. Not felt except by very few under especially favorable conditions
3.0–3.9	II–III	II. Felt only by a few persons at rest, especially on the upper floors of buildings.
		III. Felt quite noticeably by persons indoors, especially on the upper floors of buildings. Many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibrations are similar to the passing of a truck. Duration estimated.
4.0–4.9	IV–V	IV. Felt indoors by many and outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sounds. Sensation like a heavy truck striking a building. Standing motorcars rocked noticeably.
		V. Felt by nearly everyone; many awakened. Some dishes and windows broken. Unstable objects overturned. Pendulum clocks may stop.
5.0–5.9	VI–VII	VI. Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
		VII. Damage negligible in buildings of good design and construction; slight to moderate damage in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
6.0–6.9	VII–IX	VII. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.

[49] USGS, 2023, "National Seismic Hazard Model," National Seismic Hazard Model (2023) – Chance of Damaging Earthquake Shaking | U.S. Geological Survey (usgs.gov).
[50] US Geological Survey, "Magnitude/Intensity Comparison for Earthquakes," http://earthquake.usgs.gov/learn/topics/mag_vs_int.php, last modified 09/29/2014.

Magnitude	Typical Maximum MMI	Abbreviated Modified Mercalli Intensity Scale
		VIII. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
		IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.

* Note: MMI = Modified Mercalli Intensity

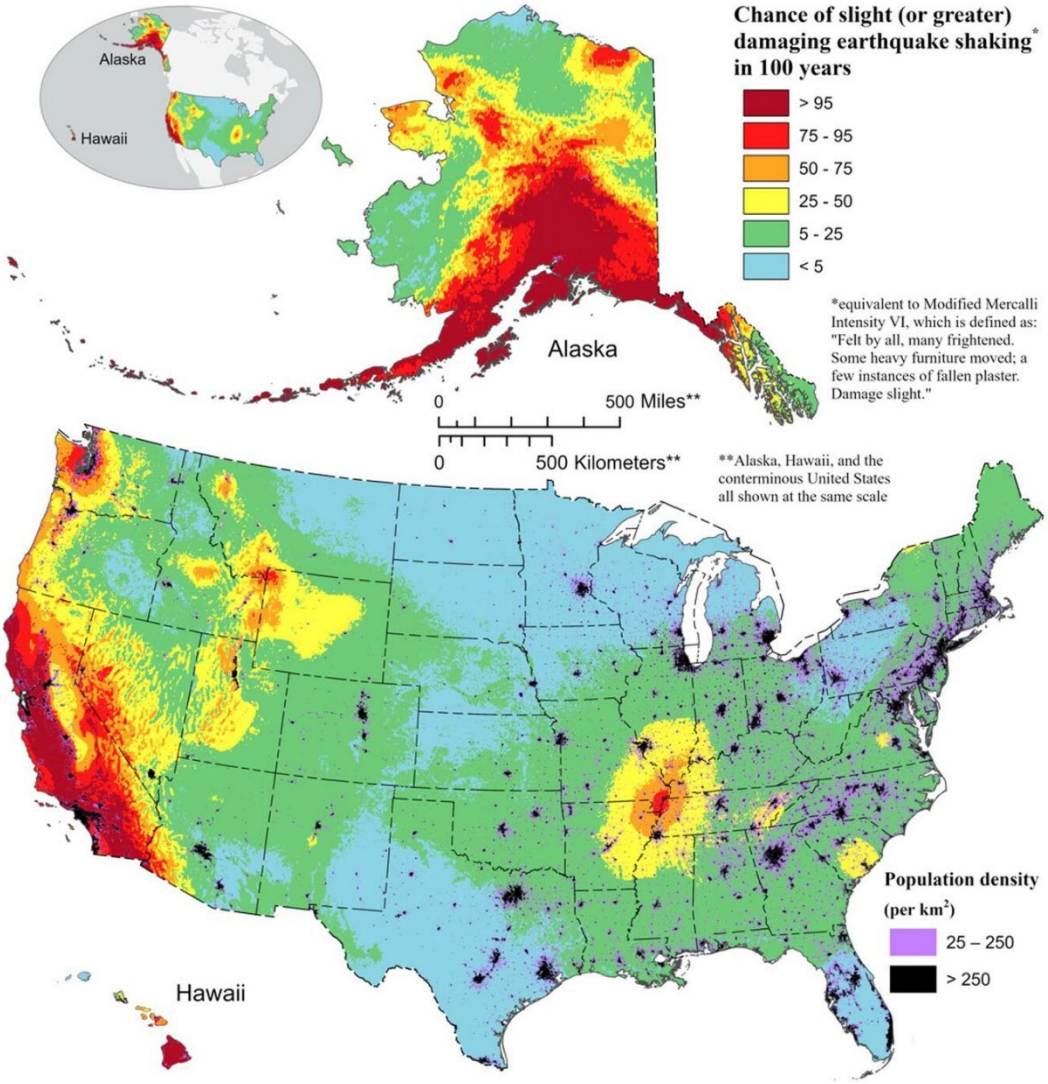


Figure 33: National Seismic Hazard Model

The ensuing seismic activity and ground motion provoke secondary hazards: surface faulting and ground failure. The vibration or shaking of the ground during an earthquake is referred to as “ground motion.” In

general, the severity of ground motion increases with the amount of energy released and declines with distance from the causative fault or epicenter. When a fault ruptures, seismic waves are propagated in all directions, causing the ground to vibrate at frequencies ranging from 0.1 to 30 Hz. Seismic waves are referred to as P waves, S waves, and surface waves. Due to the risk associated with a distant quake, earthquakes may affect the entire planning area equally. Tarrant County has a very low earthquake risk, with a total of 20 earthquakes since 1931. The United States Geological Survey (USGS) database shows that there is a 0.18% chance of a major earthquake within 30 miles of Tarrant County in the next 50 years. The largest earthquake within 30 miles of Tarrant County was a 3.2 magnitude in 2024.[51]

[51] Homefacts, Earthquake Information for Tarrant County, Texas, 2024. https://www.homefacts.com/earthquakes/Texas/Tarrant-County.html.

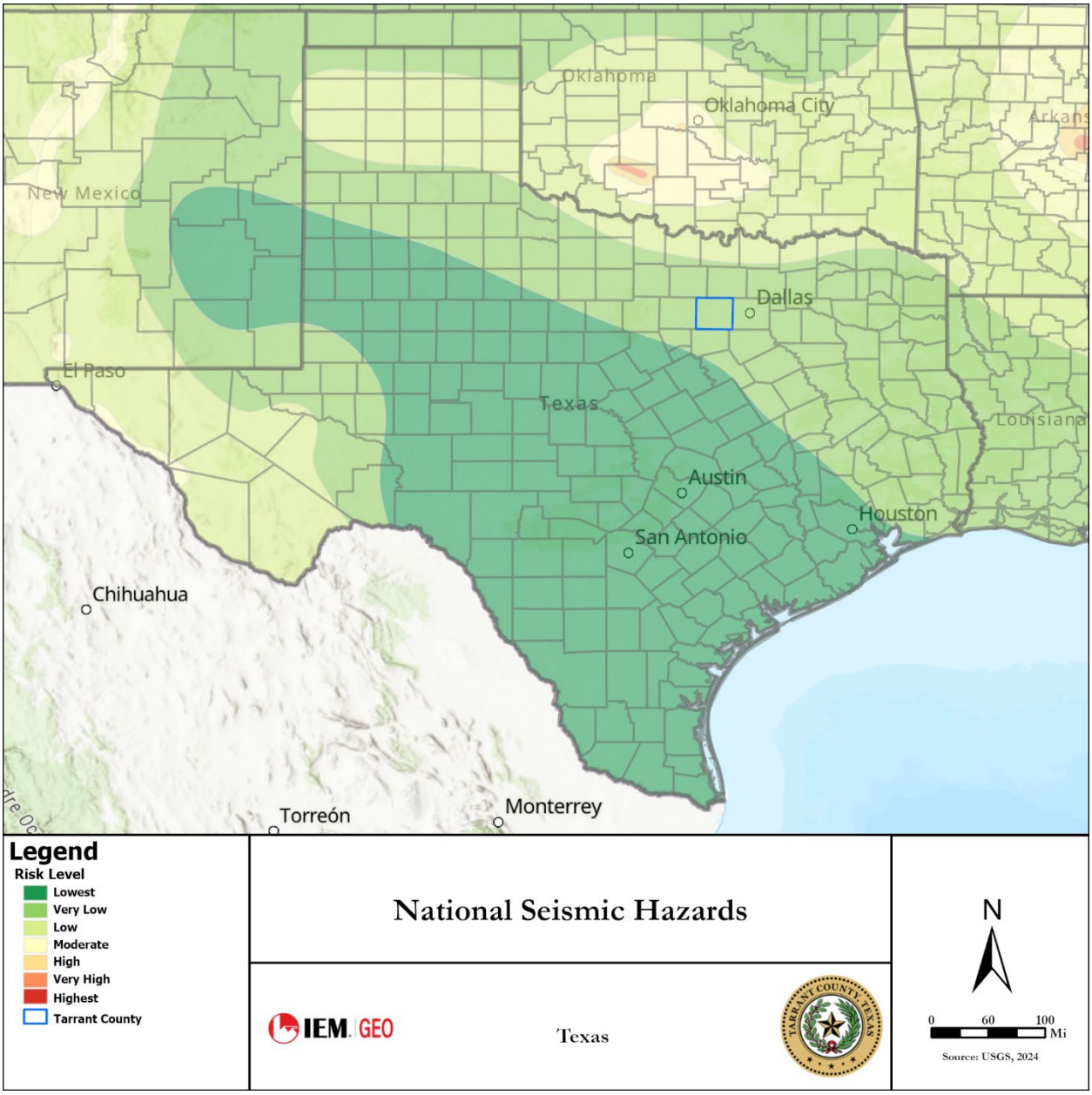


Figure 34: Seismic Risk Levels for Texas

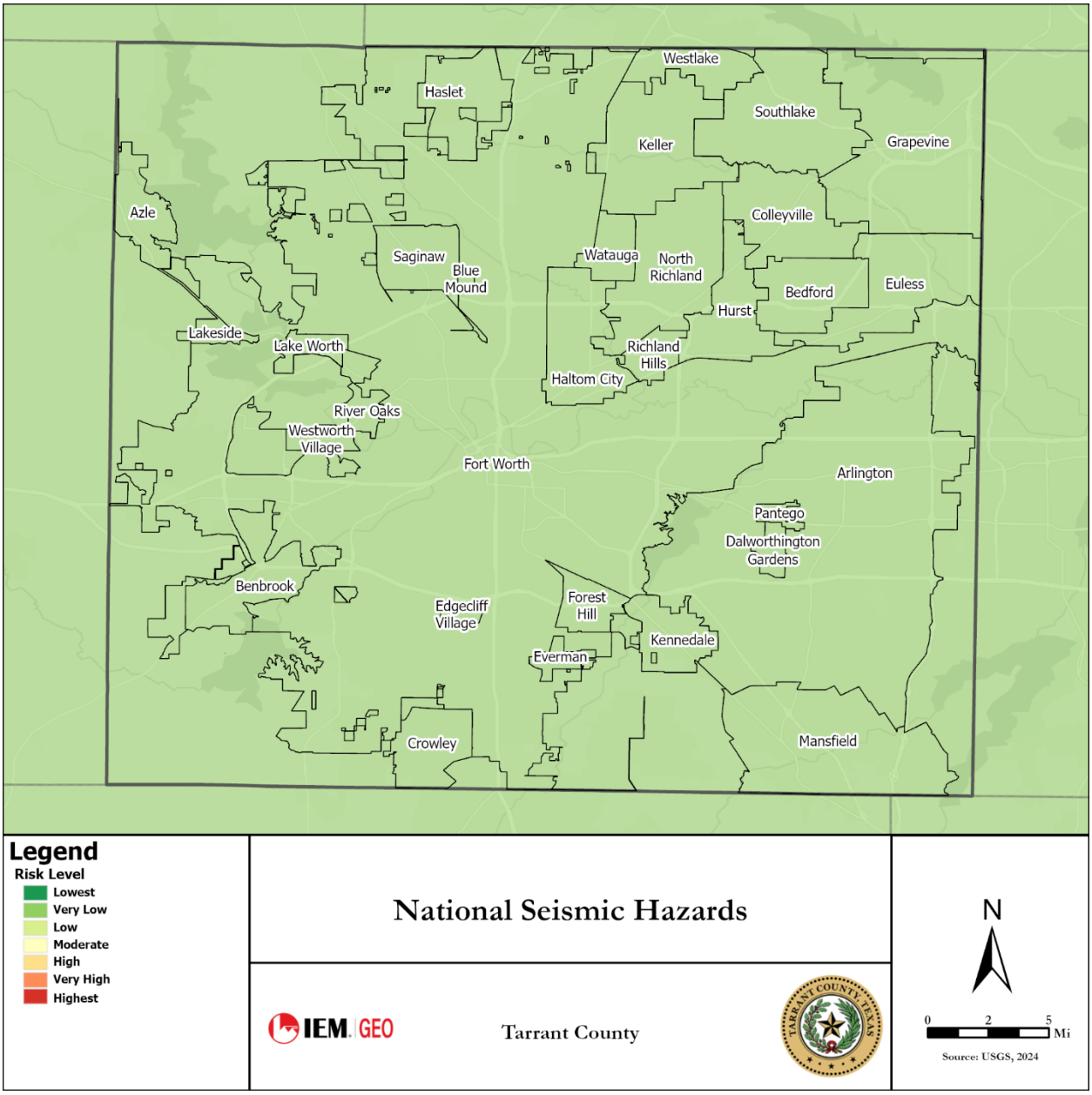


Figure 35: Seismic Risk Level for Tarrant County

Previous Historical Occurrences

According to the USGS and the National Geophysical Data Center (NGDC), there are no "significant" earthquakes on record for the State of Texas. Small earthquakes in portions of Texas are a common occurrence.[52] Figure 36 shows the location and magnitude of past earthquakes in Tarrant County.

[52] Texas Department of Emergency Management, 2023 State of Texas Hazard Mitigation Action Plan, "Historical Earthquake Events in Texas," txdem.sharepoint.com/sites/TDEMWebsiteFiles/SharedDocuments/Forms/AllItems.aspx?id=%2Fsites%2FTDEMWebsiteFiles%2FSharedDocuments%2FMitigation%2FState of Texas HMAP Update -

Additional visualizations of past earthquakes of magnitude 2.0 or greater that were recorded by the USGS in and near Tarrant County are shown in Figure 37 and Figure 38.

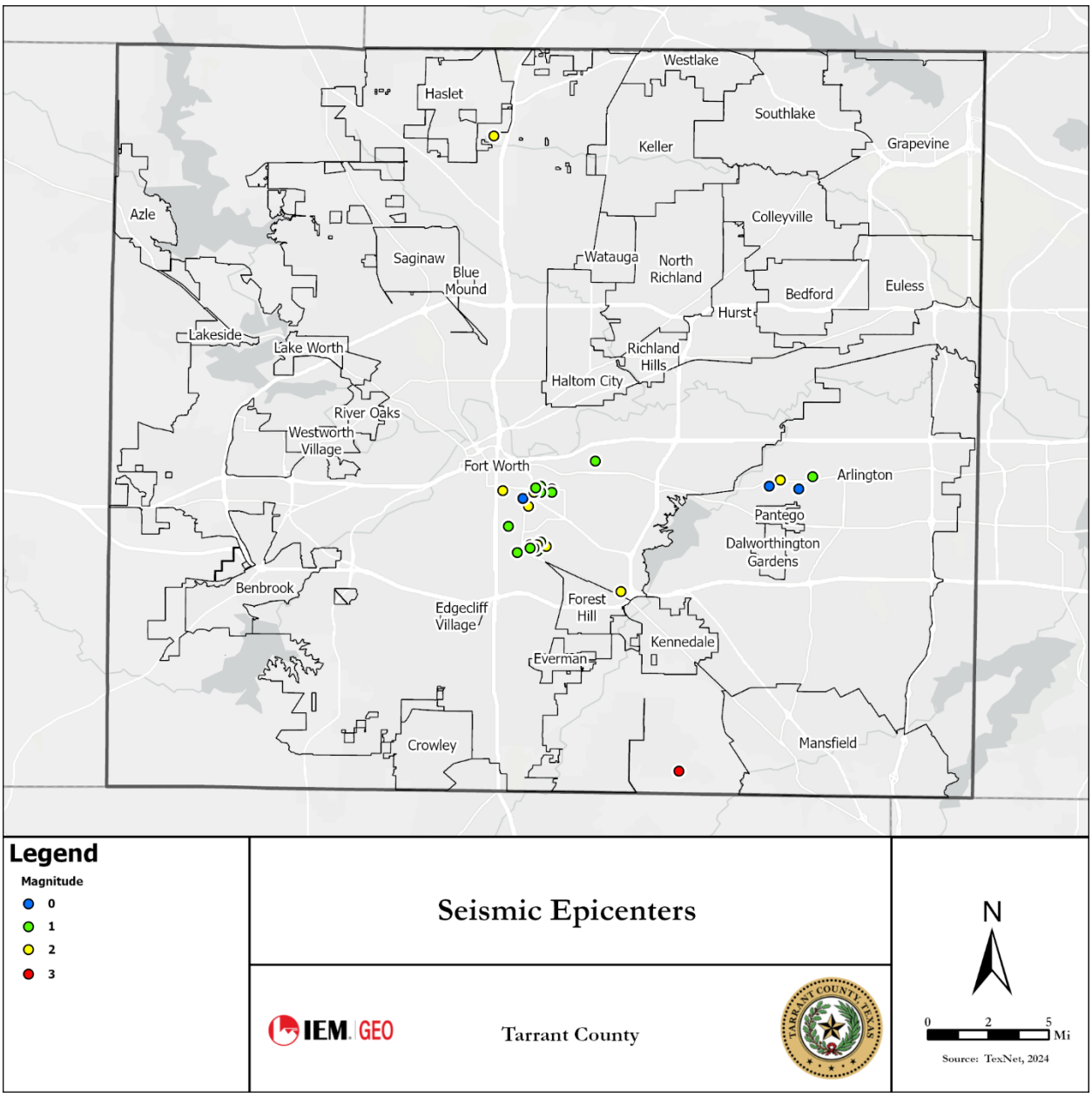


Figure 36: Historic Earthquake Epicenters in Tarrant County

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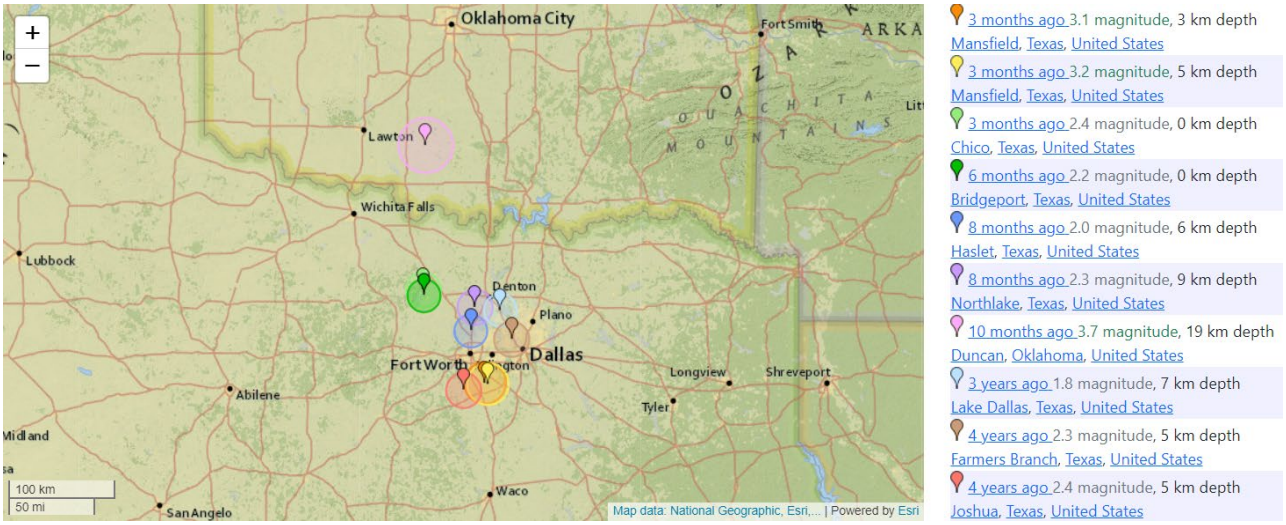


Figure 37: Earthquakes above M2 in and near Tarrant County, 2020–2024[53]

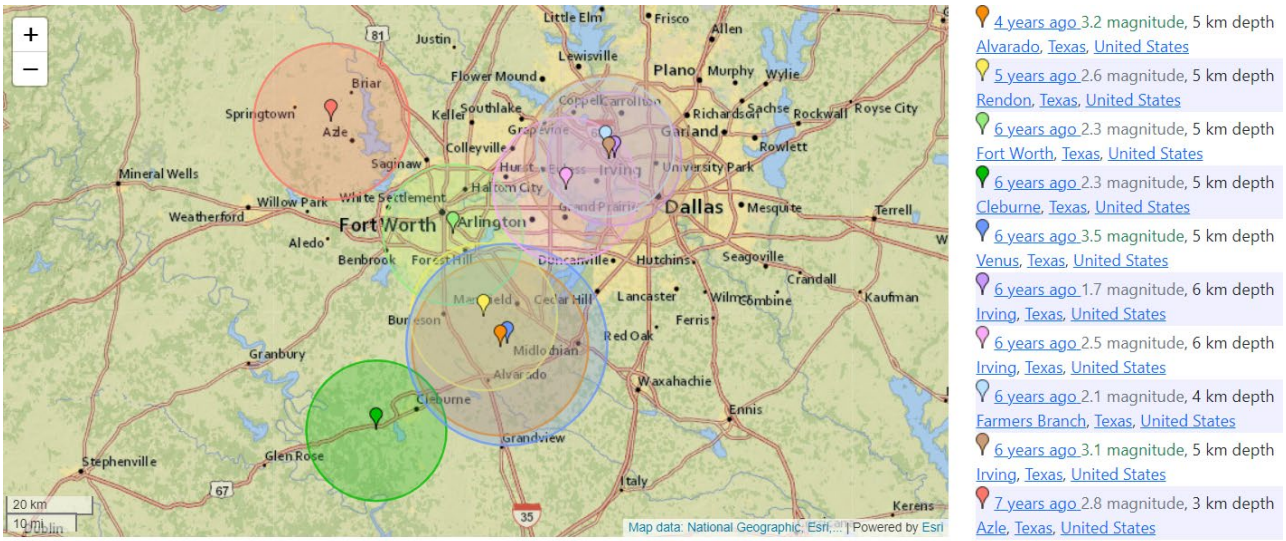


Figure 38: Earthquakes above M2 Recorded Near Tarrant County, 2017–2020[54]

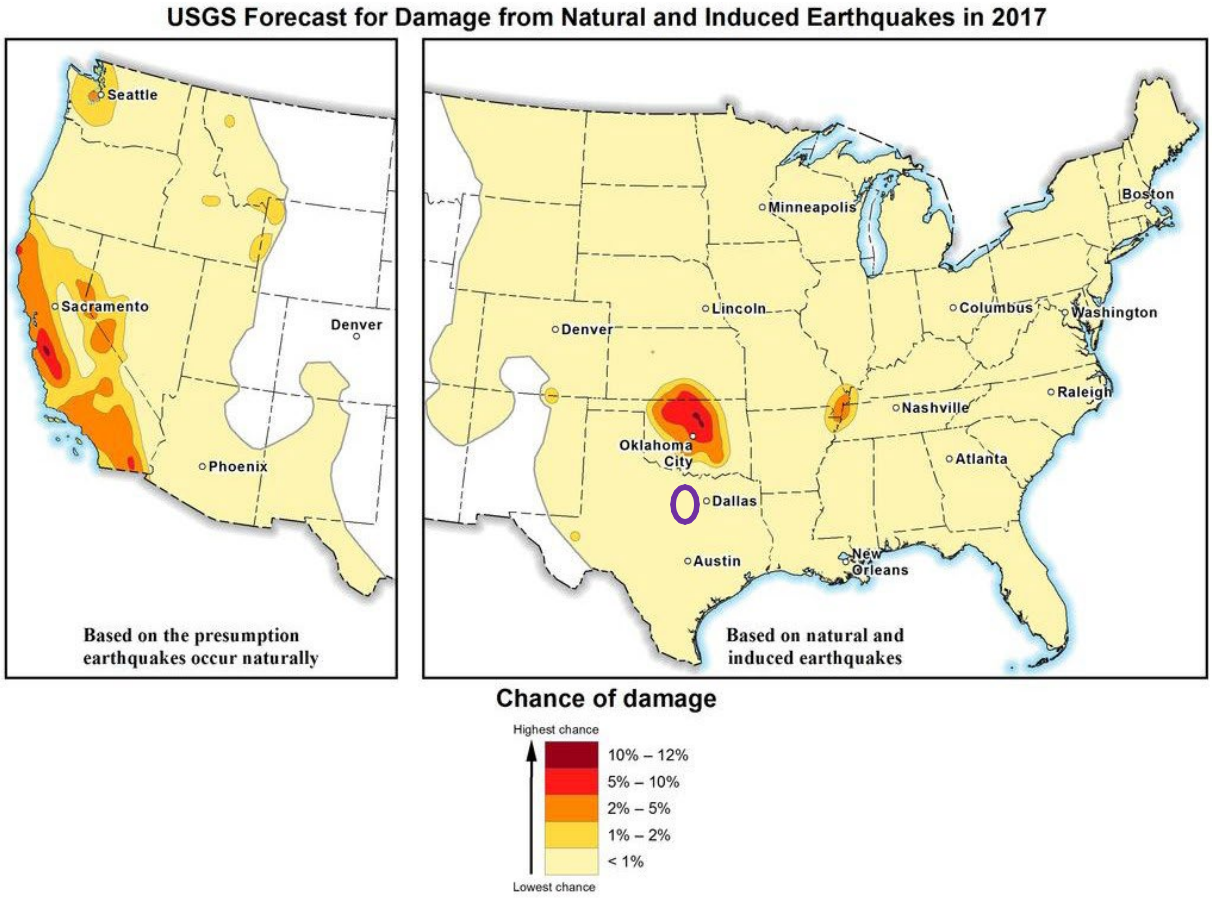
Tarrant County and participating jurisdictions experienced a few earthquakes during the time period analyzed for this plan. There is the potential for earthquake events, as evidenced by the discovery of the Azle and Irving fault lines in 2017 (see Figure 38). Earthquakes from surrounding areas can also affect the participating jurisdictions. Although no dollar amount of destruction was established, it is expected that all county and jurisdictional assets are considered vulnerable and can be exposed to this hazard. Assets near the Azle and Irving fault lines are most vulnerable to an earthquake event. Loss estimates are based on total amount over a period. The Tarrant County HazMAP reports no prior loss estimates for the time period.

[53] Earthquaketrack.com, Courtesy of United States Geological Survey, 2024, Earthquakes M2> recorded Near Fort Worth, Texas (2020–2024), "Earthquakes in Fort Worth, Texas, United States - Most Recent (earthquaketrack.com).
[54] Earthquaketrack.com, Courtesy of United States Geological Survey, 2024, Earthquakes M2> recorded Near Fort Worth, Texas (2017–2020), "Earthquakes in Fort Worth, Texas, United States - Most Recent (earthquaketrack.com).

Probability of Future Events

Figure 39 shows that most earthquakes since 1973 have occurred in the neighboring state of Oklahoma. If an Oklahoma earthquake is large enough, participating jurisdictions in Tarrant County can feel the shake, as Oklahoma is about 180 miles north. Jurisdictions in Tarrant County have experienced multiple earthquakes since 2009.

The 2023 Texas SHMP states that the occurrence of low-magnitude, negligible events is considered highly likely. However, the occurrence of a substantial or damaging event is considered occasional; that is, such an event is likely to occur in the next five years.[55]



USGS map displaying potential to experience damage from natural or human-induced earthquakes in 2017. Chances range from less than 1 percent to 12 percent.

Figure 39: Forecast for Damage from Natural and Induced Earthquakes in 2017

[55] Texas Department of Emergency Management, 2023, State of Texas Hazard Mitigation Action Plan "Earthquake Hazard Profile," txdem.sharepoint.com/sites/TDEMWebsiteFiles/SharedDocuments/Forms/AllItems.aspx?id=%2Fsites%2FTDEMWebsiteFiles%2FSharedDocuments%2FMitigation%2FState of Texas HMAP Update - 10%2E27%2E23%2Epdf&parent=%2Fsites%2FTDEMWebsiteFiles%2FSharedDocuments%2FMitigation&p=true&ga=1.

Impact of Climate Trends and Variations

The impacts of climate trends and variations on earthquake frequency are largely unknown. According to USGS statistics, there is a nearly equal distribution of earthquakes across all weather conditions (e.g., hot, cold, rainy). Very large low-pressure changes associated with major storm systems, such as typhoons and hurricanes, are known to trigger episodes of fault slip or slow earthquakes in the Earth's crust, and they may play a role in triggering some damaging earthquakes. However, such cases are rare and not statistically significant.[56]

Vulnerability Assessment

Damaging earthquakes are rare in Texas. However, it is important to be selective about mitigation efforts, focusing attention on structures or areas where potential hazard is greatest. The increasing population growth and dense urban construction in major cities inside the earthquake zones pose an increasing risk factor to the damage and loss of life potential from the next major earthquake incident. Tarrant County's vulnerability to earthquake has not changed since the last plan update.

VULNERABILITY SCORE

The NRI includes data on the EALs to individual natural hazards, historical loss, and overall risk at a county and Census tract level. Based on the NRI, Tarrant County has a rating of relatively low and a score of 89.6 for earthquake, which is lower than the national percentile.

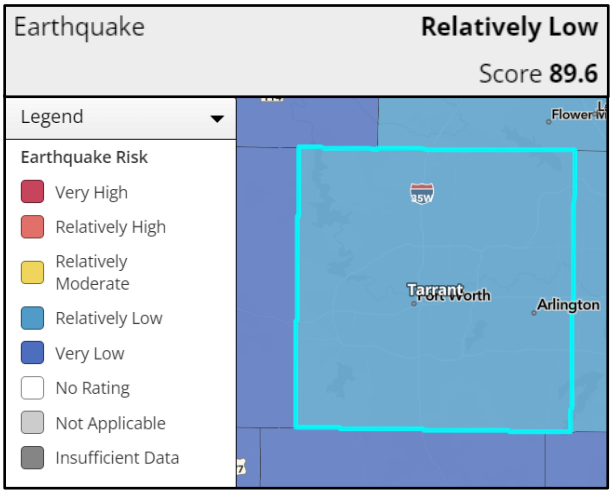


Figure 40: National Risk Index Data on Earthquake Risk, Tarrant County[57]

[56] Texas Department of Emergency Management, 2023 State of Texas Hazard Mitigation Action Plan, "Changing Future Conditions on Earthquake in Texas," txdem.sharepoint.com/sites/TDEMWebsiteFiles/Shared.Documents/Forms/AllItems.aspx?id=%2Fsites%2FTDEMWebsiteFiles%2FShared Documents%2FMitigation%2FState of Texas HMAP Update - 10%2E27%2E23%2Epdf&parent=%2Fsites%2FTDEMWebsiteFiles%2FShared Documents%2FMitigation&p=true&ga=1.

[57] FEMA, National Risk Index, "Tarrant County Earthquake Score, Map, and Legend." Map | National Risk Index (fema.gov).

ESTIMATED IMPACT AND POTENTIAL LOSSES

The annualized loss value can be interpreted as the impact expected from earthquake in terms of annualized human losses and human injuries, and annualized property losses. Figure 41 illustrates the NRI rating for the EAL for Tarrant County at $2.5M from earthquake, with a "relatively low" EAL rating (**87.7**) compared with percentile rankings in the United States.

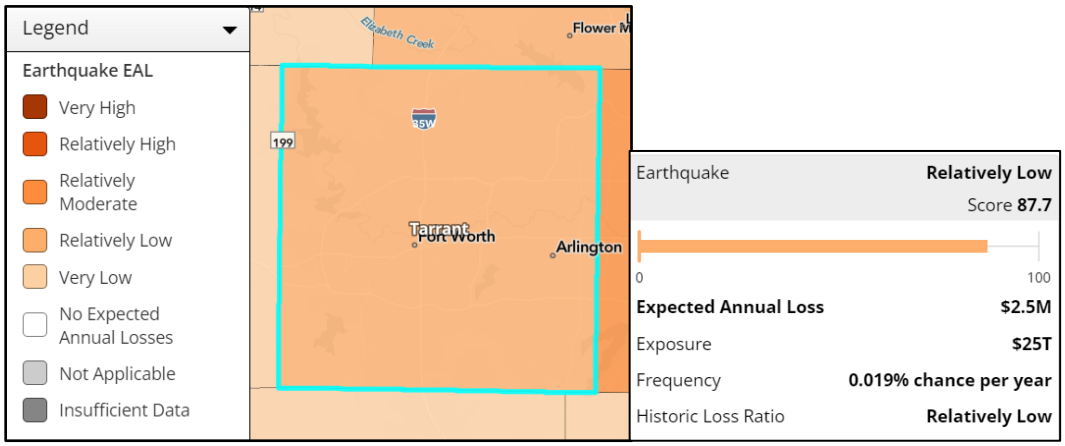


Figure 41: National Risk Index Data on Estimated Annual Loss from Earthquakes, Tarrant County[58]

IMPACT ON COUNTY ASSETS

Community lifelines are the most fundamental services in the community; when stabilized, they enable all other aspects of society to function. As such, community lifelines are essential for the well-being of any community. They provide support and assistance to individuals who require help, especially during times of crisis. FEMA community lifelines are a critical component of emergency management in the United States. These lifelines are designed to address the essential needs of a community during and after a disaster. There are eight FEMA community lifelines, each with its own focus and purpose (see Figure 42).

Figure 42: FEMA Community Lifelines

[58] FEMA, National Risk Index, "Tarrant County Earthquake Expected Annual Loss – Earthquake, Map, Legend, and Score," Map | National Risk Index (fema.gov).

In the event of an earthquake event, electrical power lines on the National Power Grid are likely to be damaged and cause extended power outages and potential fires. Downed telecommunication towers would result in loss of communications systems throughout the county. Emergency responders' access to affected areas could be limited by road debris (e.g., downed trees and powerlines) and cracks in road surfaces due the impact of an earthquake.

VULNERABLE POPULATIONS

When an earthquake damages buildings and infrastructure, the people in and around them are in danger. Individuals and families can suffer injury and death both during and after an earthquake. Debris and damage can trap people in buildings, creating unknown survival conditions depending on the extent of building damage and resources available. When buildings collapse, roads crack, or bridges are damaged, those in the vicinity can suffer injuries ranging from minor to extensive, including permanent disability or death. Following a severe earthquake with extensive damage, entire communities can become homeless and emergency services can be stressed beyond capacity. Such devastation can have lasting effects on people's physical, emotional, and mental well-being.[59]

Earthquakes can have immediate and long-term impacts on health. Immediate heath impacts from earthquakes include trauma-related deaths and injuries from building collapse as well as trauma-related deaths and injuries from secondary effects, such as burns from fires. Long-term health effects from earthquakes can include such conditions as posttraumatic stress disorder (PTSD), depression, and severe anxiety. Earthquakes strike quickly with no warning, and because of their unpredictable nature, it is normal for people to experience emotional distress. Common responses to such disasters include feelings of overwhelming anxiety, trouble sleeping, and other depression-like symptoms.[60]

[59] Centers for Disease Control, 2024, "Earthquakes: Safety Guidelines: After an Earthquake-Mental Health and Wellbeing," Safety Guidelines: After an Earthquake | Earthquakes | CDC.
[60] Substance Abuse and Mental Health Services Administration, 2024, "Earthquakes," https://www.samhsa.gov/find-help/disaster-distress-helpline/disaster-types/earthquakes.

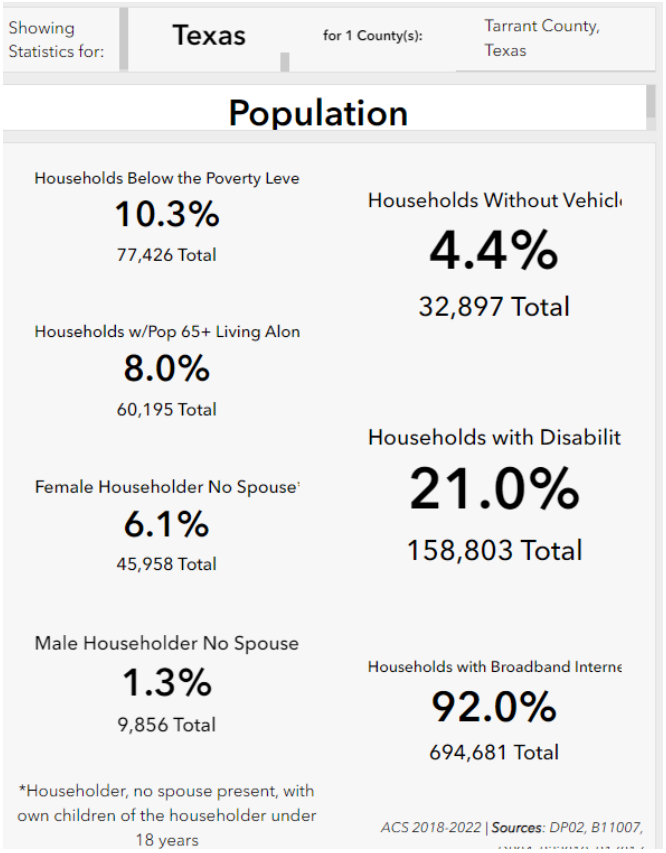


Figure 43: 2022 Community Resilience Estimates, Tarrant County, 2022[61]

Using statistics from the United States Census Bureau, the Community Resilience Estimate (CRE) for Equity indicates that 21% of the population (158,803) of Tarrant County has a disability.[62] The Resilience Analysis Planning Tool notes that 54,421 report a hearing disability, 40,545 report an independent living disability, 35,063 report a self-care disability, 98,788 report an ambulatory disability, 77,696 report a cognitive disability, and 41,254 report a vision disability.[63]

Development Trends

Since the previous plan, Tarrant County has experienced no changes in development that have impacted hazard-prone areas' vulnerability to earthquake. Although there has been an increase in population in the county, the overall likelihood and potential impacts of earthquake remain low.

[61] Community Resilience Estimates (CRE) for Equity, 2022, "Tarrant County Population Social Vulnerability Statistics," CRE for Equity (arcgis.com).
[62] Ibid.
[63] FEMA, Resilience Analysis Planning Tool, 2024, Resilience Analysis and Planning Tool (RAPT) (arcgis.com).

Expansive Soils

Expansive soils are soils that contain high percentages of swelling clays that may experience volume changes of up to 40% in the absence or presence of water. This type of plastic deformation is common in Tarrant County. Homes built on expanding smectite clays without due precautions will likely be structurally damaged as the clay takes up water. Cracks will appear in walls and floors. Damage can be minor, or it can be severe enough for the home to be structurally unsafe. Expansive soil is considered one of the most common causes of pavement distress in roadways. Depending on the moisture level, expansive soils will experience changes in volume due to moisture fluctuations from seasonal variations. Expansive soils may affect all of the Tarrant County planning area equally.

Location and Extent

Expansive soils are common in Texas soil and can be documented only when they lead to structural or infrastructure damage. The great increase in damage in Texas caused from expansive soils can be traced to the rise in residential slab-on-grade construction, which began to accelerate in the 1960s. Prior to that time, most residential construction in Texas was pier and beam, with wood siding or other non-masonry coverings. Affected homes will be heavily influenced by their proximity to a large body of water, such as homes on Eagle Mountain Lake, whereas older pier and beam foundations will behave in an entirely different manner.

Western and Central Tarrant County has several limestone formations (the Washita group) made up of limestone and shale that produce various clay-rich soils with rocky shallow soil horizons. Eastern Tarrant County is supported by Woodbine sandstone, a picturesque rolling topography dominated by sandy loams and clay-rich soils. These sandier soils allow for subsurface water movement and require special consideration. This propensity for water movement can easily compromise the foundations of homes in Tarrant County.[64]

Expansive soils, particularly after heavy rainfall followed by drought and then more heavy rain, can pose a significant risk to structures and infrastructure. The changes in soil can threaten the stability of buildings, water lines, and buried pipelines. The swelling pressure is a major threat to houses and one-story buildings, making it crucial for professionals and homeowners to be vigilant, understand the risks, and be prepared with effective mitigation strategies. Multi-story buildings can usually withstand the expansion of swelling clays unless the property is constructed on wet clay; damage could occur because of the shrinkage of the clay.

The risk of expansive soils is measured by the degree to which they may shrink or swell. Linear extensibility is used to determine the shrink–swell potential of soils. The shrink–swell potential is low if the soil has a linear extensibility of less than 3%, moderate if 3–6%, high if 6–9%, and very high if more than

[64] Fort Worth Foundation Repair. Perma Pier Foundation Repair of Texas. 2018. https://www.permapier.com/service-areas/fort-worth-foundation-repair/.

9%. If the linear extensibility is more than 3%, shrinking and swelling can damage buildings, roads, and other structures. Texas features the full range of expansive soil categories from low to very high.[65]

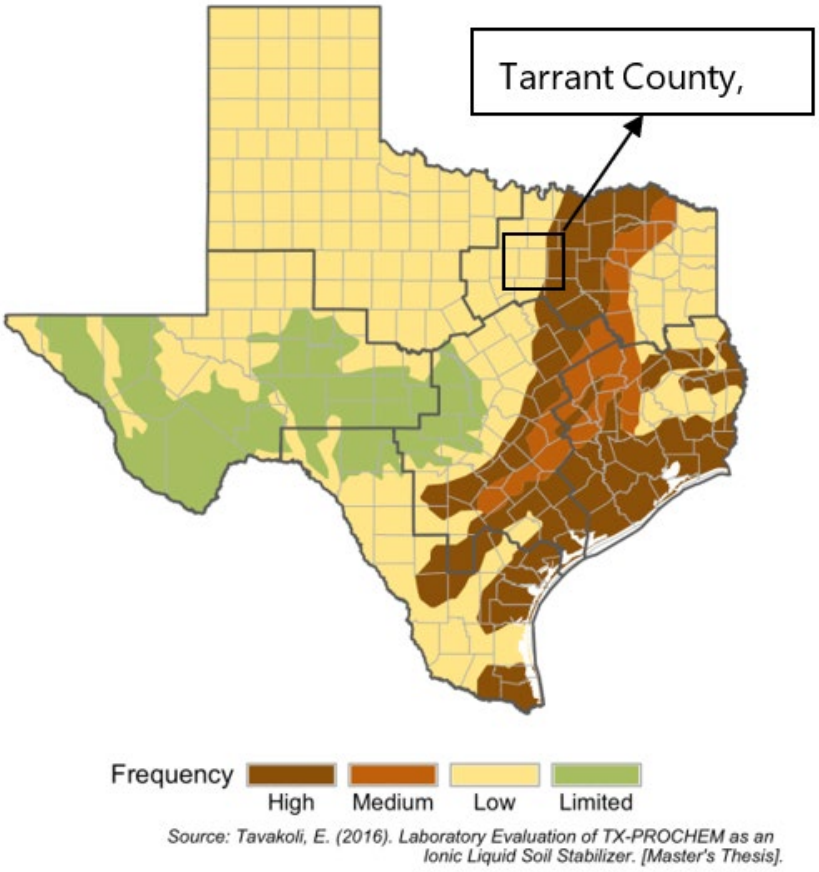


Figure 44: Location and Frequency of Expansive Soils in Texas

[65] Hazard Mitigation Plan Update, 2023. txdem.sharepoint.com/sites/TDEMWebsiteFiles/SharedDocuments/Forms/AllItems.aspx?id=%2Fsites%2FTDEMWebsiteFiles%2FSharedDocuments%2FMitigation%2FState of Texas HMAP Update – 10%2E27%2E23%2Epdf&parent=%2Fsites%2FTDEMWebsiteFiles%2FSharedDocuments%2FMitigation&p=true&ga=1.

Table 18: National Resources Conservation Service Soil Linear Extensibility Risk Categories

Potential Category	Linear Extensibility %	Clay %
Low	< 3%	< 25%
Moderate	3% - 6%	25% - 35%
High	6% - 9%	35% - 45%
Very High	> 9%	> 45%

Previous Historical Occurrences

Texas, including Tarrant County, is at risk of structural foundation issues. The American Society of Civil Engineers estimates that ¼ of all homes in the United States have some damage caused by expansive soils.[66] However, there are limited sites or reports for past events, as most soil damage is found in residential structures and not reported as hazard events. Expansive soil damage is challenging to quantify on a statewide or local level.

Probability of Future Events

Since 2005, all structures have been required by the Texas Department of Licensing and Regulation to have a soil test conducted. Soil tests can determine the risk of soil expansion and address issues before a structure is built. Drainage water should also be evaluated to ensure that it does not drain toward but away from the structure. Older structures are more likely than new ones to experience a higher impact from expansive soil. It is likely that high-risk areas in Tarrant County will experience some expansive soil impacts in the next year.

Impact of Climate Trends and Variations

Climate change directly impacts drought conditions, which cause the ground to lose moisture and can lead to permanent sinking of the ground. According to the 2023 Global Climate Report, June–December were the hottest months on record, and in July, August, and September, global temperatures were month than 1.0°C (1.8°F) above the long-term average.[67] Increases in drought will affect the frequency of damage from expansive soils.

[66] Geoscience News and Information. Expansive Soil and Expansive City. Expansive Soil Causes Basement & Foundation Problems (geology.com)
[67] Climate. Climate Change: Global Temperature. Climate Change: Global Temperature | NOAA Climate.gov.

Vulnerability Assessment

Expansive soil can have an impact both locally and statewide. The risk to stability of buildings, especially older built structures, could be costly to owners of the structure. The dry soil could damage pipes beneath the ground, and cracks to foundations of homes and businesses. The cost of repairing damage can lead to an economic loss, especially if it is a business that has to close doors during repairs.

ESTIMATED IMPACT AND POTENTIAL LOSSES

Expansive soils are a condition that is native to Texas soil characteristics and cannot be documented as a time-specific event, except when it leads to structural and infrastructure damage. Damage from expansive soils is typically associated with droughts. There are no historical data available for expansive soil damage.

IMPACT ON COUNTY ASSETS

The impact of expansive soils ranges from cosmetic cracks in walls to substantial foundation and structural damage that can require that the building be demolished. Infrastructure, such as pipelines, can be damaged, causing increased maintenance and repairs, replacement, or damage to the point of failure. Sewer and water lines are also affected by shrink and swell soils. The movement of the soils can snap water and sewer lines, producing a minimum of temporary discomfort, and a maximum of a serious health and welfare risk.

Development Trends

Houses and one-story commercial buildings are more apt to be damaged by the expansion of swelling clays than are multi-story buildings, which are usually heavy enough to counter swelling pressures. However, if constructed on wet clay, multi-story buildings may be damaged by clay shrinkage when moisture levels are substantially reduced. While all infrastructure is vulnerable, slab-on-grade structures are most likely to be damaged by expansive soils. In addition, older structures built to less stringent building codes may be more susceptible to damage than new construction. Bridges, highways, streets, and parking lots are especially vulnerable when they are constructed when clays are dry, such as during a drought, and then subsequent soaking rains swell the clay.[68]

COMMUNITY LIFELINES

Lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function. Community lifelines are essential for the well-being of any community. They provide support and assistance to individuals who require help, especially during times of crisis. FEMA community lifelines are a critical component of emergency management in the United States. Given the

[68] Hazard Mitigation Plan Update, 2023. txdem.sharepoint.com/sites/TDEMWebsiteFiles/Shared Documents/Forms/AllItems.aspx?id=%2Fsites%2FTDEMWebsiteFiles%2FShared Documents%2FMitigation%2FState of Texas HMAP Update – 10%2E27%2E23%2Epdf&parent=%2Fsites%2FTDEMWebsiteFiles%2FShared Documents%2FMitigation&p=true&ga=1.

impacts of expansive soils, the lifeline most likely to be impacted will be water systems due to the impact that the movement of soils can have on water and sewer lines (Figure 45).

Figure 45: Water Systems Community Lifeline

VULNERABLE POPULATIONS

All Tarrant County populations, agriculture, property, and the environment are vulnerable to expansive soils. Although expansive soils are not known to affect human health, they are a widespread cause of property damage, ranging from jammed doors and windows to warped flooring, ruptured foundations, cracked swimming pools, buckled roads, and severed utility lines. Wetting and drying cycles and the resulting expansions and contractions cause repetitive stress. Standard homeowner's insurance does not cover damage from expansive/compressive soils or frost heave.[69]

[69] Virginia Department of Energy. Virginia Energy – Geology and Mineral Resources – Expansive Soils.

Extreme Heat

Extreme heat encompasses both very high temperatures and exceptionally humid conditions. When extreme heat persists for several days, it is termed a “heat wave.” Extreme heat can also significantly worsen drought conditions because high temperatures accelerate evaporation. If vulnerable populations, such as the elderly and the very young, are exposed to high temperatures for an extended period, it can lead to heat stroke and even death. Extreme heat may affect the entire Tarrant County planning area equally.

Location and Extent

Although there have been recorded instances of fatalities due to extreme heat at specific locations in the county, it is important to note that the risk is not limited to a particular geographic area. Extreme heat is a potential danger across the entire Tarrant County planning area, encompassing all participating jurisdictions. It is crucial to be aware of this risk and take necessary precautions regardless of your location in the county.

The intensity of an extreme heat event is measured using the “Heat Index,” which combines high temperatures and humidity levels to indicate how hot it feels outside. The Heat Index Chart in Figure 46 shows different levels of caution recommended for various combinations of temperature and relative humidity. For instance, it indicates that when the temperature is 90°F or lower, caution is recommended when the humidity level reaches or exceeds 40%. This information is vital for individuals to understand the potential heat-related risks based on these factors.

Table 19 uses shaded zones to represent various symptoms or disorders that may arise based on the magnitude or intensity of the event. These zones indicate potential health repercussions associated with specific Heat Index levels. The NWS uses Table 20 to determine and issue alerts corresponding to different Heat Index values.

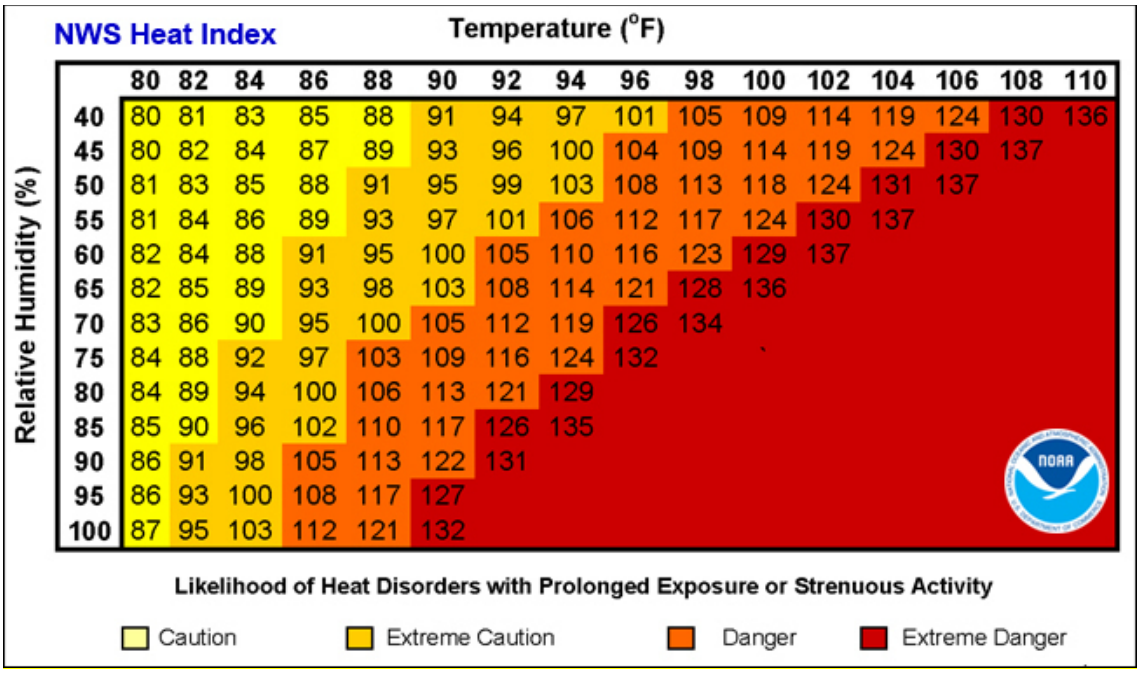


Figure 46: Heat Index Chart[70]

Table 19: Heat Classifications[71]

Classification	Heat Index	Effect on the body
Caution	80°F - 90°F	Fatigue possible with prolonged exposure and/or physical activity
Extreme Caution	90°F - 103°F	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	103°F - 124°F	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
Extreme Danger	125°F or higher	Heat stroke highly likely

Table 20: Heat Index and Warnings

Category	Heat Index	Possible Heat Disorders	Warning Type
Extreme Danger	125°F and higher	Heat stroke or sunstroke is likely.	A heat advisory will be issued to warn that the Heat Index may exceed 105°F.
Danger	103°F–124°F	Sunstroke, muscle cramps, and/or heat exhaustion are likely. Heatstroke is possible with prolonged exposure and/or physical activity.	
Extreme Caution	90°F–103°F	Prolonged exposure and/or physical activity can cause sunstroke, muscle cramps, and/or heat exhaustion.	An Excessive Heat Warning is issued if the Heat Index remains above 105°F during

[70] National Weather Service, "What Is the Heat Index," https://www.weather.gov/ama/heatindex.
[71] Ibid.

Category	Heat Index	Possible Heat Disorders	Warning Type
Caution	80°F–90°F	Fatigue is possible with prolonged exposure and/or physical activity.	the day, or 80°F at night, for at least three hours.

Previous Historical Occurrences

From January 1, 2020, to September 16, 2024, 12 excessive heat events were reported in Tarrant County, resulting in 16 deaths. No non-fatal injuries, property damage, or crop damage were recorded.[72][73]

Table 21: Historical Periods of Extreme Heat, Tarrant County, 2020–2023

Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Tarrant (Zone)	08/13/2020	0	0	$0.00K	$0.00K
Tarrant (Zone)	08/28/2020	0	0	$0.00K	$0.00K
Tarrant (Zone)	06/12/2022	0	0	$0.00K	$0.00K
Tarrant (Zone)	07/07/2022	0	0	$0.00K	$0.00K
Tarrant (Zone)	07/17/2022	0	0	$0.00K	$0.00K
Tarrant (Zone)	06/19/2023	0	0	$0.00K	$0.00K
Tarrant (Zone)	06/26/2023	0	0	$0.00K	$0.00K
Tarrant (Zone)	07/12/2023	1	0	$0.00K	$0.00K
Tarrant (Zone)	07/17/2023	1	0	$0.00K	$0.00K
Tarrant (Zone)	08/01/2023	11	0	$0.00K	$0.00K
Tarrant (Zone)	08/17/2023	3	0	$0.00K	$0.00K
Tarrant (Zone)	09/07/2023	0	0	$0.00K	$0.00K
Totals:		**16**	**0**	**$0.00K**	**$0.00K**

Probability of Future Events

The average high temperatures for the planning area during the summer months suggest a high likelihood of at least one extreme temperature event occurring yearly; this frequency indicates a strong probability of such events. According to the Texas State Hazard Mitigation Plan (SHMP), the likelihood of

[73] National Center for Environmental Information, "Storm Event Database," https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29+Excessive+Heat&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=2020&endDate_mm=09&endDate_dd=16&endDate_yyyy=2024&county=TARRANT%3A439&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=48%2CTEXAS.

extreme temperature events is considered high, with at least one event expected to occur in a 25-year timeframe. The impacts of extreme heat are also evaluated as high, meaning that 25% or more of the population is exposed to a hazard.

