EXHIBIT

“A”

CITY OF ROUND ROCK

HAZARD MITIGATION ACTION PLAN UPDATE

2025 UPDATE

Mitigating Risk for a Safe, Secure, Sustainable Future

For more information, visit our website at:

https://www.roundrocktexas.gov/

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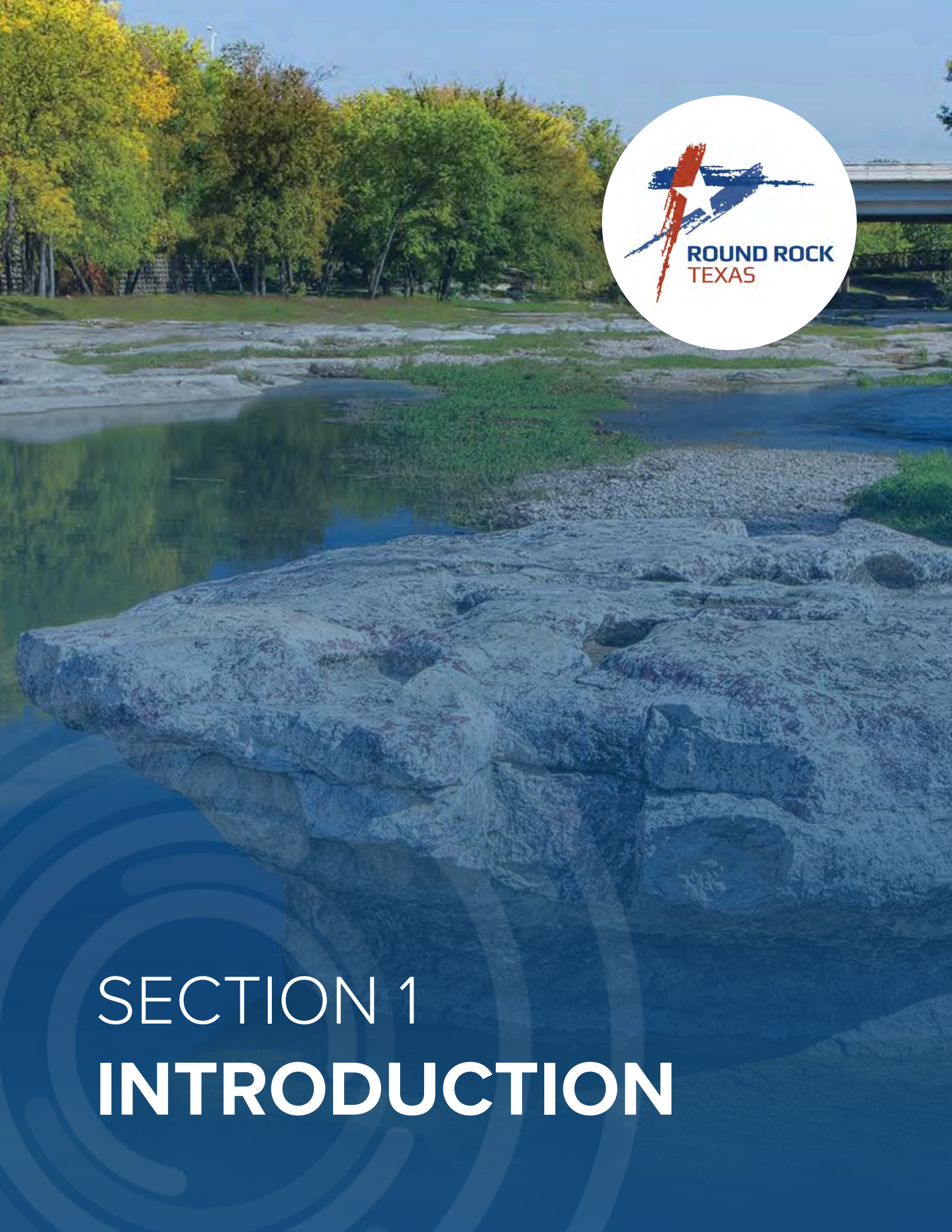


SECTION 1
INTRODUCTION

HAZARD DESCRIPTION

The City of Round Rock is located in the Central Texas Hill Country, 15 miles north of Austin. Located within both Travis and Williamson County, the city is a part of the Greater Austin metropolitan area. Cedar Park is adjacent to the west, Wells Branch borders the southern portion of the city, Hutto to the east, and Georgetown is to the north.

Texas is prone to extremely heavy rains and flooding with half of the world record rainfall rates (48 hours or less).[1] While flooding is a well-known risk, the City of Round Rock is susceptible to a wide range of natural hazards, including but not limited to tornadoes, extreme heat, wildfire, and drought. These life-threatening hazards can destroy property, disrupt the economy, and lower the overall quality of life for individuals.