Impact of Climate Trends and Variations

Climate projections indicate temperatures will increase. Figure 47 shows the number of summer days with a daily max heat index above 105 degrees by mid-century, according to climate models in the ClimRR Local Climate Projection tool.[74]

[74] ClimRR Heat Index Map Explorer. https://climrr.anl.gov/mapexplorer.

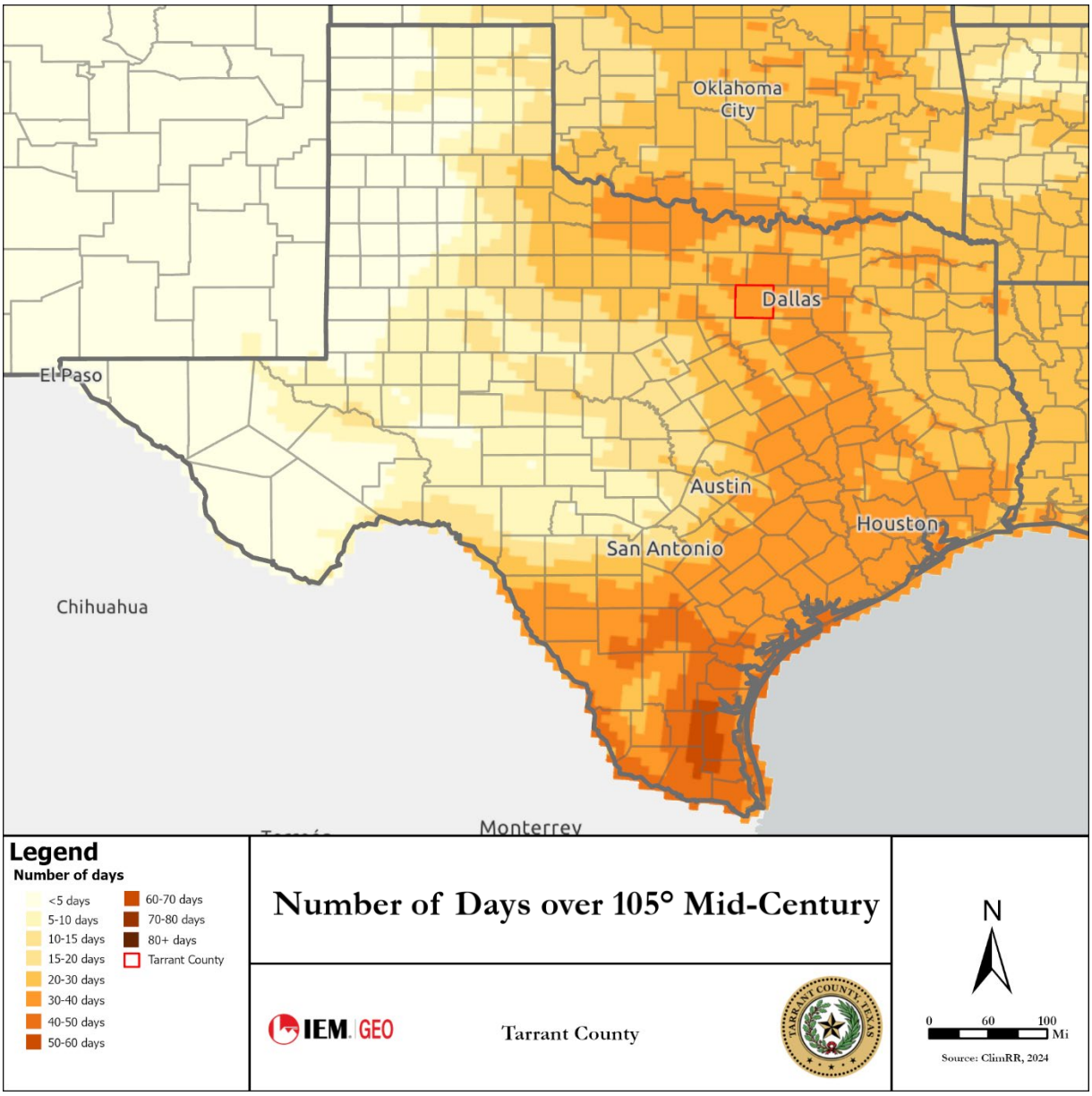


Figure 47: Number of Days over 105°F by Mid-Century

Figure 48 shows how many days per year, on average, the temperature for a given location is expected to exceed 100°F by the end of this century if greenhouse gas emissions continue to increase. Based on this information, parts of Texas that experienced 10–20 days of temperatures above 100°F in recent decades may experience more than 100 days over 100°F by the end of the century. This includes Tarrant County.

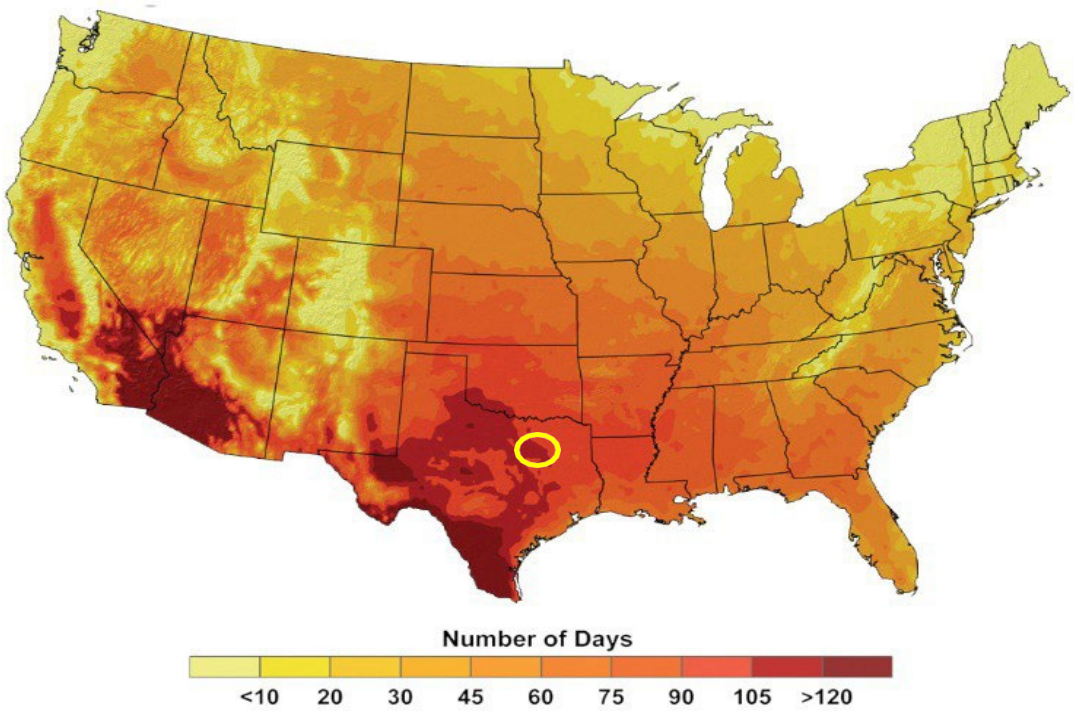


Figure 48: Average Number of Days Annually Expected to Exceed 100°F by the End of the Century[75]

Extreme heat can be exacerbated by urban heat islands, which are areas within cities where surface temperatures are hotter than average for the city as a whole. In cities, a high percentage of area is covered by materials that absorb a significant proportion of solar energy which is then released as heat. Cities can exhibit temperatures several degrees higher than rural surroundings. This heat often reaches its highest intensity during the afternoon. The heat is released slowly and can continue into the night when rural areas have already cooled down. There is a direct relationship between heat intensity peaks and heat-related illness.[76] Extreme heat exacerbated by urban heat islands can contribute to increased heat-illness and increased demand on energy infrastructure for cooling. The deeper red values in Figure 49 indicates areas of higher relative heat severity.

[75] Climate.gov. 100˚ Days, Past and Future. https://www.climate.gov/news-features/featured-images/100%C2%B0-days-past-and-future.
[76] Urban Heat Islands. https://www.urbanheatislands.com/home.

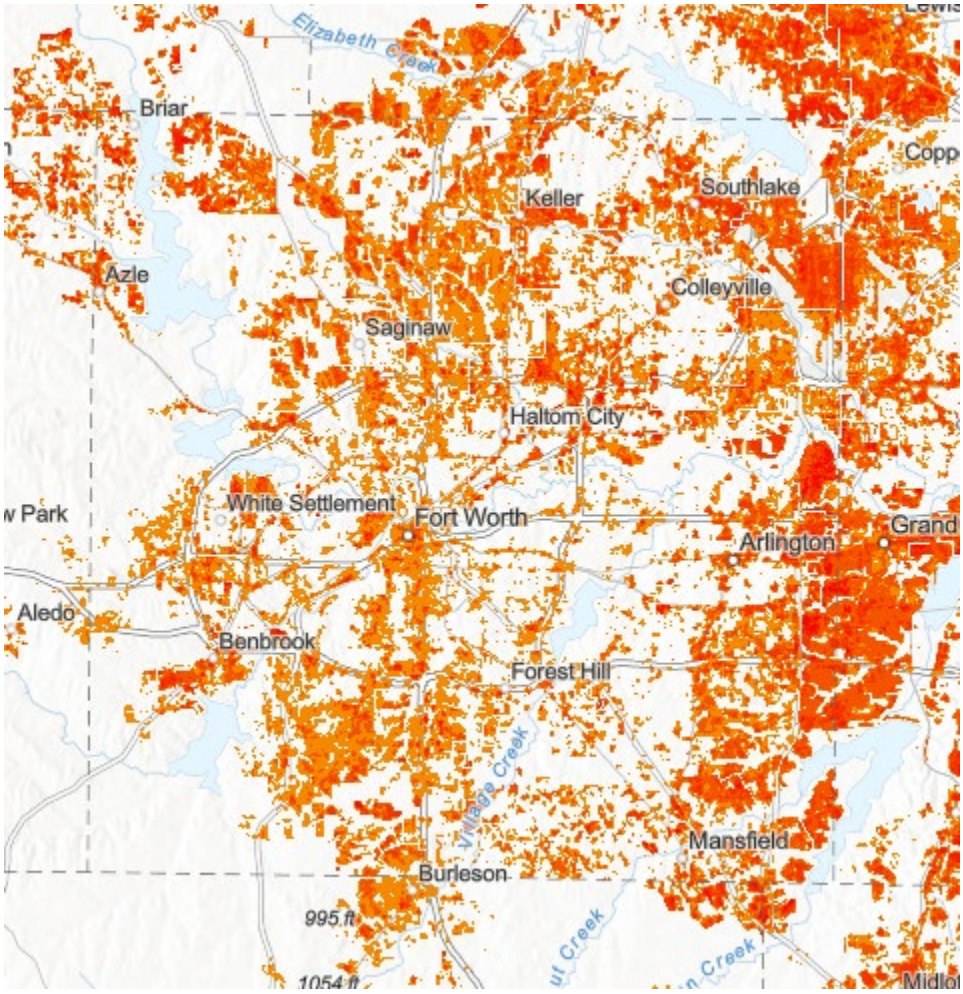


Figure 49: Urban Heat Island Severity, Tarrant County Region, 2022[77]

Vulnerability Assessment

It is important to note that extreme heat events do not have a defined geographic boundary. Although the entire Tarrant County planning area and all participating jurisdictions are susceptible to extreme temperatures, the current buildings, infrastructure, and critical facilities are not expected to suffer significant damage. As a result, any estimated property losses related to the extreme heat hazard are predicted to be minimal across the area.

The most noteworthy impacts of extreme heat are heat-related illnesses. It is worth noting that elderly individuals are more susceptible to serious consequences from extreme heat because their bodies have more difficulty regulating temperature, coupled with potential underlying respiratory or pulmonary health conditions. Other vulnerable groups include young children, outdoor athletes, outdoor workers, and populations without permanent housing.

[77] The Trust for Public Land, Heat Severity – USA 2022. https://www.arcgis.com/home/item.html?id=22be6dafba754c778bd0aba39dfc0b78.

Extended periods of extreme heat may place additional demands on energy infrastructure as air-conditioning systems are used more frequently. Although not currently reported in Tarrant County, instances of brownouts and blackouts have been recorded in some areas during periods of elevated energy use. Power outages during an extreme heat event could make it more challenging for individuals to find relief from high temperatures and thus increase the risk of heat-related illnesses for more people.

ESTIMATED IMPACT AND POTENTIAL LOSSES

Expected loss values related to extreme heat for Tarrant County, and its jurisdictions provide crucial information about the potential monetary impact of extreme heat events over a year. By estimating the Expected Annual Loss from extreme heat, authorities can gain insights into the financial risks associated with heat-related challenges, such as infrastructure damage, population loss, and lost agricultural productivity. Extreme heat can cause problems like cracked foundations, warped roofs, and wilted crops that could inflict significant damage on buildings and agriculture in Tarrant County.

Table 22 shows the find expected loss values from heat waves/extreme heat for Tarrant County.

Table 22: Expected Loss Values, Tarrant County

Building Value	Population Equivalence	Population	Agriculture Value	Total
$186	$36,509,048	3.15	$30	$36,509,265

Table 23 shows expected loss values from extreme heat for locations in Tarrant County.

Table 23: Expected Loss Values in Tarrant County by Jurisdiction

Jurisdiction	Building Value	Population Equivalence	Population	Agriculture Value	Total
Arlington	$0	$97,765	0.01	$0	$97,765
Azle	$0	$30,710	0.01	$0	$62,710
Bedford	$0	$65,309	0.01	$0	$65,309
Benbrook	$0	$76,746	0.01	$0	$76,746
Blue Mound	$1	$162,849	0.01	$0	$162,850
Colleyville	$1	$142,852	0.01	$0	$142,853
Crowley	$0	$114,850	0.01	$0	$114,851
Dalworthington Gardens	$0	$43,805	0.00	$0	$43,806
Edgecliff Village	$0	$65,639	0.01	$0	$65,639
Euless	$0	$112,771	0.01	$0	$112,771
Everman	$0	$106,637	0.01	$0	$106,637
Forest Hill	$0	$73,436	0.01	$0	$73,436

Jurisdiction	Building Value	Population Equivalence	Population	Agriculture Value	Total
Fort Worth	$2	$109,704	0.01	$0	$109,706
Grapevine	$1	$86,692	0.01	$0	$86,693
Haltom City	$0	$80,731	0.01	$0	$80,731
Haslet	$0	$84,526	0.01	$0	$84,527
Hurst	$0	$101,386	0.01	$0	$101,387
Keller	$0	$57,206	0.00	$0	$57,027
Kennedale	$0	$47,080	0.00	$0	$47,081
Lake Worth	$1	$81,424	0.01	$0	$81,425
Mansfield	$0	$75,550	0.01	$0	$75,550
North Richland Hills	$0	$65,604	0.01	$0	$65,604
Richland Hills	$0	$74,805	0.01	$0	$74,805
River Oaks	$0	$132,490	0.01	$0	$132,490
Saginaw	$0	$117,397	0.01	$0	$117,398
Watauga	$0	$83,313	0.01	$0	$83,313
Westworth Village	$0	$44,793	0.00	$0	$44,793
Dallas–Fort Worth International Airport	$1	$243	0.00	$0	$243
North Central Texas Council of Governments	$1	$38,485	0.00	$0	$38,486
Lakeside	$1	$126,044	0.01	$0	$126,045
Westlake	$20	$32,959	0.00	$0	$32,979
University of North Texas Health and Science	$0	$54,739	0.00	$0	$54,739
University of Arlington	$2	$99,307	0.01	$0	$99,309

A substantial heat event in Tarrant County could significantly impact the community. The population may experience health issues due to the extreme heat, especially among vulnerable groups such as the elderly and young children. Agriculture may suffer from crop damage and loss of livestock due to heat stress, while productivity could decrease as workers struggle to perform outdoor tasks in high temperatures. Infrastructure, such as roads and buildings, also may be affected, with the potential for heat-related damage and strain on utilities like power grids and water supplies.

Development Trends

Tarrant County has seen significant development trends recently, particularly in urban areas like Fort Worth and Arlington. These trends include increased commercial and residential construction and infrastructure improvements to accommodate the growing population.

However, this growth in Tarrant County development could be significantly impacted by extreme heat, which can increase worker safety concerns and cause construction delays. In addition, extreme heat can strain existing infrastructure, such as power grids and water supply systems, as they struggle to meet the heightened demand for cooling and water during heat waves.

Furthermore, extreme heat can affect the demand for certain types of development. For example, in addition to driving up demand for residential properties with adequate cooling systems and access to shade, prolonged periods of high temperatures may also increase the need for public spaces with effective heat mitigation strategies, such as cooling stations and parks with ample tree cover.

In response to these challenges, developers and local authorities in Tarrant County are increasingly considering climate-resilient design and construction practices to mitigate the impact of extreme heat on development projects. This may include using heat-resistant building materials, incorporating sustainable landscaping to provide shade that reduces the urban heat island effect, and implementing energy-efficient cooling systems to minimize the strain on local utilities during heat waves.

Overall, although development trends in Tarrant County continue to show growth and expansion, stakeholders should consider the potential effects of extreme heat and implement strategies to ensure sustainable, resilient development in the face of ongoing climate challenges.

IMPACT ON COUNTY ASSETS

Extreme heat affects all FEMA Community Lifelines. It threatens public safety, strains emergency response systems, and can lead to heat-related illnesses and fatalities. High temperatures disrupt the food supply chain, impact water availability, and can exacerbate preexisting health conditions. In addition, extreme heat strains energy infrastructure, affects transportation, and compromises the integrity of hazardous materials. Electricity-reliant communications systems are also at risk of disruption due to overheating and power outages.

Figure 50: FEMA Community Lifelines

Vulnerability Score

The NRI evaluates a nation's vulnerability by considering factors such as exposure to natural hazards, susceptibility of the population and infrastructure to those hazards, and its ability to withstand and rebound from their effects.

The NRI helps identify areas with higher vulnerability scores, which indicate a more significant risk and potential for damage and loss during natural disasters. It can also highlight where additional resources may be needed to improve resilience and reduce vulnerability to natural disasters.

NRI data indicates an overall risk index score of 98.8 for Tarrant County, signifying a high level of risk. The annual loss score of 98.8 points to a substantial potential for financial loss because of natural disasters.

Tarrant County's social vulnerability score of 74.8 suggests that it may encounter difficulties recovering from natural disasters. This could result from poverty, inadequate access to healthcare, and limited infrastructure. However, the community resilience score of 26.3 indicates that it may struggle to recover effectively from a natural hazard. It suggests that the county might have limited resources, infrastructure, and capacity to withstand and bounce back from the impacts of a natural disaster. This could result in prolonged recovery times, increased vulnerability, and difficulty restoring normalcy after the event.

In conclusion, communities with a high risk index, high expected annual loss, high social vulnerability, and low community resilience are particularly susceptible to the devastating outcomes of hazardous events. When such events occur, these communities will likely experience severe damage to infrastructure, homes, and public services, leading to a significant economic impact. Tarrant County's high social vulnerability means that its residents may struggle to cope with the aftermath, facing challenges, such as limited access to healthcare, resources, and support systems. In addition, low community resilience may hinder the county's ability to recover and rebuild, prolonging the community's recovery process and exacerbating the long-term social and economic impacts.

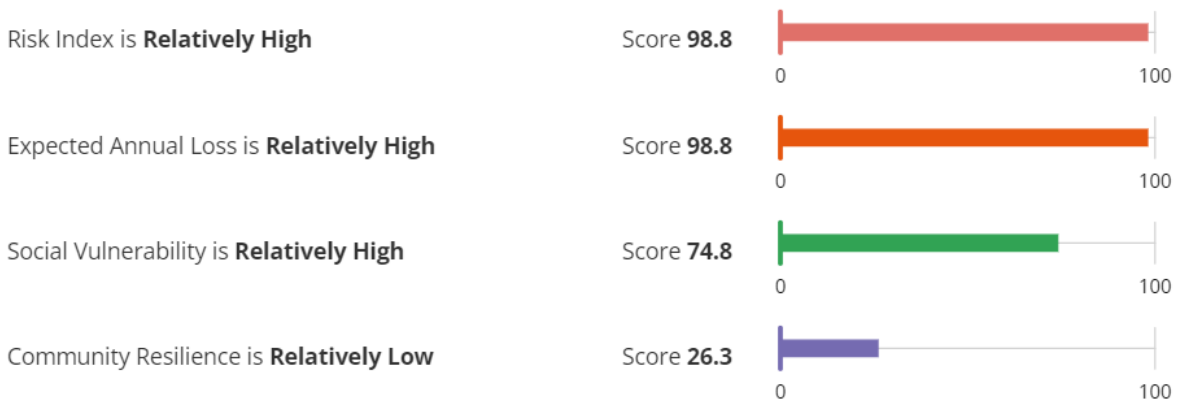


Figure 51: Risk Ratings for Extreme Heat, Tarrant County

The risk overview includes expected annual loss, social vulnerability, and community resilience. The table provides the heat wave risk rating and overall risk from the FEMA National Risk Index website and compares them to the overall risk rating for the state of Texas.

Table 24: Heat Wave Index Score, Tarrant County

Heat Wave Risk Rating	Expected Annual Loss	Social Vulnerability	Community Resilience	Overall Risk Rating, Tarrant County	Overall Risk Rating, Texas
99.7	99.8	74.76	26.32	98.82	97.60

Table 25: Heat Wave Risk Factor Breakdown

Hazard	EAL Value	Social Vulnerability	Community Resilience	Community Resilience Framework	Risk Value	Risk Index Score
Heat Wave	$36,509,265	Relatively High	Relatively Low	1.19	$44,507,090	99.7

Based on NRI data, Tarrant County's heat wave risk of 99.7% is considered relatively high, meaning there is a high likelihood of heat wave events occurring in the county.

People and communities can face several risk factors during heat waves. For individuals, heat waves can lead to heat exhaustion, heatstroke, and dehydration, especially among the elderly, young children, and those with preexisting health conditions. In addition, heat waves can exacerbate respiratory problems and cardiovascular issues.

On a community level, heat waves can strain healthcare systems, increase energy demands for cooling, and potentially lead to power outages. Agricultural productivity may also be affected, leading to food and water shortages. Furthermore, heat waves can impact infrastructure, such as roads and railways, due to the expansion of materials under high temperatures.

Therefore, it is important that communities take measures to mitigate the risks from heat waves. These may include establishing cooling centers in public buildings to provide relief for those without access to air-conditioning, implementing urban planning strategies that incorporate more green spaces and shade to reduce the urban heat island effect, and providing education and outreach to vulnerable populations about the risks of heat waves and how to stay safe during extreme heat events. Other crucial steps to mitigate the impact of heat waves on communities include developing early warning systems and heat action plans to coordinate emergency response efforts, improving building codes to require better insulation and reflective roofing, and encouraging community members to check on neighbors (particularly the elderly or those with health conditions) during heat waves.

VULNERABLE POPULATIONS

Tarrant County is home to various vulnerable populations who are at higher risk during periods of excessive heat. These vulnerable groups include the elderly, individuals with chronic medical conditions, young children, individuals with mental or physical disabilities, and those who are economically disadvantaged and may not have access to cooling resources.

Elderly individuals often have a diminished ability to perceive and respond to changes in temperature, putting them at a higher risk of heat-related illnesses. Similarly, people with chronic medical conditions, such as heart disease, obesity, or respiratory illnesses, may be more susceptible to heat stress. Young children also are susceptible to heat-related illnesses because their bodies are less effective at regulating temperature.

Individuals with mental or physical disabilities may have limited mobility or may not be able to communicate their discomfort, increasing their vulnerability to extreme heat. In addition, economically disadvantaged individuals may not have access to air-conditioning or may be unable to afford cooling resources, increasing their susceptibility to heat-related illnesses.

Flooding

Flooding is defined as the accumulation of water in a water body and the overflow of excess water onto adjacent floodplain lands. A floodplain is the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that is susceptible to flooding. Floods are commonly described in terms of the likelihood that a given area will be inundated. Thus, a “100-year flood” means there is a one percent chance that the area will be flooded in a given year, and a “500-year flood” means there is a one-half percent chance the area will be flooded.

Location and Extent

Common flooding hazards in the planning area include areas of flash flooding and new development. Floodwater can disguise many dangerous obstacles, like uncovered utility holes or debris that can cause falls and injuries. Standing water (i.e., water that isn’t flowing) can also become a breeding ground for insects that can make people very ill. Another risk is posed by downed power lines, which may still be live.

Figure 52 shows the floodway and 100-year floodplain along the rivers and creeks in Tarrant County.

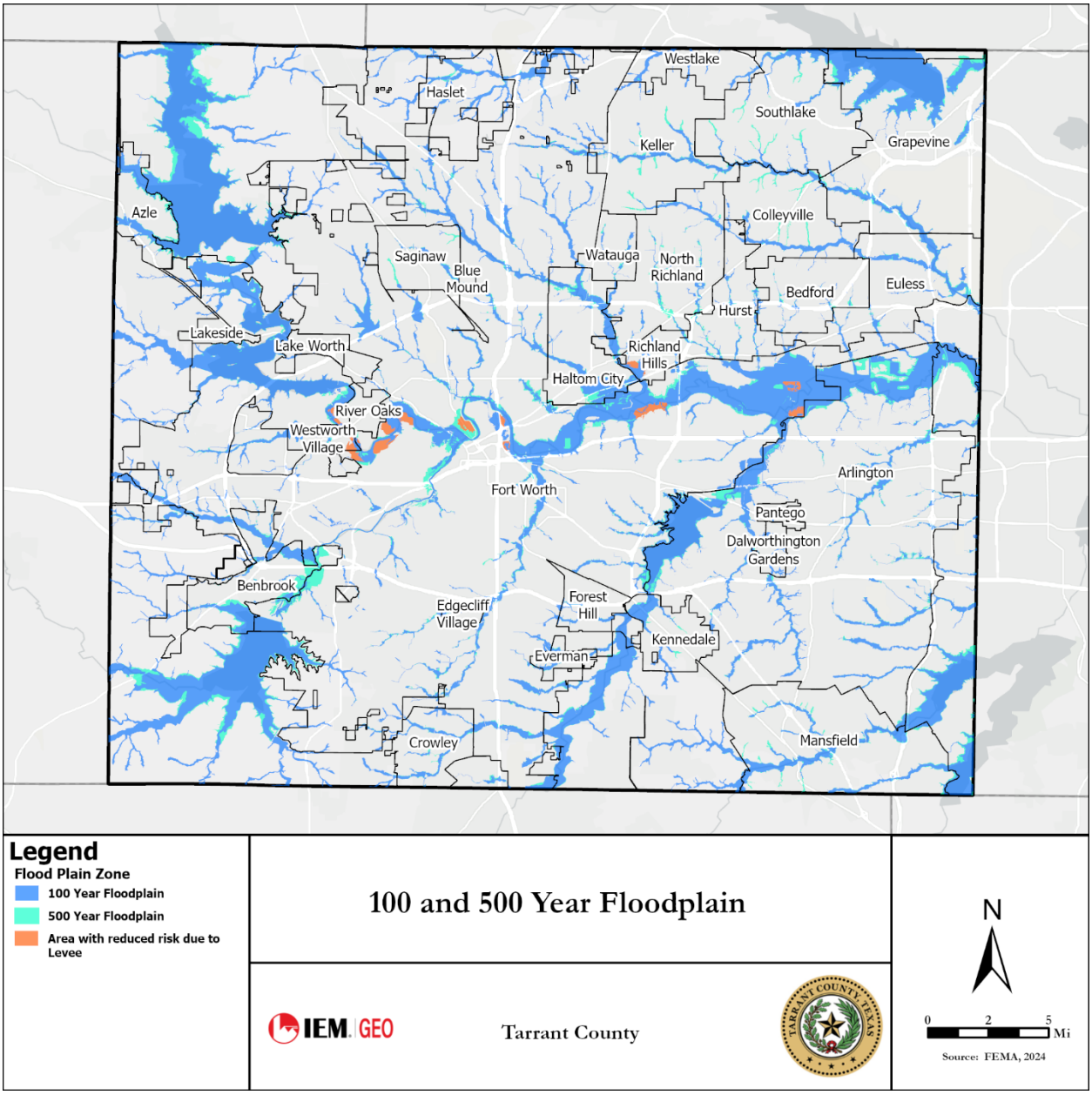


Figure 52: Tarrant County Floodway and 100-Year Floodplain

A flash flood is a rapid flood that inundates low-lying areas in less than six hours. This is caused by intense rainfall from one or more thunderstorms. Flash floods can also occur from the collapse of a human-made structure or ice dam. Construction and development can change the natural drainage and create entirely new flood risks as the concrete that comes with new buildings, parking lots, and roads create less land that can absorb excess precipitation from heavy rains. Flash floods are a high-risk hazard because they can tear out trees and destroy buildings and bridges.

Figure 53 shows the low-water crossings in Tarrant County as of 2012, which are identified by yellow circles. A low-water crossing provides a bridge or overpass when water flow is low. Under high-flow conditions, water runs over the roadway and impedes vehicular traffic. Texas leads the nation in flash

flood deaths, most of which are due to people crossing these low areas in times of flooding. Additional details on flooding are provided in the jurisdictional annexes.

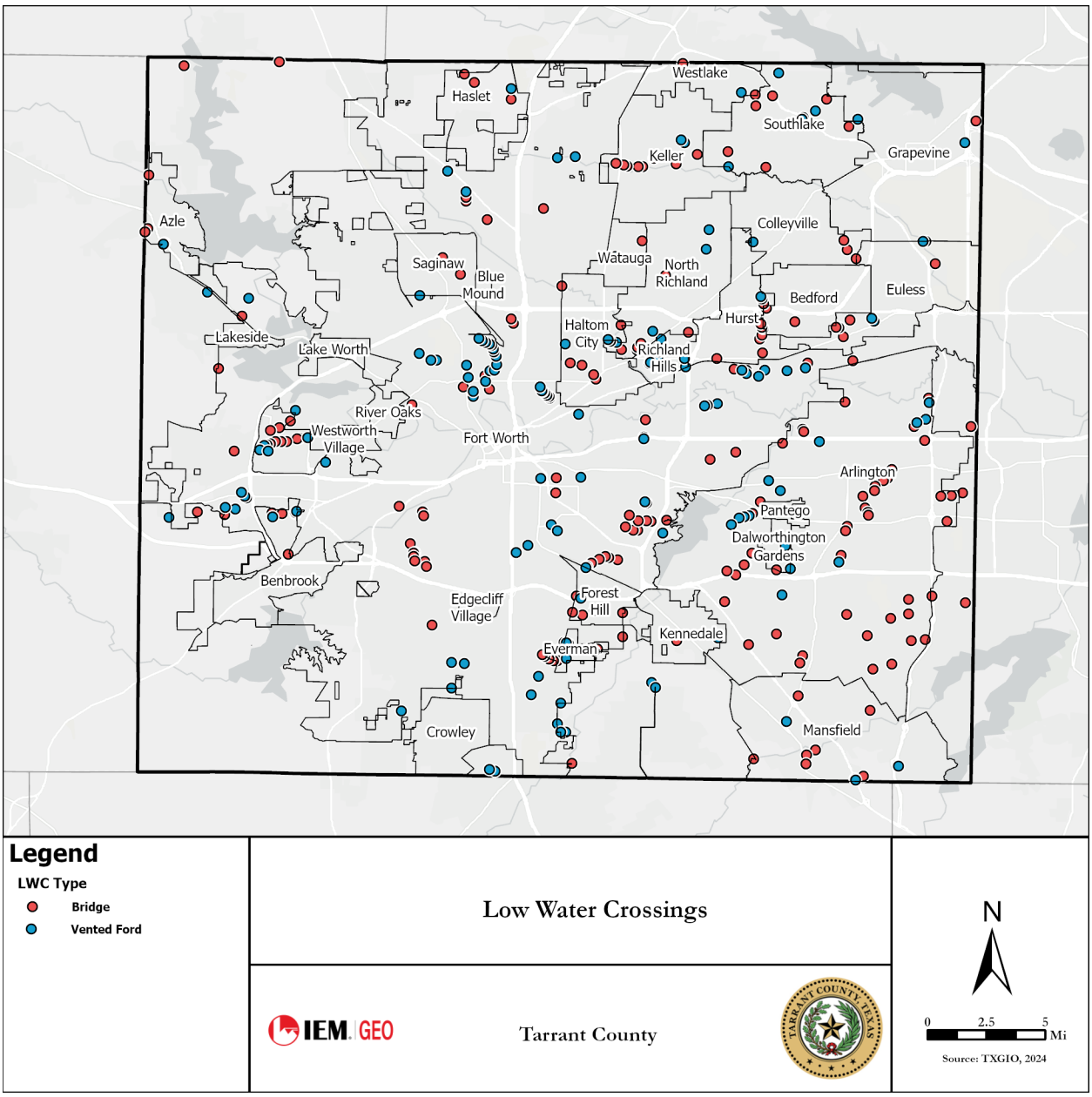


Figure 53: Low-Water Crossings in Tarrant County, 2012[78]

Texas has 15 major river basins and 8 coastal basins, each with varying hydrological regimes and water supply capabilities. Each of the basins has several unique features, both climatic (such as precipitation and evaporation), as well as physiographic (geology, slope, soil type, vegetation and land use practices) which contribute to the nature of runoff from the basins. The West Fork Trinity River is the only major river in Tarrant County, and it can affect some of the participating jurisdictions. The Trinity River has four

[78] Source: Texas Low Water Crossing Inventory_032312.

branches: West Fork, Clear Fork, Elm Fork, and East Fork. The Trinity is a slow, meandering river with many twists and turns from its headwaters to its mouth. Dams have been erected to create Lake Bridgeport, Eagle Mountain Lake, and Lake Worth, the latter two being in or near Fort Worth. The West Fork of the Trinity River has its headwaters in Archer County. From there it flows southeast, through human-made reservoirs Lake Bridgeport and Eagle Mountain Lake, before flowing eastward through Lake Worth and then the city of Fort Worth.

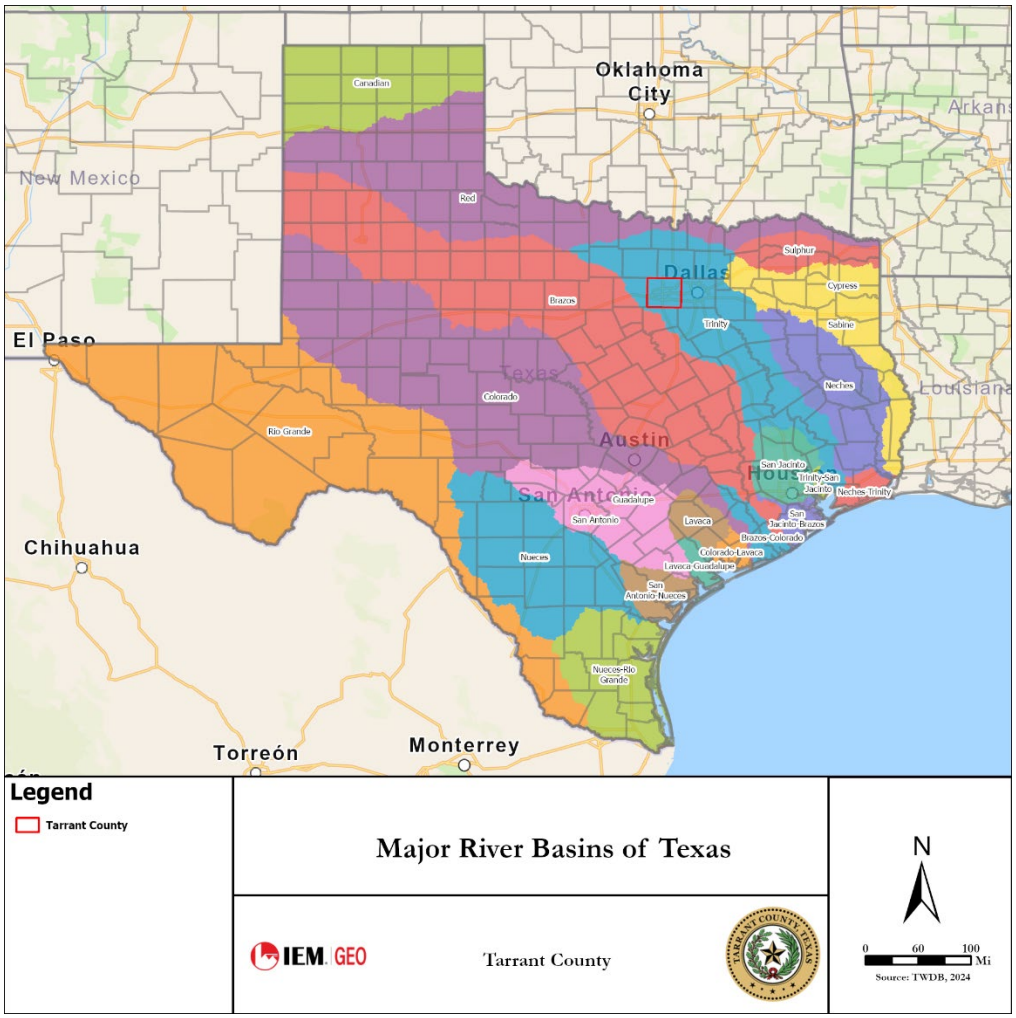


Figure 54: Major River Basins of Texas

Table 26: Features of Major River Basins in Tarrant County

River Basin	Total Area (square miles)	Area in Texas (square miles)	River Length (miles)	Length in Texas (miles)	Average Flow (acre-feet per year)
Trinity	17,913	17,913	550	550	5,727,000

Figure 55: Trinity River Watershed and the Location of Tarrant County

Tarrant County has a few major lakes that are used for surface water and recreation. Their current water levels are listed in Table 27.

Table 27: Conditions of Lakes in Tarrant County, September[79]

Reservoir	Percent Full	Water Level (feet)	Height Above Conser-vation Pool (feet)	Reservoir Storage (acre-feet)	Conservation Storage (acre-feet)	Conservation Capacity (acre-feet)	Surface Area (acres)
Arlington	72.1	543.98	-6.02	29,001	28,969	40,157	1,800
Benbrook	88.2	691.14	-2.86	75,575	75,575	85,648	3,393
Cedar Creek	92.5	320.48	-1.52	596,328	596,229	644,686	31,118
Eagle Mountain	78.0	644.33	-4.77	144,414	144,414	185,087	7,907
Grapevine	98.2	534.55	-0.45	160,120	160,120	163,064	6,483
Richland–Chambers	97.9	314.47	-0.53	,102,059	1,076,276	1,099,417	43,451
Worth	65.3	591.41	-2.59	25,025	15,949	24,419	3,088

Based on previous flood events, the worst-case scenarios are based on several types of flooding events. Storm water excesses and riverine flooding primarily affect low-lying areas of the county, and flood depths of up to five feet can be expected in the unincorporated areas of the county and in the areas of Arlington, Azle, Colleyville, Edgecliff Village, Southlake, Watagua, and Westworth Village. The areas of Bedford, Crowley, Eules, and Mansfield can expect flood depths of three to five feet while the areas of Benbrook, Everman, and Lake Worth can expect flood depths of two to five feet. Flood depths of up to four feet can be expected in the areas of Fort Worth, Grapevine, Haltom City, Lakeside, North Richland Hills, Richland Hills, White Settlement, and the University of North Texas Health Science Center. The areas of Haslet, Hurst, Keller, Kennedale, River Oaks, Saginaw, and Westlake can expect flood depths of one to three feet.

Previous Historical Occurrences

Historical evidence indicates that areas within the planning area, including all participating jurisdictions, are susceptible to flooding, especially in the form of flash flooding. It is important to note that only flood events that have been reported have been factored into this risk assessment. Therefore, it is likely that additional flood occurrences have gone unreported before and during the recording period. Table 28 identifies historical flood events that resulted in damages, injuries, or fatalities within the Tarrant County planning area, including all participating jurisdictions. Historical data is provided by the Storm Events Database (NOAA), NCEI database for Tarrant County. In total, 40 flood and flash flood events were

[79] Water Data for Texas, September 3, 2024, “Recent Conditions of Reservoirs,” Water Data For Texas

reported between January 1, 2019, and July 1, 2024. Only recorded events with fatalities, injuries, and/or damages are listed.

Table 28: Historical Flood Events, 2019–2024

Location	Date	Event Type	Deaths	Injuries	Property Damage	Crop Damage
Meacham Airport Fort Worth	10/25/2023	Flash Flood	0	0	$50,000	$0
Azle	08/22/2022	Flash Flood	0	0	$0	$0
Eagle Mountain	05/18/2019	Flash Flood	0	0	$0	$0
Everman	1/10/2020	Flash Flood	0	0	$7,000	$0
Everman	06/20/2020	Flood	0	0	$25,000	$0
Fort Worth	05/01/2019	Flash Flood	0	0	$0	$0
Fort Worth	05/08/2019	Flash Flood	0	0	$0	$20,000
Fort Worth	05/18/2019	Flash Flood	0	0	$20,000	$0
Fort Worth	01/16/2020	Flash Flood	0	0	$10,000	$0
Fort Worth	08/21/2022	Flash Flood	0	0	$0	$0
Fort Worth	08/21/2022	Flash Flood	0	0	$0	$0
Fort Worth	08/22/2022	Flood	0	0	$0	$0
Fort Worth	10/25/2023	Flash Flood	0	0	$50,000	$0
Fort Worth	10/25/2023	Flash Flood	0	0	$0	$0
Fort Worth Blue Mound Airport	05/16/2020	Flash Flood	0	0	$0	$0
Fort Worth Saginaw Airport	08/22/2022	Flash Flood	0	0	$0	$0
Handley	01/16/2020	Flash Flood	0	0	$10,000	$0
Handley	01/16/2020	Flash Flood	0	0	$10,000	$0
Haslet	05/18/2019	Flash Flood	0	0	$0	$0
Hicks	05/18/2019	Flash Flood	0	0	$0	$0
Jamestown	06/01/2019	Flash Flood	0	0	$20,000	$0
Jamestown	06/03/2022	Flash Flood	0	0	$100,000	$0
Johnsons Station	06/07/2021	Flood	0	0	$0	$0
Keller	06/07/2021	Flood	0	0	$0	$0
Keller	08/22/2022	Flood	0	0	$0	$0
Keller	10/26/2023	Flash Flood	0	0	$50,000	$0
Keller	03/07/2024	Flash Flood	0	0	$0	$0
Keller	04/20/2024	Flood	0	0	$0	$0

Location	Date	Event Type	Deaths	Injuries	Property Damage	Crop Damage
Keller Alta Vista Airport	05/16/2020	Flash Flood	0	0	$0	$0
Lake Worth	08/22/2022	Flash Flood	0	0	$0	$0
Mara	01/16/2020	Flash Flood	0	0	$10,000	$0
North Richland Hills	08/22/2022	Flash Flood	0	0	$0	$0
North Richland Hills	08/22/2022	Flash Flood	0	0	$150,000	$0
North Richland Hills	10/26/2023	Flash Flood	0	0	$20,000	$0
Pleasant Glade	10/26/2023	Flood	0	0	$10,000	$0
Polytechnic	01/16/2020	Flash Flood	0	0	$10,000	$0
Richland Hills	06/03/2022	Flash Flood	0	0	$50,000	$0
Smithfield	10/26/2023	Flood	0	0	$50,000	$0
Southlake	06/07/2021	Flood	0	0	$0	$0
Webb	06/03/2022	Flood	1	0	$10,000	$0

Probability of Future Events

According to the "Flooding is one of the deadliest natural disasters that occurs in the U.S. each year, and it poses a constant and significant threat to the health and safety of the citizens of Texas."[80] Based on recorded historical occurrences and extent within the Tarrant County planning area, including all participating jurisdictions, flooding is highly likely, and an event will likely occur within the next year. Over time, extreme rainfall has become more frequent and severe and is expected to continue to increase. For a predominantly urban area like Tarrant County, this likely will result in increased urban flooding.

Impact on Climate Trends and Variations

Flooding in Tarrant County, Texas, is heavily influenced by climate trends and variations, with increasing risks linked to changes in precipitation patterns and extreme weather events. The region's semi-arid climate, combined with urbanization, often leads to flash flooding, particularly during intense storms. Climate change is expected to exacerbate these trends, with more frequent and severe rainfall events leading to overwhelmed drainage systems, swollen rivers, and runoff from impermeable surfaces. Seasonal variations, such as heavy rainfall in spring and fall, heighten the risk of both localized flooding and riverine flooding, impacting residential areas, infrastructure, and critical assets. As these climate trends evolve, Tarrant County anticipates heightened flood risks to the communities.

[80] 2023 Texas State Hazard Mitigation Plan, TDEM, https://txdem.sharepoint.com/sites/TDEMWebsiteFiles/Shared%20Documents/Forms/AllItems.aspx?id=%2Fsites%2FTDEMWebsiteFiles%2FShared%20Documents%2FMitigation%2FState%20of%20Texas%20HMAP%20Update%20%2D%2010%2E27%2E23%2Epdf&parent=%2Fsites%2FTDEMWebsiteFiles%2FShared%20Documents%2FMitigation&p=true&ga=1.

Vulnerability Assessment

The flood hazard areas throughout the planning area are subject to periodic inundation, which may result in loss of life and property, health and safety hazards, disruption of commerce and governmental services, and extraordinary public expenditures for flood protection and relief, of which adversely affect public safety. Further, debris would present a threat to public safety and debris removal would drain local resources and be an economic detriment to the area.

A property's vulnerability to a flood depends on its location and proximity to the floodplain. Structures that lie along banks of a waterway are the most vulnerable and are often repetitive loss structures. These flood losses are created by the cumulative effect of obstructions in floodplains which cause an increase in flood heights and velocities, and by the occupancy of flood hazard areas by uses vulnerable to floods and hazardous to other lands because they are inadequately elevated, flood-proofed or otherwise protected from flood damage.

Development Trends

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.

COMMUNITY LIFELINES

Lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function. Community lifelines are essential for the well-being of any community. They provide support and assistance to individuals who require help, especially during times of crisis. FEMA Community Lifelines are a critical component of emergency management in the United States. These lifelines are designed to address the essential needs of a community during and after a disaster. There are eight lifelines, each with its own focus and purpose (see Figure 56).

Figure 56: FEMA Community Lifelines[81]

Flooding can significantly disrupt FEMA community lifelines in Tarrant County, Texas, affecting key services and infrastructure essential for public safety and recovery. Transportation networks may be severely impacted, with roads, bridges, and railways becoming impassable, hindering emergency response and evacuations. The energy grid could suffer damage to power lines or substations, resulting in widespread outages. Floodwaters may contaminate water supplies and disrupt wastewater systems, leading to public health risks. Additionally, healthcare facilities may experience operational challenges, compromising medical services. Disruption of these lifelines exacerbates the community's vulnerability, requiring a coordinated emergency response and swift recovery efforts.

Participation in the National Flood Insurance Program

As a participating member in the National Flood Insurance Program (NFIP), Tarrant County is required to regulate any development in designated flood prone areas. All work in a FEMA-designated floodplain requires a floodplain permit. The floodplain permit is free; however, it may require additional information indicating that adjacent property owners will not be adversely impacted due to the development.

Additional information may include, but is not limited to, an elevation certificate, a flood study, a topographical survey of before and after conditions, Conditional Letter of Map Revision (CLOMR), Letter of Map Revision (LOMR), and Letter of Map Amendment (LOMA).

A property owner is required to obtain a floodplain permit prior to performing any type of work in the floodplain, including the placement of fill. The finished floor elevation of new homes constructed in a floodplain must be located at least one foot above the base flood elevation.

Prior to the submittal of any documents to FEMA, the county Floodplain Administrator will review the documents to ensure their compliance with the county's floodplain regulations

[81] Federal Emergency Management Agency. "Community Lifelines Implementation Toolkit 2.0." https://www.fema.gov/sites/default/files/2020-05/CommunityLifelinesToolkit2.0v2.pdf.

A permit will be issued only after it is determined that the proposed work will not have an adverse impact on adjacent property owners, will not decrease the flood-carrying capacity of the watercourse, and will not create a situation that is dangerous during flooding events.

As growth and development occur, more property becomes exposed. In fact, due to the rapid development in the area, the planners have encountered difficulties in determining building footprints in the floodplain and are working to accurately identify the number and types of buildings vulnerable to flooding.

Among the NFIP's policyholders are thousands of residents whose properties have been flooded multiple times. Called "repetitive loss properties," these are buildings and/or contents for which the NFIP has paid at least two claims of more than $1,000 in any 10-year period since 1978. "Severe repetitive loss properties" are those for which the program has made either (1) at least four payments for buildings and/or contents of more than $5,000 or (2) at least two building-only payments that exceeded the value of the property.

These two kinds of properties are the biggest draw on the NFIP Fund. They not only increase the NFIP's annual losses and the need for borrowing; they also drain funds needed to prepare for catastrophic events. Community leaders and residents are also concerned about the repetitive loss problem because residents' lives are disrupted and may be threatened by the continual flooding.

The primary objective of identifying these properties is to eliminate or reduce the damage to property and the disruption to life caused by repeated flooding of the same properties.

Table 29 presents the statistics for repetitive loss properties in participating jurisdictions. In summary, more than $50 million has been paid to the jurisdictions for approximately 2,990 losses.

Table 29: Overview of Repetitive Loss Properties in Tarrant County by Jurisdiction[82]

Jurisdiction	Total Losses	Closed Losses	Open Losses	Closed Without Payment (CWOP) Losses	Total Payments
Arlington	956	737	0	219	$21,015,811.20
Azle	55	41	0	14	$1,150,384.57
Bedford	60	34	0	26	$190,081.99
Benbrook*	9	9	0	0	$356,272.60
Blue Mound	3	2	0	1	$21,810.93
Colleyville	51	31	0	18	$653,149.49
Crowley	2	2	0	0	$10,676,72
Dalworthington Gardens	9	5	0	4	$38,738.70

[82] As of 02/29/2024; FEMA OpenFEMA Dataset, FEMA National Flood Insurance Program Redacted Policies, 2024, FEMA NFIP Redacted Claims - v2 | FEMA.gov Loss Statistics: from January 1, 1978 through report "as of" date above except as indicated by *.

Jurisdiction	Total Losses	Closed Losses	Open Losses	Closed Without Payment (CWOP) Losses	Total Payments
Edgecliff Village	15	10	0	5	$72,918.51
Euless	110	92	0	18	$2,936,233.07
Everman	98	65	0	12	$1,631,559.51
Forest Hill	26	18	0	8	$478,101.87
Fort Worth	618	459	3	156	$5,460,594.47
Grapevine	57	46	0	11	$1,223,796.33
Haltom City	126	92	1	34	$3,629,208.40
Haslet	2	1	0	1	$2,645.94
Hurst	117	88	1	29	$1,281,239.10
Keller	53	43	0	10	$1,147,189.35
Kennedale	20	17	0	3	$118,404.88
Lake Worth	1	1	0	0	$3,951.81
Lakeside	1	0	0	1	$0
Mansfield*	10	10	0	0	$338,663.19
North Richland Hills	115	91	0	24	$899,423.71
Richland Hills	104	83	1	21	$1,332,446.33
River Oaks	4	4	0	0	$67,027.56
Saginaw	7	7	0	0	$111,199.79
Southlake	29	24	0	4	$679,016.50
Tarrant County (unincorporated)	248	198	0	49	$4,657,234.02
Watauga	85	68	1	17	$533,697.51
Total	**2991**	**2278**	**7**	**686**	**$50,030,801.03**
Total losses – All losses submitted regardless of the status.					
Closed losses – Losses that have been paid.					
Open losses – Losses that have not been paid in full.					
CWOP losses – Losses that have been closed without payment.					
Total Payments – Total amount paid on losses.					
***Jurisdiction with limited data availability from NFIP datasets**					

Table 30 and Table 31 provide information about the repetitive loss and severe repetitive loss properties in the participating jurisdictions as of August 28, 2024. The types of properties are identified in the individual annexes, as applicable.

Table 30: Payments for Repetitive Loss Properties in Tarrant County by Jurisdiction

Community Name	CID	Total Payments	Average Payment	Losses	Properties
Arlington	485454	$3,889,452.43	$34,118.00	114	46
Azle	480584	$21,535.92	$10,767.96	2	1
Bedford	480585	$58,571.22	$5,857.12	10	5
Colleyville	480590	$599,369.37	$27,244.06	22	8
Crowley	480591	$220,430.81	$55,107.70	4	1
Dalworthington Gardens	481013	$36,535.65	$6,089.28	6	3
Edgecliff Village	480592	$41,616.15	$20,808.08	2	1
Euless	480593	$824,603.42	$24,253.04	34	14
Everman	480594	$59,488.23	$11,897.65	5	2
Forest Hill	480595	$94,672.35	$47,336.18	2	1
Fort Worth	480596	$1,889,511.41	$12,681.28	149	50
Grapevine	480598	$479,318.89	$22,824.71	21	10
Haltom City	480599	$2,769,530.21	$57,698.55	48	13
Keller	480602	$591,093.51	$23,643.74	25	8
Kennedale	480603	$24,266.13	$6,066.53	4	2
North Richland Hills	480607	$111,736.97	$11,173.70	10	4
Mansfield	480606	$4,126,961.46	$178,796.05	125	4
Richland Hills	480608	$512,929.49	$15,543.32	33	9
Saginaw	480610	$10,825.99	$2,706.50	4	1
Southlake	480612	$142,182.06	$35,545.52	4	2
Tarrant County (unincorporated)	480582	$1,176,586.27	$21,392.48	55	16
Watauga	480613	$250,061.33	$8,622.80	29	12

Table 31: Payments for Severe Repetitive Loss Properties in Tarrant County by Jurisdiction

Community Name	CID	Total Payments	Average Payment	Losses	Properties
Arlington	485454	$102,089.39	$25,522.35	4	1
Euless	480593	$67,429.34	$16,857.33	4	1
Fort Worth	480596	$6,474,971	$181,589	218	186
Keller	480602	$297,060.09	$59,412.02	5	1
Richland Hills	480608	$168,692	$168,692	6	1
Tarrant County (unincorporated)	480582	$380,296.75	$27,164.05	14	2

The Community Rating System (CRS) is a voluntary program for communities that participate in the NFIP. The goals of the CRS are to reduce flood damages to insurable property, strengthen and support the insurance aspects of the NFIP, and encourage a comprehensive approach to floodplain management. The CRS was developed to provide incentives in the form of premium discounts for communities to exceed the minimum floodplain management requirements to develop additional measures that provide further protection from flooding. For a community to be eligible, it must be in full compliance with the NFIP.

There are 10 CRS classes: Class 1 requires the most credit points and gives the greatest premium discount, whereas Class 10 identifies a community that does not apply for the CRS or does not obtain a minimum number of credit points and thus receives no discount. (All communities start out with a Class 10 rating, which provides no discount.) There are 18 activities recognized as measures for eliminating exposure to floods, with credit points assigned to each activity. The activities are organized into four main categories:

- Public Information
- Mapping and Regulation
- Flood Damage Reduction
- Flood Preparedness

In recognition of communities' floodplain management activities, premium discounts ranging from 5% to a maximum of 45% are applied to eligible policies implemented in each participating community.

All CRS communities must maintain completed FEMA elevation and floodproofing certificates for all new and substantially improved construction in the Special Flood Hazard Area (SFHA) after the date of their applications for CRS classification. These certificates must be available upon request. Therefore, in writing a policy, an agent/producer should be able to obtain these certificates from any CRS community. In addition, some CRS communities receive credit for having completed certificates for post-Flood Insurance Rate Map (FIRM) buildings constructed prior to the CRS application date. If they do receive this credit, these certificates should also be available to agents/producers writing flood insurance.

Table 32 lists the participating jurisdictions in Tarrant County that have CRS ratings, and Figure 57 shows their locations. They provide details of their NFIP participation in their jurisdictional annex. The other participating jurisdictions are not ranked.

Table 32: Community Rating System Eligible Communities, Effective August 28, 2024[83][84]

Community Number	Name	CRS Entry Date	Current Effective Date	Current Class	Discount for SFHA*[85]	Discount for Non-SFHA	Status**
485454	Arlington	10/01/91	10/01/21	5	25%	10%	C
480586	Benbrook	10/01/91	10/01/22	6	20%	20%	C
480596	Fort Worth	10/01/12	04/01/23	7	15%	5%	C
480599	Haltom City	10/01/12	10/01/18	8	10%	5%	C
480601	Hurst	10/01/92	10/01/17	8	10%	5%	C
480607	North Richland Hills	10/01/91	10/01/16	7	15%	5%	C
480608	Richland Hills	05/01/14	05/01/14	8	10%	5%	C

* SFHA = Special Flood Hazard Area; ** Status: C = Current, R = Rescinded

[83] FEMA Community Rating System, 2023, Community Rating System | FEMA.gov.
[84] FEMA Community Status Book Report, August 28, 2024, Community status book report for state TX (fema.gov).
[85] For the purpose of determining CRS discounts, all AR and A99 zones are treated as non-SFHAs.

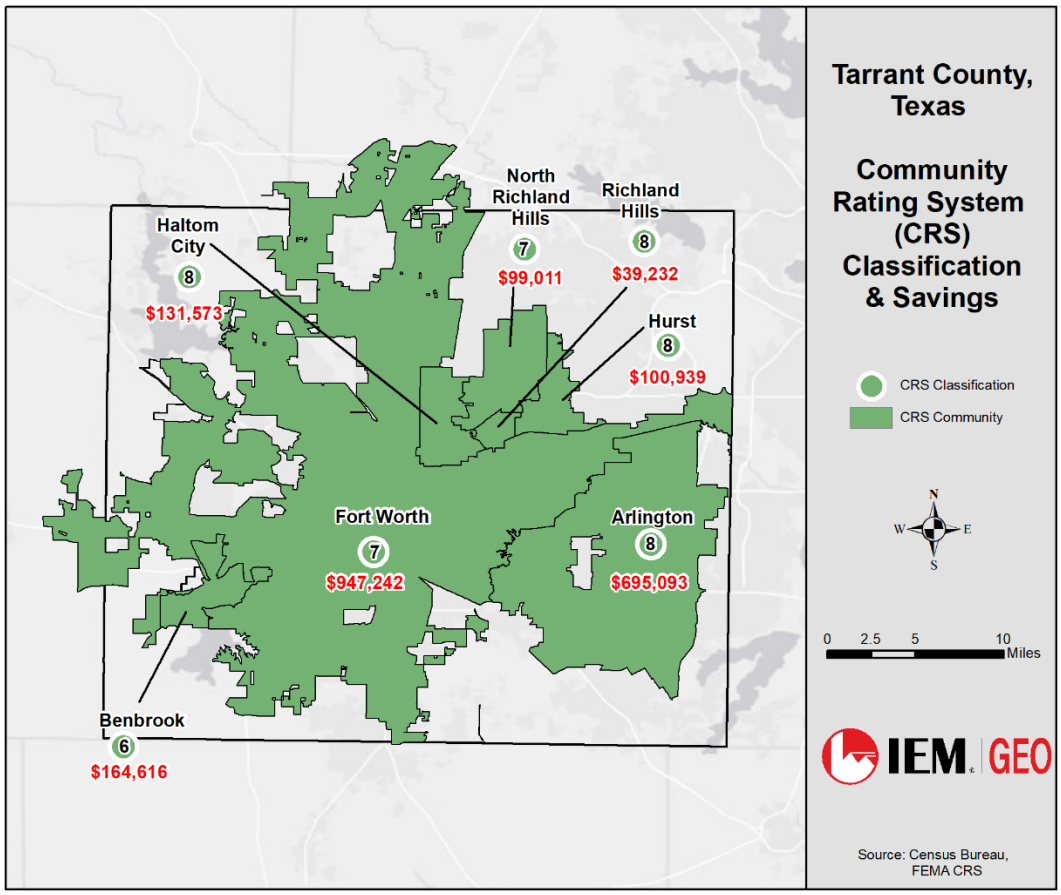


Figure 57: CRS Communities in Tarrant County

Dam Failure

All dam failure-related data, including hazard profiles, risk assessments, dam inventories, emergency action plans, impact analyses, and detailed dam profiles, are now consolidated in Appendix C of this plan. Please refer to “Appendix C: Dam Profile Information” for the most current and comprehensive information regarding dam failure hazards in Tarrant County.

Technological Hazards

Some participating jurisdictions have chosen to analyze technological hazards that impact them. Technological hazards are an increasing source of risk to people and the environment. The rising threat of technological hazards is an effect of the globalization of production, increasing industrialization, and a certain level of risk related to accidents connected with production, processes, transportation, and waste management. These risks are associated with the release of substances in accident conditions or with the production of substances under certain conditions such as fire. These substances could affect human health or the environment by contamination and their effects on animals and plants.[86] Technological hazards include hazardous material events, infectious disease outbreaks, national security hazards, nuclear accidents, power failure, and telecommunication failure.

The jurisdictions that chose to profile technological hazards identified and described technological hazards in their individual annex.

[86] American Red Cross, Jessica Ports Robbins, 2024, “Technological Hazard,” https://www.preparecenter.org/topics/technological-hazard.

Thunderstorms – Including Hail, Wind, and Lightning

A thunderstorm is a weather phenomenon characterized by lightning and thunder, often accompanied by heavy rain, strong winds, and sometimes hail. Thunderstorms are caused by the rapid upward movement of warm, moist air, which cools and condenses, forming cumulonimbus clouds and releasing electrical activity in the form of lightning and thunder. Thunderstorms can occur individually, in clusters, or along cold fronts. The following image displays dangerous thunderstorm alerts across the United States in 2022.

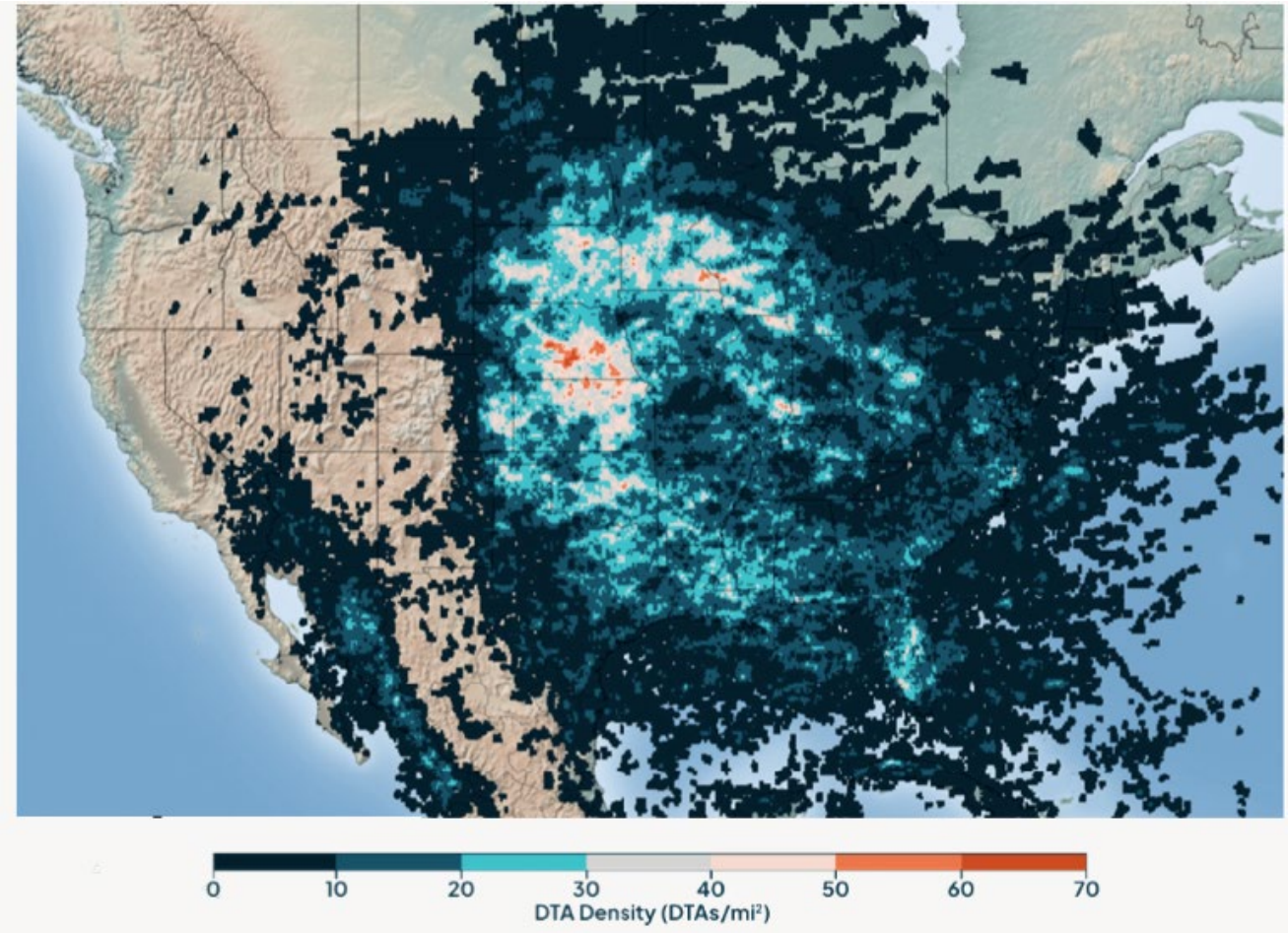


Figure 58: Dangerous Thunderstorm Alerts in the United States, 2022[87]

HAIL

Hail occurs when spherical or irregularly shaped lumps of ice greater than 0.75 inches in diameter fall with rain at the outgrowth of a severe thunderstorm. Early in the developmental stages of a hailstorm, ice crystals form in a low-pressure front due to warm air rising rapidly into the upper atmosphere and the

[87] AEM, "2022 United States Lightning Report," https://aem.eco/2022-united-states-lightning-report/.

subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until they have developed sufficient weight and fall as precipitation.

WIND

Straight-line winds are often responsible for the wind damage associated with a thunderstorm. Similar damage and wind speeds frequently confuse these winds with tornadoes. However, the strong and gusty winds associated with straight-line winds blow roughly in a straight line, unlike the rotating winds of a tornado. Downbursts or micro-bursts are examples of damaging straight-line winds. A downburst is a small area of rapidly descending rain and rain-cooled air beneath a thunderstorm that produces a violent, localized downdraft covering 2.5 miles or less. Wind speeds in some of the stronger downbursts can reach 100 to 150 miles per hour, like that of a strong tornado. The winds produced from a downburst often occur in one direction, and the worst damage is usually on the forward side of the downburst.

LIGHTNING

Lightning results from the buildup and discharge of electrical energy between positively and negatively charged areas in thunderstorms. A “bolt” or brilliant flash of light is created when the buildup becomes strong enough. These bolts of lightning can be seen in cloud-to-cloud or cloud-to-ground strikes. Bolts of lightning can reach temperatures approaching 50,000°F. Although lightning is mainly affiliated with thunderstorms, lightning often strikes outside of these storms, as far as 10 miles away from any rainfall. FEMA states that an average of 300 people are injured and 80 people are killed in the United States each year by lightning. Direct strikes can cause significant damage to buildings, critical facilities, and infrastructure and the ignition of wildfires, resulting in widespread damage to property and persons. Lightning is the most critical natural contributor to fires affecting the built environment.

Location and Extent

Hail, wind, and lightning can happen in any area, but they are frequently observed in Texas. The Tarrant County planning area, along with all participating jurisdictions, is moderately prone to these occurrences. Thus, these natural hazards could happen anywhere in the planning area. It is assumed that the entire Tarrant County planning area is uniformly at risk of lightning. Figure 59 shows the lightning flashes and thunder hours in Texas during 2022.[88] Figure 60 shows lightning density across the United States in 2023 according to the Vaisala Annual Lightning Report. This report also indicates the Dallas–Fort Worth–Arlington Metro Area is ranked 16th in the top 20 most lightning-prone U.S. metropolitan areas.

[88] AEM, “2022 United States Lightning Report.” https://aem.eco/2022-united-states-lightning-report/.

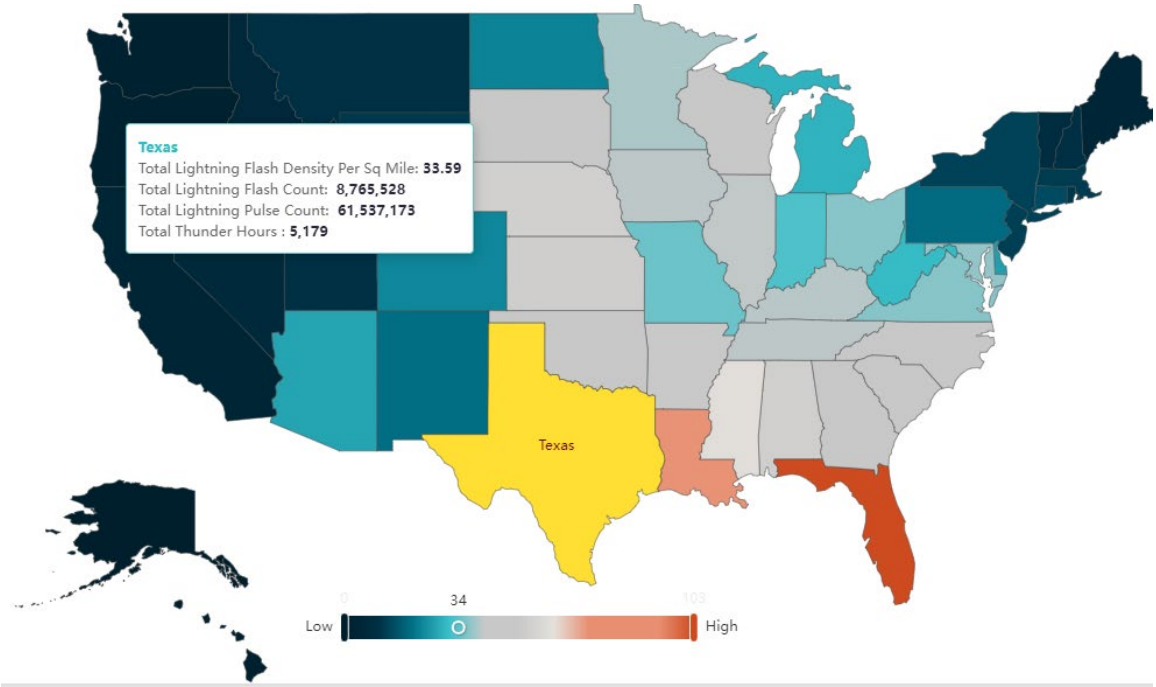


Figure 59: Lightning Flashes and Thunder Hours, Texas 2022

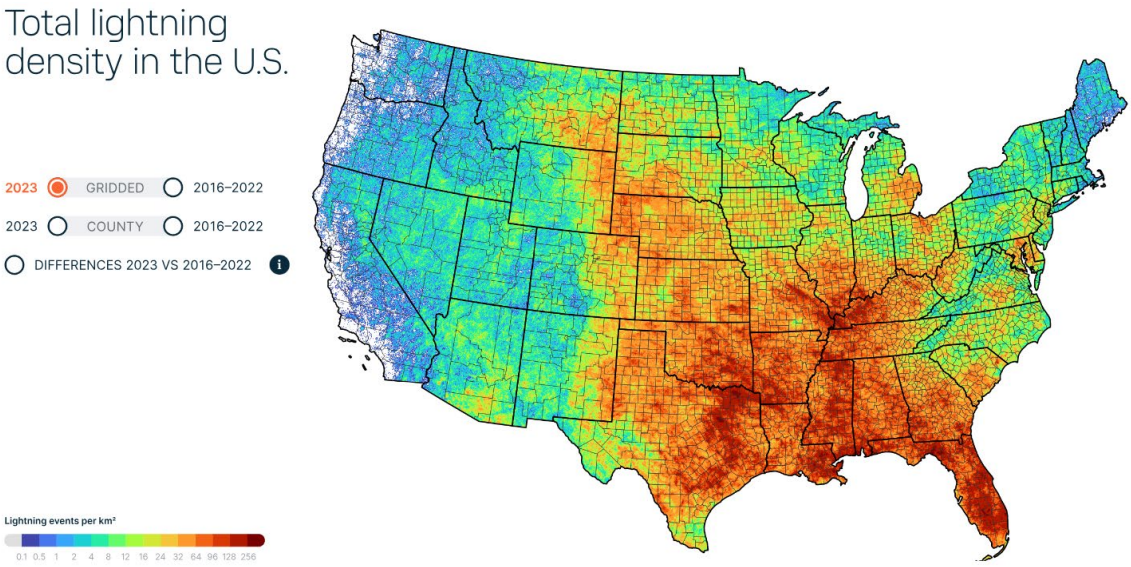


Figure 60: United States Lightning Density[89]

The NRI also provides awareness of the level of risk these weather hazards pose in Tarrant County. Figure 61, Figure 62, and Figure 63 show the levels of risk in the United States for hail, wind, and lightning, respectively.[90]

[89] Vaisala Annual Lightning Report 2023. https://www.xweather.com/annual-lightning-report.
[90] FEMA, "National Risk Index." https://hazards.fema.gov/nri/map.

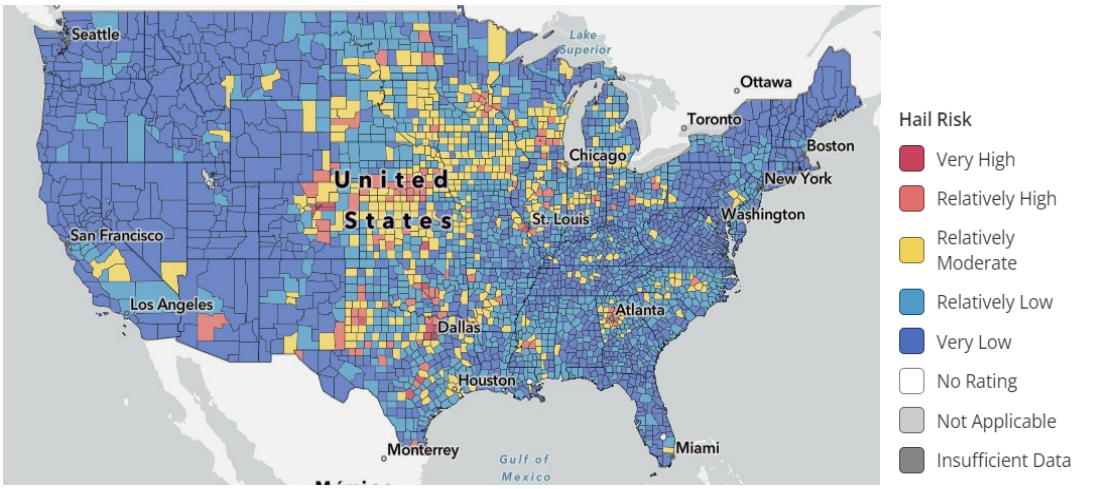


Figure 61: Hail Risk across the United States

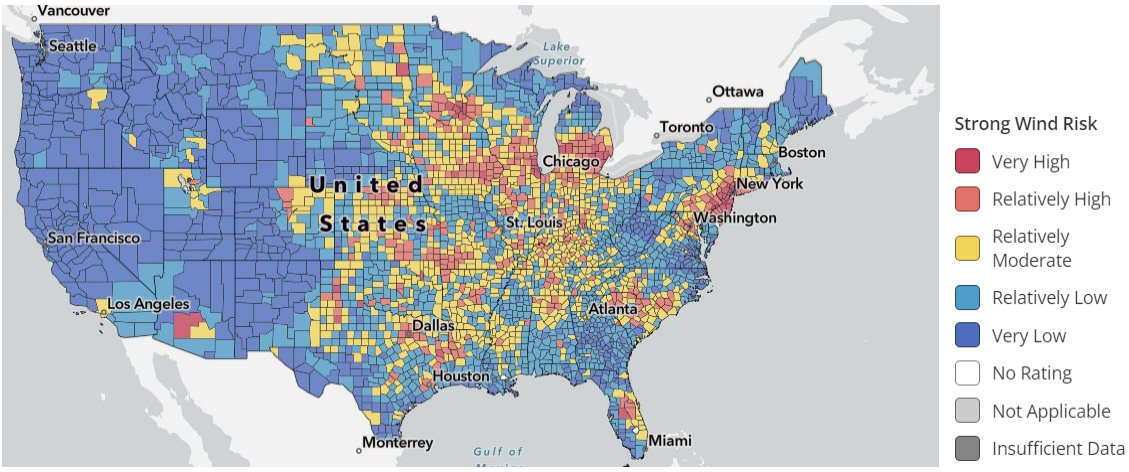


Figure 62: Strong Wind Risk across the United States

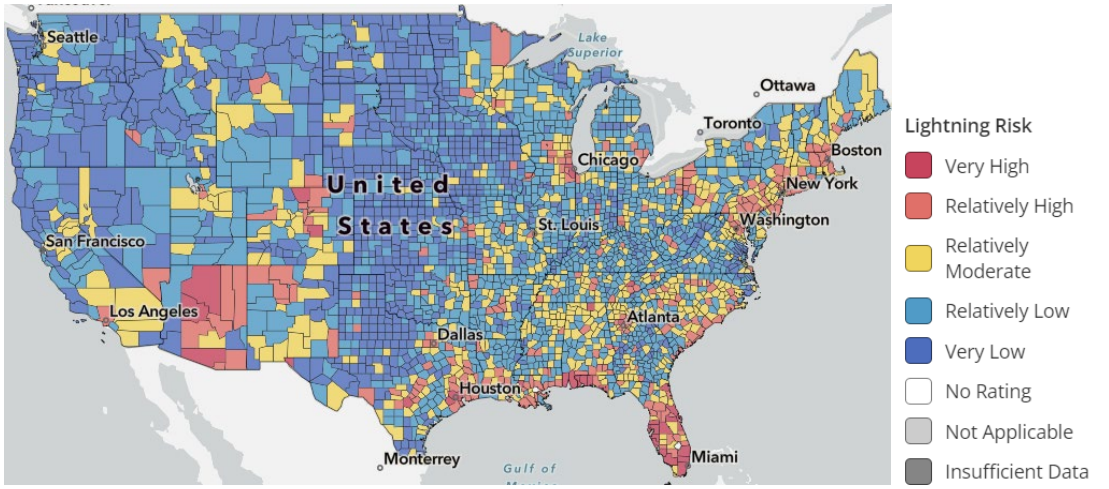


Figure 63: Lightning Risk across the United States

HAIL EXTENT

The Tornado and Storm Research Organization (TORRO) scale for hail extends from H0 to H10; its increments of intensity or damage potential are related to hail size (distribution and maximum), texture, fall speed, speed of storm translation, and strength of the accompanying wind.

An indication of equivalent hail kinetic energy ranges (in joules per square meter) has now been added to the first six increments on the scale, which may be derived from radar reflectivity or hail pads. The International Hailstorm Intensity Scale recognizes that hail size alone cannot accurately categorize a hailstorm's intensity and damage potential, especially toward the lower end of the scale. For example, without additional information, an event in which hail of up to walnut size is reported (hail size code 3: hail diameter of 21–30 mm) would be graded as a hailstorm with a minimum intensity of H2–H3. Additional information, such as the ground wind speed or the nature of the damage the hail caused, would help clarify the event's intensity. For instance, a fall of walnut-sized hail with little or no wind may scar fruit and sever the stems of crops but would not break vertical glass and so would be ranked H2–H3. However, if accompanied by strong winds, the same hail may smash many windows in a house and dent a car's bodywork such that it might be graded at an intensity as high as H5.

However, evidence indicates that maximum hailstone size is the most important parameter relating to structural damage, especially toward the more severe end of the scale. It must be noted that hailstone shapes also are an important feature, especially as the "effective" diameter of non-spheroidal specimens should ideally be an average of the coordinates. Spiked or jagged hail can also increase some aspects of damage. Table 33 presents the TORRO Hailstorm Intensity Scale in relation to typical damage caused and hail size codes.

Table 33: The Tornado and Storm Research Organization Hailstorm Intensity Scale

Size Code	Intensity Category	Typical Hail Diameter (mm)*	Probable Kinetic Energy, Joule-m^2	Typical Damage Impacts
H0	Hard Hail	5	0–20	No damage
H1	Potentially Damaging	5–**15**	>20	Slight general damage to plants, crops
H2	Significant	10–**20**	>100	Significant damage to fruit, crops, vegetation
H3	Severe	20–**30**	>300	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	25–**40**	>500	Widespread glass damage, vehicle bodywork damage
H5	Destructive	30–**50**	>800	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	40–**60**		Bodywork of grounded aircraft dented, brick walls pitted
H7	Destructive	50–**75**		Severe roof damage, risk of serious injuries

Size Code	Intensity Category	Typical Hail Diameter (mm)*	Probable Kinetic Energy, Joule-m^2	Typical Damage Impacts
H8	Destructive	60–**90**		Severe damage to aircraft bodywork
H9	Super Hailstorms	75–**100**		Extensive structural damage, risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	>100		Extensive structural damage, risk of severe or even fatal injuries to persons caught in the open

Note: * Approximate range (typical maximum size in bold) because other factors (e.g., number and density of hailstones, hail fall speed, and surface wind speeds) affect severity.

WIND EXTENT

The Beaufort Wind Chart shows the description and scale used to classify the wind intensity in a thunderstorm. The scale is now rarely used by professional meteorologists, having been largely replaced by more objective methods of determining wind speeds—such as using anemometers, tracking wind echoes with Doppler radar, and monitoring the deflection of rising weather balloons and radiosondes from their points of release. Nevertheless, it is still helpful in estimating the wind characteristics over a large area and may be used to calculate the wind without wind instruments. The Beaufort scale can also measure and describe the effects of different wind velocities on land or sea objects.

Table 34: The Beaufort Scale of Wind (Nautical)

Beaufort Number	Name of Wind	Wind Speed knots	mph
0	Calm	<1	<1
1	Light air	1–3	1–5
2	Light breeze	4–6	6–11
3	Gentle breeze	7–10	12–19
4	Moderate breeze	11–16	20–28
5	Fresh breeze	17–21	29–38
6	Strong breeze	22–27	39–49
7	Moderate gale (or near gale)	28–33	50–61
8	Fresh gale (or gale)	34–40	62–74
9	Strong gale	41–47	75–88
10	Whole gale (or storm)	48–55	89–102
11	Storm (or violent storm)	56–63	103–114
12–17	Hurricane	>64	>117

LIGHTNING EXTENT

The lightning activity level (LAL) is a crucial parameter used in fire weather forecasts nationwide. It measures the extent of lightning activity, with values ranging from 1 to 6. Each value of LAL corresponds to a specific level of lightning activity, helping forecasters and emergency responders assess the potential fire risk associated with lightning strikes.

Table 35: Lightning Activity Level and Its Effects

LAL	Cloud and Storm Development	Lightning Strikes/ 15 Minutes
1	No thunderstorms.	–
2	Cumulus clouds are common, but only a few reach the towering cumulus stage. A single thunderstorm must be confirmed in the observation area. The clouds produce mainly virga, but light rain occasionally reaches the ground. Lightning is very infrequent.	1–8
3	The towering cumulus covers less than two tenths of the sky. Thunderstorms are few, but two to three must occur in the observation area. Light to moderate rain will reach the ground, and lightning is infrequent.	9–15
4	The towering cumulus covers two to three tenths of the sky. Thunderstorms are scattered, and more than three must occur in the observation area. Moderate rain is common, and lightning is frequent.	16–25
5	Towering cumulus and thunderstorms are numerous. They cover more than three tenths of the sky and occasionally obscure the sky. Rain is moderate to heavy, and lightning is frequent and intense.	>25
6	Similar to LAL 3, except thunderstorms are dry.	

According to Figure 64, Tarrant County experienced 48.05 flashes per square mile (flash density), 41,150 lightning flashes, 541,432 lightning pulses, and 332 hours of thunder in 2022.[91] "A lightning pulse is a surge of electric current in lightning accompanied by a flash of light, while a lightning flash is a series of pulses close in space and time that approximates the continuous ionized channels of a complete bolt of lightning."[92]

[91] AEM, "2022 United States Lightning Report." https://aem.eco/2022-united-states-lightning-report/.
[92] Earth Networks, "Washington Lightning Reports." https://get.earthnetworks.com/hubfs/2021%20State%20Lightning%20Reports/Lightning_Report_Washington.pdf.

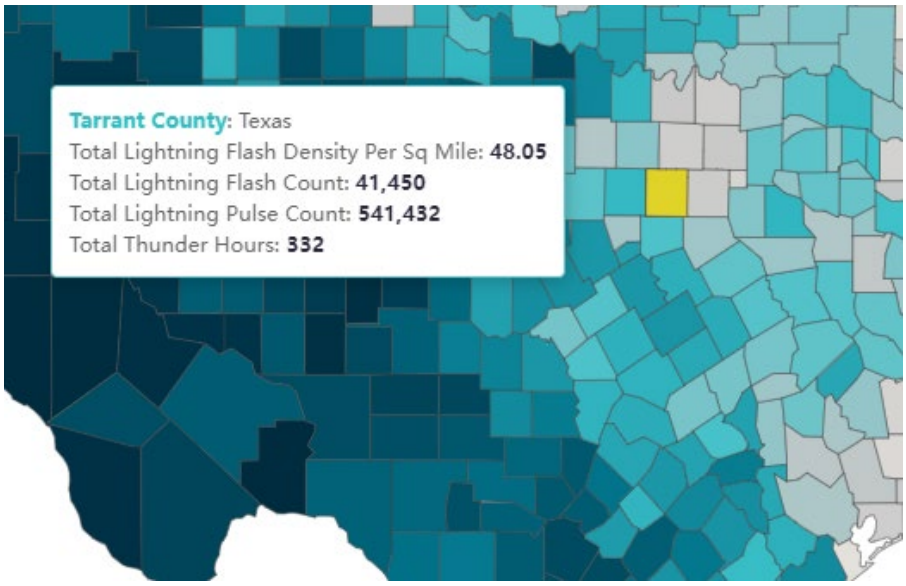


Figure 64: Lightning Flashes in Tarrant County, 2022

Previous Historical Occurrences

Between 01/01/2020 and 09/17/2024, 374 thunderstorm-related events occurred in Tarrant County. Two resulted in injury, and 29 caused property damage, with total property damage at $823,178,000.00. No deaths or crop damage were reported during that time. Table 36 provides information on those events. Events that had no fatalities or crop damage were eliminated.

Table 36: Hail, Thunderstorm Wind, and Lightning Events, Tarrant County, 01/01/2020–09/17/2024[93]

Jurisdiction	Date	Type	Magnitude in inches	Injuries	Property Damage
Arlington Municipal Airport	06/13/2023	Hail	1.75 in.	0	$7K
Arlington Municipal Airport	05/28/2024	Thunderstorm wind	50 kts. MG	0	$5K
Avondale	03/02/2023	Thunderstorm wind	61 kts.	0	$5K
Azle	06/13/2023	Hail	1.75 in.	0	$5K
Bedford	08/01/2021	Hail	1.75 in,	0	$50K
Bedford	05/27/2024	Hail	2.75 in.	0	$150K
Bedford	05/27/2024	Hail	1.75 in.	0	$8K
Bedford	05/27/2024	Hail	2.00 in.	0	$11K

[93] National Centers for Environmental Information, "Storm Events Database," https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28C%29+Hail&eventType=%28C%29+Lightning&eventType=%28C%29+Thunderstorm+Wind&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=2020&endDate_mm=09&endDate_dd=17&endDate_yyyy=2024&county=TARRANT%3A439&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=48%2CTEXAS

Jurisdiction	Date	Type	Magnitude in inches	Injuries	Property Damage
Benbrook	033/16/2023	Hail	2.00 in	0	$150K
Benbrook	03/16/2023	Hail	1.75 in.	0	$60K
Benbrook	09/08/2023	Thunderstorm wind	61 kts. EG	0	$10K
Benbrook	05/16/2024	Lightning	N/A	0	$300K
Blue Mound	03/24/2021	Hail	2.00 in.	0	$20M
Blue Mound	04/28/2021	Lightning	N/A	0	$0.50K
Blue Mound	04/28/2021	Hail	2.00 in.	0	$18M
Blue Mound	04/28/2021	Hail	1.75 in.	0	$18M
Blue Mound	04/28/2021	Hail	1.75 in.	0	$18M
Blue Mound	08/01/2021	Lightning	N/A	0	$10K
Center Point	09/08/2023	Thunderstorm wind	50 kts. EG	0	$30K
Dalworthington	04/26/2024	Hail	1.75 in.	0	$7K
Dalworthington	05/22/2024	Hail	2.25 in.	0	$20K
Dalworthington	05/27/2024	Hail	1.75 in.	0	$8K
Dalworthington	05/27/2024	Hail	3.25 in.	0	$300K
Eagle	08/19/2020	Thunderstorm wind	78 kts. EG	0	$300K
Ed Pit	08/01/2021	Lightning	N/A	0	$200K
Euless	08/01/2021	Hail	1.75 in.	0	$50K
Euless	08/01/2021	Hail	1.75 in.	0	$50K
Euless	05/27/2024	Hail	2.75 in.	0	$160K
Everman	01/10/2020	Hail	1.50 in.	0	$1K
Everman	09/08/2023	Thunderstorm wind	61 kts EG	0	$10K
Fort Worth	04/19/2020	Hail	1.75 in.	0	$10K
Fort Worth	04/19/2020	Hail	1.75 In.	0	$10K
Fort Worth	09/04/2022	Thunderstorm wind	50 kts. EG	0	$50K
Fort Worth	04/26/2024	Hail	1.75 in.	0	$10K
Fort Worth Airport	04/28/2020	Hal	1.25 in.	0	$10K
Fort Worth Blue Mound Airport	08/29/2020	Thunderstorm wind	43 kts. MG	0	$1K
Fort Worth Luck Airport	04/26/2023	Lightning	N/A	2	$0
Fort Worth Mangham Airport	03/02/2023	Thunderstorm wind	60 kts. EG	0	$100K
Fort Worth Mangham Airport	03/02/2023	Thunderstorm wind	59 kts.	0	$50K

Jurisdiction	Date	Type	Magnitude in inches	Injuries	Property Damage
Fort Worth Mangham Airport	05/27/2024	Hail	1.75 in.	0	$15K
Fort Worth Mangham Airport	05/27/2024	Hail	1.75 in.	0	$8K
Fort Worth Meacham Airport	12/13/2022	Hail	1.00 in.	0	$2K
Fort Worth Oak Grove Airport	06/12/2023	Hail	1.75 in.	0	$15K
Fort Worth Saginaw Airport	04/28/2021	Hail	1.75 in.	0	$18M
Fort Worth Saginaw Airport	04/28/2021	Hail	3.00 in.	0	$40M
Grapevine	07/12/2020	Thunderstorm wind	55 kts. EG	0	$3K
Grapevine	05/28/2024	Thunderstorm wind	67 kts. MG	0	$100K
Haltom City	04/02/2023	Hail	1.50 in.	0	$100K
Handley	09/08/2023	Thunderstorm wind	61 kts. EG	0	$10K
Haslet	03/24/2021	Hail	2.50 in.	0	$50M
Haslet	03/24/2021	Hail	3.00 in.	0	$58M
Haslet	03/24/2021	Hail	2.00 in.	0	$50M
Haslet	03/24/2021	Hail	1.75 in.	0	$58M
Haslet	03/24/2021	Hail	2.00 in.	0	$58M
Haslet	05/28/2024	Thunderstorm wind	54 kts. MG	0	$5K
Hicks	03/24/2021	Hail	3.00 in.	0	$58M
Hodge	07/12/2021	Thunderstorm wind	50 kts.EG	0	$8K
Hodge	03/21/2022	Thunderstorm wind	61 kts. EG	0	$5K
Hurst	05/27/2024	Hail	2.00 in.	0	$15K
Hurst	05/27/2024	Hail	2.75 in.	0	$160K
Johnsons Station	05/27/2024	Hail	2.00 in,	0	$11K
Keller	04/28/2021	Hail	2.50 in.	0	$40M
Keller	04/28/2021	Hail	3.00 in.	0	$40M
Keller	04/28/2021	Hail	2.25 in.	0	$40M
Keller	04/28/2021	Hail	2.50 in.	0	$40M
Keller	04/28/2021	Hail	3.25 in.	0	$40M
Keller	06/01/2024	Lightning	N/A	0	$50K
Keller Alta Vista Airport	08/29/2020	Thunderstorm wind	55 kts. EG	0	$25K

Jurisdiction	Date	Type	Magnitude in inches	Injuries	Property Damage
Keller Alta Vista Airport	04/28/2021	Hail	1.75 in.	0	$18M
Keller Alta Vista Airport	04/28/2021	Hail	1.75 in.	0	$18M
Keller Alta Vista Airport	04/28/2021	Hail	3.00 in.	0	$40M
Keller Alta Vista Airport	04/28/2021	Hail	2.00 in.	0	$18M
Keller Alta Vista Airport	04/28/2021	Hail	2.50 in.	0	$40M
Keller Alta Vista Airport	08/01/2021	Lightning	N/A	0	$10K
Keller Alta Vista Airport	09/04/2022	Thunderstorm wind	56 kts. EG	0	5K
Keller Alta Vista Airport	03/02/2023	Thunderstorm wind	70 kts. MG	0	$30K
Keller Goode Airport	05/27/2024	Hail	2.00 in.	0	$70K
Kennedale	04/12/2020	Hail	0.75 in.	0	$1K
Mansfield	04/28/2020	Hail	1.75 in.	0	$15K
Mansfield	06/12/2023	Hail	4.00 in.	0	$750K
Mansfield	06/12/2023	Hail	5.00 in.	0	$1M
Mansfield	06/12/2023	Hail	2.75 in.	0	$500K
Mansfield	06/12/2023	Hail	2.75 in.	0	$250K
Mansfield	05/27/2024	Hail	2.10 in.	0	$13K
Mara	04/19/2020	Hail	1.50 in.	0	$3K
Mara	03/16/2023	Hail	3.00 in.	0	$500K
North Richland Hills	09/25/2022	Thunderstorm wind	52 kts. EG	0	$50K
North Richland Hills	05/28/2024	Thunderstorm wind	56 kts. EG	0	$2K
Pleasant Glade	03/21/2022	Thunderstorm wind	43 kts. EG	0	$0.50K
Pleasant Glade	05/27/2024	Hail	1.75 in.	0	$8K
Richland Hills	09/08/2023	Thunderstorm wind	61 kts. EG	0	$20K
Saginaw	07/02/2020	Thunderstorm wind	50 kts. EG	0	$3K
Saginaw	04/28/2021	Hail	2.00 in.	0	$18M
Seminary Hill	04/18/2020	Hail	1.75 in.	0	$10K
Seminary Hill	04/19/2020	Hail	1.50 in.	0	$3K
Smithfield	05/27/2024	Hail	1.75 in.	0	$8K

Jurisdiction	Date	Type	Magnitude in inches	Injuries	Property Damage
Sublett	04/28/2020	Hail	1.75 in.	0	$15K
Tarrant	05/27/2024	Hail	2.00 in.	0	$15K
Watauga	03/02/2023	Thunderstorm wind	59 kts. MG	0	$70K
Watauga	03/02/2023	Thunderstorm wind	59 kts. MG	0	$60K
Watauga	05/28/2024	Thunderstorm wind	52 kts. EG	0	$2K
Webb	06/12/2023	Hail	2.75 in.	0	$500K
Webb	06/12/2023	Hail	2.50 in.	0	$200K
Webb	05/27/2024	Hail	2.00 in.	0	$50K
Webb	05/27/2024	Hail	1.75 in.	0	$8K
Webb	05/27/2024	Hail	1.75 in.	0	$8K
Westland	03/02/2023	Thunderstorm wind	60kts. EG	0	$65K
Westland	09/08/2023	Thunderstorm	56 kts. EG	0	$10K
Westland	10/04/2023	Thunderstorm wind	61 kts EG	0	$10K
Westland	10/04/2023	Hail	1.50 in.	0	$150K
Westland	10/04/2023	Thunderstorm wind	61 kts. EG	0	$75K
Westover Hills	03/21/2022	Thunderstorm wind	50 kts. MG	0	$3K

Probability of Future Events

The Tarrant County planning area, including all participating jurisdictions, is expected to experience frequent hail, wind, and lightning events in the future. According to the NRI and climate change data, the probability of these events is relatively high. Based on the 2022 data, the area experiences an average of 48.05 lightning flashes per square mile annually (approximately 41,450 flashes per year) and 332 thunder hours. These events are expected to continue to cause moderate property damage throughout the planning area and its participating jurisdictions.

Impact of Climate Trends and Variations

The changing climate in Tarrant County is projected to have a range of effects on extreme weather events. As temperatures rise, increased evaporation may contribute to the intensification of thunderstorms and the possibility of heavier rainfall, which could heighten the risk of hail events. Furthermore, elevated temperatures may also cause greater atmospheric energy, potentially leading to more powerful wind events.

Regarding lightning, the higher temperatures could spur an uptick in convective activity in the atmosphere, potentially increasing the frequency of lightning. It is essential to recognize that although these are potential outcomes of climate change, the specific impacts on hail, wind, and lightning events in Tarrant County will be influenced by a multitude of factors and could evolve over time.

Vulnerability Assessment

Tarrant County's high relative risk of thunderstorms that produce hail, lightning, and strong winds increases the community's vulnerability. These factors can lead to property damage, power outages, and potential safety hazards for residents from flash flooding and flying debris. The increased vulnerability can affect the community in various ways, including higher insurance costs, disruption of daily activities, and risks to public safety. In addition, infrastructure damage from these weather events can strain local resources and emergency response capabilities, thus impacting the community's overall resilience.

ESTIMATED IMPACT AND POTENTIAL LOSSES

Expected loss values related to thunderstorms for Tarrant County, and its jurisdictions provide crucial information about the potential monetary impact of thunderstorm events over a year. By estimating the EAL from thunderstorms, including hail, strong winds, and lightning, authorities can understand the financial risks associated with thunderstorm challenges, such as infrastructure damage, population loss, and lost agriculture productivity.

Thunderstorms can lead to a range of damage to both agriculture and infrastructure. In agriculture, thunderstorms can damage crops through heavy rainfall, hail, and strong winds. This can cause crop destruction, soil erosion, and yield loss. In addition, infrastructure damage from thunderstorms can include power outages from lightning strikes or strong winds, damage to buildings caused by hail, strong winds, or lightning, and flooding that can damage roads, bridges, and other infrastructure. Communication infrastructure, such as cell towers and antennas, may also be vulnerable to damage from strong winds or lightning strikes. Furthermore, transportation infrastructure, including roads, railways, and airports, can suffer from the impacts of thunderstorms, such as wind damage, heavy rain, or flooding.

Table 37 lists the expected loss values from hail, strong winds, and lightning in Tarrant County.

Table 37: Expected Loss Values Tarrant County Thunderstorms

Thunderstorm Hazards	Building Value	Population Equivalence	Population	Agriculture Value	Total
Hail	$85,007,912	$475,613	0.04	$1,044	$85,484,569
Strong Winds	$1,729,489	$666,851	$1,062,570	0.09	$68
Lightning	$1,683,664	$536,092	$1,147,572	0.10	n/a

Table 38: Expected Loss Values, Thunderstorms, Tarrant County Jurisdictions

Jurisdiction	Thunderstorm Hazard	Building Value U.S. Dollars	Population Equivalence U.S. Dollars	Population	Agriculture Value U.S. Dollars	Total U.S. Dollars
Arlington	**Hail**	$190,486	$1,240	0.00	$0	$191,726
	Strong wind	$1,492	$2,771	0.00	$0	$4,262
	Lightning	$1,394	$3,443	0.00	n/a	$4,837
Azle	**Hail**	$281,321	$1,685	0.00	$1	$283,007
	Strong wind	$2,194	$3,750	0.00	$0	$5,945
	Lightning	$1,368	$3,120	0.00	n/a	$4,488
Bedford	**Hail**	$113,594	$879	0.00	$0	$114,472
	Strong wind	$886	$1,956	0.00	$0	$2,842
	Lightning	$652	$1,939	0.00	n/a	$2,591
Benbrook	**Hail**	$136,075	$973	0.00	$5	$137,053
	Strong wind	$1,065	$2,175	0.00	$0	$3,241
	Lightning	$771	$2,108	0.00	n/a	$2,879
Colleyville	**Hail**	$489,779	$1,922	0.00	$0	$491,701
	Strong wind	$3,820	$4,278	0.00	$0	$8,098
	Lightning	$2,761	$4,152	0.00	n/a	$6,914
Crowley	**Hail**	$199,400	$1,457	0.00	$4	$200,860
	Strong wind	$1,561	$3,255	0.00	$0	$4,816
	Lightning	$1,198	$3,331	0.00	n/a	$4,529
Edgecliff Village	**Hail**	$104,652	$833	0.00	$0	$105,485
	Strong wind	$819	$1,860	0.00	$0	$2,680
	Lightning	$675	$2,041	0.00	n/a	$2,716
Euless	**Hail**	$139,417	$1,517	0.00	$0	$140,934
	Strong wind	$1,087	$3,377	0.00	$0	$4,464
	Lightning	$906	$3,758	0.00	n/a	$4,664
Everman	**Hail**	$151,938	$1,353	0.00	$5	$153,295
	Strong wind	$1,190	$3,022	0.00	$0	$4,212
	Lightning	$989	$3,373	0.00	n/a	$4,363
Fort Worth	**Hail**	$861,530	$1,392	0.00	$0	$862,921
	Strong wind	$6,746	$3,109	0.00	$0	$9,855
	Lightning	$5,970	$3,364	0.00	n/a	$9,335

Jurisdiction	Thunderstorm Hazard	Building Value U.S. Dollars	Population Equivalence U.S. Dollars	Population	Agriculture Value U.S. Dollars	Total U.S. Dollars
Grapevine	**Hail**	$520,307	$1,166	0.00	$0	$521,474
	Strong wind	$4,058	$2,596	0.00	$0	$6,654
	Lightning	$2,972	$2,534	0.00	n/a	$5,506
Haltom City	**Hail**	$132,442	$1,086	0.00	$0	$133,528
	Strong wind	$1,033	$2,417	0.00	$0	$3,450
	Lightning	$845	$2,607	0.00	n/a	$3,451
Haslet	**Hail**	$155,735	$1,137	0.00	$6	$156,878
	Strong wind	$1,215	$2,531	0.00	$0	$3,746
	Lightning	$920	$2,586	0.00	n/a	$3,507
Hurst	**Hail**	$196,325	$1,364	0.00	$0	$197,689
	Strong wind	$1,531	$3,036	0.00	$0	$4,567
	Lightning	$1,259	$3,303	0.00	n/a	$4,562
Keller	**Hail**	$170,622	$767	0.00	$0	$171,389
	Strong wind	$1,331	$1,708	0.00	$0	$3,038
	Lightning	$1,003	$1,723	0.00	n/a	$2,726
Kennedale	**Hail**	$186,277	$597	0.00	$6	$186,881
	Strong wind	$1,459	$1,334	0.00	$0	$2,793
	Lightning	$1,239	$1,510	0.00	n/a	$2,749
Lake Worth	**Hail**	$260,727	$1,096	0.00	$0	$261,822
	Strong wind	$2,034	$2,438	0.00	$0	$4,472
	Lightning	$1,562	$2,501	0.00	n/a	$4,063
Mansfield	**Hail**	$159,730	$958	0.00	$1	$160,689
	Strong wind	$1,251	$2,141	0.00	$0	$3,392
	Lightning	$1,050	$2,394	0.00	n/a	$3,444
North Richland Hills	**Hail**	$197,450	$883	0.00	$0	$198,333
	Strong wind	$1,540	$1,964	0.00	$0	$3,505
	Lightning	$1,263	$2,151	0.00	n/a	$3,414
Richland Hills	**Hail**	$169,452	$1,006	0.00	$0	$170,459
	Strong wind	$1,322	$2,240	0.00	$0	$3,562
	Lightning	$1,102	$2,490	0.00	n/a	$3,593

Jurisdiction	Thunderstorm Hazard	Building Value U.S. Dollars	Population Equivalence U.S. Dollars	Population	Agriculture Value U.S. Dollars	Total U.S. Dollars
River Oaks	**Hail**	$209,242	$1,781	0.00	$0	$211,023
	Strong wind	$1,632	$3,965	0.00	$0	$5,597
	Lightning	$1,267	$4,108	0.00	n/a	$5,375
Saginaw	**Hail**	$195,772	$1,580	0.00	$0	$197,352
	Strong wind	$1,527	$3,515	0.00	$0	$5,042
	Lightning	$1,176	$3,608	0.00	n/a	$4,784
Watauga	**Hail**	$156,967	$1,121	0.00	$0	$158,087
	Strong wind	$1,224	$2,495	0.00	$0	$3,719
	Lightning	$928	$2,519	0.00	n/a	$3,447
Westworth Village	**Hail**	$132,504	$570	0.00	$0	$133,074
	Strong wind	$1,037	$1,273	0.00	$0	$2,310
	Lightning	$846	$1,389	0.00	n/a	$2,235
Dallas–Fort Worth International Airport	**Hail**	$327,731	$3	0.00	$1	$327,735
	Strong wind	$2,684	$7	0.00	$0	$2,691
	Lightning	$1,986	$7	0.00	n/a	$1,993
Lakeside	**Hail**	$300,799	$1,677	0.00	$6	$302,482
	Strong wind	$2,347	$3,734	0.00	$0	$6,082
	Lightning	$1,715	$3,686	0.00	n/a	$5,402
Westlake	**Hail**	$393,000	$4,891	0.00	$1	$397,892
	Strong wind	$4,117	$14,023	0.00	$0	$18,140
	Lightning	$1,556	$3,688	0.00	n/a	$5,245
University of North Texas Health and Science Center	**Hail**	$71,800	$588	0.00	$0	$72,388
	Strong wind	$560	$1,308	0.00	$0	$1,868
	Lightning	$439	$1,371	0.00	n/a	$1,810
University of Arlington	**Hail**	$931,262	$1,260	0.00	$0	$932,522
	Strong wind	$7,292	$2,814	0.00	$0	$10,106

Jurisdiction	Thunderstorm Hazard	Building Value U.S. Dollars	Population Equivalence U.S. Dollars	Population	Agriculture Value U.S. Dollars	Total U.S. Dollars
	Lightning	$6,835	$3,458	0.00	n/a	$10,293

Development Trends

Recent development trends in Tarrant County have been quite robust, with new commercial and residential projects continually popping up. However, the increase in thunderstorm activity, including hail, strong winds, and lightning, could impact future development in the area.

Developers and builders may need to consider the potential for more extreme weather events when planning and constructing new buildings. This could mean incorporating more substantial building materials, better drainage systems, and hardier roofing to withstand hail and strong winds. In addition, developers may need to consider implementing lightning protection systems to ensure the safety of the structures and occupants.

Local government and planning authorities may also need to revisit building codes and zoning regulations to account for the potential impacts of increased thunderstorm activity. This could involve updating infrastructure standards and requirements to mitigate the risks associated with severe weather.

Overall, the increase in thunderstorm activity in Tarrant County may necessitate a shift in development practices and policies to ensure the resilience and safety of future construction projects.

VULNERABLE POPULATIONS

In Tarrant County, Texas, several vulnerable populations can be significantly impacted by thunderstorm activity. These include the elderly, individuals with disabilities, low-income households, and those without access to reliable transportation.

During thunderstorms, these vulnerable populations may experience power outages, which can be particularly dangerous for individuals who rely on medical equipment that requires electricity. In addition, flooding can pose a severe threat to those in low-lying areas or inadequate housing.

Furthermore, individuals with disabilities may face challenges in evacuating or seeking shelter during severe thunderstorms, and the elderly may require additional support and assistance during and after the storm.

Local authorities and community organizations should have plans to support these vulnerable populations during thunderstorm events. This can include providing transportation to shelters, ensuring access to medical care and supplies, and helping with cleanup and recovery efforts after the storm has passed.

COMMUNITY LIFELINES

Thunderstorms can impact several FEMA community lifelines. Safety and Security may be compromised due to lightning, strong winds, and potential damage to infrastructure. Health and Medical services may be affected by power outages, which can disrupt medical facilities and individuals reliant on electricity-powered medical equipment. Thunderstorm flooding can disrupt Food, Hydration, and Shelter access for affected populations. The Energy lifeline can be disrupted by power outages caused by thunderstorms, impacting services for residents and businesses. In addition, Transportation may be affected, posing challenges for vulnerable populations, such as the elderly and individuals with disabilities, in accessing reliable transportation during and after thunderstorm events.

Figure 65: FEMA Community Lifelines

Vulnerability Score

The NRI evaluates a nation's vulnerability by considering factors such as exposure to natural hazards, the susceptibility of its the population and infrastructure to those hazards, and its ability to withstand and rebound from their effects.

The NRI helps identify areas with higher vulnerability scores, which indicate a more significant risk and potential for damage and loss during natural disasters. It can also highlight where additional resources may be needed to improve resilience and reduce vulnerability to natural disasters.

The NRI data indicate an overall risk index score of 98.8 for Tarrant County, signifying a high level of risk. The annual loss score of 98.8 points to a substantial potential for financial loss because of natural disasters. Tarrant County's social vulnerability score of 74.8 suggests that it may encounter difficulties recovering from natural disasters. This could result from poverty, inadequate access to healthcare, and limited infrastructure.

However, Tarrant County's community resilience score of 26.3 indicates that it may struggle to recover effectively from a natural hazard. It suggests that the county might have limited resources, infrastructure, and capacity to withstand and bounce back from the impacts of a natural disaster. This could result in prolonged recovery times, increased vulnerability, and difficulty restoring normalcy after the event.

In conclusion, communities with a high risk index, high EAL, high social vulnerability, and low community resilience are particularly susceptible to the devastating outcomes of hazardous events. When such events occur, these communities will likely experience severe damage to infrastructure, homes, and public services, leading to a significant economic impact. Tarrant County's high social vulnerability means that its residents may struggle to cope with the aftermath, facing challenges, such as limited access to healthcare, resources, and support systems. In addition, low community resilience may hinder the county's ability to recover and rebuild, prolonging the community's recovery process and exacerbating the long-term social and economic impacts.

As Figure 66, shows the risk rating for Tarrant is 98.82%, which is higher than the 97.60% of counties in Texas.[94]

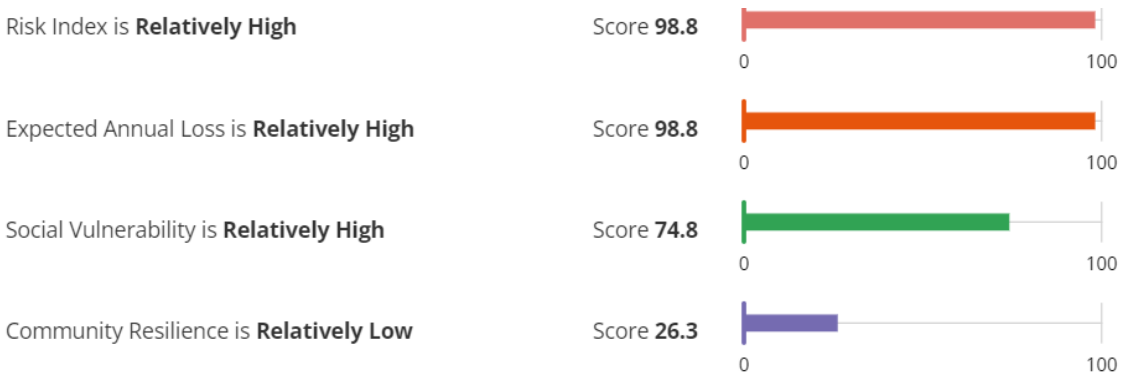


Figure 66: Risk Ratings for Tarrant County, Texas

The risk overview includes EAL, social vulnerability, and community resilience. Table 39 provides the hail, strong wind, lightning risk rating, and overall risk from the NRI website and compares them to the overall risk rating for the state of Texas.

Table 39: National Risk Index Scores for Hail, Strong Wind, and Lightning, Tarrant County

Hazard	Risk Rating	Expected Annual Loss	Social Vulnerability	Community Resilience	Overall Risk Rating, Tarrant County	Overall Risk Rating, Texas
Hail	100	99.9	74.76	26.32	98.82	97.60
Strong Wind	92.2	91.2	74.76	26.32	98.82	97.60
Lightning	97.9	97.7	74.76	26.32	98.82	97.60

[94] FEMA, "National Risk Index," https://hazards.fema.gov/nri/map.

Table 40: Hail, Strong Wind, and Lightning Risk Factor Breakdown

Hazard	EAL* Value	Social Vulnerability	Community Resilience	CRF*	Risk Value	Risk Index Score
Hail	$85,484,569	Relatively High	Relatively Low	1.19	$99,220,348	100
Strong Wind	$1,729,489	Relatively High	Relatively Low	1.19	$2,066,003	92.2
Lightning	$1,683,664	Relatively High	Relatively Low	1.19	$2,035,880	97.9

* Note: CRF = Community Risk Factor, EAL = expected annual loss

Based on NRI data, Tarrant County's hail risk of 100%, strong wind risk of 92.2%, and lightning risk of 97.9 are considered relatively high, meaning there is a high likelihood of continued thunderstorm events occurring in the county.

The NWS uses activity levels from Storm Prediction Center to represent severe weather outlooks (see Figure 67).

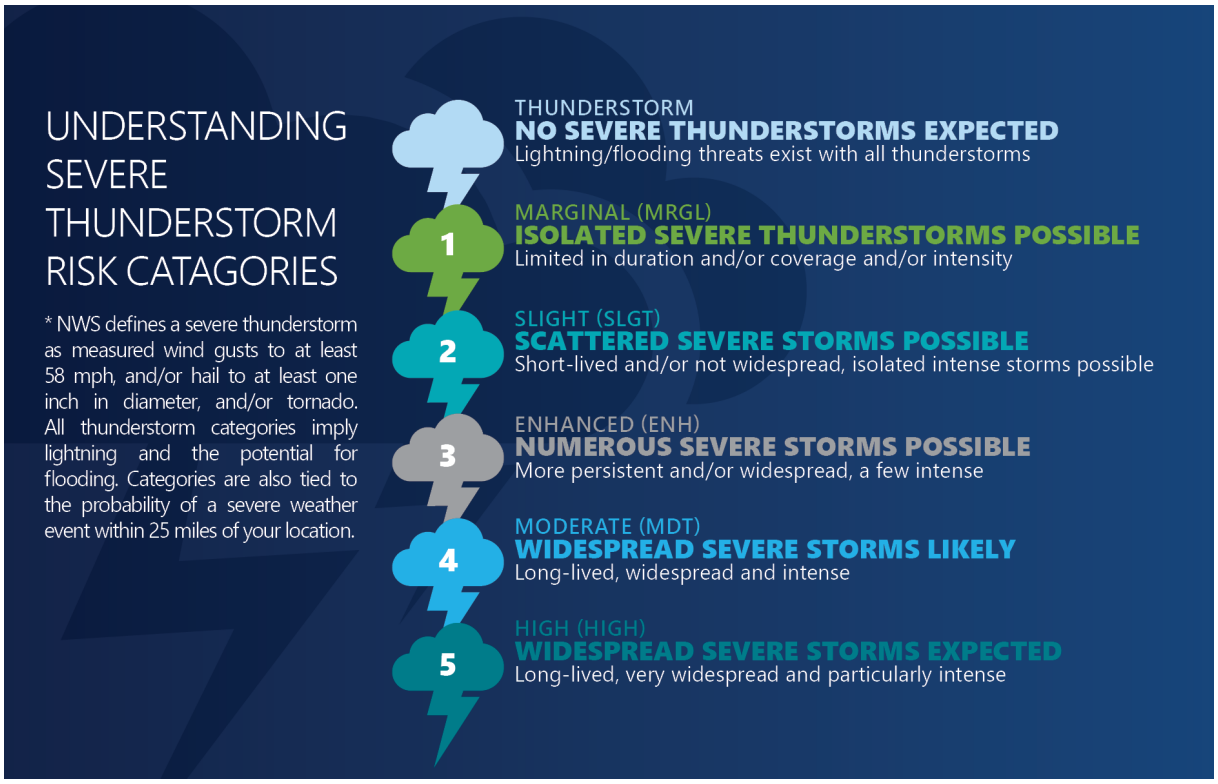


Figure 67: Severe Thunderstorm Risk Categories

Tarrant County averages approximately 11 significant thunderstorm events (with hail and high winds) per year, according to NWS records. Although most new homes and buildings in participating jurisdictions are built to resist the effects of all but the strongest thunderstorms, a number of mobile and manufactured home parks and vehicles remain vulnerable. According to the National Structure Inventory, a nationwide

databased of structure points and attributes compiled by USACE, 7,368 residences in Tarrant County are manufactured homes. Thousands of homes and vehicles can be damaged in a single storm, causing millions of dollars in damage.[95]

[95] State of Texas Mitigation Plan, 2013, page 72.

Tornado

A tornado is a violently rotating column of air that comes in contact with the ground. A tornado can either be suspended from, or occur underneath, a cumuliform cloud. It is often, but not always, visible as a condensation funnel.

Tornadoes develop from two types of supercell and non-supercell thunderstorms. Those developing from supercell storms are most common and are often the most powerful ones. Supercell thunderstorms are created when horizontal wind shears (winds moving in different directions at different altitudes) begin to rotate the storm. When horizontal wind shears, which are winds moving in different directions at different altitudes, start to rotate a storm, they can cause the formation of a tornado. Strong updrafts can turn this rotation vertically, and the rotating air can eventually reach the ground, creating a swiftly twisting column of air, forming a tornado.

Location and Extent

Tornadoes can occur in Tarrant County without any specific geographic boundary. It is assumed that all areas in the county, including all participating jurisdictions, are equally exposed to tornado activity. Figure 68 shows activity for EF3, EF4, and EF5 tornadoes in the United States from 1950 to 2021.

Historically, tornadoes are not equally distributed across Texas and appear to occur more frequently in the area referred to as “Tornado Alley,” a line of activity that stretches north from Central Texas into Oklahoma and beyond. Tornadoes occur in Texas with the greatest frequency during the late spring and early summer months and typically occur in the early evening hours. Nearly 62.7% of all Texas tornadoes occurred in the three-month period of April, May, and June, with almost one third of the total tornadoes occurring in May in the years between 1951 and 2011. By virtue of its size, Texas has more recorded tornadoes than any other state.[96,97]

[96] 2023 Texas State Hazard Mitigation Plan, https://txdem.sharepoint.com/sites/TDEMWebsiteFiles/Shared%20Documents/Forms/AllItems.aspx?id=%2Fsites%2FTDEMWebsiteFiles%2FShared%20Documents%2FMitigation%2FState%20of%20Texas%20HMAP%20Update%20%2D%2010%2E27%2E23%2Epdf&parent=%2Fsites%2FTDEMWebsiteFiles%2FShared%20Documents%2FMitigation&p=true&ga=1.

[97] Texas Almanac, “Texas Tornadoes,” Texas Tornados | TX Almanac (texasalmanac.com).

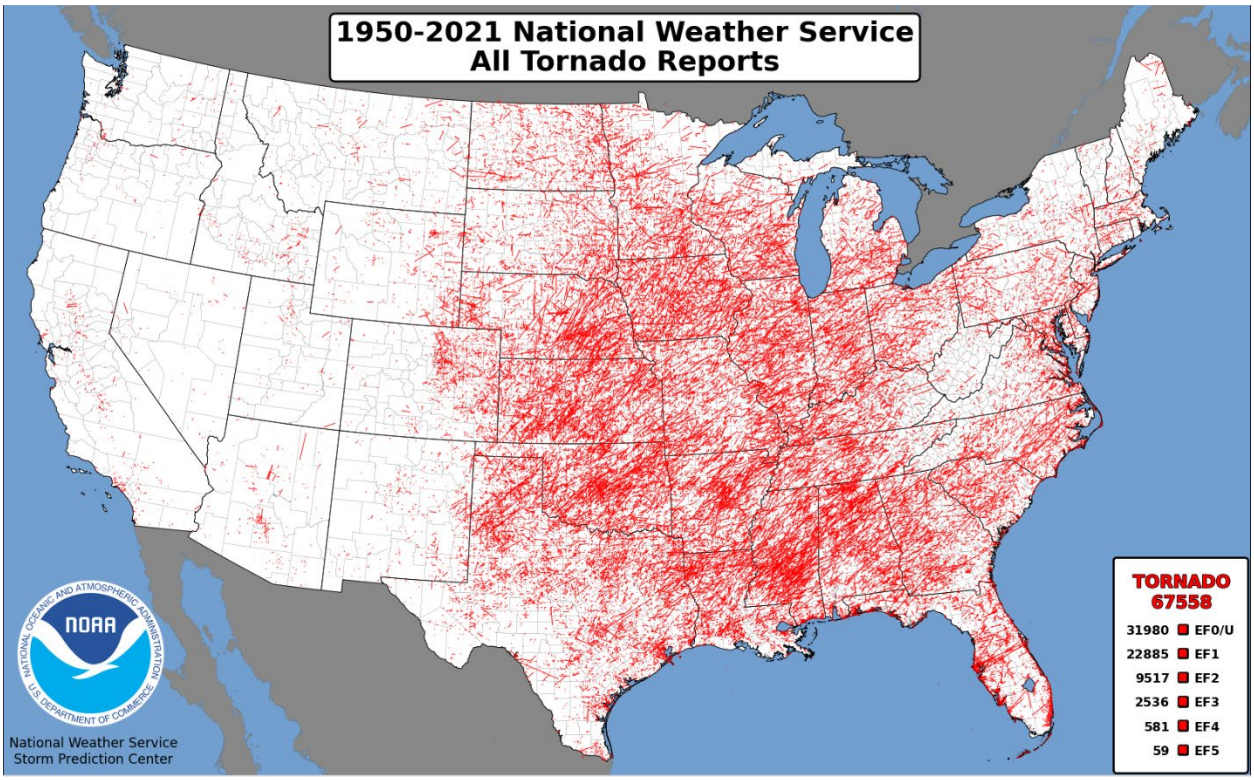


Figure 68: Tornado Paths, 1950–2021[98]

Damage from tornadoes can range from light to inconceivable. Factors affecting the amount of destruction include the intensity, size, and duration of a storm. The greatest damage from tornadoes is usually to structures of light construction, such as residential homes. Manufactured homes are particularly vulnerable to damage.

The Enhanced Fujita Scale (or EF Scale), shown in Table 41, is the scale for rating the magnitude of tornadoes during the observed time in terms of the damage they produce. Six categories, from EF0 to EF5, represent increasing degrees of damage. The scale considers how most structures are designed and is thought to accurately represent the surface wind speeds in the most violent tornadoes. The EF Scale considers multiple variables to assign a wind speed rating to a tornado. It incorporates 28 damage indicators, including building types, structures, and trees. Each damage indicator has eight degrees of damage ranging from the beginning of visible damage to complete destruction.[99]

[98] National Oceanic and Atmospheric Administration Storm Prediction Center.
[99] National Oceanic and Atmospheric Storm Prediction Center, "The Enhanced Fujita Scale," The Enhanced Fujita Scale (EF Scale) (weather.gov).

Table 41: Enhanced Fujita Scale for Tornadoes

F-Scale	Fasted Quarter Mile Wind Speed	Typical Impacts	Enhanced Sclae: 3 Sec Wind Gust Speed	Enhanced F-Scale
F0	**40-72 mph**	Some damage to chimney; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.	**65-85 mph**	**EF0**
F1	**73-112 mph**	Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads; attached garages may be destoryed.	**86-110 mph**	**EF1**
F2	**113-157 mph**	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.	**111-135 mph**	**EF2**
F3	**158-206 mph**	Roof and some walls torn off well constructed houses; trains overturned; most trees in forest uprooted.	**136-165 mph**	**EF3**
F4	**207-260 mph**	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated	**166-200 mph**	**EF4**
F5	**261-318 mph**	Strong frame houses lifted off foundations and carried considerable distances; automobile-sized missles fly through the air in excesss of 100 meters; trees debarked; steel reinforced concrete structures damaged.	**Over 201 mph**	**EF5**

Tornadic events in Tarrant County during this planning period ranged from EF0 (No Damage) to EF3 (Severe Damage) on the Enhanced Fujita Scale. Based on this, the range of tornado intensity that Tarrant County planning area and all its jurisdictions would be expected to mitigate ranges between weak tornadoes with low risk of damage to strong tornadoes with severe risk of damage.

The highest likelihood of tornadoes can be expected in the spring season, from March to May. Figure 69 shows that there were 66 tornadoes during the spring between 1880 and 2024.

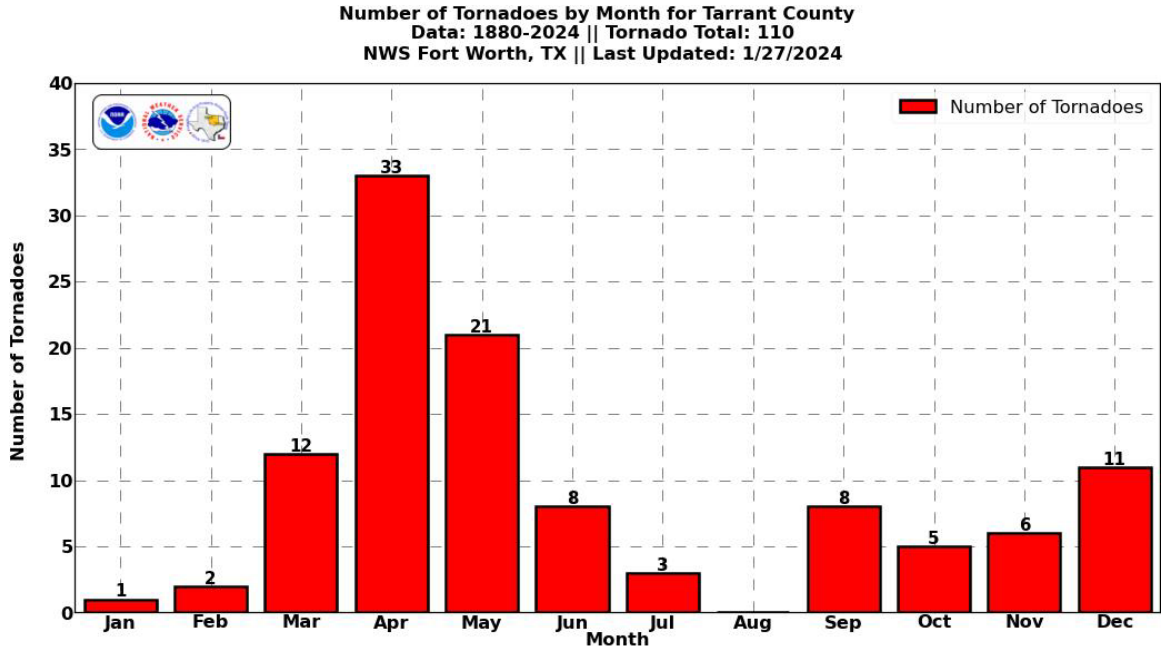


Figure 69: Number of Tornadoes by Month, Tarrant County, 1950–2024[100]

According to Figure 70, 78% of the tornadoes in Tarrant County are classified as weak on the intensity scale (EF0-EF1), with the remaining 22% measured as Strong (EF2-EF3).

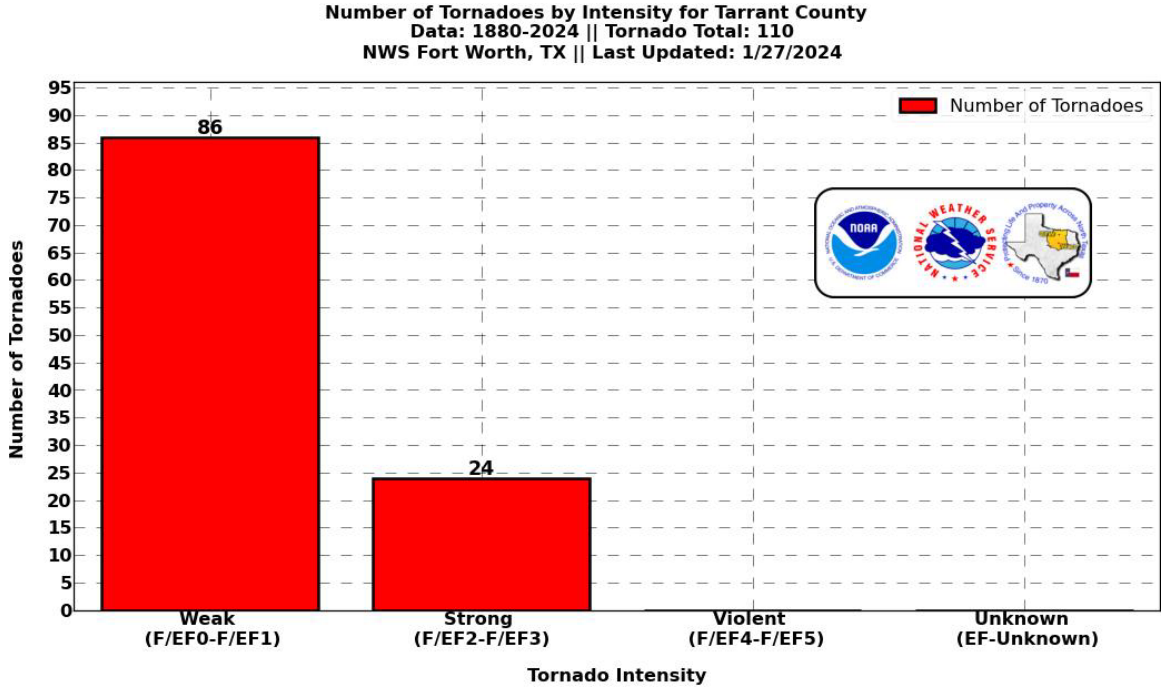


Figure 70: Number of Tornadoes by Intensity, Tarrant County[101]

[100] National Weather Service, last updated January 27, 2024.
[101] Ibid.

Most tornadoes occur in the afternoon and evening hours of the day; Figure 71 shows a high number of tornado occurrences between the hours of 1500 to 2000 (3 p.m. to 8 p.m.).

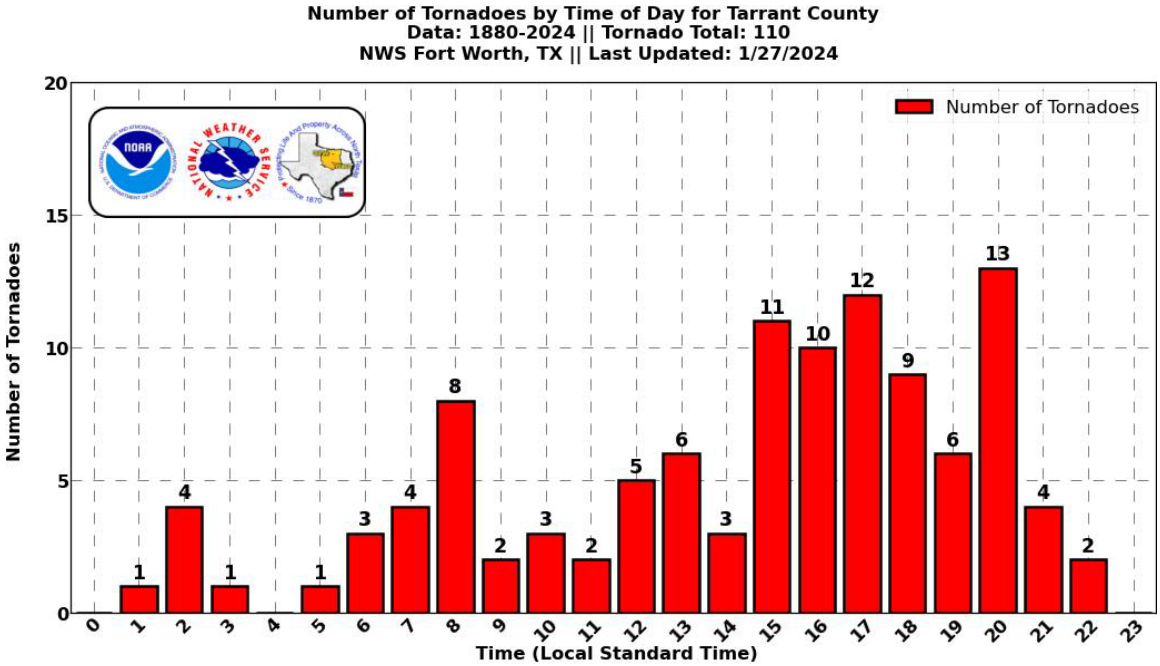


Figure 71: Time of Tornado Occurrence, Tarrant County, 1950–2024[102]

[102] Ibid.

Figure 72 shows tornado tracks between 1950 and 2024. The strongest tornadoes in Tarrant County were EF3.

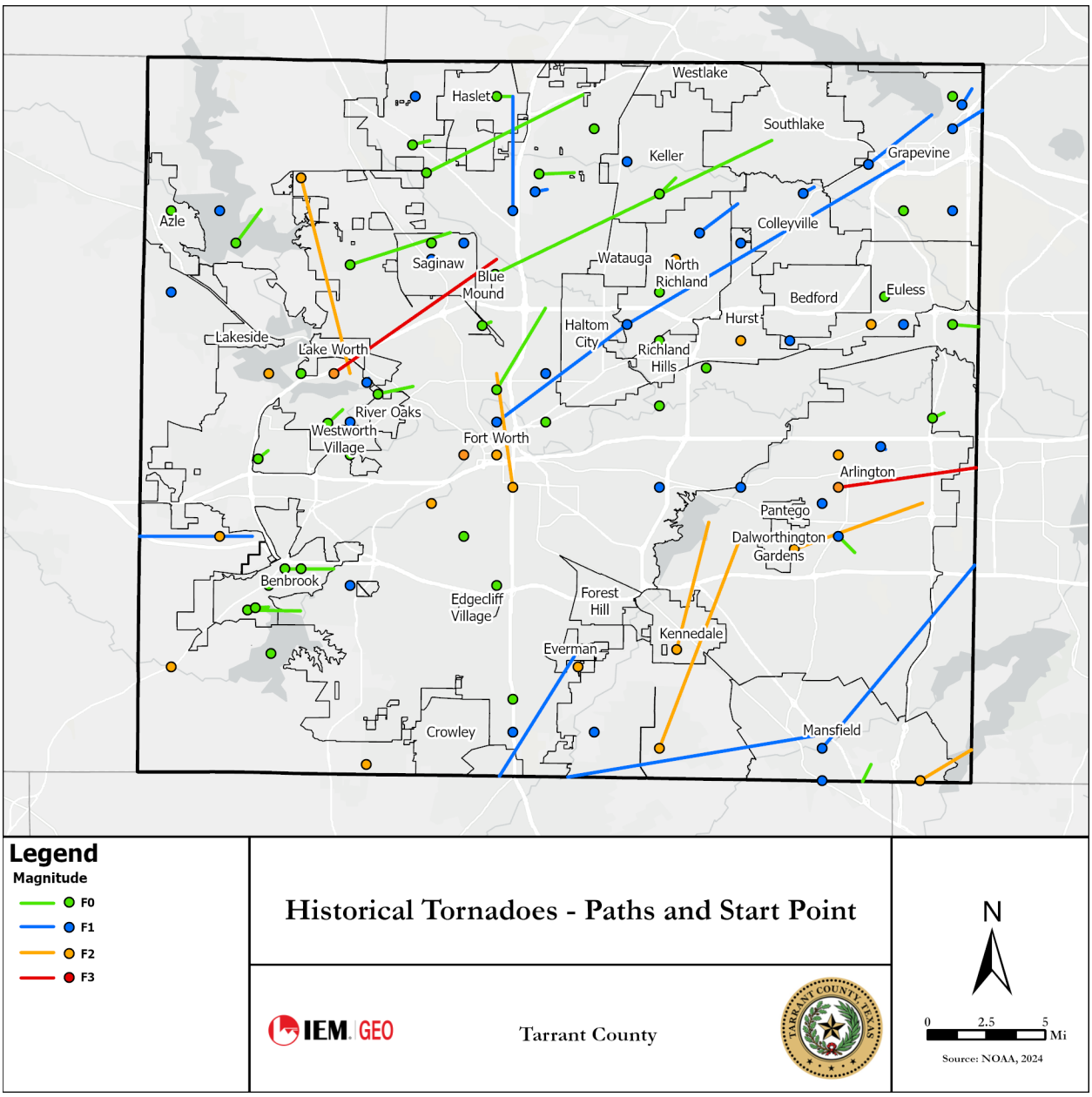


Figure 72: Tornado Tracks, Tarrant County, 1880–2024

Between 2019 and 2024 there were 14 recorded tornadoes in Tarrant County, according to Figure 73. Nine of those occurred in 2022.

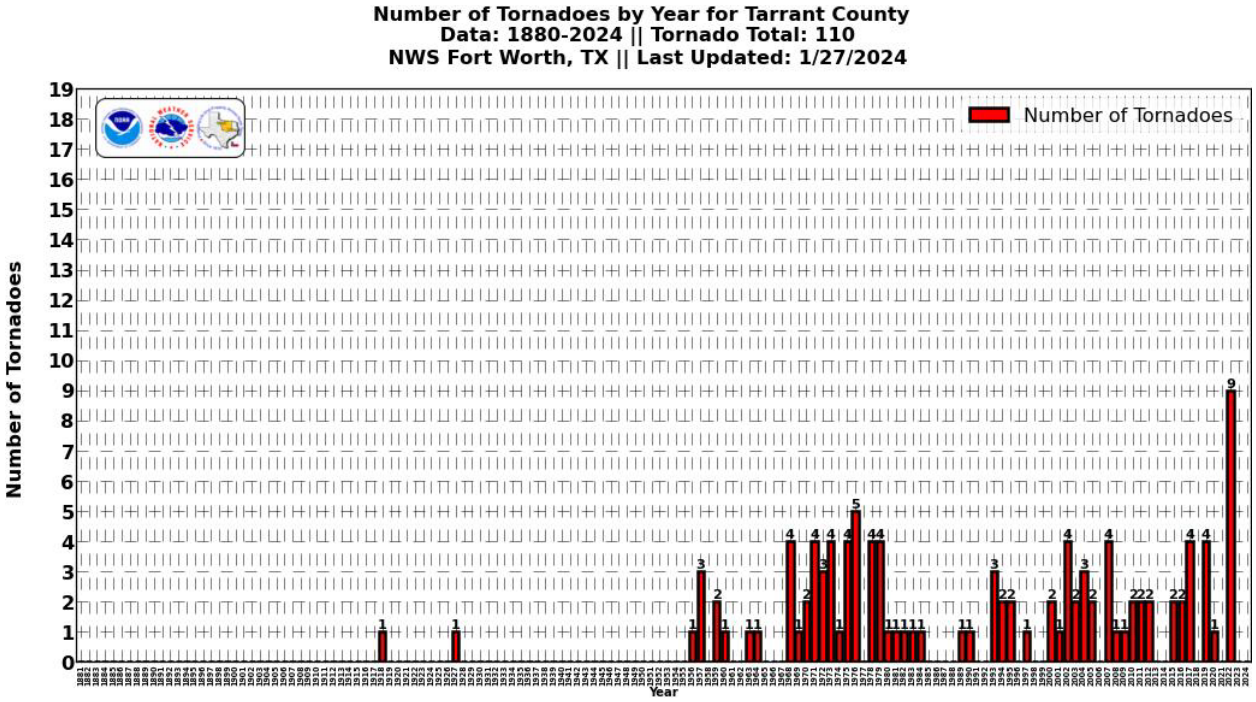


Figure 73: Number of Tornadoes by Year, Tarrant County,1880–2024[103]

[103] Ibid.

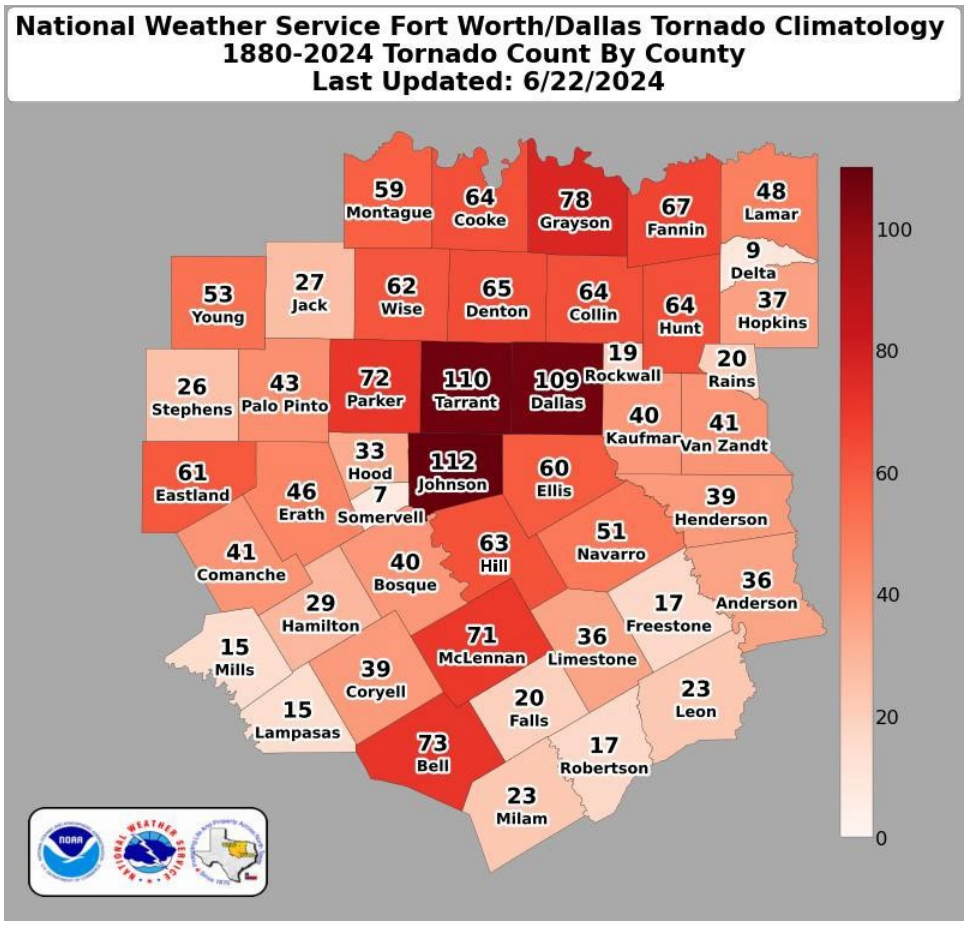


Figure 74: Number of Tornadoes in Tarrant and Surrounding Counties, 1880–2024

Figure 74 shows the total number of tornadoes that have occurred in each county in the region since 1880. Tarrant County has the second highest number of occurrences at 110. The neighboring Johnson County to the south has had 112 tornadoes, and Dallas County to the east has had 109.

Previous Historical Occurrences

The historical data were reported to NCEI, the Storm Prediction Center at the National Oceanic and Atmospheric Administration (NOAA), and the Spatial Hazard Events and Losses Database (SHELDUS). It should be noted that only reported tornadoes are included; many tornadoes likely go unreported. Figure 75 reflects historic events by county that are ranked by order of severity, and Figure 76 identifies historic losses by county. According to the National Climatic Data Center, tornadoes have caused more than $17.52 million in property damage in Tarrant County since 2015, with zero crop damage reported.

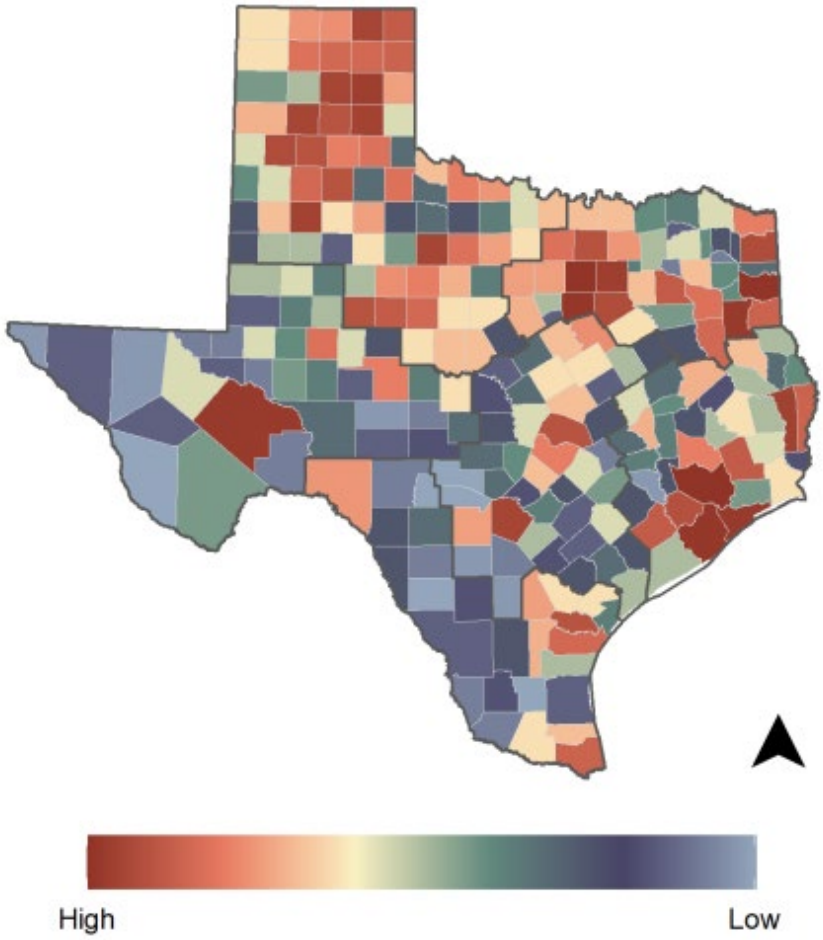


Figure 75: Frequency of Tornadoes in Texas Counties[104]

[104] 2023 Texas Division of Emergency Management. National Centers for Environmental Information Storm Events Database. "Tornado: Historic Events by County," TDEM Website Files – State of Texas HMAP Update, txdem.sharepoint.com/sites/TDEMWebsiteFiles/SharedDocuments/Forms/AllItems.aspx?id=%2Fsites%2FTDEMWebsiteFiles%2FShared Documents%2FMitigation%2FState of Texas HMAP Update -10%2E27%2E23%2Epdf&parent=%2Fsites%2FTDEMWebsiteFiles%2FSharedDocuments%2FMitigation&p=true&ga=1 (login required).

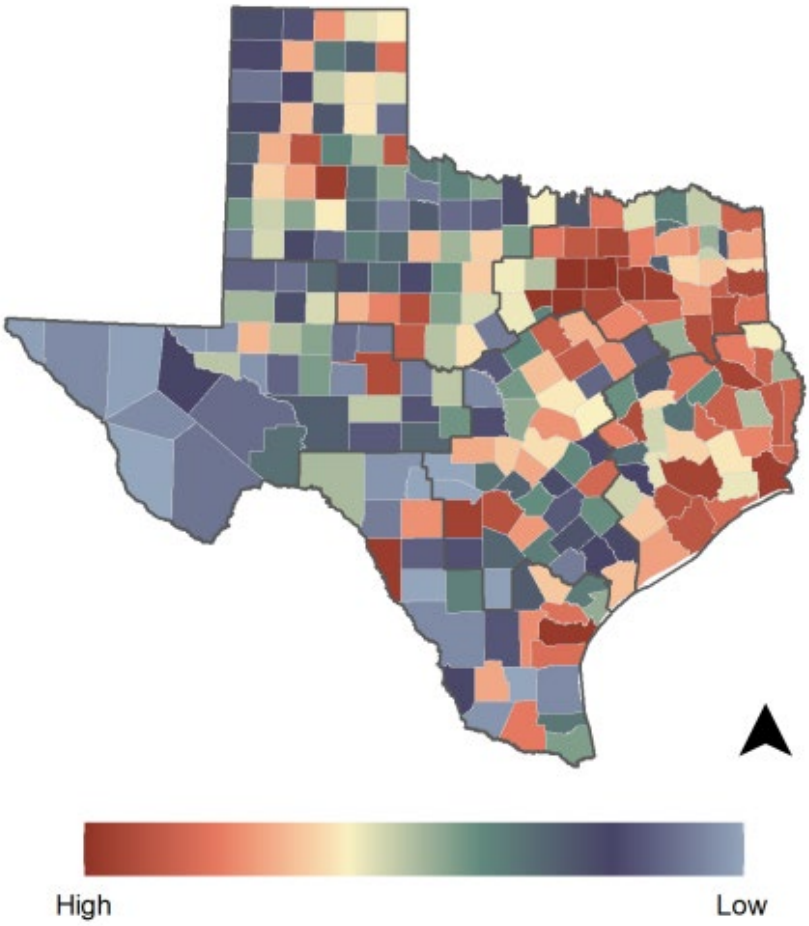


Figure 76: Historical Losses from Tornadoes in Texas Counties, 2000–2021[105]

Between 2015 and 2022, there were 22 recorded tornadoes in Tarrant County. According to the National Climatic Data Center, tornadoes in Tarrant County have caused no deaths, 10 reported injuries, more than $17 million in property damage, and zero crop damage. Table 42 lists tornado events by date and location.

Table 42: Historical Losses from Tornadoes, Tarrant County 2015–2022[106]

Location	Date	Time	Magni-tude	Deaths	Injuries	Property Damage	Crop Damage
Hodge (non-participant)	11/05/2015	16:08	EF0	0	0	$120K	$0.00K
Keller	11/17/2015	03:28	EF0	0	0	$210K	$0.00K

[105] 2023 Texas State Hazard Mitigation Plan, txdem.sharepoint.com/sites/TDEMWebsiteFiles/SharedDocuments/Forms/AllItems.aspx?id=%2Fsites%2FTDEMWebsiteFiles%2FSharedDocuments%2FMitigation%2FState of Texas HMAP Update - 10%2E27%2E23%2Epdf&parent=%2Fsites%2FTDEMWebsiteFiles%2FSharedDocuments%2FMitigation&p=true&ga=1.

[106] National Weather Service National Oceanic and Atmospheric Administration, "The Enhanced Fujita Scale (EF Scale)," The Enhanced Fujita Scale (EF Scale) (weather.gov).

Location	Date	Time	Magni-tude	Deaths	Injuries	Property Damage	Crop Damage
Benbrook Lake (non-participant)	03/08/2016	08:03	EF0	0	0	$330K	$0
Hicks (non-participant)	03/23/2016	20:08	EF0	0	0	$90K	$0
Mansfield	01/15/2017	20:13	EF0	0	0	$75K	$0
Hicks (non-participant)	03/29/2017	01:08	EF0	0	0	$300K	$0
Fort Worth Blue Mound Airport	03/29/2017	01:10	EF0	0	0	$100K	$0
Fort Worth Saginaw Airport	05/29/2019	12:19	EF0	0	0	$5K	$0
Keller Alta Vista Airport	5/29/2019	12:31	EF1	0	0	$100K	$0
Eagle Mountain Lake (non-participant)	06/16/2019	13:58	EFU*	0	0	$0	$0
Keller Alta Vista Airport	06/16/2019	14:25	EF0	0	0	$150K	$0
Arlington	06/16/2019	14:25	EF1	0	0	$200K	$0
Johnsons Station (non-participant)	11/24/2020	20:51	EF2	0	5	$0	$0
Benbrook Lake (non-participant)	03/21/2022	16:31	EF00	0	0	$0	$0
River Oaks	03/21/2022	16:37	EF0	0	0	$0	$0
Euless	03/21/2022	17:12	EF0	0	0	$20K	$0
Westover Hills (non-participant)	12/13/2022	08:10	EF0	0	0	$50K	$0
Lake Worth	12/13/2022	08:14	EF1	0	0	$1K	$0
Fort Worth Meacham Airport	12/13/2022	08:18	EF0	0	0	$1K	$0
Smithfield (non-participant)	12/13/2022	08:34	EF1	0	0	$0	$0
Grapevine	12/13/2022	08:42	EF1	0	5	$0	$0
Grapevine	12/13/2022	08:49	EF1	0	0	$0	$0
Totals:				**0**	**10**	**$17.52M**	**$0**

Note: EFU = Unknown scale (used when damage does not clearly indicate an EF category and does not cause injuries or fatalities)

Tornadoes have impacted Tarrant County and its surrounding jurisdictions in the past and will continue to do so. Between 1950 and 2022, NOAA recorded 108 tornadoes in Tarrant County.

Selected events since 2017 with some details/descriptions are listed below. The events listed exclude any that did not cause property damage, injuries, or deaths.

- **May 29, 2019:** On this date, a cold front resulted in many scattered thunderstorms across the region. Many of the storms were severe and produced damaging tornadoes. An EF0 tornado with maximum winds estimated at 80 mph formed near the Villages of Eagle Mountain subdivision, causing damage to one home. The tornado tracked east-northeast between W Bailey Boswell Road and WJ Boaz Road to a neighborhood, causing damage to trees and tree branches. The tornado continued to North Saginaw Blvd (US 287/81), damaging business signs and bending power poles. It moved east-northeast and dissipated between East Bailey Boswell Road and Darlington Trail without causing further damage. Total property damage was estimated at $5,000.

  On this same date, a brief EF1 tornado occurred in North Fort Worth in the Heritage neighborhood. Most of the damage occurred on Heritage Trace Parkway in an approximately eight-block area. Approximately 30 homes were damaged, with two homes reporting minor damage. There was significant tree damage, roof cover loss, and broken windows. The tornado began near Burst Drive (east of Old Denton Road) and dissipated three minutes later near Kimball Drive. The tornado's maximum sustained winds were estimated at 90 mph.

- **June 16, 2019:** Thunderstorms erupted an outflow boundary between the Red River and the Interstate 20 corridor when a disturbance moved from the northwest. The storms produced significant wind damage and a few brief tornadoes as they moved southeast through the DFW Metroplex. Severe weather reports continued as storms pushed southeasterly into Central and East Texas. An EF0 tornado with maximum winds of 85 mph was found on an NWS survey. The tornado began in the Crawford Farms Subdivision on the west end of Aldersyde Drive, tracked east for about one and one-quarter miles, lifting just east of the Vista Meadows subdivision. There was damage to roofs, windows, and siding on many single-family homes. Tree limbs were blown off mostly Bradford pear trees. The most considerable damage was reported to one home on Sourwood Drive that had more than 20% of its roof decking removed, broken windows, and a garage door damaged. The damage was consistent with a high end EF0 tornado having winds of 85 mph. This tornado caused property damage of $150,000.

  The NWS survey team confirmed that a brief tornado occurred in the neighborhood east of Collins Street in Arlington. The pattern of the damage indicated a brief EF1 tornado that dissipated before extending to the AT&T Stadium and Globe Life Park area. A few neighborhood homes had significant loss of roofing, and several trees snapped. Additional damage in Arlington resulted from straight-line winds of 60–70 mph.

- **November 24, 2020:** During the evening, a line of storms moved through the 1 NW Johnsons Station into the ESE Arlington region. The storms intensified as they reached the I-35 corridor, and a quasi-linear convection system tornado occurred in Arlington. This tornado was rated EF2 because of the amount of roof damage to an apartment complex. The EF2 tornado produced mostly EF0 and EF1 damage with a small area of EF2 damage reported. Five non-life-threatening injuries were reported along the tornado path. There was sporadic damage to trees, siding, fences, and roofs toward the

end of the tornado's path. Fannin County had notable wind damage related to the line of storms. The maximum winds in this tornado were around 115 mph.

- **March 21, 2022:** On this date, a strong shortwave trough aided in the development of scattered to many thunderstorms during the late morning, afternoon, and evening hours. Thunderstorms initially fired along a dryline, many became severe, and some produced strong tornadoes. According to storm survey teams, 17 tornadoes occurred. The strongest winds reported were related to the EF3 Jacksboro tornado. One death was caused by a tornado in Grayson County near the Red River. According to damage survey, surveillance video, and Collaborative Adaptive Sensing of the Atmosphere (CASA) radar data, a brief EF0 tornado passed across the Dutch Branch arm of Lake Benbrook at approximately 5:31 p.m. on March 21, 2022. The tornado moved across a marina where a floating marina cover lifted off and destroyed or caused damage to several boats and one shoreline tree. The maximum winds were estimated at 85 mph.

  On this same date, an EF0 tornado with peak winds of 85 MPH struck the City of Euless as confirmed by damage survey and Doppler radar data. The damage path was sporadic, beginning on Ector Drive and tracking toward the northeast, with the most considerable damage being noted along Milam Drive and Harris Drive. Most damage consisted of tree limbs down and a few larger trees being blown over. Structural damage was minimal and related to trees downed on homes. The damage path ended near the intersection of Harwood Drive and North Euless Main. The tornado was on the ground no longer than about two minutes as suggested by radar data. $20,000 in property damage occurred.

- **December 13, 2022:** On this date, a tornado outbreak occurred, resulting in 16 tornadoes across the northern half of the Central Weather Advisory and along and north of Interstate 20. Four tornadoes were rated EF2. Nine people sustained non-life-threatening injuries, and most of the reported injuries were caused by the Grapevine tornado in Tarrant County. Tennis-ball-sized hail was reported from one storm in Rockwall County. A supercell embedded in the line of storms moved into the White Settlement area in far northwestern Fort Worth area around 8:00 a.m. with a tornado developing near the Naval Air Station Joint Reserve Base Fort Worth control tower. The tornado traced northeast, damaging a fitness facility and trees along its path. Maximum sustained winds were reported at 75 mph. Property damage of $50,000 was reported.

  This parent mesocyclone that hit the Naval Air Station Joint Reserve Base continued moving to the northeast and developed another tornado that mainly impacted Marion Sansom Park, crossed Roberts Cutoff Road, and eventually dissipated upon entering the city of Samson Park. Some damage occurred to trees and fences. Maximum winds were estimated at 105 mph, and $1,000 in property damage was reported.

  On the same date, a brief EF0 tornado crossed the train tracks at a railyard east of Blue Mound Road and north of Meacham Blvd. The tornado knocked over some rail cars and resulted in a few broken branches east of the railyard. Property damage equal to $1,000 resulted. Maximum winds were estimated at approximately 70 mph.

  In addition, an EF1 tornado moved through Grapevine near Ira E Woods Avenue, south of Highway 114. This tornado resulted in significant roof damage of businesses, downed power poles, and damage to trees and residential roof shingles along its path. The tornado continued to move near the

intersection of Northwest Highway and North Dove Road, damaging a car wash, a restaurant, and two Heating, Ventilation, and Air Conditioning Units (HVACs) at Grapevine Middle School. Additional roof and garage door damage occurred at the Grapevine Service Center. A small truck overturned. The tornado continued through a residential area, causing minor damage to several trees and roofs there and to several large trees at the Grapevine Cemetery. The tornado continued to weaken and dissipated but still downed power poles and damaged trees, near the Glass Cactus on the Gaylord Texan Resort property. Five injuries were reported from this tornado. Maximum winds were estimated at 110 mph.

Probability of Future Events

Tornadoes may occur at any time of day or night, but they typically occur more frequently in the late afternoon and evening hours during spring months. A smaller, high-frequency period can occur in the fall during the brief transition between the warm and cold seasons. According to a review of historical records, Tarrant County and its participating jurisdictions experience a tornado touchdown approximately once every year. The frequency of these instances is supportive that Tarrant County and all its participating jurisdictions will continue to have a "Likely" probability of tornado events.[107] Older structures that were not built under updated guidelines will experience a higher impact from tornadoes in the future.

Impact of Climate Trends and Variations

Prediction of the effect of frequency and power of tornadoes based on climate change is challenging. Meteorologists must rely on the conditions that increase the likelihood of tornado production. Scientists must rely on how climate change affects the development of temperature and wind flow patterns in the atmosphere that produce the following: (1) warm, moist air; (2) atmospheric instability; (3) lift; and (4) wind shear (i.e., wind at diverse levels moving in different directions at different speeds) for tornadic thunderstorms.[108]

As global temperatures rise, the hotter atmosphere will hold more moisture, thereby creating atmospheric instability—a vital supercell ingredient. A second vital ingredient is wind shear, which is likely to decrease. These two forces oppose and work against each other. It is difficult to anticipate which of these two opposing forces will have the larger impact on tornado formation. The outbreak of tornadoes has coincided with the rise of ocean temperatures, although it is not certain whether this is a contributing factor to the tornadic events.[109]

[107] 2023 Texas State Hazard Mitigation Plan, "Appendix A: County Hazard Summary Data," txdem.sharepoint.com/sites/TDEMWebsiteFiles/SharedDocuments/Forms/AllItems.aspx?id=%2Fsites%2FTDEMWebsiteFiles%2FShared Documents%2FMitigation%2FState of Texas HMAP Update -10%2E27%2E23%2Epdf&parent=%2Fsites%2FTDEMWebsiteFiles%2FSharedDocuments%2FMitigation&p=true&ga=1.
[108] Texas A&M University College of Arts & Sciences, "Why Tornadoes Are Still Hard To Forecast, Even Though Storm Predictions Are Improving," Why Tornadoes Are Still Hard To Forecast, Even Though Storm Predictions Are Improving | Texas A&M University College of Arts and Sciences (tamu.edu).
[109] National Geographic. "Tornadoes and Climate Change," Tornadoes and Climate Change (nationalgeographic.org).

Some studies suggest that climate change could lead to the formation of more severe thunderstorms. This does not necessarily indicate an increase in tornadoes, as only about 20% of supercell thunderstorms cause tornado formation. Adding to the complexity, the exact process of tornado formation is not yet fully understood.

Vulnerability Assessment

An area's wind vulnerability is determined primarily by its topography, surface roughness, and proximity to the sea. Many factors can exacerbate the effects of wind across an area, including the angle of incidence between a house and the onrushing winds. Damage may occur to the roofs, walls, and windows of structures. Common vulnerability to wind damage includes but is not limited to:

- Neighborhood construction materials
- City planning and layout
- Distance to sea or large open areas
- Nearby trees, hills, and shoreline vegetation[110]

Tornadoes can impact all buildings, facilities, and populations in the entire planning area of Tarrant County. Tornadoes often cross jurisdictional boundaries, so all participating jurisdictions can be affected. Damage produced by tornadoes is commonly due to high wind velocity, wind-blown debris, lightning, and large hail.

Tornadoes can move in any direction, although they usually move from southwest to northeast. Because tornadoes can move in random directions, form at different strengths, and create relatively narrow paths of destruction, it is difficult to assess the vulnerability of humans and property.

Structures including manufactured homes, recreational vehicles (RVs), homes on crawlspaces (which are more susceptible to lift), and structures with large spans (including shopping malls, gymnasiums, and factories), are more vulnerable to tornadic damage. Based on historical damage in Tarrant County, these types of structures, as well as power lines and poles, trees, and business signage, are vulnerable to damage. Figure 77 shows the locations of mobile home and RV parks in Tarrant County.

[110] 1 First Street: "Does Tarrant County Have Wind Risk?" Tarrant County, TX Hurricane Map and Climate Risk Report | First Street.

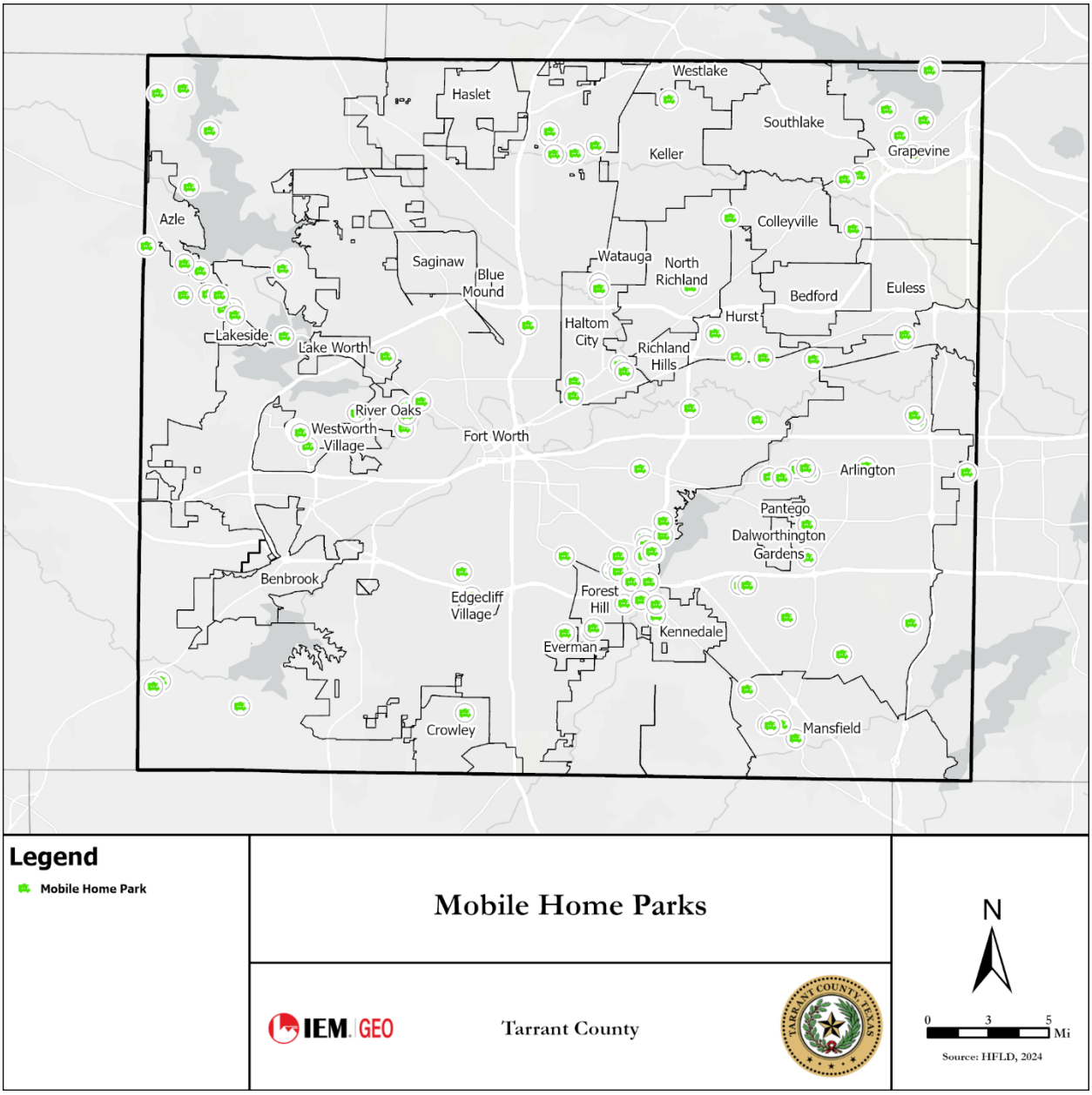


Figure 77: Locations of Mobile Home Parks in Tarrant County

ESTIMATED IMPACT AND POTENTIAL LOSSES

The entire County of Tarrant can be considered at risk of tornadoes including the population, all critical facilities, buildings (commercial and residential), and infrastructure.

The NRI is a comprehensive dataset and online tool designed to effectively highlight the U.S. communities most susceptible to natural hazards. FEMA meticulously developed this index in collaboration with a diverse range of stakeholders and partners across academia as well as local, state, and federal government entities. Leveraging available data on natural hazards and CRFs, the NRI aims to establish a baseline relative risk assessment for each county and census tract. Noteworthy CRFs

considered in this assessment include social vulnerability, derived from data collected during the decennial U.S. Census. It is important to note that a higher social vulnerability score correlates with a higher risk score.

Estimates of the EAL from tornadoes provides authorities with vital information into financial risks associated with tornado damage including infrastructure damage, population, and agricultural losses. Tornadoes can cause significant damage to infrastructure, buildings, and crops in Tarrant County.

The total loss estimate for property and agriculture in Tarrant County was $44,569,151, with an approximate total annual loss of $125,485,646 (Table 43).

Table 43: Potential Annualized Losses, Tarrant County & Jurisdictions[111]

Jurisdiction	Building Value U.S. Dollars	Agriculture Value U.S. Dollars	Total Annual Loss Estimates U.S. Dollars
Tarrant County	$44,568,536	$615	$125,485,646
Arlington	$104,376	$0	$331,391
Azle	$77,212	$0	$207,902
Bedford	$56,182	$0	$192,288
Benbrook	$74,566	$3	$252,777
Blue Mound	$239,919	$0	$579,300
Colleyville	$249,864	$0	$511,568
Dalworthington Gardens	$90,440	$0	$192,159
Edgecliff Village	$57,344	$0	$209,760
Euless	$68,954	$0	$303,971
Everman	$83,254	$0	$330,872
Forest Hill	$48,403	$0	$218,926
Fort Worth	$472,072	$0	$726,810
Grapevine	$257,338	$0	$438,006
Haltom City	$65,504	$0	$233,750
Haslet	$273,790	$25	$568,417
Hurst	$97,100	$0	$308,391
Keller	$137,188	$0	$334,432
Kennedale	$115,455	$1	$348,386
Lake Worth	$128,952	$0	$298,643
Mansfield	$155,021	$4	$408,436

[111] National Risk Index, “Tarrant County & Jurisdictions.”

Jurisdiction	Building Value U.S. Dollars	Agriculture Value U.S. Dollars	Total Annual Loss Estimates U.S. Dollars
North Richland Hills	$51,032	$0	$174,282
River Oaks	$104,164	$0	$380,622
Saginaw	$239,919	$0	$579,300
Southlake	$192,941	$0	$368,193
Watauga	$62,171	$0	$233,017
Westworth Village	$71,370	$0	$174,877
Dallas–Fort Worth International Airport	$177,301	$1	$177,814
North Central Texas Council of Governments (NCTCOG)	$230,747	$0	$320,113
Lakeside	$150,546	$6	$419,196
West Lake	$116,198	$0	$466,088
University of North Texas	$193,315	$102	$657,739
University of Texas at Arlington	$510,281	$0	$740,878

Tornado events in Tarrant County could have serious consequences for the community. Particularly vulnerable groups include the elderly, people with disabilities, and young children. The population may experience injuries or death due to tornadic action. Damage may occur to infrastructure roofs, walls, and windows in both residential and commercial structures. Infrastructure such as roads, buildings, utilities, and water supplies, also is at risk. Additional damage may occur to trees and vegetation. Agriculture may suffer from crop damage and loss of livestock.

According to the National Structure Inventory, 7,368 residences in Tarrant County are manufactured homes. Manufactured homes and mobile homes cannot withstand the force of strong tornado winds and are not a safe shelter during a tornado, including EF-1 tornadoes. On average, 72% of all tornado-related fatalities occur in homes, and 54% of those fatalities are in mobile homes even though mobile homes only make up 6% of the overall housing stock. Residents in mobile homes are 15–20 times as likely to be killed compared to permanent homes. Even well-built manufactured homes can be destroyed if they become airborne.[112]

VULNERABLE POPULATIONS

According to the Center for Disease Control/Agency for Toxic Substances and Disease Registry Social Vulnerability Index, Tarrant County is 52% less vulnerable in comparison to other counties in Texas. This data was based on 120 variables related to public health including the Texas Department of State Health Services, the U.S. Census Bureau and the Centers for Disease Control and Prevention. The study found

[112] National Weather Service, Severe Weather Preparedness Week. “Mobile Home/Manufactured Home Tornado Safety.” https://www.weather.gov/jan/swpw_mhsafety.

that the most influential factor in determining vulnerability was race and ethnicity. Tarrant County was listed as 68% more vulnerable compared to other Texas counties.

Other vulnerability groups include the elderly, those with pre-existing medical conditions, children, individuals with mental, physical or communication disabilities, and those who are socioeconomically disadvantaged. These people are more susceptible to tornado impact, injuries, and even death due to poor mobility and decreased ability to respond rapidly to tornado warnings or evacuate. Other barriers include the lack of a safe place to go during tornadoes.

Development Trends

Tarrant County has experienced a remarkable development trend in recent years. Tarrant County is ranked as the 15th most populous county in the United States and the third most populous in Texas.[113] This growth includes greater commercial and residential and infrastructure construction to support the increasing population. This increased density in population, infrastructure and development is likely to increase the region's vulnerability to tornadoes.

The county has experienced commercial and residential growth during recent years. One report indicates that Dallas–Fort Worth (DFW) was number two in the U.S. in 2022 in commercial and multifamily construction starts. According to the U.S. Census, the population of Tarrant County increased from 1,809,034 in 2010 to 2,110,640 in 2020. The estimated population percentage increase was 3.4% (from 2,110,640 in April 2020 to an estimated 2,182,947 in July 2023).[114] The growing population and development in the planning area increase the county's vulnerability.

Tarrant County is responsively considering climate-resilient design and construction practices to mitigate the impact of tornadoes. This includes planning and layout of buildings, because dense neighborhoods and nearness to commercial structures can produce higher debris vulnerability.

Overall, while development trends in Tarrant County continue to show growth and expansion, stakeholders should consider the potential effects tornadoes and implement strategies to ensure resilient development setting building standards and regulations for new structure sand retrofitting older buildings to mitigate against tornado damage.

COMMUNITY LIFELINES

Tornadoes affect all FEMA community lifelines. They threaten public safety and security, strain emergency response and communication systems, and disrupt food and water supply chains. Besides the risk of injuries and fatalities, tornadoes can have disastrous effects on medical and healthcare services and delivery. All aspects of infrastructure, including transportation and energy (power and fuel), may be

[113] Fort Worth Chamber of Commerce, "State of the County Highlights Tarrant County's Growth and Potential," State of the County Highlights Tarrant County's Growth and Potential - FWC (fortworthchamber.com).
[114] United States Census, "Quick Facts Tarrant County, Texas; United States," U.S. Census Bureau QuickFacts: United States.

affected. Because tornado paths can be random, there is increased risk of compromise to hazardous materials.

Figure 78: FEMA Community Lifelines

VULNERABILITY SCORE

The NRI provides risk scores and ratings based on data including EAL due to natural hazards, social vulnerability, and community resilience.

The NRI considers elements such as exposure to natural hazards, population, infrastructure susceptibility, and the ability to rebound from their effects. Higher vulnerability scores are indicative of more significant risk and potential for loss or damage during natural disasters. These scores can be helpful by increasing communities' resilience in preparation of natural hazards, helping to adapt to changing conditions and recovering more quickly.

The risk rating for Tarrant County is at the 98.82nd percentile, which is higher than the 97.60th percentile rank for all counties in Texas. The risk overview includes EAL, social vulnerability, and community resilience. Figure 79 provides the Tornado risk rating and overall NRI risk rating and compares them to the overall risk rating of the State of Texas.

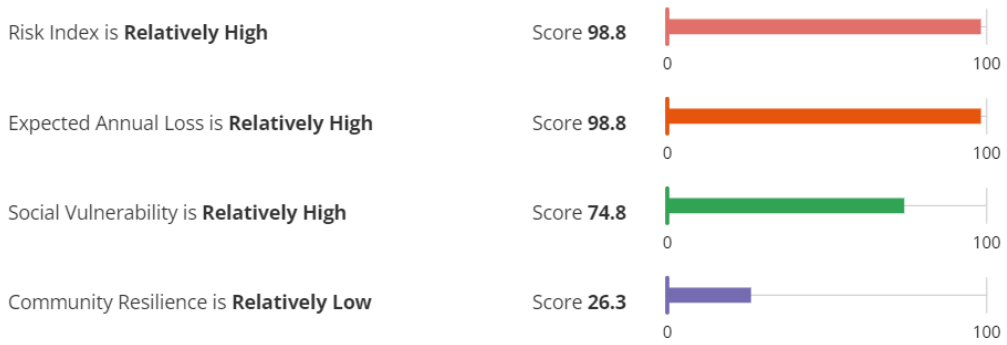


Figure 79: National Risk Index Data for Tornadoes, Tarrant County[115]

The risk rating for Tarrant County is at the 98.82nd percentile, which signifies a "High Level" of risk and is higher than the 97.60th percentile ranking of all counties in Texas. In addition, the following information should be noted:

- Tarrant County received an EAL score at the 98.8th percentile, which shows a substantial potential for financial loss due to natural disasters.
- Tarrant County received a Social Vulnerability score at the 74.8th percentile, which is "Relatively High" and suggests that it may face difficulties recovering from natural disasters. This could be attributed to poverty, inadequate access to healthcare, and limited infrastructure.
- Tarrant County received a Community Resilience score at the 26.3rd percentile, suggesting that the community may struggle to recover effectively from a natural hazard. This indicates that the community might have limited resources, infrastructure, and capacity to withstand and bounce back from the impacts of a natural disaster. This could lead to prolonged recovery times, increased vulnerability, and difficulty restoring normalcy after the event.

In conclusion, communities with a high risk index, high EAL, high social vulnerability, and low community resilience are particularly susceptible to the devastating outcomes of hazardous events. When such events occur, these communities will likely experience severe damage to infrastructure, homes, and public services, leading to a significant economic impact. The high social vulnerability of the community means that the residents may struggle to cope with the aftermath, facing challenges such as limited access to healthcare, resources, and support systems. In addition, low community resilience may hinder the community's ability to recover and rebuild, thus prolonging the community's recovery process and exacerbating the long-term social and economic impacts.

[115] FEMA. National Risk Index (NRI), "Tarrant County," Community Report – Tarrant County, Texas | National Risk Index (fema.gov).

Table 44: Tornado Index Score, Tarrant County

Tornado Risk Rating	Expected Annual Loss	Social Vulnerability	Community Resilience	Overall Risk Rating, Tarrant County	Overall Risk Rating, Texas
99.9th percentile	99.9th percentile	74.6th percentile	26.32nd percentile	98.82nd percentile	97.60th percentile

Table 45: Tornado Risk Factor Breakdown

Hazard	EAL* Value	Social Vulnerability	Community Resilience	CRF*	Risk Value	Risk Index Score
Tornado	$125,485,646	Relatively High	Relatively Low	1.19	$151,027,318	99.9th percentile

*Note: CRF = Community Risk Factor, EAL = expected annual loss

Based on NRI data, the 99.9th percentile rating is considered “Very High,” indicating that there is a high likelihood of the occurrence of tornado events in Tarrant County.

Communities face multiple risk factors related to tornadoes, including injuries and even fatalities related to damaged buildings and flying debris. People in motor homes, RVs, and older built structures that may not be up to current code are most at risk of injury by tornadoes. Community losses may include loss of homes and businesses. Infrastructure damage to buildings, transportation, electricity, water, gas, and other services may occur. Area healthcare systems can be strained because of tornadoes. Agriculture also may be impacted by tornadic activity resulting in loss of crops and livestock. Ultimately, tornadoes may cause significant direct and indirect economic losses.

In conclusion, it is imperative that communities take steps to mitigate against the harm that tornadoes can inflict. This may include establishing easily accessible tornado shelters and safe rooms, using tornado-resistant materials and incorporating tornado resistance into building codes and development planning. It is also very important to offer public education and outreach to the community, particularly to vulnerable population groups, about the risks and safety measures associated with tornado events. Developing early warning systems and emergency planning coordination also are important mitigation steps.

Wildfire

Wildfire, or wildland fire, is any fire occurring on grassland, forest, or prairie, regardless of ignition source, damage, or benefits. Wildfires are fueled almost exclusively by natural vegetation. Interface or intermix fires are urban/wildland fires in which vegetation and the built environment provide fuel. Firestorms are events of such extreme intensity that effective suppression is virtually impossible. Firestorms occur during extreme weather and generally burn until conditions change, or the available fuel is exhausted.

Location and Extent

For the purposes of this hazard analysis, wildfires are assessed under what is known as the wildland–urban interface (WUI). The WUI is an area of development that is susceptible to wildfires due to the number of structures in an area with vegetation that can act as fuel for a wildfire. The WUI creates an environment in which fire can move readily between structural and vegetation fuels. The expansion of these areas has increased the likelihood that wildfires will threaten structures and people. Figure 80 shows the WUI for Tarrant County and indicates areas with a higher concentration of houses that meet or intermix with wildland fuels. This WUI dataset is derived from the Where People Live dataset and LandScan USA population counts. Non-burnable areas (interior urban areas) are removed from the Where People Live dataset as these are not expected to be directly impacted by wildfire. For the Tarrant County project area, it is estimated that 513,970 people or 28.7% of the total project area population of 1,789,634 live in the WUI.[116]

[116] Texas Wildland Risk Assessment Summary Report, Texas A&M Forest Service. Report generated 09/17/2024. www.texaswildfirerisk.com.

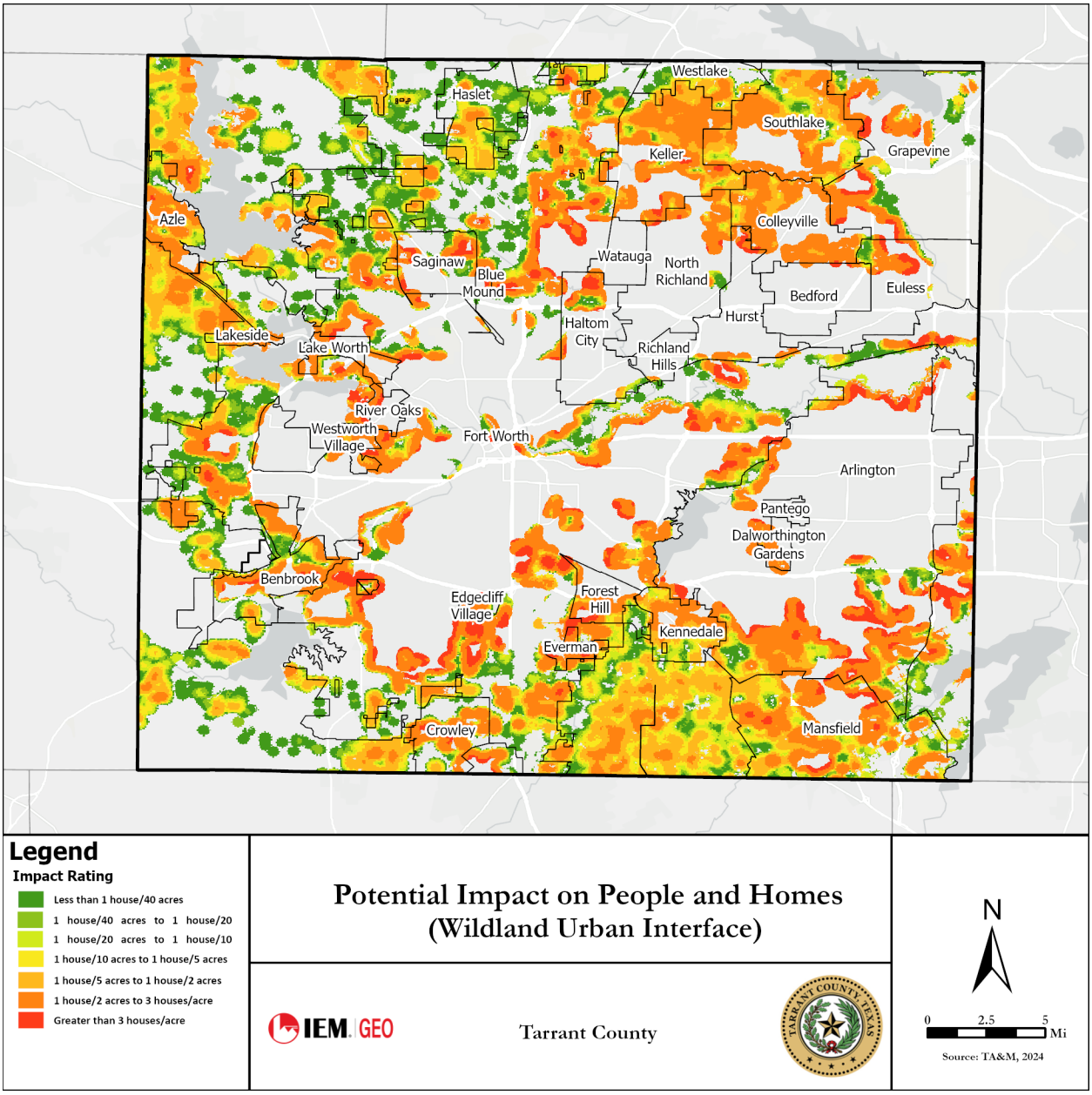


Figure 80: Wildland–Urban Interface Map of Tarrant County

Wildfires can cause significant damage to property and threaten the lives of people who are unable to evacuate WUI areas. All improved property, critical facilities, and critical structures and infrastructure in these wildfire-prone areas are considered vulnerable and can be exposed to this hazard. Jurisdictions that are not at risk of wildfires include Bedford, Blue Mound, Forest Hill, Lake Worth, Saginaw, Watauga, and Westworth Village due to their urbanized landscape and short fire department response time.

The surface fuels in the region are primarily grasses, with some areas of shrub and hardwood litter, which contribute to a moderate to high characteristic rate of spread when fires occur.

Wildfire Threat is the likelihood of a wildfire occurring or burning into an area. It is derived from characteristics including fuels, fire behavior, historical fires, historical weather observations, and terrain conditions. It is also called the Wildland Fire Susceptibility Index, which combines the probability of a wildfire igniting and the expected final fire size. Areas of higher wildfire threat are shown in Figure 81. Over 240,000 acres (42% of total acres) in Tarrant County are in moderate to high wildfire threat areas.[117]

Although there have been many ignitions, Tarrant County does not classify wildfires as a hazard until they are 25 acres or larger. This is the point at which mutual aid agreements might be used to call in outside help.

[117] Ibid.

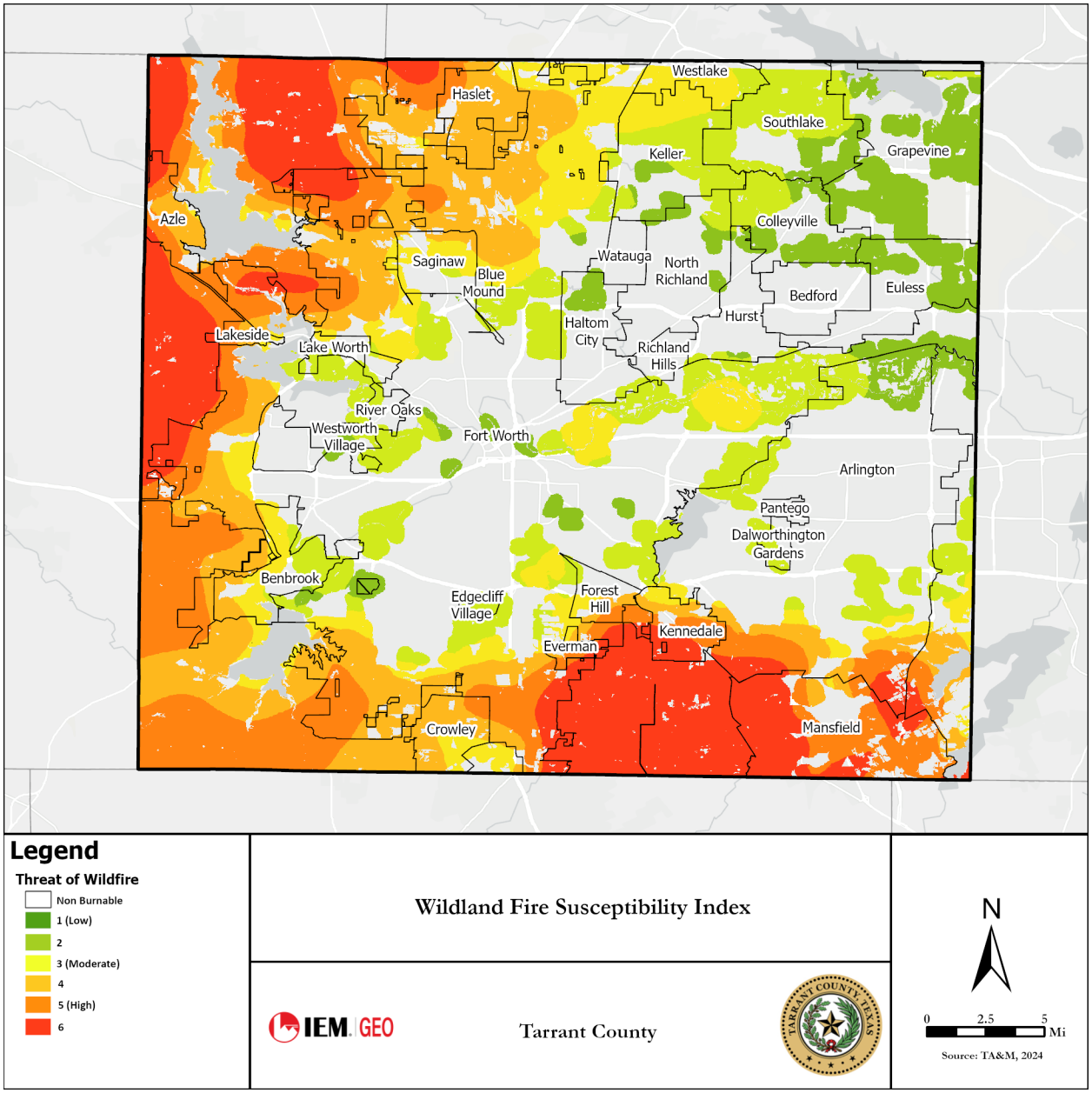


Figure 81: Levels of Threat of Wildfire in Tarrant County

Previous Historical Occurrences

There were no reports of a wildfire event in Tarrant County from November 1, 2018, to the writing of this plan, according to NCEI. The Texas Wildfire Risk Assessment Portal also indicates no wildfires were reported since 2018. 1,913 wildfires were reported between 2005 and 2016 that burned a total of 11,047 acres.[118] Wildfires have been most frequent in the month of January but occur year-round.

[118] Ibid.

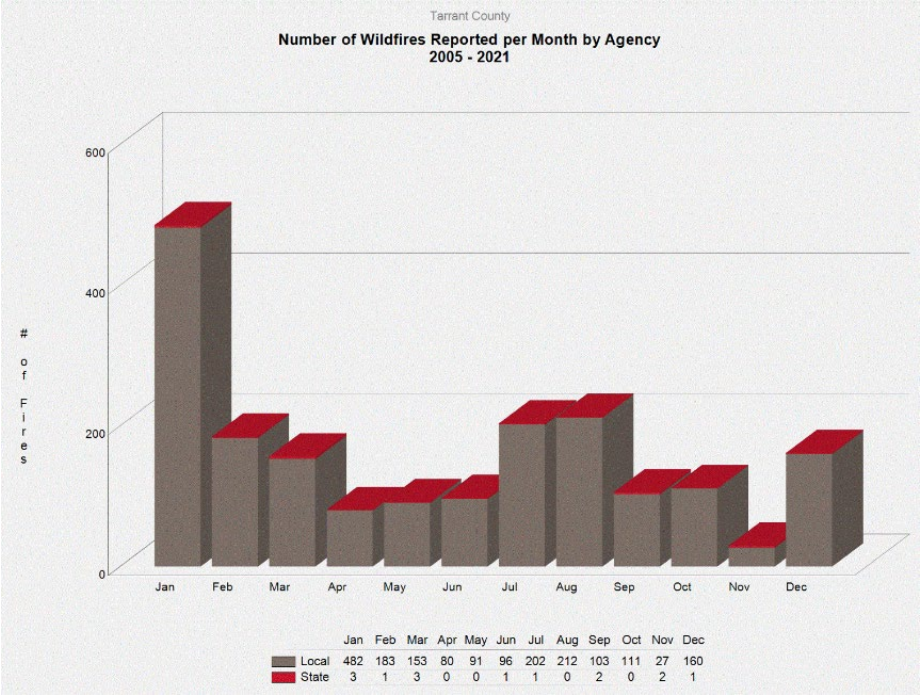


Figure 82: Number of Wildfires Reported by Month between 2005 and 2021

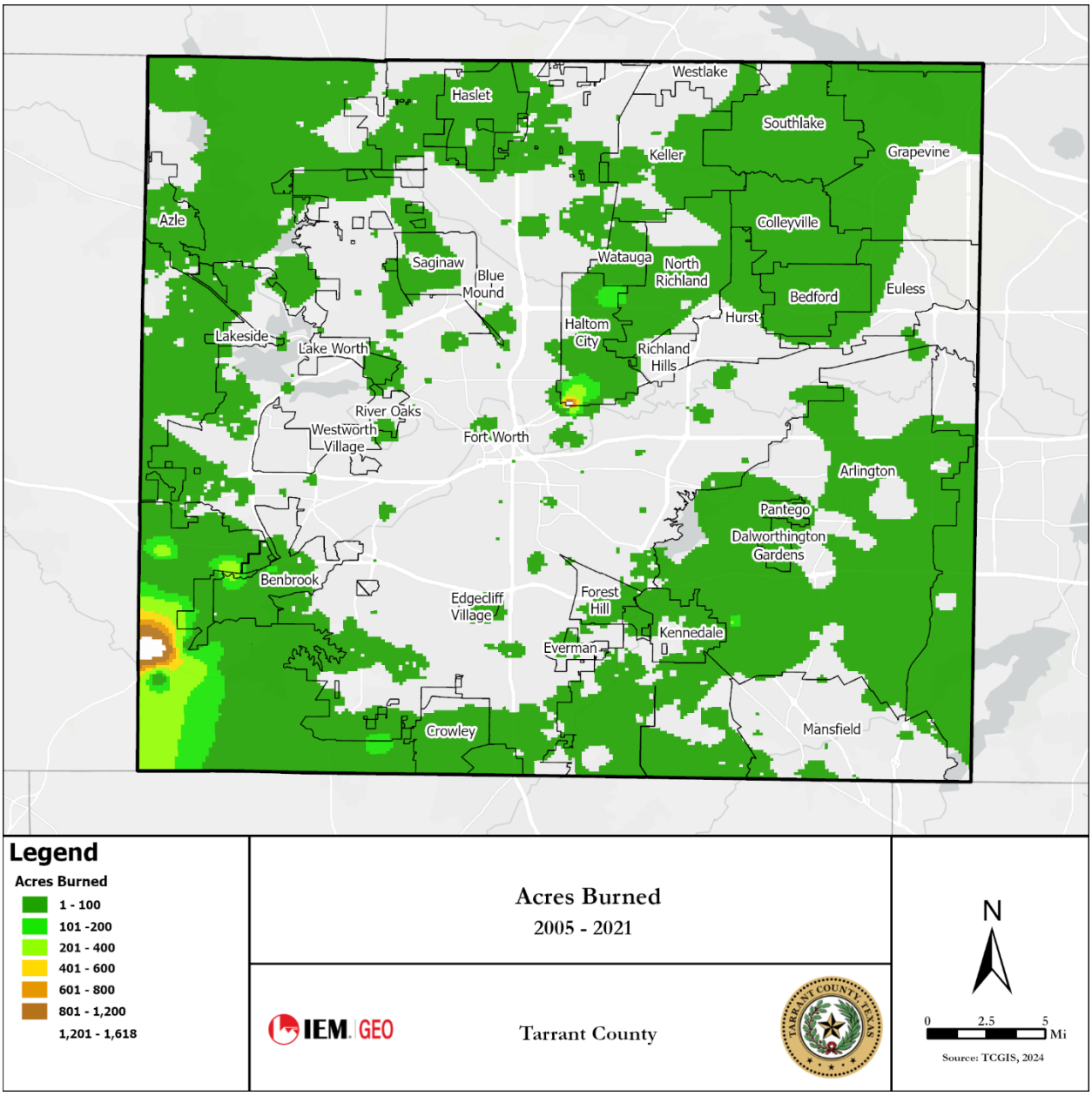


Figure 83: Acres Burned by Wildfires in Tarrant County, 2005–2021

Probability of Future Events

Figure 84 indicates Tarrant County's assessment of wildfire risk on the Texas Wildfire Risk Assessment Portal. Tarrant County has minimal direct wildfire impacts in the more urbanized areas, but ranges to moderate to high wildfire risk closer to the perimeter of the county.[119] In Texas, local governments are empowered to take action on behalf of those they serve. When drought conditions exist, a burn ban can

[119] Texas A&M Fire Service, 2024, "Tarrant County Fire Risk Map", Texas Wildfire Risk Assessment Portal.

be put in place by a county judge or the county commissioners court prohibiting or restricting outdoor burning for public safety. Tarrant County is not currently under a burn ban.[120]

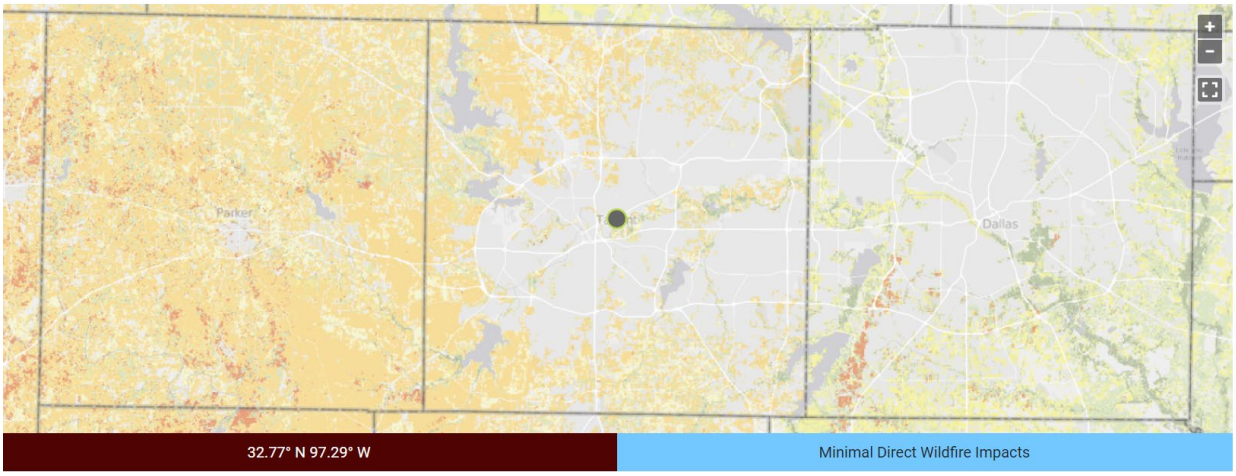


Figure 84: Map of the Risk of Fire in Tarrant County[121]

The 2023 Texas SHMP states that wildfire probability depends on local weather conditions, topographic factors, and existing fuels, such as natural vegetation. Outdoor activities, such as camping, debris burning, and construction, can affect the number and the extent of wildfires. Wildfires can cause widespread property damage, significant injuries, fatalities, and substantial forest industry impacts. Wildfires can occur at any time of year under the right conditions. As jurisdictions across the state move into wildland, the potential area of occurrence of wildfire increases. With eight events in a 19-year period, an event in Tarrant County, including all participating jurisdictions, is highly likely, meaning that an event is probable in the next year.

Impact on Climate Trends and Variations

Wildfire risk in Tarrant County, Texas, is increasingly influenced by climate trends and variations, with rising temperatures, prolonged droughts, and shifting weather patterns contributing to heightened wildfire potential. Historically, the county has experienced dry periods that, when combined with high winds and dry vegetation, create ideal conditions for wildfires to ignite and spread. Climate change is projected to worsen these trends, with more frequent heatwaves and extended periods of low rainfall drying out vegetation and increasing fire risk. Seasonal variations, particularly during the hot summer months, further elevate the wildfire threat as high temperatures and low humidity create a conducive environment for fires.

Vulnerability Assessment

Wildfires can occur at any time of year. The potential area for the occurrence of wildfires increases in jurisdictions away from the urban center and closer to undeveloped wildlands. Periods of drought, dry

[120] Fire Danger: Texas Burn Bans. Texas A&M Forest Service. 2024. https://tfsweb.tamu.edu/burnbans/.
[121] Texas A&M Fire Service, 2024, “Tarrant County Fire Risk Map,” Texas Wildfire Risk Assessment Portal.

conditions, high temperatures, and low humidity are factors that contribute to the occurrence of a wildfire event. Areas along railroads and people whose homes are in grass or woodland settings have an increased risk of being affected by wildfire.

The heavily populated urban areas of Tarrant County are not likely to experience large, sweeping fires. Areas in the unincorporated areas of Tarrant County are more vulnerable, including rural areas. Unoccupied buildings and open spaces that have not been maintained have the greatest vulnerability to wildfire. Rural areas may have more spur or dead-end roads that may limit egress in a wildfire evacuation.

IMPACT ON ASSETS

Lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function. Community lifelines are essential for the well-being of any community. They provide support and assistance to individuals who require help, especially during times of crisis. FEMA community lifelines are a critical component of emergency management in the United States. These lifelines are designed to address the essential needs of a community during and after a disaster. There are eight lifelines, each with its own focus and purpose (see Figure 85).

Figure 85: Community Lifelines[122]

Wildfires pose a direct risk to many parts of the built environment, including homes and infrastructure. Wildfires can damage power lines and infrastructure, particularly in regions with overhead power lines running through forested areas. They can damage or destroy communications infrastructure, including cell towers and fiber optic cables, causing service disruptions and isolating communities.[123]

ESTIMATED IMPACT AND POTENTIAL LOSSES

The annualized loss value can be interpreted as the impact expected from wildfire in terms of annualized human losses and human injuries, and annualized property losses. The NRI (see Figure 86) shows that

[122] FEMA, “Community Lifelines Toolkit 2.0.” https://www.fema.gov/sites/default/files/2020-05/CommunityLifelinesToolkit2.0v2.pdf.
[123] Ibid.

Tarrant County has an EAL from wildfire of $4.2M, a relatively moderate rating compared with the rest of the United States, and a score of 95.8.[124]

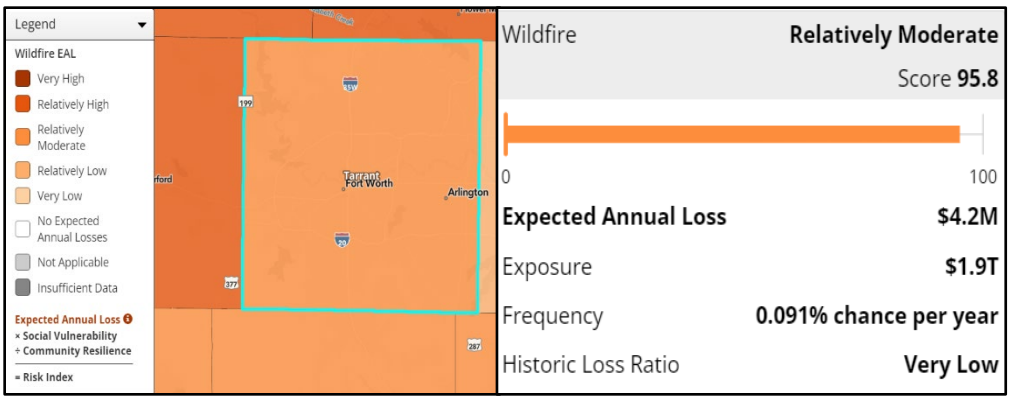


Figure 86: National Risk Index Data on Expected Annual Loss from Wildfire in Tarrant County – Map, Legend, and Score[125]

VULNERABLE POPULATIONS

Social and economic factors have a direct impact on how people prepare for, respond to, and recover from wildfire. A lack of access to resources, along with cultural and institutional barriers and limited mobility, or medical conditions brought on by stress or smoke can increase the impact of wildfire on vulnerable populations. People 65 years or older with disabilities are more susceptible to air pollution and particulates associated with wildfire smoke.

People with language barriers may find it difficult to follow directions during an evacuation or to access support after a disaster. Disparities in access to healthcare and disaster recovery aid and resources have been strongly correlated to race and ethnicity. People who live in poverty are disproportionately impacted by wildfires due to inadequate housing and limited financial resources to afford evacuation or relocation expenses.

Tarrant County residents most vulnerable to wildfire live in areas near the WUI, with 60% of all properties (407,028 properties) at risk of wildfire over the next 30 years.[126] Table 46 lists demographics on vulnerable populations in Tarrant County and Figure 87 shows census tracts where those populations reside in the county.

[124] FEMA, National Risk Index, Tarrant County Wildfire Expected Annual Loss, Map | National Risk Index (fema.gov).
[125] FEMA, National Risk Index, "Tarrant County Expected Annual Loss – Wildfire, Map, Legend and Score'", Map | National Risk Index (fema.gov).
[126] FirstStreet.com, 2024, "Does Tarrant County Have Wildfire Risk?", https://firststreet.org/county/tarrant-county-tx/48439_fsid/fire.

Table 46: Vulnerable Populations, Tarrant County, All Areas[127]

Vulnerable populations
All areas in Tarrant County

Indicator	Number	Percent
Families in poverty	41,856 ±1,929	8.2% ±0.4%
People with disabilities	206,377 ±4,231	9.8% ±0.2%
People over 65 years	247,826 ±4,207	11.7% ±0.2%
People under 5 years	138,410 ±4,116	6.5% ±0.2%
People of color	1,186,346 ±21,988	56.1% ±1.1%
Black	364,924 ±9,488	17.3% ±0.5%
Native American	11,409 ±1,535	0.5% ±0.1%
Hispanic	630,175 ±12,413	29.8% ±0.6%
Difficulty with English	105,213 ±4,135	5.3% ±0.2%
Households with no car	32,897 ±1,677	4.4% ±0.2%
Mobile homes	13,924 ±1,317	1.8% ±0.2%

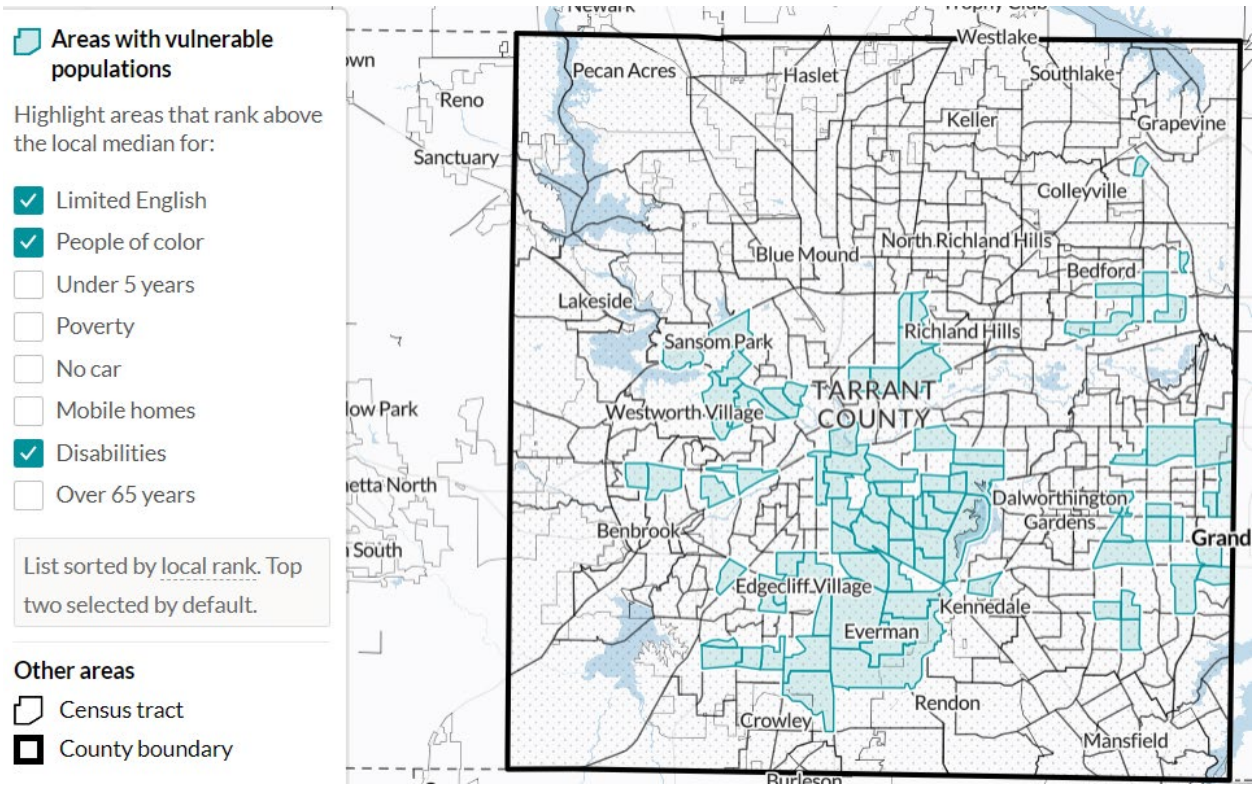


Figure 87: Vulnerable Populations in Tarrant County[128]

VULNERABILITY SCORE

The NRI includes data on the EALs to individual natural hazards, historical loss, and overall risk at county and census tract levels. Based on the NRI, Tarrant County has a rating of relatively moderate and a score of **95.3** for wildfire, which is lower than the national percentile.

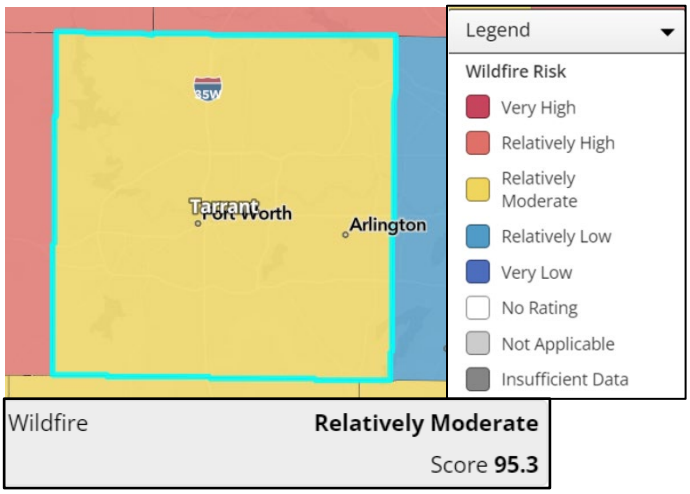


Figure 88: National Risk Index Data on Wildfire Risk, Tarrant County[129]

[127] Wildfire Risk.org, 2024, "Vulnerable Populations Statistics-All Areas of Tarrant County Texas", Wildfire Risk to Communities.
[128] Wildfire Risk.org, 2024, "Vulnerable Populations-Map of Tarrant County Texas", Wildfire Risk to Communities.
[129] FEMA, National Risk Index, "Tarrant County Wildfire Score, Map and Legend.'", Map | National Risk Index (fema.gov).

Winter Storms

Winter storms originate as mid-latitude depressions or cyclonic weather systems, sometimes following the path of the jet stream. A winter storm or blizzard combines heavy snowfall, high winds, extreme cold, and ice storms. Many winter depressions give rise to exceptionally heavy rain and widespread flooding, and conditions worsen if the precipitation falls in the form of snow. The winter storm season varies widely, depending on latitude, altitude, and proximity to moderating influences. The time period of most winter weather is between November and March. Winter storms can affect the entire planning area.

Location and Extent

According to the National Weather Service (NWS), winters in Tarrant County are "generally mild, but [with] considerable temperature variability," in which cold fronts alternate with warming trends.[130] The scale in Figure 89 was used to determine the extent of winter conditions. While the impacts of winter weather are relatively low, the risk of winter weather of any etiology is very high.

Weather Conditions and SPIA Index Levels at a Glance:

Ice and Wind: Radial Ice in Inches; Wind in Miles per Hour.	< 15 mph	15-25 mph	25-35 mph	> = 35 mph
0.10 – 0.25 inches	0	1	2	3
0.25 – 0.50 inches	1	2	3	4
0.50 – 0.75 inches	2	3	4	5
0.75 – 1.00 inches	3	4	5	5
1.00 – 1.50 inches	4	5	5	5
> 1.50 inches	5	5	5	5

Figure 89: Weather Conditions and the Levels of the Sperry–Piltz Ice Accumulation Index

Cold snaps in which temperatures fall below the freezing point of 32 °F do happen every year in Tarrant County. Those that have occurred are listed in Table 47.

[130] Dallas/Fort Worth Climate Narrative. Dallas/Fort Worth Climate Narrative (weather.gov).

Table 47: Dallas/Fort Worth Freeze Data and Cold Season Temperatures, 2014–2024

Season	First Occurrence Equal or Less Than:			Low for Winter (°F)	Last Occurrence Equal or Less Than:			Number of Freezes
	32 °F	19 °F	09 °F		9 °F	19 °F	32 °F	
2023–2024	November 27	January 14	–	11	–	January 20	February 18	15
2022–2023	November 20	December 22	–	11	–	December 23	March 19	21
2021–2022	December 12	January 02	–	19	–	February 05	March 12	37
2020–2021	November30	February 14	February 14	–2	February 16	February 19	February 20	24
2019–2020	October 31	–	–	22	–	–	February 27	21
2018–2019	November 10	–	–	21	–	–	March 06	28
2017–2018	December 07	January 01	–	13	–	January 18	February 12	25
2016–2017	December 08	December 18	–	14	–	January 08	January 08	11
2015–2016	November 22	–	–	27	–	–	February 26	17
2014–2015	November 12	January 08	–	16	–	January 08	March 07	40

Previous Historical Occurrences

The following narrative highlights the severe impacts of winter weather in North Central Texas and Tarrant County. Although it is about a storm in 2013, it describes what Tarrant County could experience again.

- **December 5–6, 2013:** Freezing rain, sleet, and a little snow began falling during the day on the 5th and continued through the morning of the 6th. On the 6th, accumulations of sleet and ice measured up to 5 inches. A new term, “cobblestone ice,” was used to describe the compaction of ice and sleet on the highways (see Figure 90). Elsewhere, bridges, overpasses, and elevated surfaces were iced over, and thousands of tree branches fell under the weight of the ice. Power lines also were brought down, and at the peak of the storm, 275,000 customers were without power in the North Texas region. Most schools and many businesses closed, hundreds of injuries due to falls on the ice were reported, and there were seven fatalities. Early estimates from the insurance council estimated $30

million in residential insured losses. The cleanup from this event took weeks and even a few months in some places.[131]

Figure 90: "Cobblestone ice" on North Texas Roads[132]

- **January 30–February 1, 2023:** A multi-day ice and sleet event occurred across much of North and Central Texas on Monday Jan 30 through Wednesday Feb 1st. This resulted in several hundred traffic accidents across the region due to icy roads and highways. The official total for the snowfall event at Dallas/Fort Worth International Airport was 1.3". As frozen precipitation, sleet is included in snowfall tallies for climate records. The NWS received several reports of ice accumulations of 0.5" across North and Central Texas. The heaviest precipitation occurred from Tuesday (January 31) through Wednesday morning (February 1).

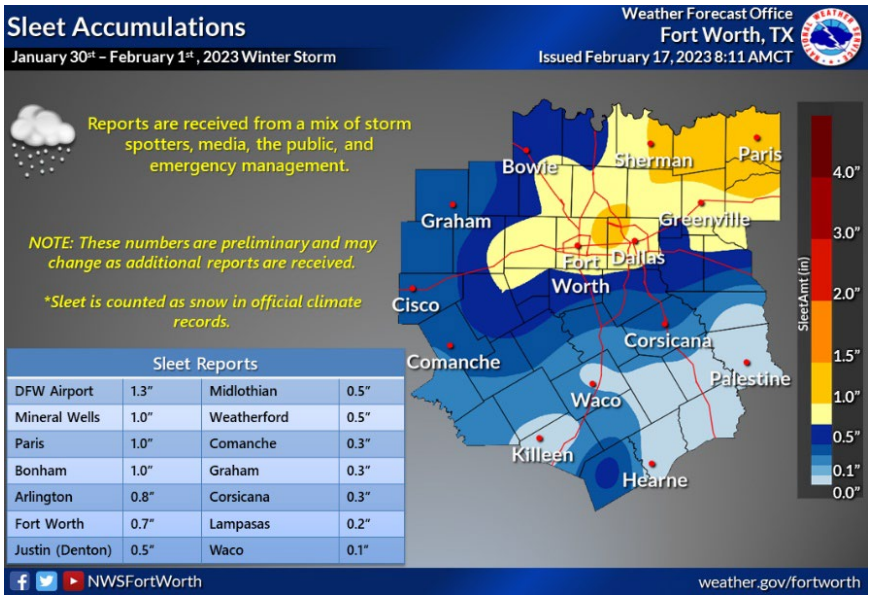


Figure 91: Sleet Accumulation in Fort Worth Texas, January 2023

[131] National Weather Service. North Texas Snowfall Events 1879–2013. https://www.weather.gov/fwd/snowevents.
[132] NBC 5 News.

Table 48: Historical Events of Winter Storms since 2015[133]

Location	Date	Time	Type	Deaths	Injuries	Property Damage	Crop Damage
Tarrant (Zone)	02/22/2015	18:30	Winter Storm	0	0	$25,000	$0
Tarrant (Zone)	02/13/2021	06:00	Winter Storm	0	0	$0	$0
Tarrant (Zone)	02/02/2022	18:00	Winter Storm	0	0	$0	$0
Tarrant (Zone)	02/23/2022	02:30	Winter Storm	0	0	$0	$0
Tarrant (Zone)	01/30/2023	12:00	Winter Storm	0	0	$0	$0
Tarrant (Zone)	01/30/2023	12:00	Winter Storm	0	0	$0	$0
Tarrant (Zone)	01/30/2023	12:00	Winter Storm	0	0	$0	$0
Tarrant (Zone)	01/30/2023	12:00	Winter Storm	0	0	$0	$0
Totals:				**0**	**0**	**$25,000**	**$0**

Table 49: Historical Sleet Events in Tarrant County since 2015[134]

Location	Date	Time	Type	Deaths	Injuries	Property Damage	Crop Damage
Tarrant (Zone)	03/04/2015	19:00	Sleet	0	0	$0	$0
Tarrant (Zone)	03/04/2015	20:00	Sleet	0	0	$10,000	$0
Totals:				**0**	**0**	**$10,000**	**$0**

Since 2020, property damage from the various hazards in a winter storm has totaled $35,000.

Probability of Future Events

According to the NRI, Tarrant County experiences 1.1 winter storm events per year, with 18 events occurring between 2005 and 2021. While climate change will affect winter weather in the long term, In the short term, Tarrant County as a whole can expect one or two events per year. To see where future events

[133] National Centers for Environmental Information. Winter Storms. Storm Events Database - Search Results | National Centers for Environmental Information (noaa.gov).
[134] National Centers for Environmental Information. Sleet. Storm Events Database - Search Results | National Centers for Environmental Information (noaa.gov).

could affect the state and county, one must look at the heating trend that is happening in the region. Temperatures in Texas have risen almost 1.5°F since the early 1900s. The number of days for the plant and animal growing season in December for Tarrant County is gradually increasing, as seen in Figure 93. In conclusion, while the probability of winter storms is not likely to change in the short term, in the long term, the increasing heat will make them more of an outlier than the norm.

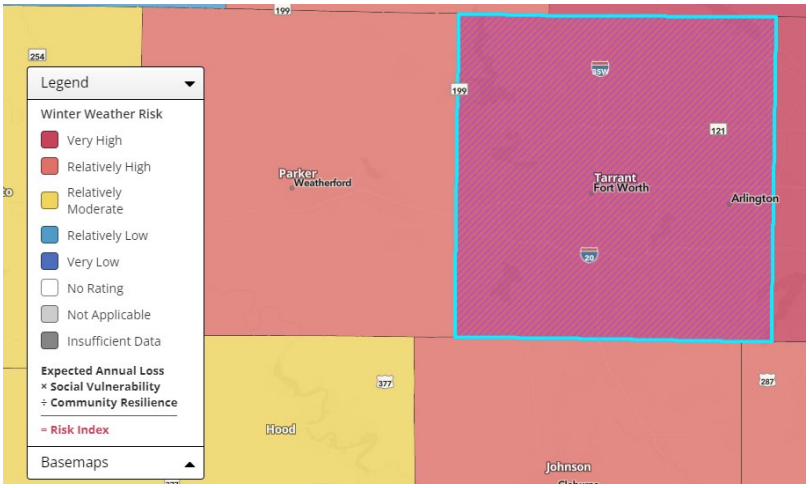


Figure 92: National Risk Index for Winter Weather Risk, Tarrant County

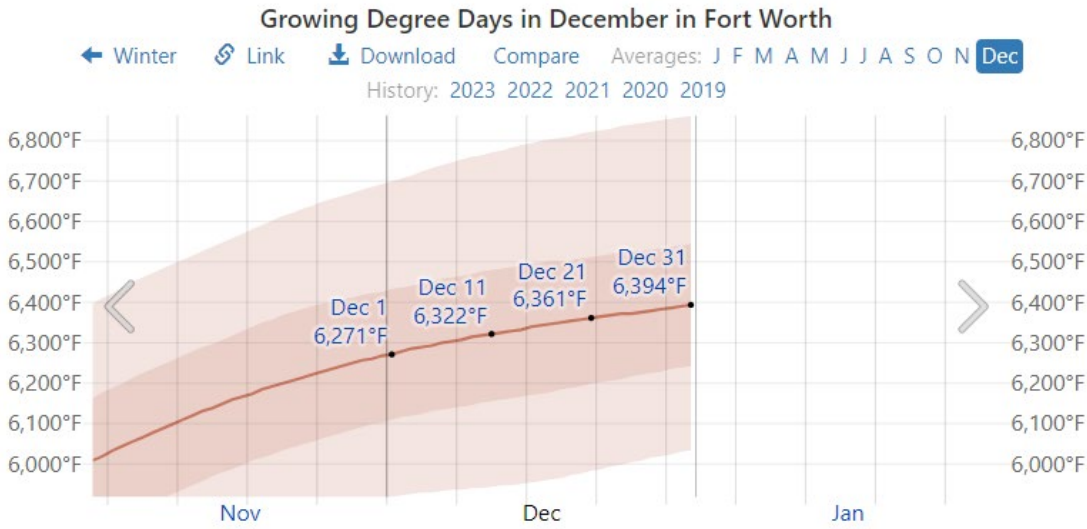


Figure 93: Growing Degree Days in December in Fort Worth[135]

[135] Growing Degree Days in December in Ft. Worth. Fort Worth December Weather, Average Temperature (Texas, United States) - Weather Spark.

Impact of Climate Trends and Variations

Climate change is expected to have a significant impact on winter storms in Tarrant County, Texas, with increasing variability in the intensity and frequency of these events. While the region is generally known for milder winters, shifting climate patterns could lead to more extreme cold snaps, as seen during the winter storm of 2021, when arctic air plunged into Texas. Warmer atmospheric temperatures hold more moisture, which can lead to heavier snowfall or freezing rain during winter storms, even in areas like Tarrant County that are not traditionally prone to significant winter precipitation. These extreme cold events, combined with increased moisture, pose risks to infrastructure, particularly power grids, water systems, and transportation networks, all of which are vulnerable to freezing conditions.[136]

Vulnerability Assessment

Winter storms and winter weather of any etiology can affect people, crops, and animals. While the days are warming in Texas, there is still winter weather and precipitation to deal with. The vulnerable and underserved populations are disadvantaged due to the higher cost of heating their homes. Winter crops can be severely impacted if a severe storm event hits the area, creating economic distress. In addition, animals, such as livestock, can be dangerously affected. An ice storm can decimate a herd and create financial hardship for the owners. Power outages, communication struggles, and impassable roads to critical facilities like hospitals can put the population at risk, with increased effects on vulnerable and underserved populations. As NRI data show, Tarrant County has a very high risk of winter weather, with a score of 98.82%. The national percentile is also 98.82, and the percentile in Texas is 97.60.

Development Trends

Texas, as a whole, is expanding due to a huge population explosion. Between 2010 and 2021, the Dallas–Fort Worth area increased by 194,302 people. In the next 24 years, Fort Worth is expected to grow by over 270,000 people. Figure 94 shows the population in 2020, according to the Census Bureau, and the projected population for 2045, according to the NCTCOG forecast in 2022. With the dramatic increase in population, more land is expected to be used for apartments and single-family housing. In addition, more schools will be needed, and service industries are likely to grow as the population grows. This narrative applies to the entire Tarrant County area.

[136] What Climate Change Means for Texas. United States Environmental Protection Agency. What Climate Change Means for Texas (epa.gov).

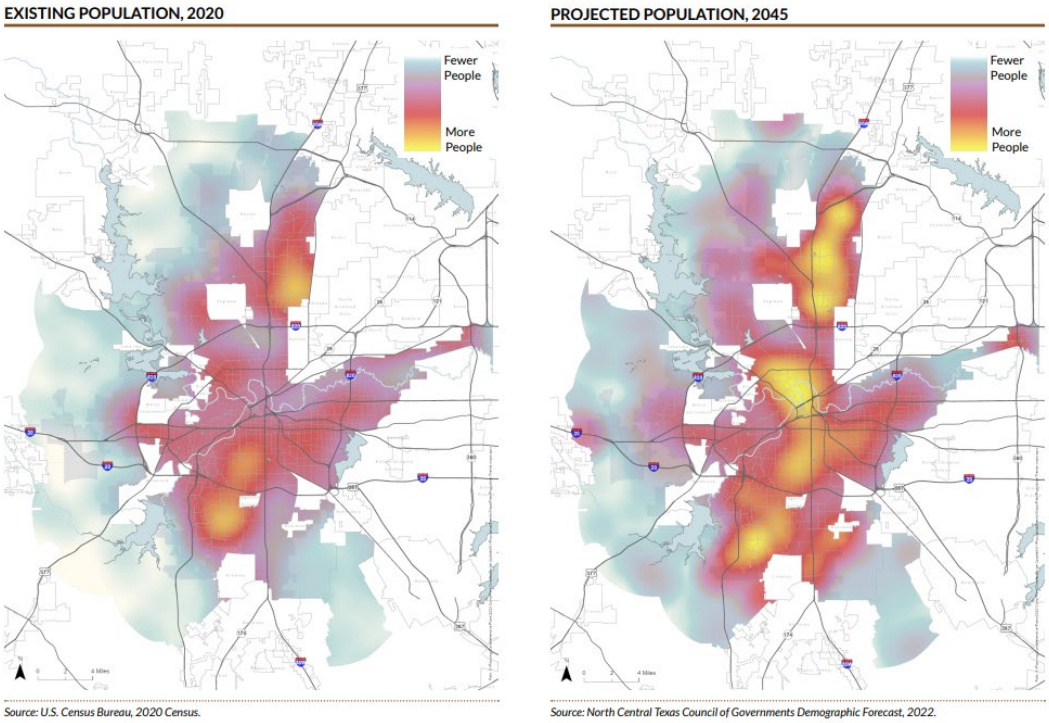


Figure 94: Population Growth, North Central Texas, 2020 and Projected for 2045[137]

IMPACT ON ASSETS

During periods of extreme cold and freezing temperatures, water pipes can freeze and crack, and ice can build up on power lines, causing them to break or causing tree limbs to fall on the lines. These events can disrupt electric service for long periods.

The increased consumption of heating fuel can have an economic impact which can lead to energy shortages and higher prices. Schools often close when severe winter weather is forecast, and this becomes a logistics burden for parents who must find alternative childcare or miss work. House fires and resulting deaths tend to occur more frequently from the increased and improper use of alternate heating sources. Fires during winter storms also present a greater danger because water supplies may freeze and impede firefighting efforts.

COMMUNITY LIFELINES

All the community lifelines can be impacted by winter storms in Tarrant County. Access to food, shelter, healthcare, and medical services can be restricted. There may be energy loss with failed power lines, and outages of communications and internet services. Transportation may be restricted due to impassable roads, and mishaps in the transfer of hazardous materials can occur in icy conditions. The supply of water can be affected by breaks in watermains and pipes.

[137] Fort Worth Comprehensive Plan. 01-population-trends-final-2023.pdf (fortworthtexas.gov).

Figure 95: Community Lifelines

Section 4: Mitigation Strategy

The mitigation strategy serves as the long-term blueprint for reducing the potential losses identified in the risk assessment. The Stafford Act directs hazard mitigation plans to describe hazard mitigation actions and to establish a strategy to implement those actions. Therefore, all other requirements for a hazard mitigation plan lead to and support the mitigation strategy.

Individual jurisdictions adopted specific goals and strategies based on the jurisdiction's needs. The Tarrant County HMPT ranked the following mitigation action items to determine which strategies they would prioritize for completion. To identify priorities, jurisdictions considered the scope and impact of action and completed a cost–benefit analysis for each action. Each participating jurisdiction recommended strategies that would benefit either the jurisdiction or the county as a whole.

All project cost estimations are based on agency expertise by those submitting mitigation actions and previous project costs. However, many projects provided have not yet undergone the official cost–benefit analysis supplied by FEMA. In these cases, jurisdictions based the cost–benefit on a study conducted by the National Institute of Building Science. This study estimated that—in the past 23 years—federally funded natural hazard mitigation has prevented approximately one million nonfatal injuries, 600 deaths, and 4,000 cases of PTSD, yielding a cost savings of $68 billion. The report's key findings included that every dollar spent on mitigation saves society an average of six dollars, with positive cost–benefit ratios for all hazard types studied.[138] Therefore, to reflect the benefits of future projects, each estimated project was multiplied by six to represent the benefit of each mitigation strategy. Using this information, in addition to their jurisdiction's priorities, jurisdictions ranked their mitigation strategies and submitted them to the HMPT.

Funding Priorities

As necessary, Tarrant County and participating jurisdictions will seek outside funding to implement mitigation projects in pre-disaster and post-disaster environments. Potential funding sources have been identified for proposed actions listed in the mitigation strategies, when applicable.

The funding priority will go toward action items positively impacting community resilience, as measured by the action's scope and cost–benefit analysis.

FEMA-Funded Projects in Tarrant County

Funding for the subrecipients in Table 50 was awarded partly due to the subrecipient's participation in hazard mitigation plans.

[138] National Institute of Building Sciences, "Natural Hazard Mitigation Saves 2019 Report," https://www.nibs.org/files/pdfs/NIBS_MMC_MitigationSaves_2019.pdf.

Table 50: FEMA-Funded Projects in Tarrant County

Subrecipient	Project Identifier	Program Area	Program Fiscal Year	Project Type	Status	Number of Final Properties
Arlington	DR-4223-0052-R	HMGP*	2015	200.1: Acquisition of Private Real Property (Structures and Land) – Riverine	Closed	6
Benbrook	DR-4136-0002-R	HMGP	2013	206.1: Safe Room (Tornado and Severe Wind Shelter) – Private Structures	Closed	27
Colleyville	DR-4245-0029-R	HMGP	2016	601.2: Generators – Regular	Closed	0
Colleyville	DR-4266-0017-R	HMGP	2016	601.2: Generators – Regular	Approved	0
Euless	DR-4255-0018-R	HMGP	2016	601.2: Generators – Regular	Closed	0
Everman	DR-4466	HMGP	2020	Flooding Study	Approved	0
Kennedale	DR-4223-0028-R	HMGP	2015	200.1: Acquisition of Private Real Property (Structures and Land) – Riverine	Closed	1
North Central Texas Council of Governments	DR-4223-0053-R	HMGP	2015	206.1: Safe Room (Tornado and Severe Wind Shelter) – Private Structures	Approved	207
Tarrant (County)	DR-4245-0016-R	HMGP	2016	601.1: Generators	Closed	0
Tarrant (County)	DR-4466-0007-P	HMGP	2020	95.2: Planning Related Activities	Approved	0

* Note: HMGP = Hazard Mitigation Grant Program

Mitigation Goals and Objectives

Tarrant County, the participating jurisdictions, and the planning participants identified nine natural hazards. Two human-made hazards, one technical hazard, and one vulnerability hazard also were addressed by the plan. The specific goals of the plan are as follows:

1. Build capacity and capabilities to increase disaster resilience among historically underserved populations, individuals with access and functional needs, and communities disproportionately impacted by disasters and climate change.
2. Protect critical public facilities and infrastructure and take targeted measures to improve the resiliency of critical infrastructure against natural hazards and climate change.

3. Encourage the development and implementation of long-term, cost-effective, and sustainable mitigation projects that preserve and restore the functions and resilience of natural systems.
4. Engage and educate the public, elected officials, and relevant stakeholders about natural hazards, climate change risks and impacts, and the capabilities and resources available to create more resilient and adaptive communities.
5. Encourage partnerships.
6. Engage in wildfire-related mitigation initiatives to comply with Fire Mitigation Assistance Grant (FMAG) requirements.
7. Address High Hazard Potential Dam risk to reduce long-term vulnerabilities in risk areas.

Goals and objectives were identified as short term or long term. “Short term” means they are intended to be completed in the next one to five years, whereas “long term” is defined as completion in five or more years.

The planning team used its mitigation goals and objectives to guide the process of identifying, evaluating, and prioritizing actions and initiatives. This ensured that the actions included in the plan were cost-effective, environmentally sound, and technically feasible. After discussing and evaluating the mitigation actions, the team prioritized the results based on various factors to identify high-priority projects and timelines.

Goals are broad statements that reflect the county’s vision for its hazard mitigation program. Objectives clarify goals. Each mitigation action supports one or more goals and objectives. Mitigation actions are specific steps the county can take to achieve its stated objectives. These actions must be technically feasible, cost-effective, and environmentally sound. Table 51 lists the goals and objectives identified by the planning team. This 2025 plan update includes the original goals from the previous plan, with two additional goals addressing HHPDs and Fire Management Assistance Grants (FMAGs), reflecting elements required by the new 2023 FEMA Local Mitigation Planning Policy guidelines in Table 52.

Table 51: 2025 Hazard Mitigation Goals and Objectives

Goals and Objectives	Description	Short Term or Long Term
Goal 1	**Build capacity and capabilities to increase disaster resilience among historically underserved populations, individuals with access and functional needs, and communities disproportionately impacted by disasters and climate change.**	**Long term**
Objective 1.1	Partner with agencies serving vulnerable populations to minimize harm in an emergency.	Short term
Objective 1.2	Promote disaster contingency planning and facility safety among institutions that provide essential services, such as food, clothing, shelter, and healthcare to vulnerable populations.	Short term
Objective 1.3	Educate individuals and communities about disaster preparedness and mitigation.	Short term

Goals and Objectives	Description	Short Term or Long Term
Objective 1.4	Reduce mitigation-related disparities impacting underserved populations and historically marginalized communities by developing equitable and inclusive plans, investments, and engagements. Develop adaptive plans, programs, and policies that recognize the community's historical, economic, social, and demographic influences in a manner that expands resources to benefit the community.	Long term
Objective 1.5	Continue to develop and improve systems that provide warning, awareness, and emergency communication to significantly reduce barriers to timely, efficient, and effective hazard mitigation planning and action.	Long term
Objective 1.6	Encourage our communities to perform activities, such as strengthening building codes.	Long term
Objective 1.7	Train emergency responders.	Short term
Goal 2	**Protect critical public facilities and infrastructure and take targeted measures to improve the resiliency of critical infrastructure against natural hazards and climate change.**	**Long term**
Objective 2.1	Implement mitigation programs that protect critical facilities and services and promote the reliability of lifeline systems to minimize hazards' impacts, maintain operations, and expedite recovery in an emergency.	Long term
Objective 2.2	Consider known hazards when giving site permits to new facilities and systems.	Short term
Objective 2.3	Encourage building and rebuilding practices that address resilience through higher standards and adaptive design to resist the impacts of natural hazards on communities, infrastructure, buildings, and cultural and economic assets.	Long term
Objective 2.4	Create redundancies for critical networks, such as water, sewer, digital data, power, and communications.	Long term
Objective 2.5	Educate public officials, developers, realtors, contractors, building owners, and the public about hazard risks and building requirements.	Short term
Objective 2.6	Identify mitigation opportunities to protect, upgrade, and strengthen existing structures and repetitive loss properties from all hazards through acquisition, elevation, relocation, and retrofits.	Long term
Objective 2.7	Use mitigation grant funding to retrofit facilities against all hazards.	Long term
Objective 2.8	Consider incorporating climate resilience considerations into future land and infrastructure development, encourage resilient and sustainable structural practices that reduce vulnerabilities, and encourage the use of green and natural infrastructure.	Long term
Goal 3	**Encourage the development and implementation of long-term, cost-effective, and sustainable mitigation projects that preserve and restore the functions and resilience of natural systems.**	**Long term**
Objective 3.1	Consider the secondary effects of disasters, such as hazardous waste and hazardous materials spills, when planning and developing mitigation projects.	Short term

Goals and Objectives	Description	Short Term or Long Term
Objective 3.2	Encourage the use of green infrastructure and nature-based solutions to combat climate change, reduce flood risks, improve air and water quality, restore and protect wetlands, stabilize shorelines, increase biodiversity, reduce urban heat, add recreational space, and improve the overall well-being of natural ecosystems.	Long term
Objective 3.3	Support identification, documentation, and standardization of cost-effective natural restoration measures.	Short term
Goal 4	**Engage and educate the public, elected officials, and relevant stakeholders about natural hazards, climate change risks and impacts, and the capabilities and resources available to create more resilient and adaptive communities.**	**Short term**
Objective 4.1	Enhance understanding of local hazards and the risks they pose.	Short term
Objective 4.2	Educate the public on actions they can take to prevent or reduce the loss of life or property from all hazards and increase individual efforts to respond to potential hazards.	Short term
Objective 4.3	Encourage homeowners, renters, and businesses to insure property for all hazards, including flood coverage under the National Flood Insurance Program (NFIP).	Short term
Objective 4.4	Publicize and encourage the adoption of appropriate hazard mitigation measures.	Short term
Goal 5	**Encourage Partnerships**	**Short term**
Objective 5.1	Partner with the private sector, including small businesses, to promote structural and non-structural hazard mitigation as part of standard business practice.	Short term
Objective 5.2	Educate businesses about countywide contingency planning, targeting small businesses and those in high-risk areas.	Short term
Objective 5.3	Partner with the private sector to promote employee education about disaster preparedness and encourage conservation at work and at home.	Short term
Goal 6	**Engage in wildfire-related mitigation initiatives to comply with FMAG requirements.**	**Long term**
Objective 6.1	Prioritize mitigation actions to reduce vulnerabilities identified in the risk assessment.	Short term
Objective 6.2	Provide a framework, tools, and support to allow communities to establish locally led programs to harden, retrofit, and establish defensible space around residences, prioritizing equity priority communities and individuals.	Long term
Objective 6.3	Implement demonstration projects and develop a scaling-up strategy for the wildfire mitigation program.	Short term
Goal 7	**Address High Hazard Potential Dam (HHPD) risk to reduce long-term vulnerabilities in risk areas.**	**Long term**
Objective 7.1	Address dam risk, particularly to and from HHPDs, to protect life and property	Long term

Goals and Objectives	Description	Short Term or Long Term
Objective 7.2	Identify mitigation opportunities to protect, upgrade, and strengthen existing structures, including HHPDs and repetitive loss properties from dam failure, through acquisition, elevation, relocation, and retrofits.	Long term
Objective 7.3	Encourage building and rebuilding practices that address resilience through higher standards and adaptive design to resist the impacts of HHPD failures on buildings and cultural and economic assets.	Long term

Table 52: FEMA Elements, Local Mitigation Planning Policy Guide

C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement 44 CFR § 201.6(c)(3))
C1-a. The plan must describe how the existing authorities, policies, programs, funding and resources of each participant are available to support the mitigation strategy. This must include a discussion of the existing building codes and land use and development ordinances or regulations. Capabilities may be described in a table or narrative. **Discussion** means a narrative or other materials that provide context on a section of the plan. *Describing the current capabilities provides a rationale for which mitigation projects can be undertaken to address the vulnerabilities identified in the Risk Assessment.*
C1-b. The plan must describe the ability of each participant to expand on and improve the capabilities described in the plan. If the participants do not have the ability or authority to expand and/or improve their capabilities, the plan must describe this lack of ability or authority. *Gaps and limitations for each participant may be addressed as actions in the mitigation strategy.*

Mitigation Action Items

Each jurisdictional LPT identified a list of mitigation action items which appear in that jurisdiction's annex. Priority will be assigned to projects with the greatest positive impact on community resilience, including life safety and property protection. Previous action items are also recorded in these annexes.

Section 5: Plan Maintenance

Plan Implementation

The Tarrant County Hazard Mitigation Action Planning process was coordinated with the Tarrant County HMPT and planning consultant, Innovative Emergency Management (IEM). The plan was submitted to TDEM and FEMA for approval. It is expected that all participating jurisdictions will formally adopt the plan by resolution once the “Approved Pending Adoption” designation is received by FEMA, in accordance with the Disaster Mitigation Act of 2000.

Each jurisdiction participating in this plan is responsible for implementing specific mitigation actions, as prescribed in the mitigation strategies. In each mitigation strategy, every proposed action is assigned to a specific local department or agency to assign responsibility and accountability and increase the likelihood of subsequent implementation. This approach enables individual jurisdictions to update their unique mitigation strategies as needed without altering the broader focus of the countywide plan. The separate adoption of locally specific actions also ensures that each jurisdiction is not held responsible for monitoring and implementing the actions of other jurisdictions involved in the planning process.

The Tarrant County EMC or their designee is the lead position for plan implementation and will work with the Tarrant County HMPT to ensure that mitigation actions are implemented in jurisdictional planning procedures. Each participating jurisdiction will implement the plan and its individual mitigation actions in the timeframe appropriate for its planning processes. As necessary, the HMPT will seek outside funding sources to implement mitigation projects in both pre-disaster and post-disaster environments. When applicable, potential funding sources have been identified for the proposed actions listed in the mitigation strategies.

Evaluation

All members of the Tarrant County HMPT will be responsible for ensuring that the Tarrant County HazMAP is evaluated as required. Specifically, the Tarrant County EMC or their designee will convene the HMPT and ensure that an evaluation is conducted in a thorough manner. This evaluation will include analysis of current mitigation projects, evaluation of success, reevaluation of future mitigation needs, and prioritization based upon changes in the needs and/or capabilities of Tarrant County.

The HMPT will reconvene annually to ensure that projects are on track and to reevaluate the mitigation goals, objectives, and action items. The mitigation plan shall be viewed as an evolving, dynamic document.

Multijurisdictional Strategy and Considerations

Tarrant County will lead activities for mitigation planning countywide. Although Tarrant County will be responsible for maintaining this plan, including the documentation of in-progress and completed action

items, each participating jurisdiction is responsible for reporting hazards, their costs, and a status report on mitigation actions to Tarrant County Office of Emergency Management for recording in the plan.

Each jurisdiction is responsible for completing mitigation activities by providing the capabilities and authorities needed to carry out the activities. Participating jurisdictions completed an analysis of their current legal, staffing, and fiscal capabilities as they relate to hazard mitigation planning. Jurisdictional capabilities and authorities are identified to ensure that successful mitigation planning is located in the jurisdictional annexes.

Plan Update

The Disaster Mitigation Act of 2000 requires that the Tarrant County HazMAP be updated at least once every five years. During this process, all sections of the plan will be updated with current information and analysis, and new and/or modified mitigation actions will be developed. The revised plan will be submitted for state and federal review and approval and will be presented for approval to the Tarrant County Commissioners Court and the respective councils of incorporated cities included in this HazMAP. Similarly, each participating jurisdiction will follow the same procedure to review, revise, and update their individual plans before submitting them to Tarrant County for inclusion in the multijurisdictional plan. The plan will be updated every five years in accordance with federal requirements. Tarrant County's EMC or their designee will be responsible for ensuring that this requirement is met. Tarrant County and the HMPT will review the HazMAP annually for needed updates. The HMPT will be involved in this process to ensure that all jurisdictions provide input into the planning process. The public will be invited to participate in this process through public hearings.

Plan Maintenance

It is the intention of all documented plan participants to formally adopt the Tarrant County HazMAP after each 5-year revision. Once all participants adopt the changes, the HazMAP and proof of adoption will be submitted to TDEM and FEMA. The plan will be revised and maintained as required under the guidance of the HazMAP and formally adopted by elected officials of Tarrant County and the jurisdictions after each 5-year revision.

Following formal adoption of the plan by the Tarrant County Commissioners Court and the governing council of each participating jurisdiction, the actions outlined in the HazMAP may be implemented by the county and participating jurisdictions as described in this document.

The Tarrant County EMC or their designee is responsible for ensuring that the HazMAP and its components are monitored, evaluated, and reviewed annually by the responsible personnel. The EMC will use email to request that the monitoring activities noted below be implemented and changes documented. The progress of action items will be tracked electronically as "in progress," "deferred," or "completed."

These and other changes affecting the plan will be documented in the Tarrant County HazMAP file and identified as updates. Updates will be shared between participants by email or in a meeting (if deemed

appropriate) once a year, and included in annual evaluations and reviews, and five-year update of the plan.

The lead of each LPT is responsible for ensuring that their mitigation annex is monitored, evaluated, and reviewed on an annual basis. This may be accomplished by calling an annual meeting of the LPT and HMPT, whose members will provide assistance and expertise for plan review, evaluation, updates, and monitoring. This meeting may be open to the public, and public notices will encourage community participation.

During this annual meeting, the LPT point of contact will provide information and updates on the implementation status of each action item included in the plan. As part of the evaluation, the LPT will assess whether goals and objectives address current and expected conditions, whether the nature and/or magnitude of the risks have changed, if current resources are appropriate for implementing the HazMAP, whether outcomes have occurred as expected, and if agencies and other partners participated as originally proposed. These activities will take place according to the schedule in Table 53.

Table 53: Timetable of the Plan Review Process

Responsible Personnel	Activity	Update Schedule
Local Planning Team (LPT) Point of Contact	Monitoring Plan: track implementation and action items, changes to risk assessment, changes to the LPT, changes to capabilities, and plan integrations.	As needed
	Evaluate Plan: assess effectiveness by evaluating completed actions, implementation processes, responsible personnel, and lessons learned.	Annually
	Update Plan	Every five years

At least every five years, or more frequently if such a need is determined by the participants, the HazMAP will undergo a major update. During this process, all sections of the plan will be updated with current information and analysis, and new and/or modified mitigation action plans will be developed. The revised plan will be submitted for review and approval to TDEM and FEMA and presented to the governing council for approval and adoption. The plan will be updated every five years in accordance with federal and state regulations.

Continued Public Involvement

As stated in Requirement 201.6(c)(4)(iii), the plan maintenance process shall include a discussion on how the community will continue public participation in the plan maintenance process.

Ongoing public participation will be encouraged throughout the planning and implementation processes. A copy of the plan may be provided on the jurisdiction’s websites and/or in the office of the LPT point of contact. Annual meetings held for monitoring, evaluating, and updating the HazMAP may be open to the public, and public notices will encourage community participation. Additional public comment periods will

be available through surveys that will be distributed on newsletters and social media platforms. Not all jurisdictions will have public meetings; it just depends on the resources and capabilities that best fit that community.

Public participation will be sought throughout the implementation, evaluation, and maintenance of the HazMAP. This participation will be sought in a multitude of ways, including but not limited to periodic presentations on the plan's progress to elected officials, schools, or other community groups; annual questionnaires or surveys; public meetings; and postings on social media and interactive websites.

Incorporation into Existing Planning Mechanisms

The primary means for integrating mitigation strategies into other local planning mechanisms will be through the revision, update, and implementation of each jurisdiction's plans which require specific planning and administrative tasks (for example, plan amendments, ordinance revisions, and capital improvement projects).

The members of the HMPT will remain charged with ensuring that the goals and strategies of new and updated local planning documents for their jurisdictions are consistent with the goals and actions of the Tarrant County HazMAP and will not contribute to increased hazard vulnerability in Tarrant County or its participating jurisdictions.

During the planning process for new and updated local planning documents, such as a comprehensive plan, capital improvement plan, or emergency management plan, Tarrant County and its participating jurisdictions will provide a copy of the Tarrant County HazMAP to the appropriate parties and recommend that all goals and strategies of new and updated local planning documents are consistent with and support the goals of the Tarrant County HazMAP and will not contribute to increased hazards in the affected jurisdiction(s).

The following steps will be taken in implementing this HazMAP into local plans:

1. Change is proposed by an elected official or other interested party.
2. The proposal is placed on the local agenda of the governing body.
3. The agenda is published at least 10 days in advance of the meeting at which it will be discussed, so members of the public have an opportunity to attend the discussion meeting. Publication may be made by posting the agenda on the city's website, in the city newsletter, or on a public bulletin board.
4. The proposal is discussed at the public meeting, including any comments by members of the public attendance.
5. The proposal is voted on by the governing body.
6. If the proposal is passed, the change is implemented by the appropriate local authority.

Section 6: Conclusion

Tarrant County's development of this plan has involved a comprehensive evaluation of hazard history, critical facilities inventory, and an updated emergency contact list for critical facilities. This valuable data, combined with the latest information on hazard threats and vulnerabilities, will be immensely beneficial for Tarrant County and its participating jurisdictions. Natural hazards have been identified county wide, and technological hazards have been listed for selected jurisdictions that have chosen to include these hazards. Furthermore, mitigation projects have been compiled and prioritized, aiming at reducing the risks to lives and property.

The establishment of the Tarrant County HMPT has successfully brought together stakeholders from various communities and organizations into one planning team. This collaborative effort has been instrumental in producing this document and increasing awareness of risks and mitigation strategies. Besides the HMPT, the formation of an LPT in each jurisdiction has unified stakeholders and departments to produce jurisdictional data for this document and create a greater awareness of risks and mitigation strategies.

This plan will remain dynamic, evolving as needed to accurately represent the threats and vulnerabilities affecting Tarrant County. We encourage ongoing public participation in the multijurisdictional hazard mitigation process.

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Appendix A: Documentation from Planning and Public Meetings

Appendix A: Documentation from Planning and Public Meetings

Meeting Minutes and PowerPoint Slides

TARRANT COUNTY, TEXAS

Meeting Minutes

Date: Friday, August 23, 2024

Location: Tarrant County Hurst Courthouse / Virtual TEAMS Meeting

Host: Jeanne Bunting, IEM Project Manager

IEM Planning Lead: Kim Anthony

WELCOME AND INTRODUCTIONS

Jeanne Bunting opened the meeting with a warm welcome and facilitated the introductions.

ATTENDEES:

Name	Job Title	Jurisdiction/Agency
John Ard	Fire Chief	City of Westlake
Ryan Arthur	Fire Chief	City of Lake Worth
Jeff Ballew	Fire Chief/EMC	Town of Edgecliff Village
Randy Barkley	Fire Chief/EMC	City of Watauga
Jeff Davis	Fire Chief	City of Fort Worth
Edgardo Barreto de La Torre	Senior Emergency Manager	DFW Airport
Brandy Barrett	City Administrator/EMC	City of Westworth Village
Jeremy Blackwell	Assistant Fire Chief	City of Lake Worth FD
Shelby Brock	Marshal/EMC	City of Richland Hills
James Brown	Fire Chief/EMC	City of Kennedale

Name	Job Title	Jurisdiction/Agency
Raul Cantu	EM & AAR Administrator	University of North Texas (UNT) Health Science Center
Christopher Cook	Police Chief	City of White Settlement
Brent Craft	Fire Chief	City of Hurst
Greg Cutler	EMC	City of Mansfield
Raelyn Darnell	EMC	City of North Richland Hills
Bryce Davis	EMC	City of Haltom City
Gregory Dickens	Executive Director of Public Works	City of Hurst
Moses Druxman	Fire Marshal	City of Azle
Deea Z Elliston-Scully	EMC	City of Fort Worth
Shawn Fannan	Fire Chief	City of Blue Mound
Malaika Marion Farmer	Assistant City Manager	City of Hurst
Rob Franklin	Deputy Fire Chief/EMC	Town of Pantego
Daniel Frisby	Assistant EMC	City of Mansfield
Krissy Garrison	Senior Emergency Manager	DFW Airport
Steve Gutierrez	Fire Chief, EMC, Fire Marshal	City of Forest Hill
Irish Hancock	Emergency Management Administrator	City of Arlington
Katrina Harris	Administrative Assistant to the Fire Marshal	City of Weatherford
Suzanne Hendrickson	EMC	City of Euless
Duane Hengst	City Engineer	City of Hurst
Sean Hughes	EMC	City of Lakeside
Chris Johnson	Battalion Chief	City of Hurst
Billy Keadle	Assistant Police Chief	City of Hurst
Garrett Kemp	EMC	City of Haslet
Shelly Klein	Assistant to the City Manager	City of Hurst
Joey Lankford	Deputy Fire Chief/ Fire Marshal	City of Bedford
Joe Laster	Emergency Operations Center Manager	City of Burleson
Shawna R. Lemley	EMC	City of Arlington
Thomas J. (TJ) Manor	EMC	City of Grapevine
Maribel Martinez	Director EM Preparedness	The North Central Texas Council of Governments (NCTCOG)
Shannon Martinez	Chief of Police	Town of Westover Hills
Kirt Mays	EMC	City of Haslet

Name	Job Title	Jurisdiction/Agency
David M. McCurdy	EMC	County of Tarrant
Kennedy Meehan	Emergency Manager Specialist	City of Southlake EM
Jennifer J. Moreno	Senior Emergency Manager	DFW Airport
Kimber Morgan	EMO 2	City of Fort Worth
James Myrick	EMC	City of River Oaks
Sunil Patel	Director of Information Technology	City of Hurst
Alayna Payne	Mitigation & Recovery Coordinator	County of Wise
Chris Perry	Director of Utilities	City of Hurst
Kenny Phillips	EMC	City of Colleyville
Michael Reeves	Assistant Fire Chief	City of Hurst
Esmeralda Sanchez	Assistant EMC	County of Tarrant
Rick Sanderson	Fire Chief	City of White Settlement
Claude Scally	Deputy Fire Chief/Fire Marshal	City of Crowley
Russell Shelley	Fire Chief	City of Richland Hills
Doug Spears	Fire Chief	City of Saginaw
Rebecca Stephens	EM Analyst	City of Haltom City
Jason Tate	Fire Chief	City of Benbrook
Bobby Tatum	Fire Chief	City of Keller
Samantha Taylor	EM Director/Coordinator	County of Denton
William T. Wessel	Assistant EMC	County of Tarrant
Landon Whatley	Fire Chief	City of Everman
Chase Wheeler	EMC	City of Grand Prairie
Jeanne Bunting	Project Manager	IEM
Myrna Chase	Disaster Response Specialist	IEM
Laneta Hayes	Hazard Mitigation Technical Specialist	IEM
Sabrina Lunsford	Hazard Mitigation Planner	IEM
Lisa Mehaffey	Planner	IEM
Kristine Ravelo	Hazard Mitigation Specialist	IEM
Kate Smith	Hazard Mitigation Planner	IEM

What Is Mitigation?

Jeanne reviewed the following information with the stakeholders and participants.

Definition: Any sustained action taken to reduce hazard effects on people or property (long-term sustained actions). Helps receive funding from FEMA and other sources.

New Local Guidance (April 2023): Must have 1 action per hazard in the plan (e.g., 30 hazards = 30 actions).

Last Plan (2020): The 2020 mitigation plan has been updated to reflect significant changes. *Key updates include the integration of the National Flood Insurance Program (NFIP) to enhance flood risk management and new local guidance on building codes to improve structural resilience.*

HHPD Goal: A specific goal related to high hazard potential dams (HHPD*)* ***must be included in the mitigation plan***. This goal is essential for securing necessary funding and ensuring that these high-risk infrastructures are prioritized and managed effectively to mitigate potential hazards.

Planning Roles and Responsibilities

Reminder: All submissions are due in 5 weeks to TDEM (Sept 6) and to FEMA by Dec 31.

SharePoint Access: IEM will ensure access is available; one person from each jurisdiction should be appointed.

STAKEHOLDER ENGAGEMENT

Public Outreach: Use a “Whole Community Approach” to involve the public through digital means, public workshops, and public plan reviews.

Concerns: Time constraints limiting public involvement.

Suggestions: Jeanne requested that they send snippets of any outreach efforts.

PLANNING EXPECTATIONS

Jeanne asked if these are still current.

Review of Hazards of Concern:

- Drought
- Earthquake
- Expansive Soil
- Extreme Heat
- Flood
- Thunderstorms
- Tornadoes
- Wildfires

- Winter Storms

Additional Hazards: Tarrant County requested to add (if time permits): Cybersecurity, Major Disease Outbreak, Utility Infrastructure Failure, Civil Unrest

Jeanne informed the attendees that we will work on the basic ones first, and if there is additional time, IEM will add the others.

One participant stated that Arlington has Civil Unrest in its Plan, and we can add from that information.

RISK ASSESSMENT (slide 16)

Jeanne reviewed (see these will be updated.

Review: Use existing data from the last plan; update demographics and other relevant information.

CAPABILITIES AND FORMS (see slide 17)

Action: Jeanne recommended Fill out and return forms ASAP, preferably within a week.

MITIGATION STRATEGY AND FORMS **(**slide 18)

Action: Submit one (1) specific action for each identified hazard. For any newly identified hazards, ensure that corresponding actions are also included. This ensures that all potential risks are addressed comprehensively in the mitigation plan.

Prioritization: (see slide 19). Use the **STAPLEE** method (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) to prioritize actions. This method helps evaluate and rank actions based on various criteria, ensuring that the most effective and feasible actions are implemented first.

GOALS (see slide 20)

Discussion: Focus on reviewing and updating goals, incorporating High Hazard Potential Dams (HHPB), and setting specific objectives to support vulnerable and disadvantaged populations, ensuring the mitigation plan is robust, inclusive, and aligned with community needs

Examples: Jeanne will share examples from other plans with Stakeholders.

Cooperation: Cooperation between agencies is crucial for the successful implementation of HMGP mitigation strategies in Tarrant County. Effective collaboration ensures coordinated resources, information, and efforts, leading to comprehensive and efficient mitigation actions. This inter-agency cooperation helps reduce risks from natural hazards, enhancing community resilience and safety.

TIMELINE OF DELIVERABLES AND STAGES FOR FINAL DELIVERABLES **(**see slides 22–24)

A comprehensive ‘Timeline of Deliverables’ will be sent to Tarrant County stakeholders, outlining key deadlines and milestones to ensure all participants are informed and aligned with the project schedule.”

Jeanne informed the participants that there will be Requests for Information (RFIs); however, IEM will provide assistance with these RFIs to ensure a smooth process."

Deliverables Key Dates (see slide 23)

- CAP Worksheets: Sept 6
- Mitigation Worksheet: Sept 6
- Actions in Prior Plan: Sept 15
- FEMA Ready Plan: Dec 31, 2024

NEXT STEPS

Follow-Up: Jeanne will distribute the presentation slides, and any additional information required to ensure all participants have the necessary resources and clarity on the discussed topics. This will include detailed instructions, relevant documents, and any updates pertinent to the project.

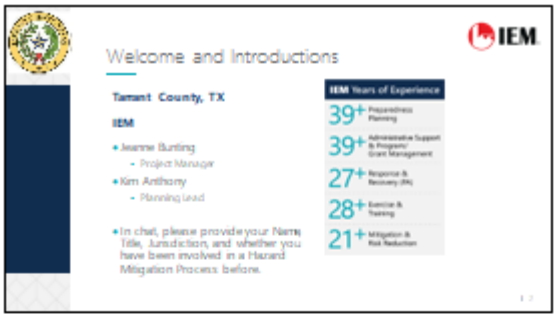
Virtual Meeting: A virtual meeting will be scheduled to take place in 3-4 weeks. This session will provide an opportunity for participants to discuss progress, address any questions or concerns, and ensure that everyone is aligned with the project goals and timelines. The meeting will facilitate further collaboration and provide a platform for real-time feedback and support.

**The meeting was adjourned at 1:00pm EDT, and all participants were encouraged to reach out to the IEM Team with any questions or concerns. Your active participation and collaboration are greatly appreciated as we move forward with the mitigation planning process. **

Minutes prepared by Laneta Hayes, IEM Hazard Mitigation Technical Specialist

PowerPoint Documentation

1



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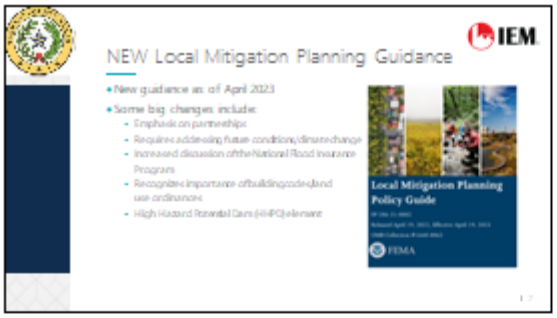
IEM
NEW Local Mitigation Planning Guidance
New guidance as of April 2023
Some big changes include:
Emphasis on partnerships
Requires addressing future conditions/climate change
Increased discussion of the National Flood Insurance Program
Recognizes importance of building codes/land use ordinances
High Hazard Potential Dam (HHPD) relevant
Local Mitigation Planning Policy Guide
FEMA

7


IEM
Hazard Mitigation Planning Team (last update)

8


IEM
Planning Expectations
ACTIVE PARTICIPATION
ACTIVE COMMUNICATION
RESPECT OF DEADLINES

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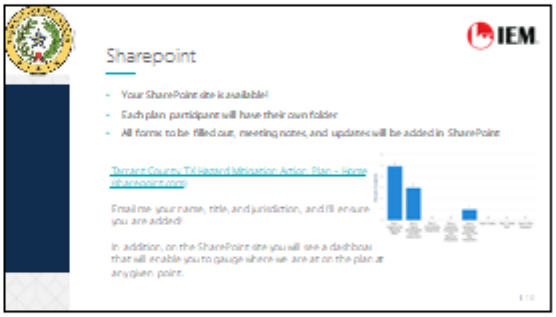
IEM
Sharepoint
Your SharePoint site is available!
Each plan participant will have their own folder
All forms to be filled out, meeting notes, and updates will be added in SharePoint
Email me your name, title, and jurisdiction, and I'll ensure you are added!
In addition, on the SharePoint site you will see a dashboard that will enable you to gauge where we are at on the plan at any given point.

10


IEM
Stakeholder Engagement
The plan must provide an opportunity for stakeholders to be involved, including:
Local and regional agencies involved in hazard mitigation activities
Agencies that have the authority to implement mitigation actions
Neighboring communities
Representatives of businesses, academia, and other private organizations
Representatives of nonprofit organizations, including community-based organizations that work directly with and/or provide support to underserved communities and socially vulnerable populations

11


IEM
Public Outreach
"Whole Community" Approach
The plan must document an opportunity for the public to participate.
Digital surveys
Public workshops
Public plan review

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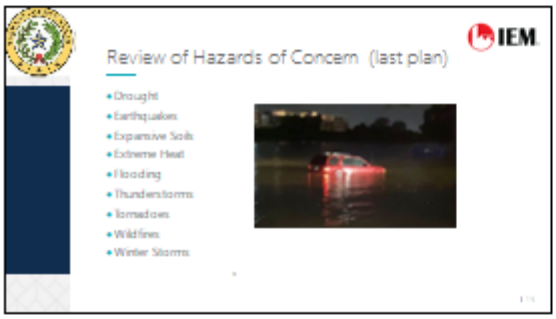

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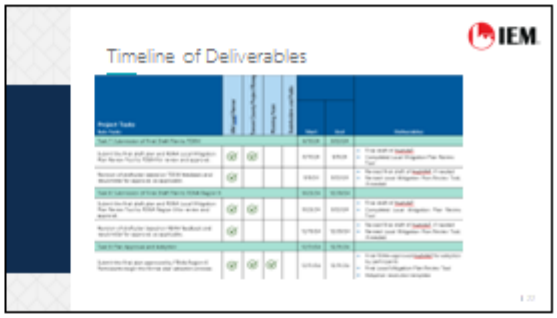

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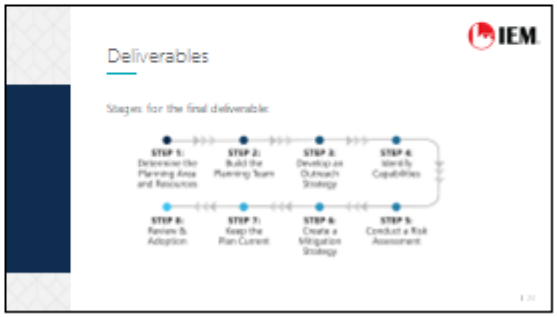

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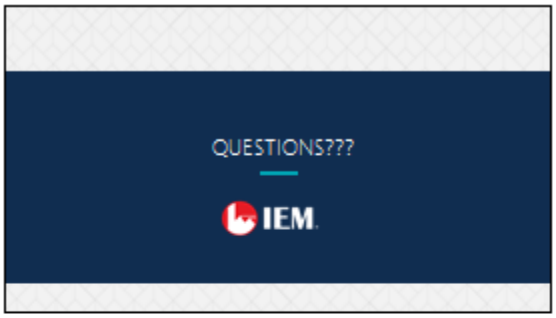

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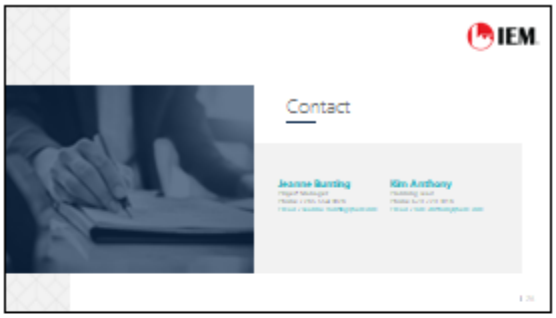

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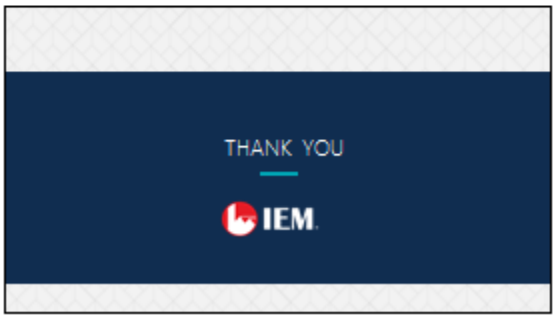


27

Engagement with Neighboring Communities

As part of the Tarrant County Hazard Mitigation Plan development, the county actively reached out to neighboring communities to foster regional collaboration and ensure a comprehensive approach to hazard mitigation. This outreach included email communication with adjacent jurisdictions to provide feedback on the draft plan. By involving neighboring communities, Tarrant County sought to address cross-jurisdictional risks and share mitigation strategies that could benefit the region as a whole. This collaborative effort not only strengthened relationships with surrounding jurisdictions but also enhanced the county's ability to implement mitigation actions that reduce risks across borders. Figure 96 shows the email correspondence asking communities to provide feedback on the draft base plan.

From: William T. Wessel
To: scott.forster@dallascounty.org; Samantha Taylor; "Jamie Moore"
Cc: David M. McCurdy; Esmeralda Sanchez
Subject: Request for Feedback on Tarrant County Hazard Mitigation Plan
Date: Thursday, November 7, 2024 9:57:00 AM
Attachments: image001.png

Good morning neighbors,

I hope this message finds you well. Tarrant County is in the process of updating its Hazard Mitigation Plan, which outlines our evaluation of natural hazards and the strategies we have developed to reduce their risks to our community. As part of this update, we are reaching out to neighboring counties to request your input on the draft plan.

Your feedback is important to us, as we aim to coordinate our mitigation efforts and ensure the plan reflects both regional concerns and strategies for addressing shared risks.

You can access the draft plan here:
https://iem.maps.arcgis.com/sharing/rest/content/items/f621704bbed546bcacc5d3ba9c1daa49/data

If you have any comments, suggestions, or concerns regarding the draft, please send them to William Wessel at wtwessel@tarrantcountytx.gov by November 15, 2024.

We greatly appreciate your time and input, and we look forward to working together to build a more resilient region.

William Wessel
Assistant Emergency Management Coordinator
Office of Emergency Management
Public Health Preparedness
Phone: 817-884-2906
Email: wtwessel@tarrantcountytx.gov

Figure 96: Outreach Letter to Neighboring Communities

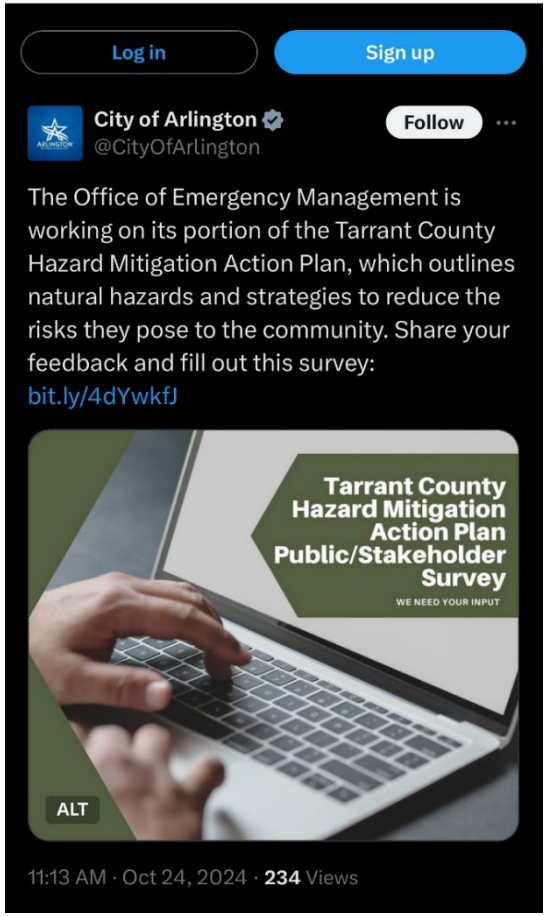
Public Outreach Survey Engagement

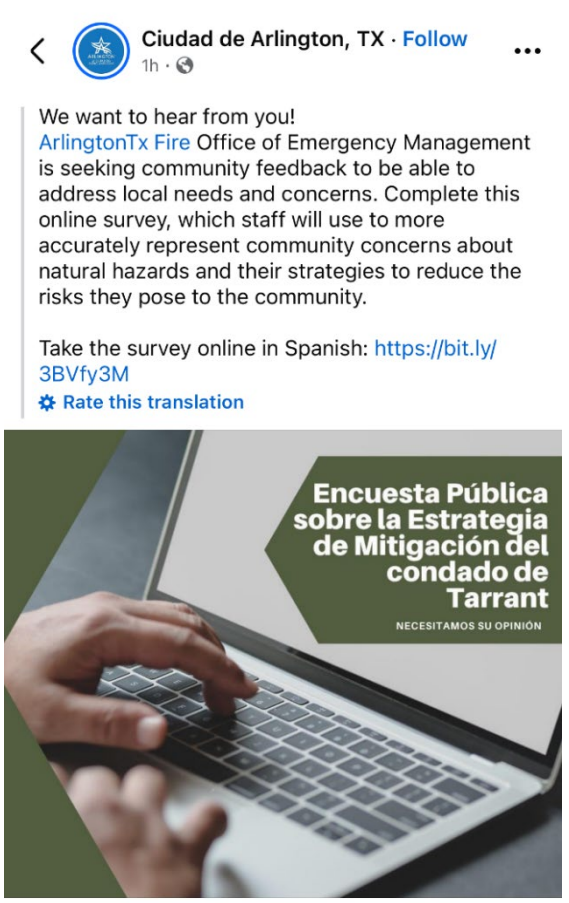
For the Tarrant County Hazard Mitigation Plan update, a comprehensive public outreach initiative was conducted to engage all participating jurisdictions and their communities. To gather valuable input, we developed a survey that was posted across the websites and social media platforms of the participating jurisdictions. This approach aimed to maximize reach and encourage widespread participation from residents, businesses, and local organizations. The survey served as a vital tool to collect feedback on the community's hazard vulnerabilities and mitigation strategies, ensuring the plan reflects local concerns and priorities. There were 155 responses to the survey for Tarrant County to be able to analyze for future mitigation and response operations.

In recognition of Tarrant County's diverse population, the survey was provided in both English and Spanish to ensure accessibility for all residents. By offering the survey in multiple languages, we aimed to promote inclusivity and encourage a broad spectrum of community members to share their perspectives. The engagement process allowed us to collect meaningful data that will inform the development of a robust and effective hazard mitigation plan, tailored to the unique needs and risks faced by Tarrant County's communities. The following section shows the efforts by participating jurisdictions to solicit input into the HazMAP.

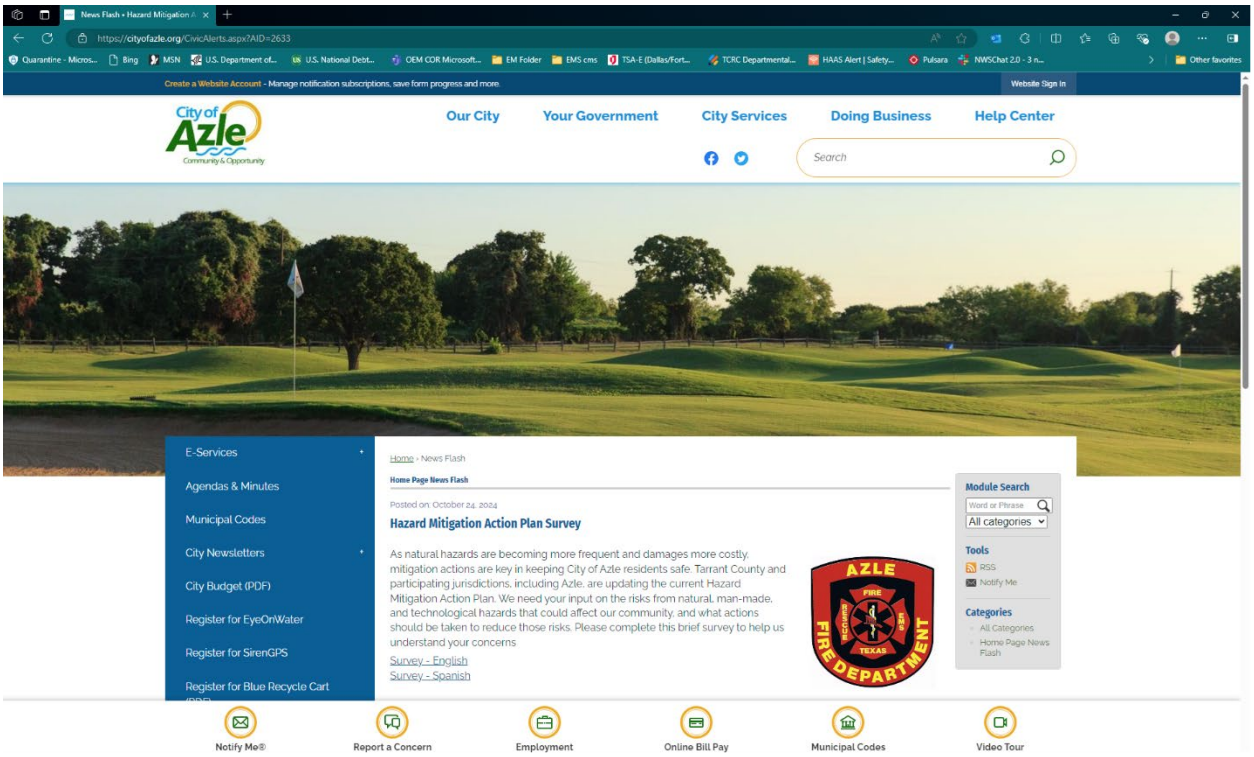
Documentation by the Jurisdictions

ARLINGTON

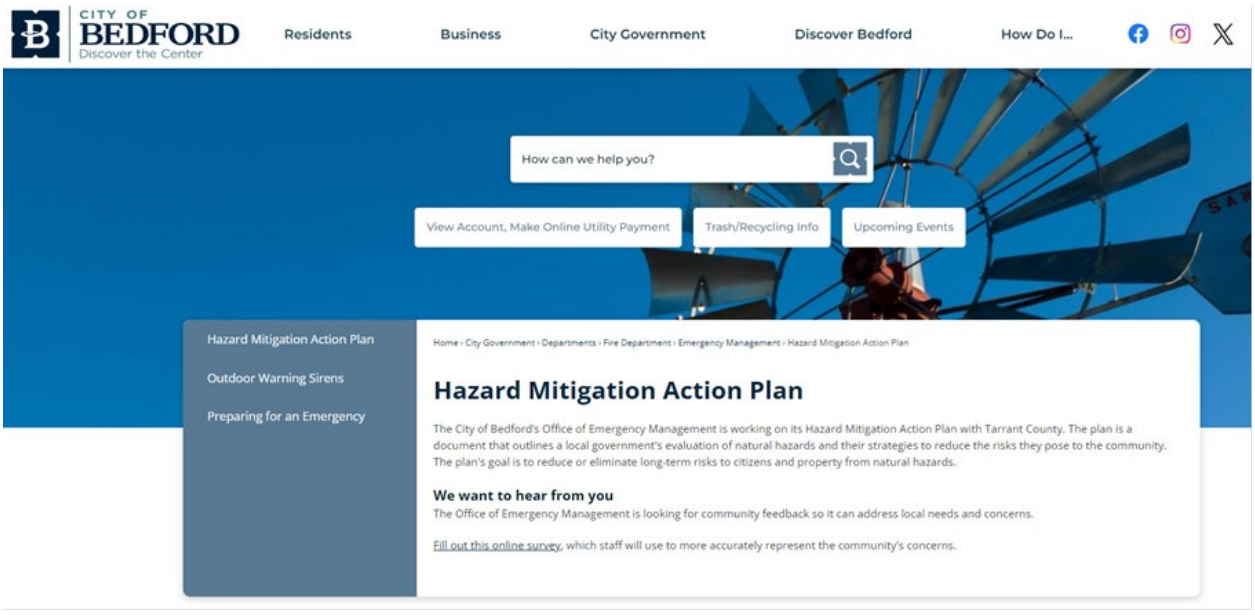




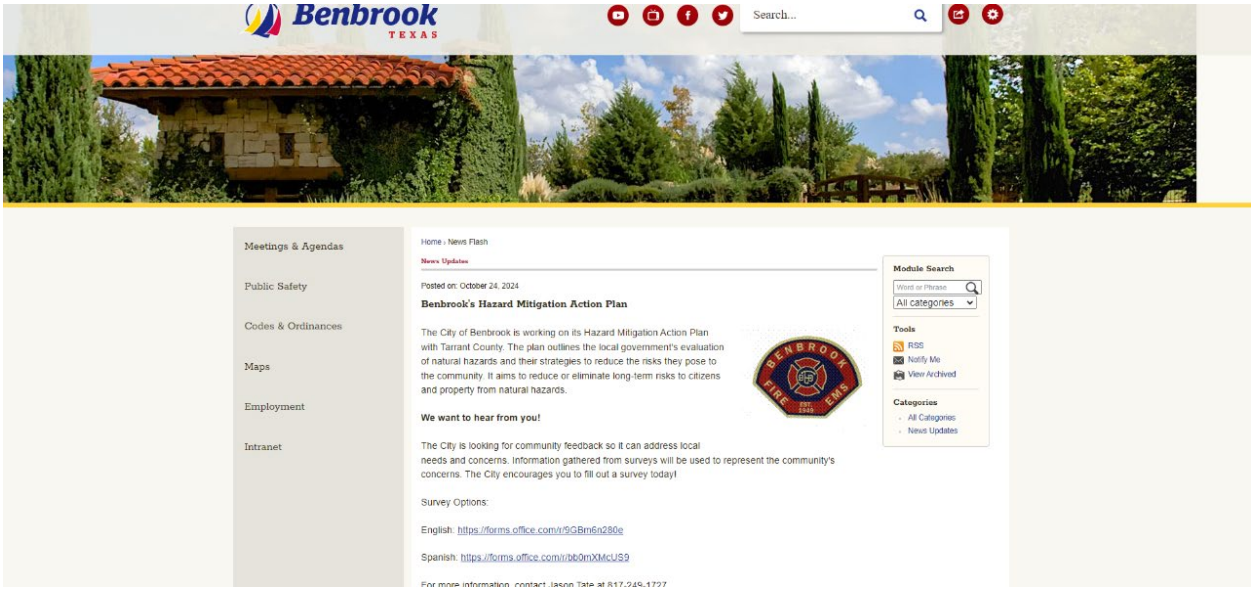
AZLE



BEDFORD



BENBROOK



COLLEYVILLE

CROWLEY


14:42
LTE
Survey: Hazard Mitigation Action Plan
News Release Date:
10-25-2024
Back to News
Tarrant County and the City of Crowley are working on a Hazard Mitigation Action Plan,
TextMyGov
Please take a moment to fill out the survey below that
ci.crowley.tx.us

EDGECLIFF VILLAGE

"A Great Place to Live" SINCE 1951

Thank you to our residents, Mayor, Council Members, City Secretary, City Hall staff, Public Works staff, Edgecliff Fire Department staff and Volunteers for making the Town of Edgecliff Village, 3rd City in the United States for "Best City to Live" in 2022, according to The New York Times.

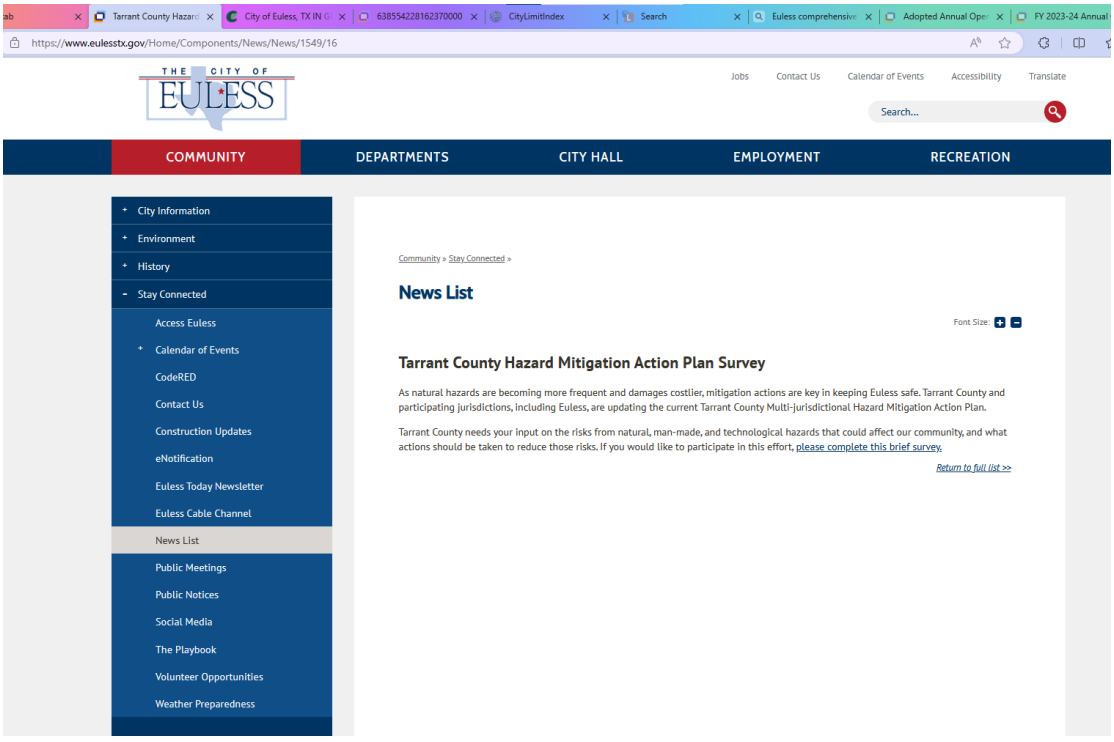
lic Imput Click Here For Important News about Tarrant County HazMAP Public Imput Click Here For Importa

DGECLIFF

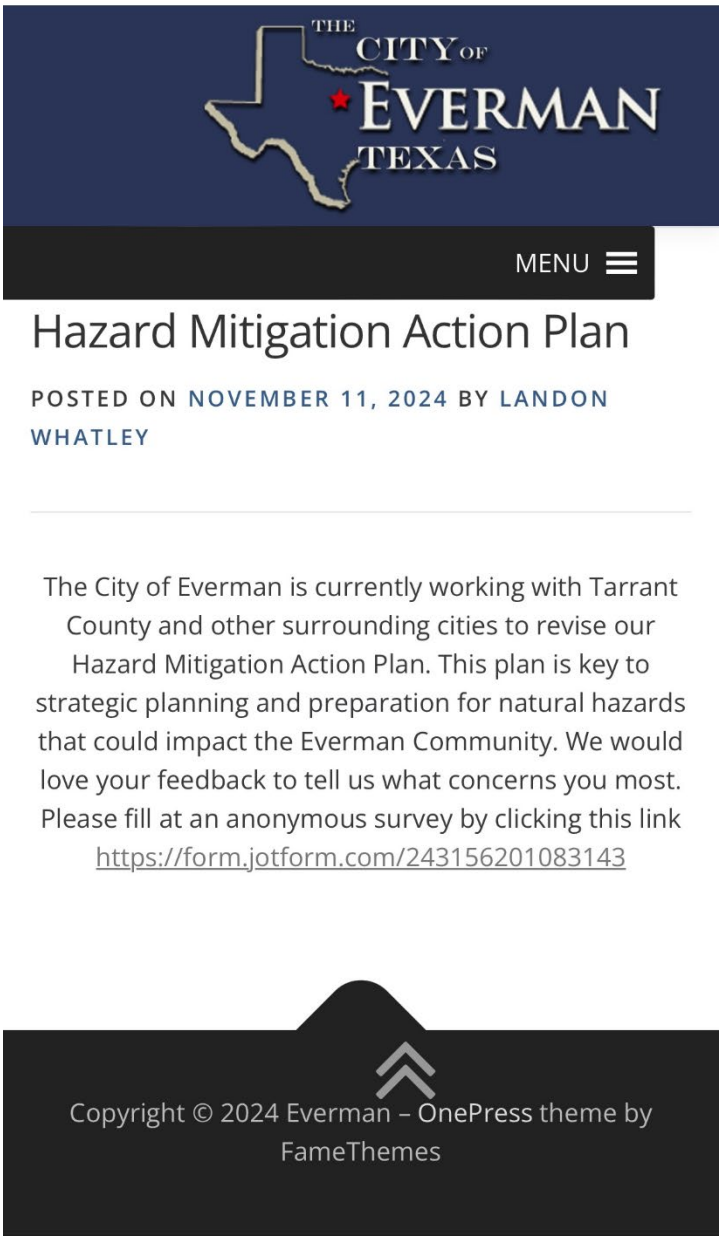
NEW! Online Payment is available for Edgecliff Village.

Experience seamless convenience and Easily pay for citations and permits online through our Third party user-friendly website, saving

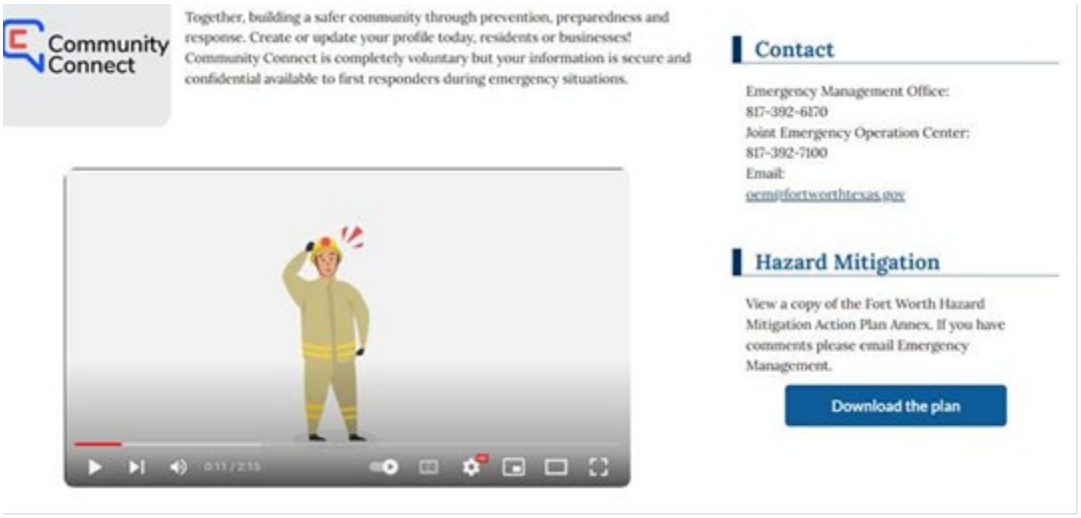
EULESS



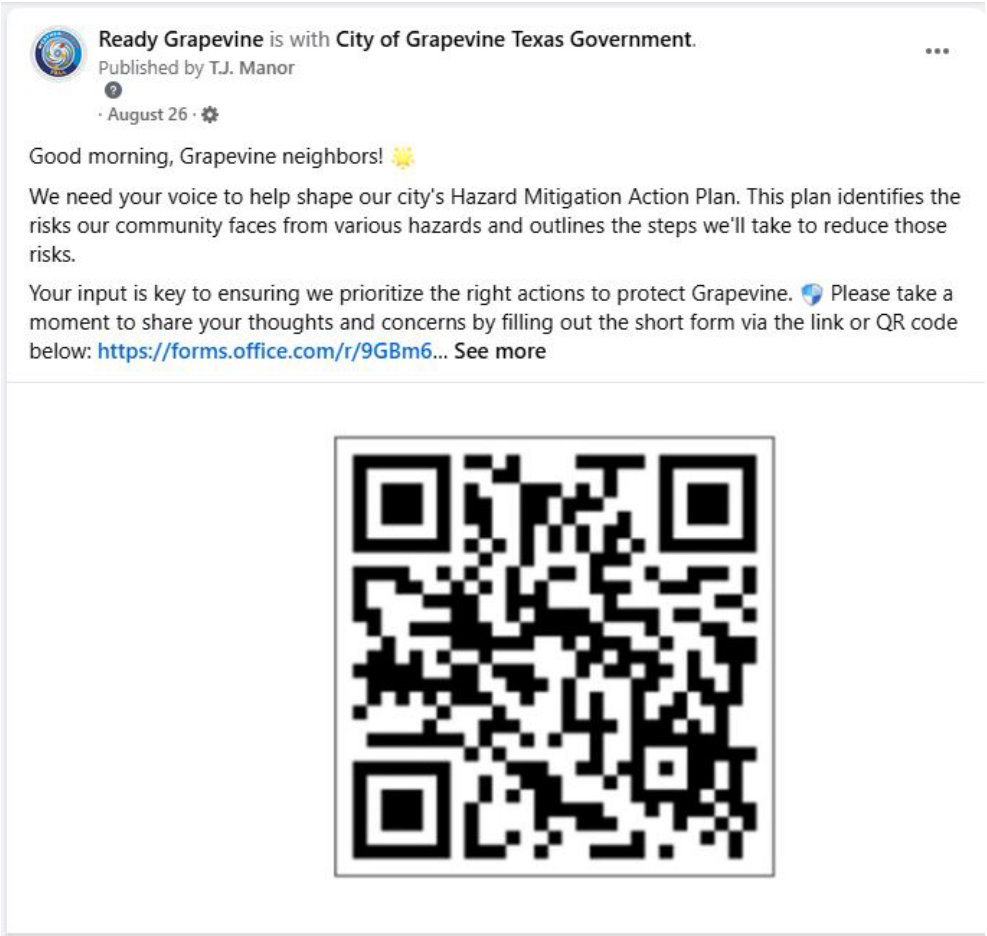
EVERMAN


THE CITY OF EVERMAN TEXAS
MENU
Hazard Mitigation Action Plan
POSTED ON NOVEMBER 11, 2024 BY LANDON WHATLEY
The City of Everman is currently working with Tarrant County and other surrounding cities to revise our Hazard Mitigation Action Plan. This plan is key to strategic planning and preparation for natural hazards that could impact the Everman Community. We would love your feedback to tell us what concerns you most. Please fill at an anonymous survey by clicking this link https://form.jotform.com/243156201083143
Copyright © 2024 Everman – OnePress theme by FameThemes

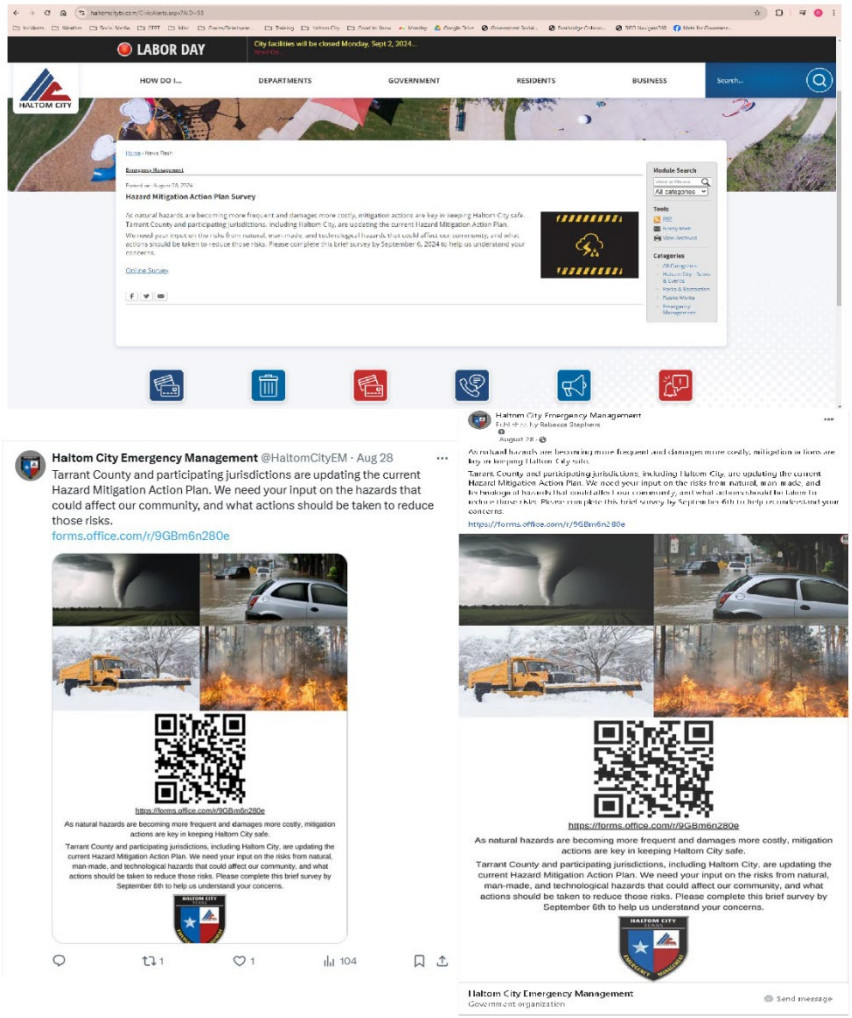
FORT WORTH



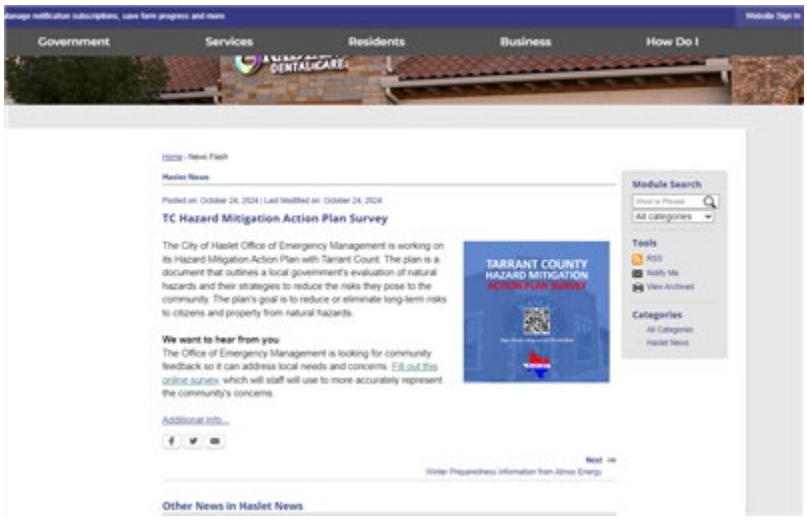
GRAPEVINE



HALTOM CITY

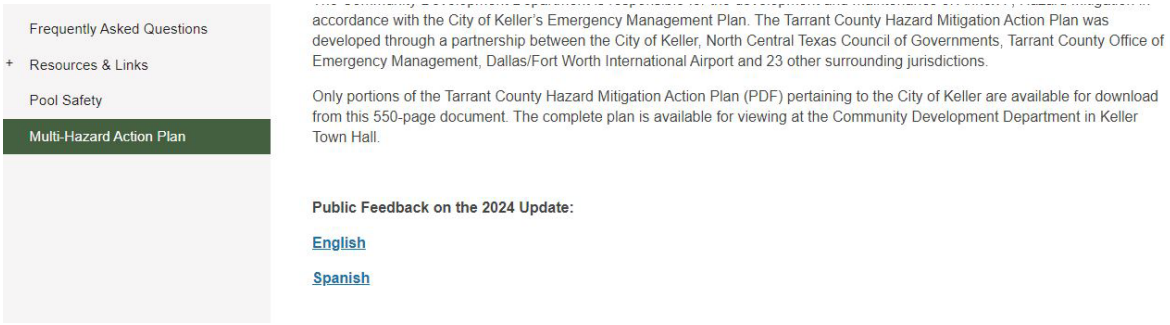


HASLET



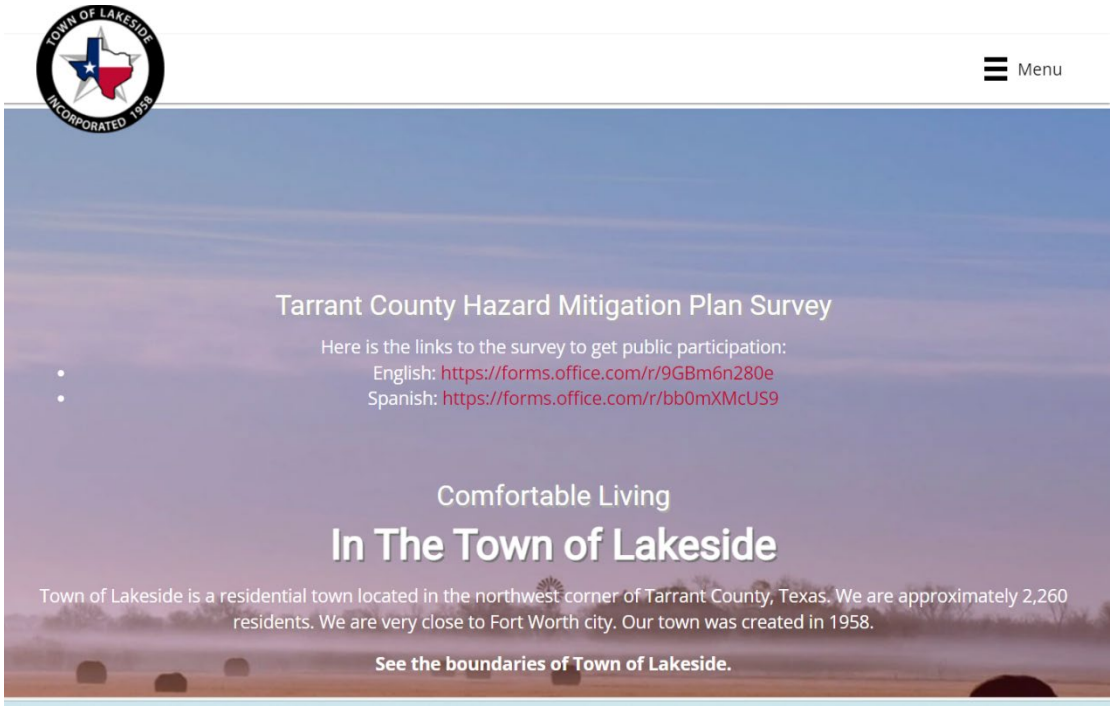
HURST

KELLER



LAKE WORTH

LAKESIDE



MANSFIELD

NORTH RICHLAND HILLS

From: Raelyn Darnell
Bcc: dean1600@sbcglobal.net; Glduboise@gmail.com; michaelwlittle1949@gmail.com; s_bridegam@hotmail.com; lesleyhenry33@gmail.com; ae5fl@pm.me; alanbentrup@gmail.com; Raddqabb@yahoo.com; tomcattech@protonmail.com; houstonjh@gmail.com; tianablackmon@gmail.com; jrblaw09@yahoo.com; vishti@ymail.com; tomonrh@gmail.com; earthrox6@gmail.com; amberensign.counseling@gmail.com; ncard1@sbcglobal.net; khtrain61@yahoo.com; Robert@RobertKeith.com; toni.qee@aacreditunion.org; RCROOK61@ATT.NET; kehoffarth@gmail.com; pg_w@hotmail.com; jberg_175@hotmail.com; dcbuehrer@hotmail.com; mcergol@hotmail.com; komachi@swbell.net; tomonrh@gmail.com; khtrain61@yahoo.com; qknight1@hotmail.com; barthur@haltomcitytx.com; gibbschrystie@gmail.com; nansii@nansiidowner.com; janejbirkes@gmail.com; stanwaite@sbcglobal.net; cesar328@flash.net; bgdogtx@gmail.com; chey3161997@yahoo.com; mcubed1956@gmail.com; macjoan02@hotmail.com; steele.taylor@yahoo.com; K27steele@gmail.com; jparke5@proton.me; msu1976wftexas@gmail.com; rob_seppy@sbcglobal.net; September Daniel; Rob Daniel; Kelvin.deupree@gmail.com; trodriguez@nrhtx.com; Teresa Koontz; Vicki_joann@hotmail.com; jonahroach@icloud.com
Subject: Community Risk Survey
Date: Tuesday, August 27, 2024 4:29:00 PM
Attachments: image001.png
image002.png

Hi NRH CERT Alumni,

This will be posted to the NRH website and social media soon – but wanted to share directly with you all in hopes you will complete this survey:
The City of North Richland Hills, alongside other jurisdictions in Tarrant County, is renewing our Hazard Mitigation Action Plan. This plan is reviewed every 5 years. Please consider taking this survey to help us understand your concerns about risks from natural hazards in NRH. Involving you all as key stakeholders and community members in this planning process is essential to becoming more disaster-resilient. We will accept responses through Sept. 20th. Survey linked here.

Thank you,

Raelyn Darnell
Emergency Management Coordinator
North Richland Hills Fire Department
817-427-6935 | cell 940-367-9981 | rdarnell@nrhfd.com
Dedication | Courage | Leadership | Honor | Compassion
A TFCA Recognized Agency

From: City of North Richland Hills
To: Raelyn Darnell
Subject: North Richland Hills e-news
Date: Thursday, August 29, 2024 3:54:09 PM

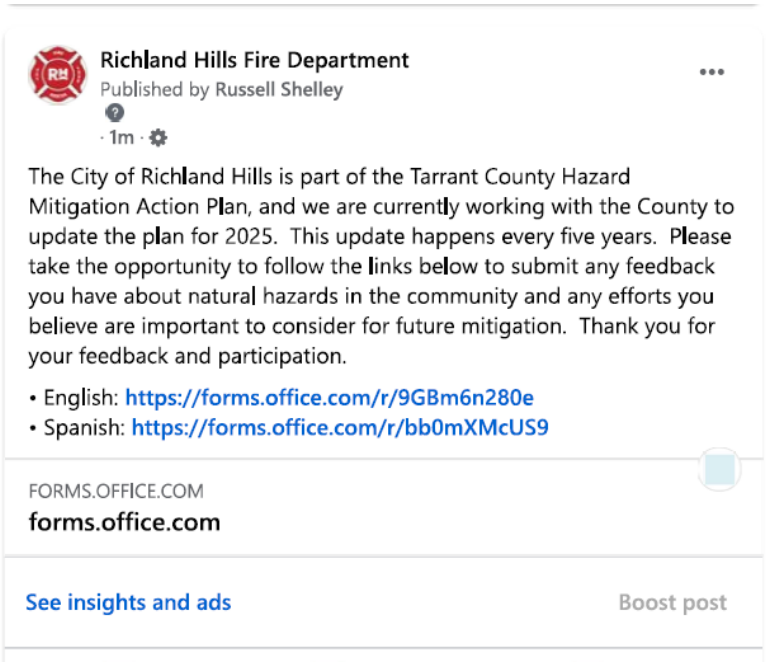
Council Meeting Highlights

Following are highlights from this week's City Council Meeting. For more meeting details and to watch the meeting video, visit www.nrhtx.com/agendas.

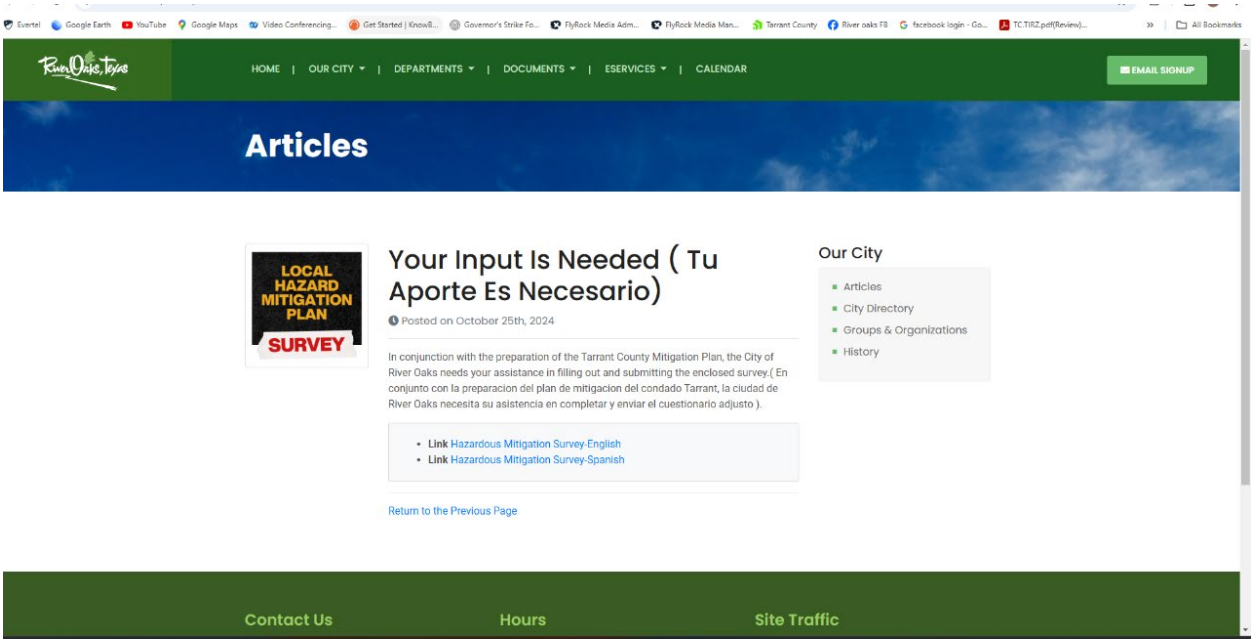
Public Hearings on City Budget & Tax Rate
The City Council held public hearings on the proposed budget and tax rate for FY 2024-2025. The proposed budget includes more funding for street maintenance and public safety and keeps the property tax rate at $0.489389, which is just below the "No New Revenue" rate of $0.489837. Even with the rate remaining the same, individual tax bills may increase, decrease, or stay the same depending on the property's value change from one year to the next. Those with a senior or disabled tax freeze will only pay more in taxes if they have added on to their home or moved to a new home. Around 30% of homes in NRH have a tax freeze in place.

Property owners are encouraged to visit www.tarranttaxinfo.com to view your estimated tax bill from the City, as well as other taxing entities. There will be another opportunity to provide input to the

RICHLAND HILLS



RIVER OAKS



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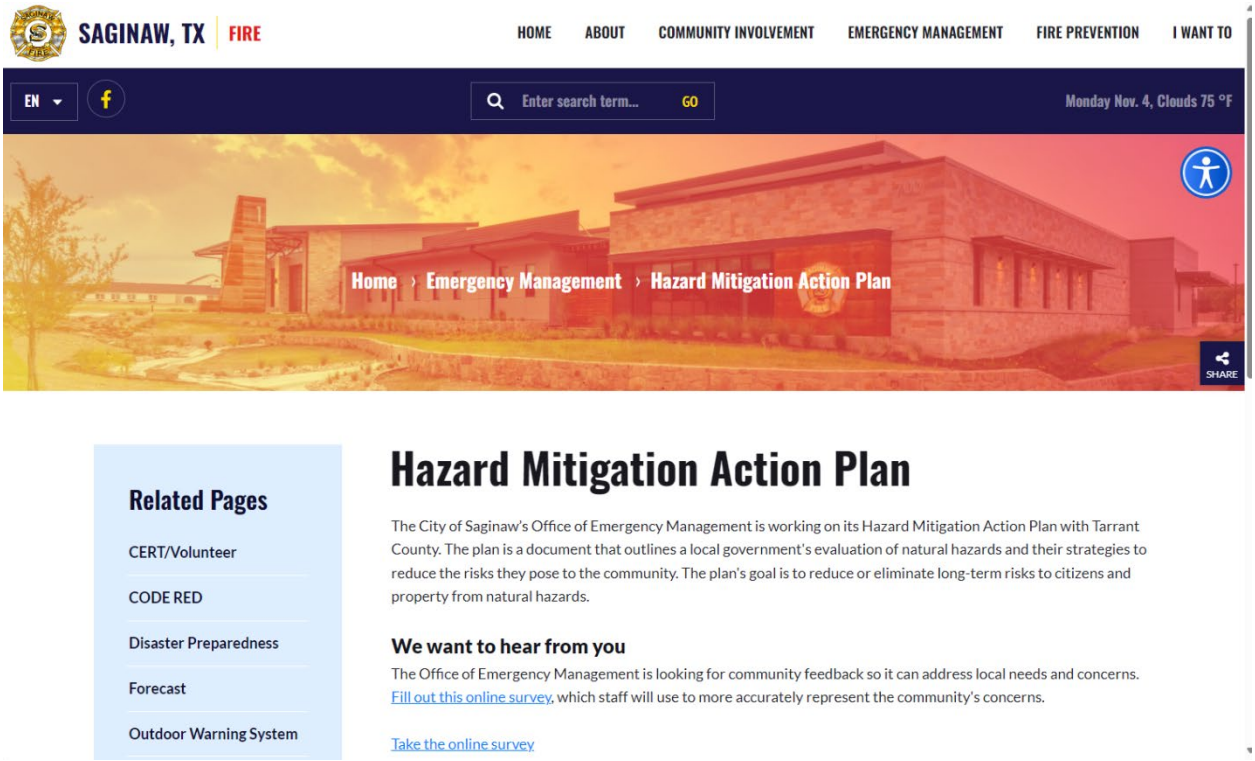
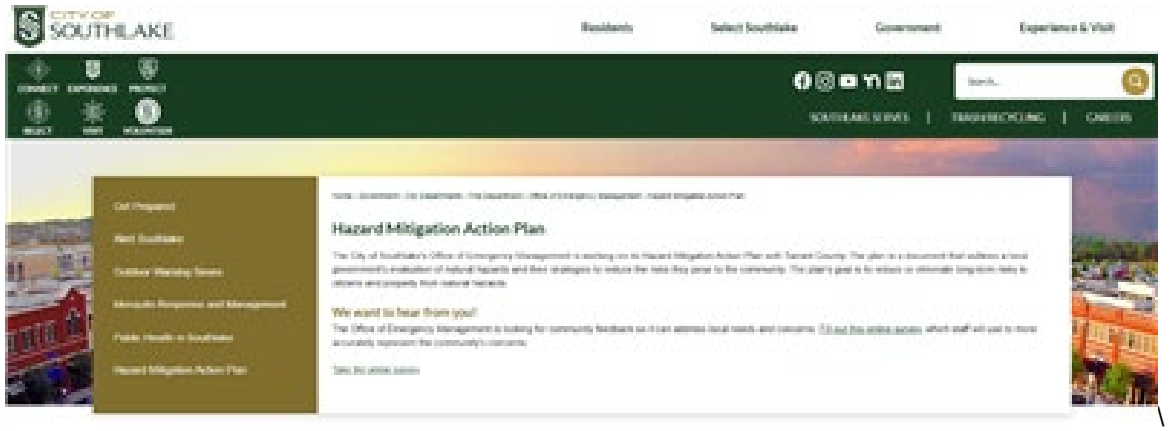
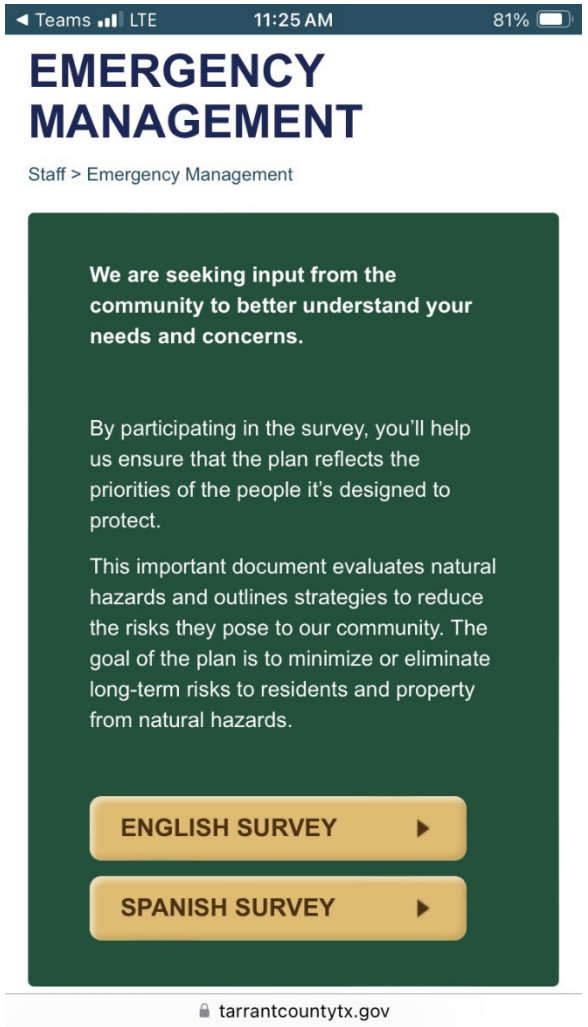


SOUTHLAKE



TARRANT COUNTY



UNIVERSITY OF NORTH TEXAS HEALTH SCIENCE CENTER

SaferCare Texas to host launch of state emergency preparedness, response collaborative

June 26, 2023 | By: Leslie Reyna | On Campus Share Tweet

Related Links

- SaferCare Texas takes students to IHI Patient Safety Congress
- SaferCare Texas hosts Stop the Bleed training event
- SaferCare Texas to host Narcan Lifesaving Training Event
- SaferCare Texas brings health care to rural Texas

In response to the growing need for quick, effective disaster responses in Texas communities, SaferCare Texas is hosting a state emergency preparedness and response collaborative. The training is designed to help integrate community health workers into preparedness and response teams and activities around the state.

The event will take place from 2 to 4 p.m. Wednesday in Room 250 of The University of North Texas Health Science Center's Interdisciplinary Research & Education Building, 3430 Camp Bowie Blvd.

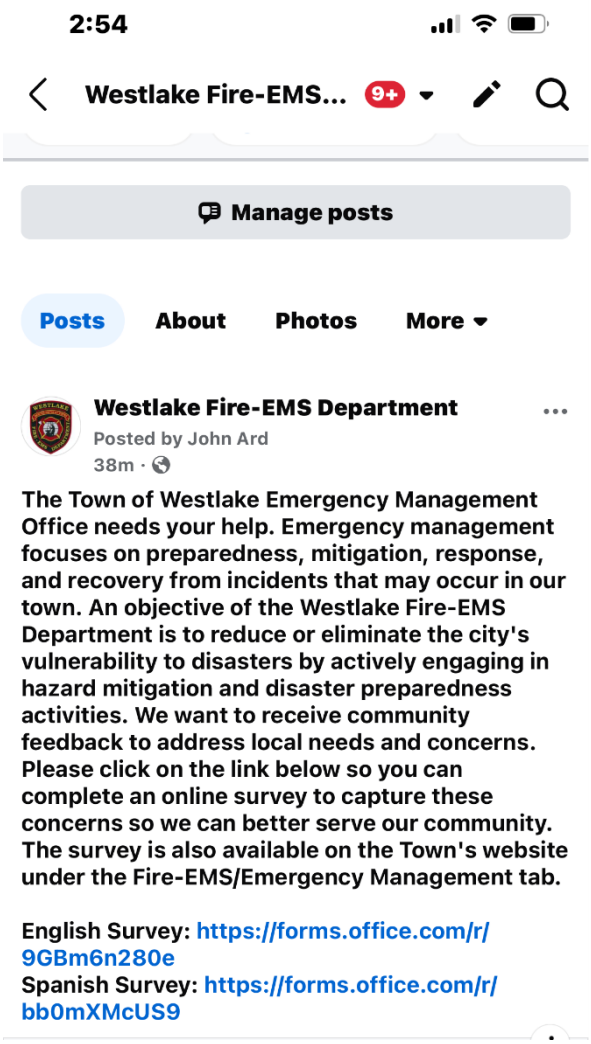
The timing of this training couldn't be more urgent. In 2022, Texas ranked second in the U.S. with the highest number of tornadoes, according to a Forbes Magazine article that uses NOAA National Severe Storms Laboratory data. The recent tornado in Perryton killed three people, damaged 200 homes and directly hit the town's fire department.

Dr. Teresa Wagner, interim director for SaferCare Texas, HSC's patient safety-focused department, hopes this program will help communities like Perryton, where local response resources may be scarce.

WATAUGA

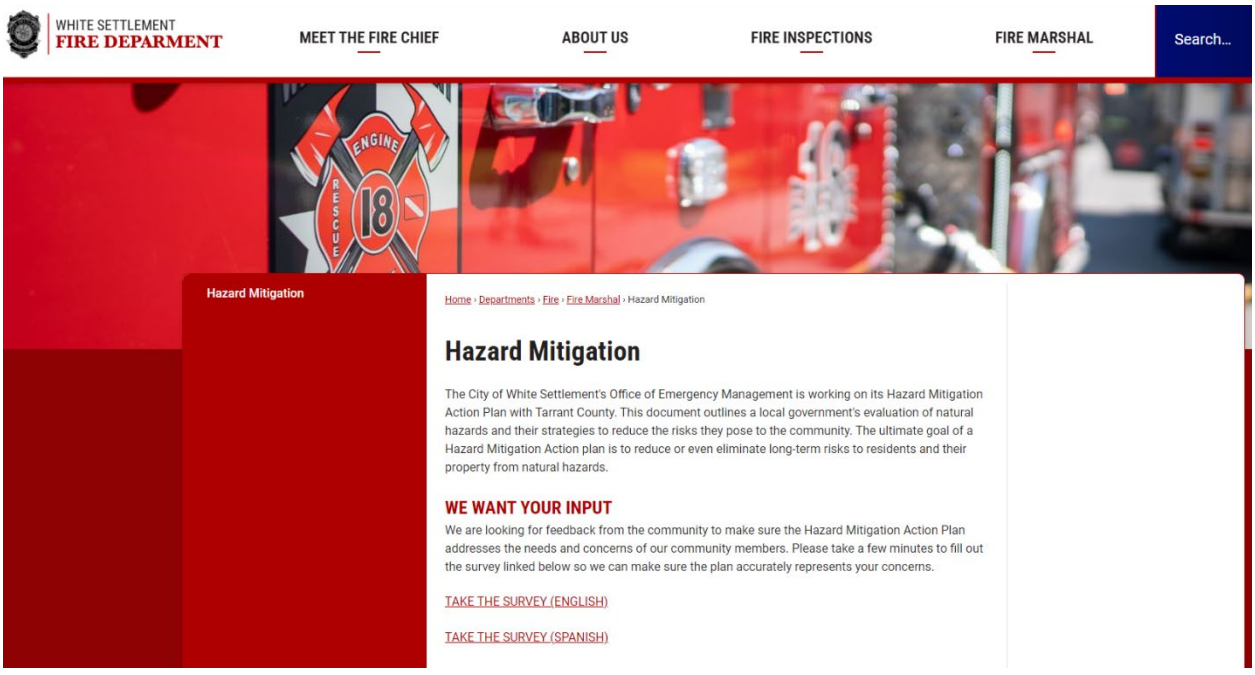

Watauga Fire Department's Post
Watauga Fire Department
Published by Randy Barkley
· October 25 at 11:06 AM ·
The City of Watauga's Office of Emergency Management is working on its Hazard Mitigation Action Plan with Tarrant County. The plan is a document that outlines a local government's evaluation of natural hazards and their strategies to reduce the risks they pose to the community. The plan's goal is to reduce or eliminate long-term risks to citizens and property from natural hazards.
The Office of Emergency Management is looking for community feedback so it can address local needs and concerns. Please Fill out this online survey, which staff will use to more accurately represent the community's concerns.
Take the online survey in English or Spanish with the links below.
English: https://forms.office.com/r/9GBm6n280e
Spanish: https://forms.office.com/r/bb0mXMcUS9
HELP US
MAKE WATAUGA
SAFER!
Comment as Watauga Fire Department

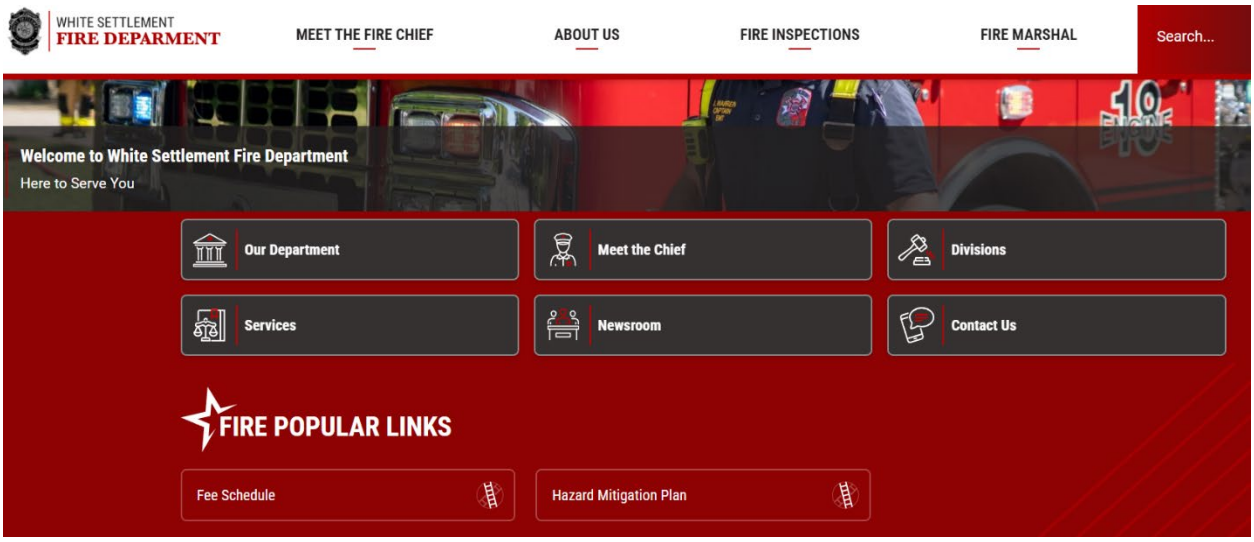
WESTLAKE


2:54
Westlake Fire-EMS... 9+
Manage posts
Posts
About
Photos
More
Westlake Fire-EMS Department
Posted by John Ard
38m ·
The Town of Westlake Emergency Management Office needs your help. Emergency management focuses on preparedness, mitigation, response, and recovery from incidents that may occur in our town. An objective of the Westlake Fire-EMS Department is to reduce or eliminate the city's vulnerability to disasters by actively engaging in hazard mitigation and disaster preparedness activities. We want to receive community feedback to address local needs and concerns. Please click on the link below so you can complete an online survey to capture these concerns so we can better serve our community. The survey is also available on the Town's website under the Fire-EMS/Emergency Management tab.
English Survey: https://forms.office.com/r/9GBm6n280e
Spanish Survey: https://forms.office.com/r/bb0mXMcUS9

WESTWORTH VILLAGE

WHITE SETTLEMENT




WHITE SETTLEMENT
FIRE DEPARMENT
MEET THE FIRE CHIEF
ABOUT US
FIRE INSPECTIONS
FIRE MARSHAL
Search...
Welcome to White Settlement Fire Department
Here to Serve You
Our Department
Meet the Chief
Divisions
Services
Newsroom
Contact Us
FIRE POPULAR LINKS
Fee Schedule
Hazard Mitigation Plan

Survey Documentation

Tarrant County Hazard Mitigation Action Plan Public/Stakeholder Survey

Oct 27, 2024

What natural hazards concern you? We need your input on the risks from natural, man-made, and technological hazards that could affect Tarrant County, and what actions should be taken to reduce those risks.

* Required

This survey will help us understand your concerns about risks from natural hazards. Natural hazards could affect Tarrant County are numerous and provided in questions below.

How familiar are you with hazard mitigation? *

Hazard mitigation is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards.

- ◯ Not at all familiar
- ◯ Not very familiar
- ◯ Not sure
- ◯ Somewhat familiar
- ◯ Very familiar

How concerned are you about the following natural hazards impacting your community? *

	Very concerned	Somewhat concerned	Neutral
Drought	○	○	○
Earthquake	○	○	○
Expansive Soils	○	○	○
Flooding (including dam failure)	○	○	○
Thunderstorms (including hail, wind, lightning)	○	○	○
Tornadoes	○	○	○
Wildfire	○	○	○
Winter Storm	○	○	○

What parts of your community (including buildings, people, economic activities and events, and natural areas) are most at risk to these hazards? Please be specific, if known. *

What at-risk areas (including structures, infrastructures, and natural areas) or people in your community would you like to see protected from future disasters? Be specific, if known. *

Examples: 1) The corner of River St. and Main St. floods, consistently blocking traffic and access to River St. Hospital. 2) Main St. School was not built to current codes. It should be prioritized for a mitigation project to reduce risk from future earthquakes. 3) The residents in Forest Neighborhood are mostly elderly and not able to maintain enough defensible space around their property themselves. A community defensible space program could help reduce their wildfire risk. 4) New buildings were built off of River St. in the last five years, and now it floods every time it rains. Suggest we do a study to find out what is happening.

Rate the importance of the following statements in determining community priorities for reducing risk from future disasters. *

	Very Important	Somewhat Important	Neutral	Low I
Protecting private property	○	○	○	
Protecting transportation networks, hospitals, fire stations	○	○	○	
Preventing development in hazard areas (e.g., not allowing construction in floodplains	○	○	○	
Improving or preserving natural features such as streams and wetlands	○	○	○	
Protecting historical and cultural landmarks	○	○	○	
Encouraging collaboration between government agencies, individuals, non-profit organizations, and companies	○	○	○	
Protecting and reducing damage to utility structures (utility poles, lines, and wires)	○	○	○	
Incorporating natural features or processes into the built environment to promote sustainability, adaptation, and resilience (allowing forests to regrow, restoring wetlands and streams, improving air and water quality)	○	○	○	
Strengthening emergency services (e.g., police, fire, ambulance)	○	○	○	

Please indicate how likely you are to support the following types of community actions to reduce risk. *

	Very Supportive	Somewhat Supportive	Neutral	Somew
Retrofitting or relocating critical facilities in high-risk areas	○	○	○	
Equipping critical facilities with emergency power sources	○	○	○	
Funding studies to understand risk and develop mitigation recommendatio ns	○	○	○	
Creating and maintaining defensible space around structures and infrastructure to reduce wildfire risk	○	○	○	
Developing community groups to support vulnerable populations before, during, and after a disaster event	○	○	○	
Sharing the draft Hazard Mitigation Plan through social media for public comment	○	○	○	
Implement-ing nature-based solutions like rain gardens, open space programs, and stream restoration.	○	○	○	
Adopting and enforcing current building codes	○	○	○	
Adopting and enforcing more stringent building codes (such as requiring additional elevation of properties in high-risk flood zones)	○	○	○	
Adopting higher				

regulatory standards for new development within unstable slope areas	○	○	○
Incorporating drought-tolerant plants into public landscaping	○	○	○
Upgrading culverts and stormwater management systems	○	○	○
Developing and enforcing water conservation measures during drought conditions	○	○	○
Holding public education/outreach events on mitigation	○	○	○
Providing the public more technical information on how to reduce risk	○	○	○

What other types of hazard mitigation activities would you support in your community taking? Be specific if you know an area or structure which needs to be mitigated. *

For your own property or business, what have you done to protect your own home from natural hazards? Select all that apply. *

- [ ] Elevated and anchored utilities (like HVAC) to protect against flood damage
- [ ] Anchored bookcases or cabinets to walls
- [ ] Secured water heater to wall
- [ ] Installed a backflow valve on your sewer system to prevent sewage backup
- [ ] Used fire-retardant and/or flood-resistant materials in new construction
- [ ] Created 6 inches of vertical clearance between the ground and home siding to reduce the likelihood of fire ignition
- [ ] Installed a generator to provide emergency power
- [ ] Installed a rain harvesting system
- [ ] Used drought-tolerant plants in landscaping and planted shade trees to reduce extreme heat effects and absorb rainwater
- [ ] Installed weather stripping on exterior doors and windows
- [ ] Constructed or installed a tornado shelter in or near the home
- [ ] Reinforced garage and double-entry doors to prevent failure under wind pressure
- [ ] Installed impact-resistant roofing shingles
- [ ] I rent my property and have not made changes.
- [ ] I am not sure.

What insurance coverage for natural hazards do you have? This may be found in your home or renters insurance policy. *

- [ ] Flood insurance
- [ ] Earthquake insurance
- [ ] Landslide insurance
- [ ] Fire insurance
- [ ] Windstorm insurance
- [ ] I do not have natural hazard insurance coverage
- [ ] I do not know if I have natural hazard insurance coverage

How do you get information about the hazards that could impact your community and steps to reduce your risk? Check all that apply. *

- [ ] Newspaper
- [ ] Television
- [ ] Radio
- [ ] Schools
- [ ] Public Workshops/Meetings
- [ ] Community groups, community members, word of mouth
- [ ] Direct mail
- [ ] Magazines
- [ ] Social media (Facebook, etc.)
- [ ] Digital advertising (pop-up ads)
- [ ] Outdoor advertisements (billboards)
- [ ] Text messages
- [ ] Other

How would you rate the effectiveness of disaster-related public education and awareness activities in your community? Check the best answer. *

- ○ I receive enough information on the hazards that threaten my community and understand how to reduce my risk from future disasters.
- ○ I receive enough information on the hazards that threaten my community but don't understand how I can reduce my risk from future disasters.
- ○ I do not receive enough information on my local hazards, but I understand how I can reduce my risk from future disasters.
- ○ I do not receive enough information on my local hazards, and I do not understand how I can reduce my risk from future disasters.

Which of the following statements applies to you? Check all that apply. *

- [ ] I am age 65 or older.
- [ ] I am age 18 or younger.
- [ ] I am a veteran.
- [ ] I have a disability.
- [ ] I primarily speak a language other than English at home.
- [ ] I am an immigrant.
- [ ] I am a single parent.
- [ ] I do not have stable housing.
- [ ] I am a woman.
- [ ] I am a person of color.
- [ ] I am a member of a tribe.
- [ ] I represent a socially vulnerable or underserved population.
- [ ] I identify as LGBTQIA+.
- [ ] My income is less than $46,200 for a one-person household.
- [ ] My household income is less than $52,800 for a two-person household.
- [ ] My household income is less than $59,400 for a three-person household.
- [ ] My household income is less than $65,950 for a four-person household.
- [ ] My household income is less than $71,250 for a five-person household.
- [ ] I identify with one or more of these groups but prefer not to specify.
- [ ] None of the above.

Where do you live or work? *

Which of the following statements applies to your work? *

- ◯ I work for the County or a City, Town or within Tarrant County
- ◯ I work for a special district within Tarrant County
- ◯ I work for a state or federal agency that operates in Tarrant County.
- ◯ I work for a neighboring jurisdiction.
- ◯ I work for a non-profit or community-based organization in Tarrant County.
- ◯ I work for a business in Tarrant County.
- ◯ I work for a school or university in Tarrant County.
- ◯ None of the above.

Do you have a disability or live with an individual with a disability and are concerned about when a disaster strikes? What planning concerns do you feel should be addressed?

Are you interested in learning more about hazard mitigation or participating in future projects? If so, please provide your email.

Appendix B: Acronyms

Appendix B: Acronyms

AAR	After Action Review
AEM	[company name]
CASA	Collaborative Adaptive Sensing of the Atmosphere
CDC	Corridor Development Certificate
CFR	Code of Federal Regulations
CRE	Community Resilience Estimates
CRF	Community Risk Factor
DFIRM	Digital Flood Insurance Rate Map
DFW	Dallas–Fort Worth
DMA 2000	Disaster Mitigation Act of 2000
EAL	expected annual loss
EMC	Emergency Management Coordinator
EOC	Emergency Operations Coordinator
EPA	United States Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FMAG	Fire Mitigation Assistance Grant
GIS	Geographic information systems
HazMAP	Hazard Mitigation Action Plan
HHPD	High Hazard Potential Dam
HMAP	Hazard Mitigation Action Plan [for the State of Texas]
HMGP	Hazard Mitigation Grant Program
HMPT	Hazard Mitigation Planning Team
HVAC	Heating, Ventilation, and Air Conditioning
KBDI	Keetch-Byram Drought Index
LAL	lightning activity level
MMI	Modified Mercalli Intensity [earthquake scale]
NCEI	National Centers for Environmental Information
NCTCOG	North Central Texas Council of Governments
NFIP	National Flood Insurance Program
NGDC	National Geophysical Data Center
NOAA	National Oceanic and Atmospheric Administration
NRI	National Risk Index
NWS	National Weather Service
PDSI	Presence-Sensing Device Initiation
PTSD	posttraumatic stress disorder

RCP	Representative Concentration Pathway [of temperature change]
SHELDUS	Spatial Hazard Events and Losses Database
SHMP	State Hazard Mitigation Plan
SVI	Social Vulnerability Index
TAD	Tarrant Appraisal District
TDEM	Texas Division of Emergency Management
TDPS	Texas Department of Public Safety
TFS	Texas Forest Service
TORRO	Tornado and Storm Research Organization
UNTHSC	University of North Texas Health Science Center
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
UTA	University of Texas at Arlington
WUI	Wildland–Urban Interface

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Appendix C: Dam Profile Information

Appendix C: Dam Profile Information (NOT PUBLIC)

Dam Failure Overview

This appendix consolidates all dam failure-related information for Tarrant County, including regulatory context, hazard classification, dam inventory, emergency action plans (EAPs), risk and vulnerability assessments, historical events, and detailed profiles for high hazard potential dams (HHPDs).

A dam is defined as a barrier constructed across a watercourse for the purpose of storing, controlling, or diverting water. Dams typically are constructed of earth, rock, concrete, or mine tailings. A dam failure is an accidental or unintentional collapse, breach, or other failure of an impoundment structure that results in downstream flooding. Because dams are human-made structures, dam failures are usually considered technological hazards.

State Dam Safety Office Coordination

In the development of Appendix C, the Texas Commission on Environmental Quality (TCEQ) played a pivotal role by serving as a primary source for regulatory guidance, dam inventory data, and emergency planning resources. TCEQ's dam safety office provided critical information regarding the classification of dams, including the identification and listing of high hazard potential dams (HHPDs) within Tarrant County for 2025. Their data was instrumental in risk and vulnerability assessments, ensuring that the profiles and historical events documented in the appendix reflected accurate and up-to-date regulatory standards. Additionally, the TCEQ dam safety office was contacted via phone call and email and provided supplemental guidance to assist with this effort. This collaboration with TCEQ ensured that Appendix C was grounded in authoritative state data and regulatory requirements.

High Hazard Potential Dam Criteria

The FEMA High Hazard Potential Dam (HHPD) grant program was established to provide financial assistance for the rehabilitation of non-Federal dams that pose a significant risk to public safety due to their classification as high hazard potential. The history of the program reflects a growing recognition of the need to address aging infrastructure and prevent catastrophic dam failures by supporting state-regulated dams that do not meet minimum safety standards. The intent of the program is to reduce risks associated with dam failures by ensuring that eligible dams are brought up to safety codes, have approved emergency action plans, and are properly maintained to protect downstream communities and critical assets.

A dam considered as eligible under the grant must meet the following criteria:[139]

> (A) In general, the term "eligible high hazard potential dam" means a non-Federal dam that

[139] FEMA, "Rehabilitation of High Hazard Potential Dams Grant Program," https://www.fema.gov/grants/mitigation/learn/dam-safety/rehabilitation-high-hazard-potential-dams.

(i) is located within a state with a state dam safety program and regulated under that state dam safety program;

(ii) is classified as high hazard potential by the relevant state dam safety agency;

(iii) has an emergency action plan that

I. is approved by the relevant state dam safety agency; or

II. is in conformance with state law and pending approval by the relevant state dam safety agency

(iv) fails to meet minimum dam safety standards of the state in which the dam is located, as determined by the state dam safety agency;

(v) and has a condition assessment rating of POOR or UNSATISFACTORY as identified in the National Inventory of Dams (NID) no later than 9/15/2023.

(B) Exclusion: the term “eligible high hazard potential dam” does not include

a licensed hydroelectric dam under a hydropower project with an authorized installed capacity of greater than 1.5 megawatts; or

a dam built under the authority of the Secretary of Agriculture under 33 U.S.C. § 467(4)(A)

Utilizing the criteria, it was determined that 2 of the State-regulated dams within Tarrant County meet the provided criteria to be considered a high hazard potential dam or HHPD.

For the purposes of this appendix, information about all dams will be provided, however analysis will be focused on those qualifying for HHPD.

LOCATION AND EXTENT

The hazard extent rating scale for dam failure is based on the amount of potential damage that can be caused by a failure. For the purposes of this hazard analysis, damage from dam failure takes into account only those areas where developed property is affected. Dam failures can cause extensive damage; thanks to diligent maintenance and an array of other measures to ensure structural integrity, none has been recorded in Tarrant County. Of the 67 dams in Tarrant County, 95% are owned/managed by a state agency, and 3% are regulated by a federal agency.[140]

Figure 97 provides a view of dam location and extent for the high and significant hazard dams within Tarrant County. Table 54 summarizes the number high/significant hazard potential dams in Tarrant

[140] National Inventory of Dams, https://nid.sec.usace.army.mil/#/dams/search/sy=@countyState:Tarrant,%20Texas&viewType=map&resultsType=dams&advanced=false&hideList=false&eventSystem=false.

County provided by the TCEQ, by jurisdiction and their ownership status (public/private). It was presumed that dams not paired with a city name are located in unincorporated areas of Tarrant County, however this may not be accurate.

Table 54: Ownership of High/Significant Hazard Dams in Tarrant County, by Jurisdiction[141]

Jurisdiction	Number of High/Significant Hazard Dams (TCEQ)	Private Ownership	Public Ownership
Arlington	4	1	3
Bedford	1	0	1
Crowley	1	1	0
Dalworthington Gardens (not profiled for this plan)	1	0	1
Euless	2	1	1
Fort Worth	18	4	14
Haltom City	1	0	1
Hurst	1	0	1
North Richland Hills	2	2	0
Southlake	2	2	0
Watauga	1	0	1
Westlake	6	6	0
Possibly Unincorporated Tarrant County	4	0	4
Totals	**44**	**17**	**27**

[141] TCEQ, Tarrant County Dam Report, 08/2025.

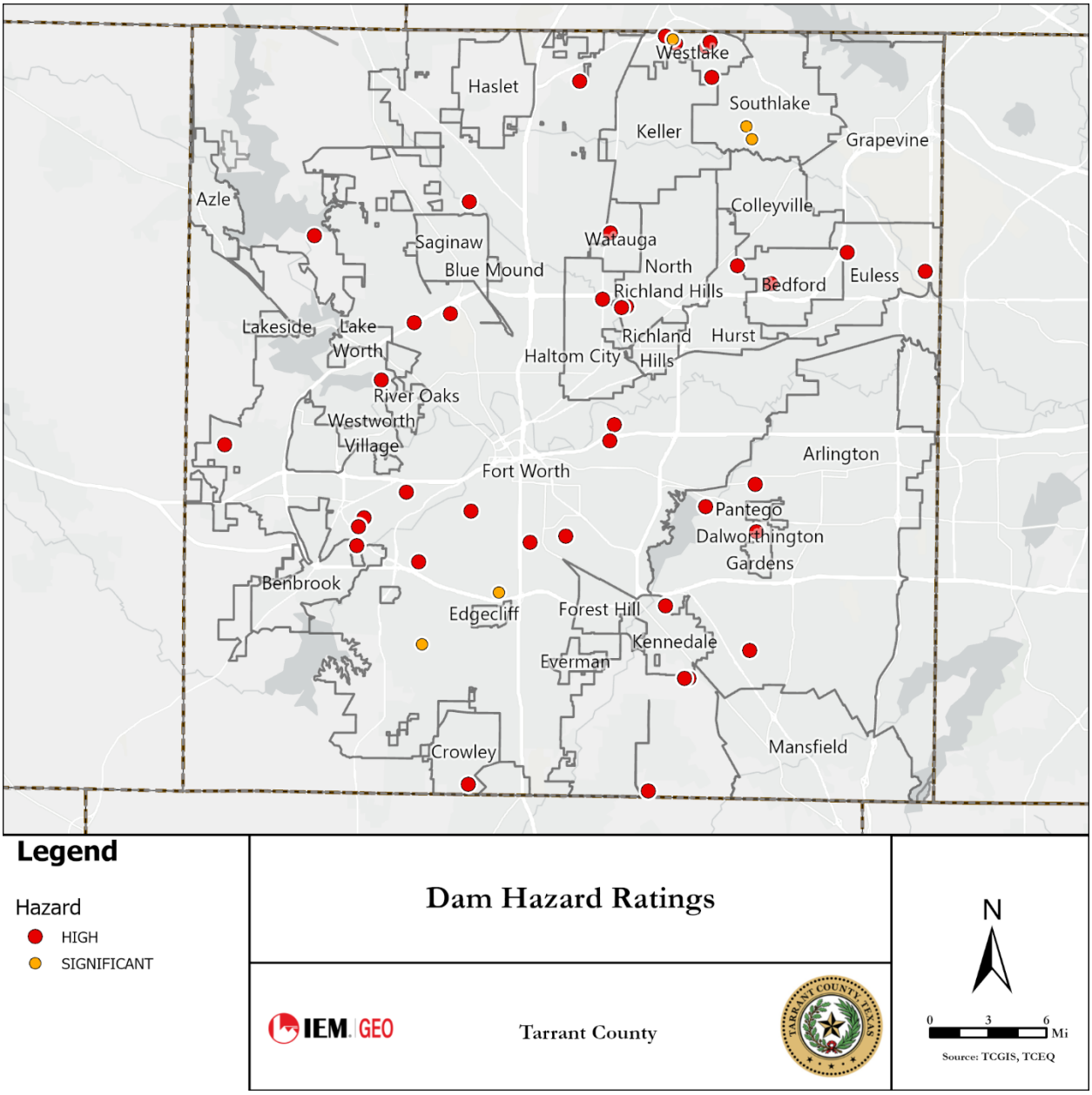

Figure 97: High and Significant Hazard Dam Ratings for Tarrant County[142]

EXTENT DESCRIPTION

Extent for dams is categorized by hazard level as well as dam condition. The TCEQ includes all dams meeting the following criteria, shown in Figure 98, from their Texas Dam Safety program jurisdiction.

Height is equal to or exceeds 25 feet, and storage exceeds 15 acre-feet.

Height exceeds 6 feet, and storage is equal to or exceeds 50 acre-feet

[142] TCEQ, Tarrant County Dam Report, 08/2025.

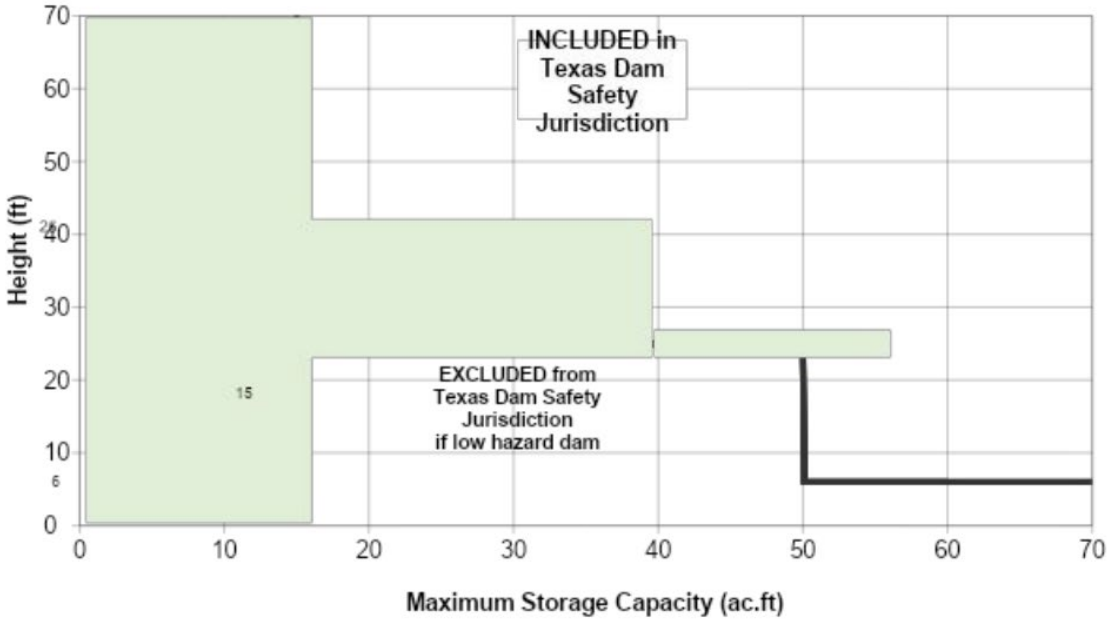

Figure 98: TCEQ Dam Safety Jurisdiction Criterion by Height and Maximum Storage Capacity[143]

For the purposes of targeted analysis, this appendix limited analysis to dams that are included in the Texas Dam Safety Jurisdiction and classified as High or Significant hazard.

HAZARD CLASSIFICATIONS

Hazard classifications issued by the TCEQ are based on potential loss of human life or property downstream. This classification is not based on the condition of the dam.

According the Dam Safety 101 curriculum provided by the TCEQ, the following characteristics are used to classify dams in Texas.

HIGH HAZARD POTENTIAL CLASSIFICATION

Loss of life is expected as the TCEQ hazard analysis indicates that three or more habitable structures are likely to be impacted by the failure of the dam. In addition to an expected loss of life, the high classification is also associated with excessive economic loss and extensive damage to public facilities, agricultural, industrial, or commercial facilities, public utilities, main highways and railroads used as a major transportation system.

SIGNIFICANT HAZARD POTENTIAL CLASSIFICATION

Loss of life is possible as the TCEQ hazard analysis indicates that one to two habitable structures are likely being impacted by the failure of the dam. In addition to the possible loss of life, significant hazard classification is also associated with appreciable economic loss through the anticipated damage to

[143] TCEQ, “Texas Dam Safety Program: Dam Safety 101” presentation file. DamSafety101_2.23.22.pptx.pdf

isolated homes, secondary highways, damage to minor railroads or interruption of service or use of public facilities.

LOW HAZARD POTENTIAL CLASSIFICATION

No loss of life is expected as the TCEQ hazard analysis indicates that there are no habitable homes expected to be impacted by the failure of the dam.

In addition to no expected loss of life, the low hazard classification is also associated with minimal economic loss, with impacts limited to local roads and limited agricultural improvements/farm buildings.

Table 55 lists the high and significant hazard dams in Tarrant County provided by the TCEQ as a report sent to the Tarrant County Office of Emergency Management in August of 2025.

Table 55: Complete Inventory of Dams for Tarrant County for all High and Significant Levels[144]

Name	Meets HHPD Criterion for Classification, EAP, Condition	TX ID	Jurisdiction	Classification	Owner	EAP	EAP Utilized Data	Condition	Height (ft)	Storage (Acre-Ft)	Risk	Day Population	Night Population	Buildings
Allan Saxe Pond	No, Fair Condition	TX09561	Arlington	**High**	City of Arlington	Yes	Identification and description of the dam. Inundation zones unavailable.	Fair	9	3	No risk index for dam	Unknown	Unknown	Unknown
Arlington Southwest Nature Preserve Dam	Yes	TX07226	Arlington	**High**	City of Arlington	Yes	Identification and description of the dam. Inundation zones unavailable.	Poor	24	69	No risk index for dam	Unknown	Unknown	Unknown
Bal Lake Dam	Yes	TX07108	Fort Worth	**High**	Jearl Walker	Yes	EAP last updated 05/24/2010	Poor	22	31	No risk index for dam	Unknown	Unknown	Unknown
Boys Ranch Activity Center Dam	No, Good Condition	TX07434	Bedford	**High**	City of Bedford Parks Department	Yes	EAP last updated 09/21/2015	Good	18	50	No risk index for dam	Unknown	Unknown	Unknown
Capp Smith Park Retention Lake Dam	No, Good Condition	TX07030	Watauga	**High**	City of Watauga	Yes	EAP last updated 02/18/2010	Good	20	287	No risk index for dam	Unknown	Unknown	Unknown
Cement Creek Dam	No, Good Condition	TX04794	Fort Worth	**High**	Tarrant Regional Water District	Yes	Identification and description of the dam. Inundation	Good	63	4,200	No risk index for dam	Unknown	Unknown	Unknown

[144] Source: National Inventory of Dams, https://nid.sec.usace.army.mil/#/dams/search/sy=@countyState:Tarrant,%20Texas&viewType=map&resultsType=dams&advanced=false&hideList=false&eventSystem=false. And TCEQ Report from August 2025
Italicized dams are not in the participating jurisdictions of this hazard mitigation plan update..

Name	Meets HHPD Criterion for Classification, EAP, Condition	TX ID	Jurisdiction	Classification	Owner	EAP	EAP Utilized Data	Condition	Height (ft)	Storage (Acre-Ft)	Risk	Day Population	Night Population	Buildings
							zones unavailable.							
Chisholm Park Lake Dam	No, Good	TX09608	Hurst	**High**	City of Hurst	Yes	Identification and description of the dam. Inundation zones unavailable.	Good	11	40	No risk index for dam	Unknown	Unknown	Unknown
Circle T Regional Detention Dam	No, No EAP and Good Condition	TX07499	Not Listed	**High**	Ail Investment LP	No	No EAP	Good	9	82	No risk index for dam	Unknown	Unknown	Unknown
Deer Creek Estates Dam	No, No EAP and Fair Condition	TX06938	Not Listed	**High**	Deer Creek Estates Homes	No	No EAP	Fair	14	126	No risk index for dam	Unknown	Unknown	Unknown
Eagle Mountain Balancing Reservoir Dam	No, Fair Condition	TX07555	Not Listed	**High**	Tarrant Regional Water District	Yes	Identification and description of the dam. Inundation zones unavailable.	Fair	37	4,200	No risk index for dam	Unknown	Unknown	Unknown
Eagle Mountain Dam	No, Good Condition	TX00779	Fort Worth	**High**	Tarrant Regional Water District	Yes	Identification and description of the dam. Inundation zones unavailable.	Good	85	677,127	No risk index for dam	Unknown	Unknown	Unknown
East Balancing Reservoir Dam	No, Good Condition	TX05215	*Bisbee*	**High**	*Tarrant Regional Water District*	*Yes*	EAP last updated 01/13/2011	Good	42	488	No risk index for dam	Unknown	Unknown	Unknown

Name	Meets HHPD Criterion for Classification, EAP, Condition	TX ID	Jurisdiction	Classification	Owner	EAP	EAP Utilized Data	Condition	Height (ft)	Storage (Acre-Ft)	Risk	Day Population	Night Population	Buildings
Echo Lake Dam	No, Fair Condition	TX04558	Fort Worth	**High**	Tarrant County	Yes	EAP last updated 02/17/2012	Fair	33	780	No risk index for dam	Unknown	Unknown	Unknown
Eden Lake Dam	No, No EAP and Good Condition	TX07155	Fort Worth	**High**	The Landing at Eden Lake Homeowners Association	No	Identification and description of the dam. Inundation zones unavailable.	Good	26	68	No risk index for dam	Unknown	Unknown	Unknown
Elkins Lake Dam	No, Fair Condition	TX07432	Dalworthington Gardens	**High**	City of Dalworthington Gardens	Yes	EAP last updated 07/30/2019	Fair	21	118	No risk index for dam	Unknown	Unknown	Unknown
Fidelity North Lake Dam	No, Fair Condition	TX07121	*Trophy Club*	**High**	*FMR Texas Limited Partnership*	*Yes*	Identification and description of the dam. Inundation zones unavailable.	Fair	24	81	No risk index for dam	Unknown	Unknown	Unknown
Fidelity South Lake Dam	No, Fair Condition	TX07120	*Trophy Club*	**High**	*FMR Texas Limited Partnership*	*Yes*	Identification and description of the dam. Inundation zones unavailable.	Fair	18	58	No risk index for dam	Unknown	Unknown	Unknown
Fosdic Lake Dam	No, Fair Condition	TX04416	Fort Worth	**High**	City of Fort Worth	Yes	EAP last updated 12/20/2010	Fair	29	125	No risk index for dam	Unknown	Unknown	Unknown
French Lake Dam	No, Significant Hazard and Good Condition	TX07106	Fort Worth	**Significant**	City of Fort Worth	Yes	EAP last updated 12/20/2010	Good	13	67	No risk index for dam	Unknown	Unknown	Unknown

Name	Meets HHPD Criterion for Classification, EAP, Condition	TX ID	Jurisdiction	Classification	Owner	EAP	EAP Utilized Data	Condition	Height (ft)	Storage (Acre-Ft)	Risk	Day Population	Night Population	Buildings
Glen Garden Golf and Country Club Dam	No, Good Condition	TX07064	Not listed	**High**	Glen Garden Golf and Country Club	Yes	Identification and description of the dam. Inundation zones unavailable.	Good	18	41	No risk index for dam	Unknown	Unknown	Unknown
Greenbriar Dam	No, Significant Hazard and Fair Condition	TX09625	Fort Worth	**Significant**	City of Fort Worth	Yes	EAP last updated 12/20/2010	Fair	11	11	No risk index for dam	Unknown	Unknown	Unknown
Knapp Lake Dam	No, No EAP and Fair Condition	TX00782	Haltom City	**High**	Texas Department of Transportation	No	Identification and description of the dam. Inundation zones unavailable.	Fair	30	154	No risk index for dam	Unknown	Unknown	Unknown
Lake Arlington Dam	No, Good Condition	TX00776	Arlington	**High**	City of Arlington	Yes	Identification and description of the dam. Inundation zones unavailable.	Good	99	130,000	No risk index for dam	Unknown	Unknown	Unknown
Lake Como Dam	No, Good Condition	TX00777	Fort Worth	**High**	City of Fort Worth	Yes	EAP last updated 12/20/2010	Good	51	327	No risk index for dam	Unknown	Unknown	Unknown
Lake Mb 3a Dam	No, No EAP and Fair Condition	TX07076	Not listed	**High**	Hillwood Properties Corporation	No	No EAP	Fair	12	20	No risk index for dam	Unknown	Unknown	Unknown
Lake Mb3 Dam	No, No EAP	TX09448	Not listed	**High**	Hillwood Properties Corporation	No	No EAP	Poor	10	15	No risk index for dam	Unknown	Unknown	Unknown

Name	Meets HHPD Criterion for Classification, EAP, Condition	TX ID	Jurisdiction	Classification	Owner	EAP	EAP Utilized Data	Condition	Height (ft)	Storage (Acre-Ft)	Risk	Day Population	Night Population	Buildings
Lake Worth Dam	No, Good Condition	TX00785	Fort Worth	**High**	City of Fort Worth	Yes	Identification and description of the dam. Inundation zones unavailable.	Good	61	110,980	No risk index for dam	Unknown	Unknown	Unknown
Loughridge Lake Dam	No, Fair Condition	TX00778	Not listed	**High**	City of Fort Worth	Not Required	EAP last updated 12/20/2010	Fair	42	295	No risk index for dam	Unknown	Unknown	Unknown
Luther Lake Dam	No, Good Condition	TX07457	Fort Worth	**High**	City of Fort Worth	Yes	Identification and description of the dam. Inundation zones unavailable.	Good	12	67	No risk index for dam	Unknown	Unknown	Unknown
Mansfield ISD Ron Whitson Agricultural Center Dam	No, No EAP and Good Condition	TX00784	Mansfield	**High**	Mansfield Independent School District (ISD)	No	Identification and description of the dam. Inundation zones unavailable.	Good	85	16,491	No risk index for dam	Unknown	Unknown	Unknown
Marine Creek Dam	No, Good Condition	TX09552	Fort Worth	**High**	Tarrant Regional Water District	Yes	EAP last updated 12/17/2010	Good	12	32	No risk index for dam	Unknown	Unknown	Unknown
McPherson Ranch Dam	No, Good Condition	TX05790	Fort Worth	**High**	McPherson Ranch Owners Association	Yes	Identification and description of the dam. Inundation zones unavailable.	Good	24	129	No risk index for dam	Unknown	Unknown	Unknown
Meadows Lakes East Lake Dam	No, No EAP and Fair Condition	TX09598	Richland Hills	**High**	Meadow Lakes Community Improvement Association,	No	No EAP	Fair	16	26	No risk index for dam	Unknown	Unknown	Unknown

Name	Meets HHPD Criterion for Classification, EAP, Condition	TX ID	Jurisdiction	Classification	Owner	EAP	EAP Utilized Data	Condition	Height (ft)	Storage (Acre-Ft)	Risk	Day Population	Night Population	Buildings
					Skylark Circle Community Improvement Association									
Meadows Lakes West Lake Dam	No, No EAP and Fair Condition	TX00787	North Richland Hills	**High**	Meadow Lakes Community Improvement Association, Skylark Circle Community Improvement Association	No	No EAP	Fair	10	130	No risk index for dam	Unknown	Unknown	Unknown
Park Hill Detention Dam	No, Good Condition	TX07572	Fort Worth	**High**	N/A	Yes		Good	Not available	Not available				
Pd3 1 East Lake Dam 1	No, Good Condition	TX07137	Not listed	**High**	The Vaquero Club Inc.	Yes	Identification and description of the dam. Inundation zones unavailable.	Good	23	100	No risk index for dam	Unknown	Unknown	Unknown
Ridglea Country Club Estates Dam	No, No EAP and Fair Condition	TX09003	Not listed	**High**	David Smith, Mark Gerrick, Shawn Smith	No	No EAP	Fair	23	23	No risk index for dam	Unknown	Unknown	Unknown
Stone Lakes Dam	No, Significant Hazard and Good Condition	TX07487	Not listed	**Significant**	Stone Lake Homeowners Association	Yes	Identification and description of the dam. Inundation zones unavailable.	Good	16	57	No risk index for dam	Unknown	Unknown	Unknown

Name	Meets HHPD Criterion for Classification, EAP, Condition	TX ID	Jurisdiction	Classification	Owner	EAP	EAP Utilized Data	Condition	Height (ft)	Storage (Acre-Ft)	Risk	Day Population	Night Population	Buildings
Timberlake Phase 5	No, Significant Hazard and Good Condition	TX09321	Southlake	**Significant**	Timber Lake Residential Association Inc, City of Southlake	Yes	Identification and description of the dam. Inundation zones unavailable.	Good	12	37	No risk index for dam	Unknown	Unknown	Unknown
Trigg Lake Dam	No, Good Condition	TX05801	Irving	**High**	Dallas-Fort Worth International Airport Board	Yes	Identification and description of the dam. Inundation zones unavailable.	Good	46	1,012	No risk index for dam	Unknown	Unknown	Unknown
West Balancing Reservoir Dam	No, Good Condition	TX05216	Bisbee	**High**	Tarrant Regional Water District	Yes	EAP last updated 01/13/2011	Good	54	568	No risk index for dam	Unknown	Unknown	Unknown
White Lake Dam	No, Fair Condition	TX00783	Fort Worth	**High**	Catholic Diocese of Fort Worth, Nolan High School	Yes	EAP last updated 03/08/2019	Fair	33	294	No risk index for dam	Unknown	Unknown	Unknown
Willow Creek Lake Dam	No, Good Condition	TX04796	Fort Worth	**High**	City of Fort Worth	Yes	EAP last updated 12/20/2010	Good	11	76	No risk index for dam	Unknown	Unknown	Unknown
Woodland West Lake Dam	No, Fair Condition	TX05825	Pantego	**High**	Woodland West Lake Association	Yes	Identification and description of the dam. Inundation zones unavailable.	Fair	13	69	No risk index for dam	Unknown	Unknown	Unknown

EXTENT SUMMARY

According to the TCEQ report data, the following key findings were identified.

- Forty state-regulated dams in Tarrant County are rated as “high hazard” and four as “significant hazard.”
- Twenty-nine of the 40 high-hazard dams and all four of the significant-hazard dams have emergency action plans (EAPs). One high hazard dam listed was identified as not requiring an EAP. Twenty-five percent of high hazard dams in Tarrant County lack an EAP.
- Of all high hazard dams with EAPs, two, the Arlington Southwest Nature Preserve Dam in Arlington and the Bal Lake Dam in Fort Worth, are considered high-hazard potential dams. The dams meet all criteria for HHPD, including high hazard, having an EAP, and being in Poor or Unsatisfactory condition.
- One dam, Lake Mb3, lacks an EAP to be eligible for HHPD eligibility, but is high hazard and in Poor condition.

Figure 99 provides the location of the high and significant dams within Tarrant County for High and Significant hazard classified dams.

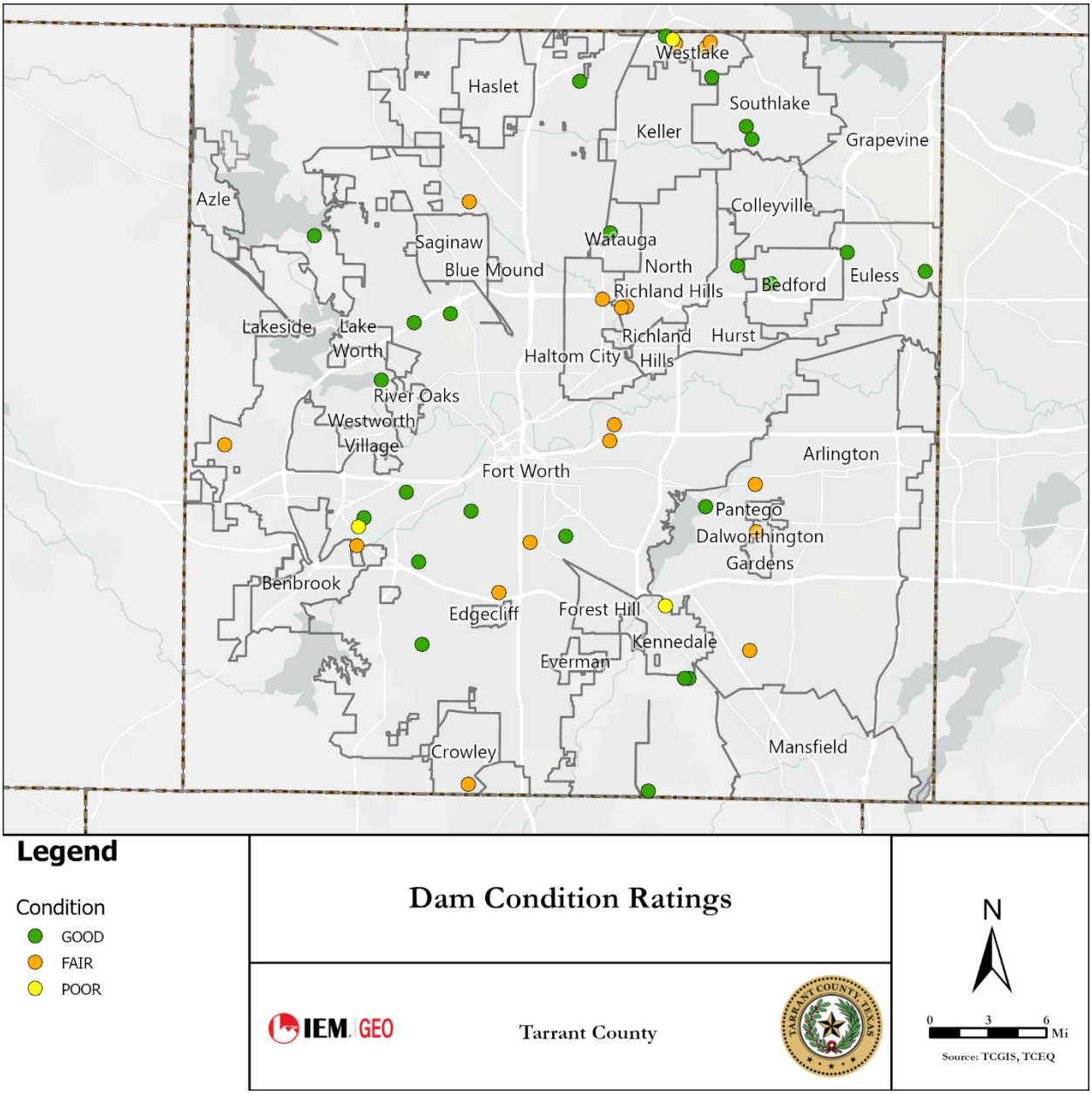

Figure 99: Dam Condition Ratings for High and Significant Hazard Dams in Tarrant County[145]

Probability of Future Events

Based on the FEMA Disaster Declarations Database, Tarrant County has received no designation for dam failure disaster declarations since the last plan update. In addition, the State has had no declarations for dam failure for Tarrant County.

The 2023 Texas State Hazard Mitigation Plan states a relatively small number of historical dam failure events have been recorded in the state of Texas, though the risk of dam failure is monitored closely by

[145] TCEQ, Tarrant County Dam Report, 08/2025.

TCEQ and local emergency managers. Relying solely on historical events, the probability of a significant future event is low for Texas. However, high-risk areas across the state are experiencing increases in population and urban construction, increasing the overall risk from dam failure. The potential increases in future rainfall intensity and duration will directly lead to an additional pressure placed on dam systems during future flood events. Additionally, aging dams increase the possibility of dam failure and the risk of catastrophic flooding inside dam inundation zones. Probability of a dam failure event in Texas is considered "Occasional" or an event possible in the next five years.[146]

General Vulnerability Assessment of Dams

Complete dam failure can be triggered by heavy rainfall, earthquakes, and flooding. With several areas in the county increasing in population and infrastructure (both public and private), this could damage a significant amount of infrastructure, property values, and commerce disruption.

VULNERABLE POPULATIONS

The failure of dams can have devastating consequences on the population, leading to significant loss of life, displacement, and long-term socioeconomic impacts. When a dam fails, it can result in uncontrolled flooding, posing a grave threat to the safety and well-being of the population living in and downstream of the affected areas.

One of the immediate impacts of dam failures is the risk of drowning and physical harm to individuals. The sudden release of a large volume of water can inundate communities, trapping people in their homes or forcing them to seek refuge on rooftops or higher ground. Swift-moving floodwaters can sweep away individuals, making rescue and evacuation efforts extremely challenging.

Moreover, the failure of dams can lead to widespread displacement of the population. Residents in affected areas may be forced to evacuate their homes and seek temporary shelter in emergency facilities or with friends and relatives. Displacement disrupts lives, separates families, and strains the resources and capacities of hosting communities. It can also result in long-term homelessness and the need for extensive efforts to provide adequate housing and support for the affected population.

In addition to the immediate physical risks, dam failures can have long-term socioeconomic impacts on the affected population. The loss of homes, businesses, and infrastructure disrupts local economies and livelihoods. Individuals may lose their jobs, and businesses may be unable to operate, leading to financial instability and hardship. The recovery and reconstruction process can be lengthy, causing prolonged economic disruptions and affecting the overall well-being of the population.

[146] 2023 Texas State Hazard Mitigation Plan, TDEM, https://txdem.sharepoint.com/sites/TDEMWebsiteFiles/Shared%20Documents/Forms/AllItems.aspx?id=%2Fsites%2FTDEMWebsiteFiles%2FShared%20Documents%2FMitigation%2FState%20of%20Texas%20HMAP%20Update%20%2D%2010%2E27%2E23%2Epdf&parent=%2Fsites%2FTDEMWebsiteFiles%2FShared%20Documents%2FMitigation&p=true&ga=1.

Populations vulnerable to dam failure encompass various groups that face increased risks. One particular vulnerable group includes communities living downstream of dams or along the path of potential floodwaters caused by dam failure. These individuals and families are at a high risk of sudden, large-scale flooding if the structures fail to hold back the water effectively.

Low-lying areas and floodplains are especially susceptible to the impacts of dam failures. These regions, often prone to flooding, face an elevated risk of inundation when structures in these areas fail. Consequently, populations residing in these areas are more vulnerable to the devastating consequences of such failures.

The concentration of infrastructure, utilities, and a large number of residents in these areas increases the potential impact of dam failures. The risks include widespread flooding, damage to critical infrastructure, and the safety and well-being of a significant population.

IMPACT ON COUNTY ASSETS

If a dam were to fail in Tarrant County, the impact on county assets could be catastrophic. Floodwaters would likely inundate large areas downstream, severely damaging infrastructure such as roads, bridges, and public utilities. Critical facilities like hospitals, emergency services, and schools could be compromised, disrupting essential services. Residential and commercial properties in floodplains could face extensive damage, displacing residents and businesses and causing economic losses. Additionally, agricultural lands and natural habitats could be devastated, leading to long-term environmental and economic repercussions for the county.

COMMUNITY LIFELINES

Lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function. Community lifelines are essential for the well-being of any community. They provide support and assistance to individuals who require help, especially during times of crisis. FEMA Community Lifelines are a critical component of emergency management in the United States. These lifelines are designed to address the essential needs of a community during and after a disaster. There are eight lifelines, each with its own focus and purpose (see Figure 100).

Figure 100: Community Lifelines[147]

In the event of dam failure, there is a risk of failure in all eight of FEMA's Community Lifelines: safety and security; food, hydration, and shelter; health and medical; energy; transportation; hazardous materials; communications; and water systems. This can result in catastrophic loss of life and property. Flooded roads can be impassible, making it difficult for emergency services to reach affected communities. The infrastructure may also be damaged or washed away. Crops and livestock may be destroyed, and power outages can lead to a loss of energy-dependent structures and services. Also, clean drinking water may be scarce or unattainable, and storage of hazardous materials can be disrupted.

HHPD Qualifying Dam Assessment Profiles

EMERGENCY ACTION PLANS (EAPS) AND DATA GAPS

During the planning process, Tarrant County made efforts to engage local dam owners and the Texas State Dam Safety Office to obtain available data related to dam risk and downstream impacts. While Emergency Action Plans (EAPs) existed for some regulated structures, most dams within the county did not have associated inundation maps or detailed breach modeling available for planning purposes. As a result, a data deficiency was identified, particularly regarding the extent and depth of potential inundation zones.

The City of Arlington provided an inundation for Arlington Southwest Nature Preserve Dam, which supported the development of impact analysis for this plan.

The Bal Lake Dam is privately owned, and the City of Fort Worth is in ongoing coordination with the owner to obtain data to support future plan updates.

[147] Federal Emergency Management Agency, "Community Lifelines Implementation Toolkit 2.0," https://www.fema.gov/sites/default/files/2020-05/CommunityLifelinesToolkit2.0v2.

While not qualifying for HHPD, it is critical to notate the implied risk present for a non-profiled high hazard dam with poor condition, the Lake Mb3 Dam. The TCEQ indicates that the dam lacks an EAP and did not have data available for evaluation.

ARLINGTON SOUTHWEST NATURE PRESERVE DAM

DESCRIPTION

Figure 101: Sheri Capeheart Nature Preserve (City of Arlington)

The Arlington Southwest Nature Preserve Dam is a 24.2 foot high earthen dam located within the Trinity River basin. It is a 24.2-foot-high earthen dam that was constructed in 1989 on an unnamed tributary of Village Creek. The dam is located within the Sheri Capehart Nature Preserve (shown in Figure 101).With a storage capacity of 69 acre-feet and a surface area of 4.5 acres, the dam serves recreational and water management purposes.[148] It is maintained by the City of Arlington and regulated by the TCEQ. The dam has a poor condition rating and high hazard potential in a TCEQ Dam Safety report from 2025.

An Emergency Action Plan (EAP) is in place for the dam and an inundation study has been done to estimate the potential impacts of a dam breach. Figure 102 provides an ariel view of the dam, per the breach analysis document.[149]

[148] City of Arlington, “Sheri-Capehart Nature Preserve.” Sheri Capehart Nature Preserve | City of Arlington, TX
[149] Freese Nichols, “Arlington Southwest Preserve Dam TX07226 Hydrologic Assessment & Dam Breach Analysis”

Figure 102: Aerial View of Arlington Southwest Nature Preserve Dam

LOCATION

The Arlington Southwest Nature Preserve Dam is located in Arlington, Texas, south of West Interstate 20, and near the Oakhill Park Addition Subdivision.[150]

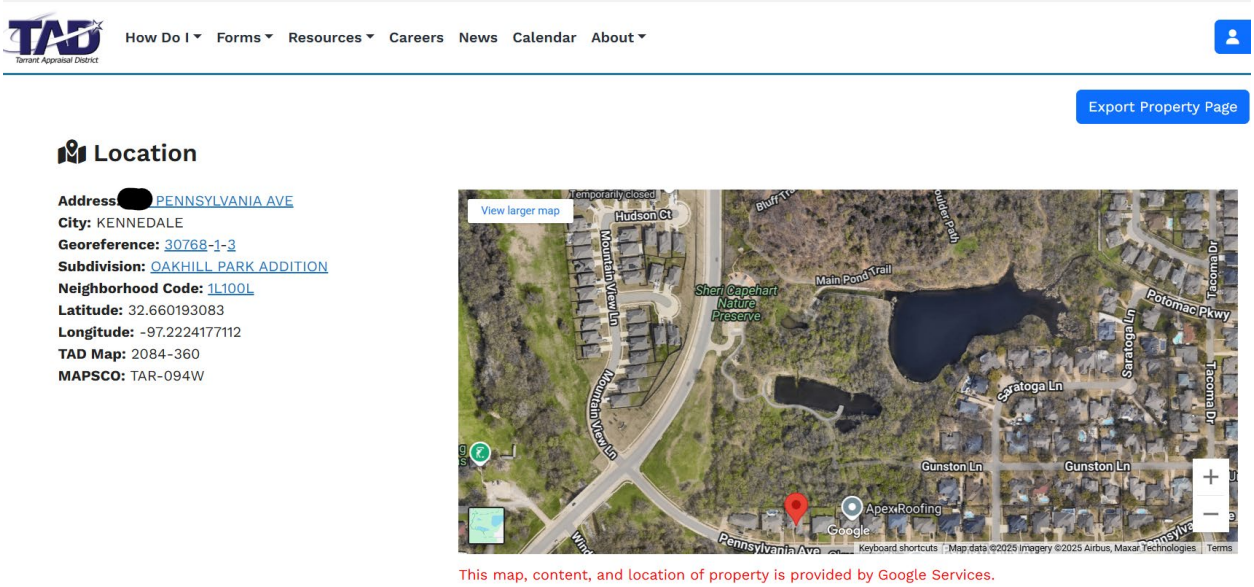

Figure 103: Arlington Southwest Nature Preserve Dam[151]

HISTORICAL EVENTS

While there has not been a failure to the Arlington Southwest Nature Preserve Dam, the City of Arlington has experienced dam incidents. A non-failure dam event occurred on October 29, 2018, at the Prestonwood Lake Dam (classified as Low Hazard by TCEQ and not profiled in this plan). The

[150] Tarrant County, "Tarrant County Appraisal District" Interactive Map - Tarrant Appraisal District
[151] Property Information - Tarrant Appraisal District

Association of State Dam Safety Officers describe the event as, “SPILLWAY FAILURE, SUBSEQUENTLY BREACHED TO AVOID A FAILURE.” This event did not impact any residences or structures directly.[152]

DAM FAILURE IMPACT CALCULATION METHODOLOGY

In coordination with the City of Arlington Office of Emergency Management, a hydrologic and hydraulic analysis of a dam failure scenario was provided to calculate potential damages and impacts to people and places within Tarrant County. The hydrologic study included analysis of the impacts of a Probable Maximum Flood or PMF. This analysis was done in accordance with guidelines provided through the “Hydrologic and Hydraulic Guidelines for Dams in Texas-January 2007.” This data was analyzed against critical facilities and population data to calculate potential damages expected from a dam failure.

DAM FAILURE POTENTIAL BREACH STUDY RESULTS

Figure 104 provides an aerial view of the potential inundation area for a dam failure of the Arlington Southwest Nature Preserve Dam. Table 56 provides a description of the impacts to population and infrastructure.

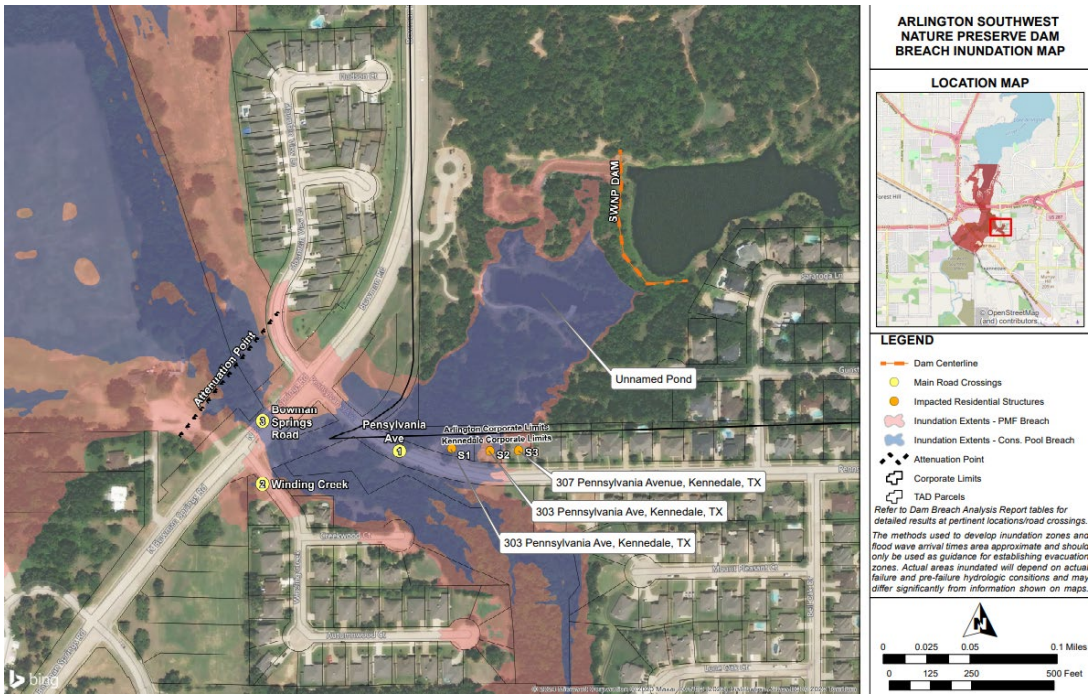

Figure 104: Aerial View of Arlington Southwest Preserve Nature Dam Failure Inundation Area[153]

[152]Association of State Dam Safety. Individual Incident | Association of State Dam Safety
[153] Freese Nichols, “Arlington Southwest Preserve Dam TX07226 Hydrologic Assessment & Dam Breach Analysis.”

Table 56: Potential Impacts of Arlington Southwest Nature Preserve Dam Failure

Damage Type	Potential Impact
Population	3 residences
Critical Facilities/Infrastructure	0
Roadways	3 main road crossings

The hydrologic and hydraulic analysis conducted on the dam indicate that the potential impacts expected for a dam breach include three residences, and no critical facilities or infrastructure. A breach would impact three main rain crossings during the event. Each of these is shown with markers identifying the at-risk areas in Figure 104.

SIGNIFICANT ECONOMIC, ENVIRONMENTAL, OR SOCIAL IMPACTS

Due to its location and function, a failure of the Arlington Southwest Nature Preserve Dam would result in economic, environmental and social impacts to the community. Located near a residential subdivision, the expenses incurred by the three houses within the predicted inundation zone would cause an economic impact to the homeowners. Functioning as a nature preserve, the impact of a breach of the dam would also result in environmental impacts to animal and plant life within the area. Two threatened species (federally and state designated) that have migratory patterns that pass through Tarrant County both nest in areas along bodies of water. Information about the threatened species of birds is provided in Table 57.

Table 57: Potential Environmental Dam Failure Impacts to Threatened Species in Tarrant County[154]

Type	Name	Federal Designation	State Designation	Reason
Bird	Black Rail *Laterallus jamaicensis*	Threatened	Threatened	Due to the county's location along common migratory routes, this bird nests along bodies of water.
Bird	Piping Plover *Charadrius melodus*	Threatened	Threatened	Due to the county's location along common migratory routes, this bird nests along bodies of water.

The dam also functions as a recreation center for the community. A dam breach would impact the sports and activities that the public enjoy at the preserve, creating a social impact. A prolonged loss of access would be expected during and after the event as the nature preserve is evacuated and then closed for repairs to the dam and recovery of the park.

POTENTIAL CASCADING VULNERABILITY/IMPACTS

Due to its location in a nature preserve with many of the characteristics of a wildland-urban interface, the risk for wildfire is amplified. In addition, public access to the dam also increases risk, as visitors could

[154] Texas Parks & Wildlife, "Rare, Threatened, and Endangered Species of Texas GIS Viewer". Rare, Threatened, and Endangered Species of Texas

cause accidental or intentional ignitions within the park. A large uncontrolled fire could impede access to the dam during a cascading event.

Seismic activity in Arlington is ranked as “Very Low” in Figure 35: Seismic Risk Level for Tarrant County and according to Figure 36: Historic Earthquake Epicenters in Tarrant County, the closest historical earthquake epicenter was a 1.0 magnitude event.

BAL LAKE DAM

DESCRIPTION

Bal Lake Dam, located in Fort Worth, is a small, privately-owned earthfill structure. The dam was completed in 1961 and is 22 feet tall, 647 feet long and has a storage capacity of about 31 acre-feet. The dam has a high-hazard potential rating, and the TCEQ lists its condition as poor. Although privately owned, the dam is included in the 2019 City of Fort Worth Flood Response Plan.[155]

LOCATION

The Bal Lake Dam is located in Fort Worth, Texas, east of TX-183/Southwest Blvd and near the Ridglea Hills, and Estates at Ridglea Hills subdivisions. A map view of the Bal Lake Dam location is shown in Figure 105.

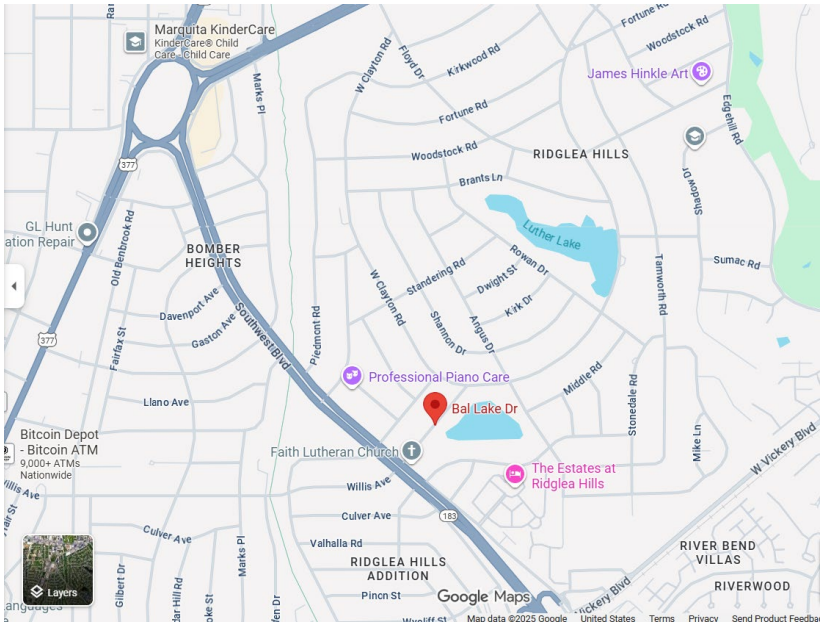

Figure 105: Bal Lake Dam Location

[155] City of Fort Worth, 2019 City of Fort Worth Flood Response Plan. https://www.fortworthtexas.gov/files/assets/public/v/1/tpw/documents/b9eeb289-8dfd-423f-9623-aa216e7155fc.pdf

HISTORICAL EVENTS

According to the Association of State Dam Safety Officers' Dam Incident Database, there has never been a recorded dam failure in Fort Worth.[156]

DAM FAILURE IMPACT

While the City is in contact with the owner of the dam and contacted them for an EAP and data to support the development of a dam breach analysis, there is no data to be shared. This data deficiency impacts the ability to accurately predict the impacts of an event; however, the jurisdiction intends to continue coordination with the owner to provide more information during the next Tarrant County HMP event.

Generically, by virtue of the TCEQ high hazard classification, the following impacts can be implied:

Loss of life is expected as the designation qualifies that 3 or more habitable structures are likely to be impacted by the failure of the dam. In addition to an expected loss of life, the high classification is also associated with excessive economic loss and extensive damage to public facilities, agricultural, industrial, or commercial facilities, public utilities, main highways and railroads used as a major transportation system.

More exact and detailed impact information can be ascertained upon successful collaboration and coordination with the private dam owner for information to support dam inundation analysis.

SIGNIFICANT ECONOMIC, ENVIRONMENTAL OR SOCIAL IMPACTS

The Bal Lake Dam is amid a significantly populated area. Due to its location near residences and arterial roads such as Southwest Boulevard (State Highway 183), a dam failure for Bal Lake would likely cause damage or access issues for residences, resulting in a social impact and possible economic impact to the homeowners. Further social impact is likely to occur due to the dam's location within one half mile of Ridglea Hills Elementary School, and within one tenth of a mile from the Faith Lutheran Church. While the failure may or may not result in damages to these two gathering places, the impacts of a breach would likely impact access to these two structures that host gatherings for the public for education and worship. According to the Faith Lutheran website,[157] the location is also available for parties, meetings and special events, indicating additional social/economic impacts in those events are cancelled due to dam failure.

While exact environmental impacts cannot be validated without an environmental assessment, the Texas Parks & Wildlife, "Rare, Threatened, and Endangered Species of Texas" GIS viewer indicates that Tarrant county is home to multiple state and/or Federally recognized designations as rare, threatened, or endangered species.

[156] Association of State Dam Safety Officers," Dam Incident Database," Dam Incident Database Search | Association of State Dam Safety.
[157] Faith Lutheran Church, "About page," Visit — Faith Lutheran Church.

Table 58: Potential Environmental Dam Failure Impacts to Threatened Species in Tarrant County[158]

Type	Name	Federal Designation	State Designation	Reason
Bird	Black Rail *Laterallus jamaicensis*	Threatened	Threatened	Due to the county's location along common migratory routes, this bird nests along bodies of water.
Bird	Piping Plover *Charadrius melodus*	Threatened	Threatened	Due to the county's location along common migratory routes, this bird nests along bodies of water.

POTENTIAL CASCADING VULNERABILITY/IMPACTS

The location of the Bal Lake dam is in an area identified by the Texas Wildfire Risk Explorer tool as a minimal fire risk, indicating a low vulnerability to wildfire impacting the dam.[159]

Seismic activity in Arlington is ranked as "Very Low" in Figure 35: Seismic Risk Level for Tarrant County and according to Figure 36: Historic Earthquake Epicenters in Tarrant County, the nearest historic epicenters have not exceeded a magnitude of 2.0.

Conclusion/Summary

The City of Arlington and Tarrant County would benefit from the mitigation of the Arlington Southwest Nature Preserve dam. Meeting all criteria, the dam may be eligible for HHPD funding and accessing those funds would provide for the actions needed to mitigate the poor condition of the dam.

The City of Fort Worth and Tarrant County would benefit from continued coordination with the Bal Lake private dam owner in order to study impacts of inundation and provide the data for upcoming plan updates and opportunities for HHPD funding. TCEQ indicates that an EAP is on file and at the time of the hazard mitigation plan update, the City was awaiting submission of that document to their engineering office for analysis.

The Lake Mb3 dam, while not eligible for HHPD funding due to a lack of EAP, necessitates the development of an EAP. Due to the high hazard and poor condition of the dam, immediate action to pursue an EAP and inundation impact data would support future updates to the hazard mitigation plan and potential application activities for accessing funding to mitigate the high risk.

[158] Texas Parks & Wildlife, "Rare, Threatened, and Endangered Species of Texas GIS Viewer," Rare, Threatened, and Endangered Species of Texas.
[159] Texas A&M Forest Service, "Texas Wildfire Risk Explorer," TEXAS WRAP - Basic Viewer.

Appendix D: Adoptions

Appendix D: Adoptions

[Placeholder]