While it is impossible to prevent an event from occurring, the impacts from many hazards on people and property can be lessened through mitigation. The Federal Emergency Management Agency (FEMA) defines mitigation as *sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects.*[2] Communities participate in hazard mitigation by developing hazard mitigation plans. The Texas Division of Emergency Management (TDEM) is required to review the plan and FEMA has the authority to review and approve hazard mitigation plans through the Disaster Mitigation Act of 2000.

In 2018, the City of Round Rock's previous Hazard Mitigation Action Plan (HMAP) was adopted. The participants of the 2018 plan were the City of Round Rock and Round Rock Independent School District (ISD.) Round Rock Independent School District (ISD) is not participating in the 2025 City of Round Rock Hazard Mitigation Action Plan Update.

The Disaster Mitigation Act requires that hazard mitigation plans be reviewed and revised every five years to maintain eligibility for Hazard Mitigation Assistance (HMA) grant funding. FEMA approved the City of Round Rock HMAP in 2019, which then expired in 2024. Therefore, the City began the process of developing a Hazard Mitigation Plan Update in order to regain eligibility for grant funding. The HMAP Update planning process provided an opportunity for the City of Round Rock to evaluate successful mitigation actions and explore opportunities to avoid future disaster loss. The City of Round Rock selected H2O Partners, Inc. to write and develop the 2025 HMAP Update, hereinafter titled: "City of Round Rock Hazard Mitigation Plan Update 2025: Maintaining a Safe, Secure, and Sustainable Community" (Plan or Plan Update). This is a single-jurisdictional plan; the City of Round Rock is the only participant in the Plan Update.

Hazard mitigation activities are an investment in a community's safety and sustainability. It is widely accepted that the most effective hazard mitigation measures are implemented at the

[1] http://www.floodsafety.com/texas/regional-info/san-antonio-flooding/
[2] http://www.fema.gov/hazard-mitigation-planning-resources

local government level, where decisions on the regulation and control of development are ultimately made. A comprehensive review of a hazard mitigation plan addresses vulnerabilities to hazards that exist today and in the foreseeable future. Therefore, it is essential that a plan identify projected patterns of how future development will increase or decrease a community's overall hazard vulnerability.

SCOPE

The focus of the Plan Update is to identify activities to mitigate hazards classified as "high" or "moderate" risk, as determined through a detailed hazard risk assessment conducted for the City of Round Rock. The hazard classification enables the City to prioritize mitigation actions based on hazards which can present the greatest risk to lives and property in the geographic scope.

PURPOSE

The Plan Update was prepared by the City of Round Rock and H2O Partners, Inc. The purpose of the Plan Update is to protect people and structures and to minimize the costs of disaster response and recovery. The goal of the Plan Update is to minimize or eliminate long-term risks to human life, property, operations, and the environment from known hazards by identifying risks and implementing cost-effective hazard mitigation actions. The planning process is an opportunity for the City of Round Rock, stakeholders, and the general public to evaluate and develop successful hazard mitigation actions to reduce future risk of loss of life and damage to property resulting from a disaster in City of Round Rock.

The Mission Statement of the Plan Update is, "*Maintaining a secure and sustainable future through the revision and development of targeted hazard mitigation actions to protect life and property.*"

The City of Round Rock Planning Team identified 12 natural hazards and 5 human-caused hazards to be addressed by the Plan Update. The specific goals of the Plan Update are to:

- Provide a comprehensive update to the 2018 HMAP;
- Minimize disruption to the City of Round Rock following a disaster;
- Streamline disaster recovery by articulating actions to be taken before a disaster strikes to reduce or eliminate future damage;
- Demonstrate a firm local commitment to hazard mitigation principles;
- Serve as a basis for future funding that may become available through grants and technical assistance programs offered by the State or Federal government. The Plan will enable the City of Round Rock to take advantage of rapidly developing mitigation grant opportunities as they arise; and
- Ensure that the City of Round Rock maintains eligibility for the full range of future Federal disaster relief.

AUTHORITY

The Plan is tailored specifically for the City of Round Rock and plan participants including Planning Team members, stakeholders, and the general public who participated in the Plan Update development process. The Plan complies with all requirements promulgated by

the Texas Division of Emergency Management (TDEM) and all applicable provisions of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Section 104 of the Disaster Mitigation Act of 2000 (DMA 2000) (P.L. 106-390), and the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 (P.L. 108–264), which amended the National Flood Insurance Act (NFIA) of 1968 (42 U.S.C. 4001, et al). Additionally, the Plan complies with the Interim Final Rules for the Hazard Mitigation Planning and Hazard Mitigation Grant Program (44 CFR, Part 201), which specify the criteria for approval of mitigation plans required in Section 322 of the DMA 2000 and standards found in FEMA's "Local Mitigation Planning Policy Guide" (April 2023), and the "Local Mitigation Planning Handbook" (May 2023).

SUMMARY OF SECTIONS

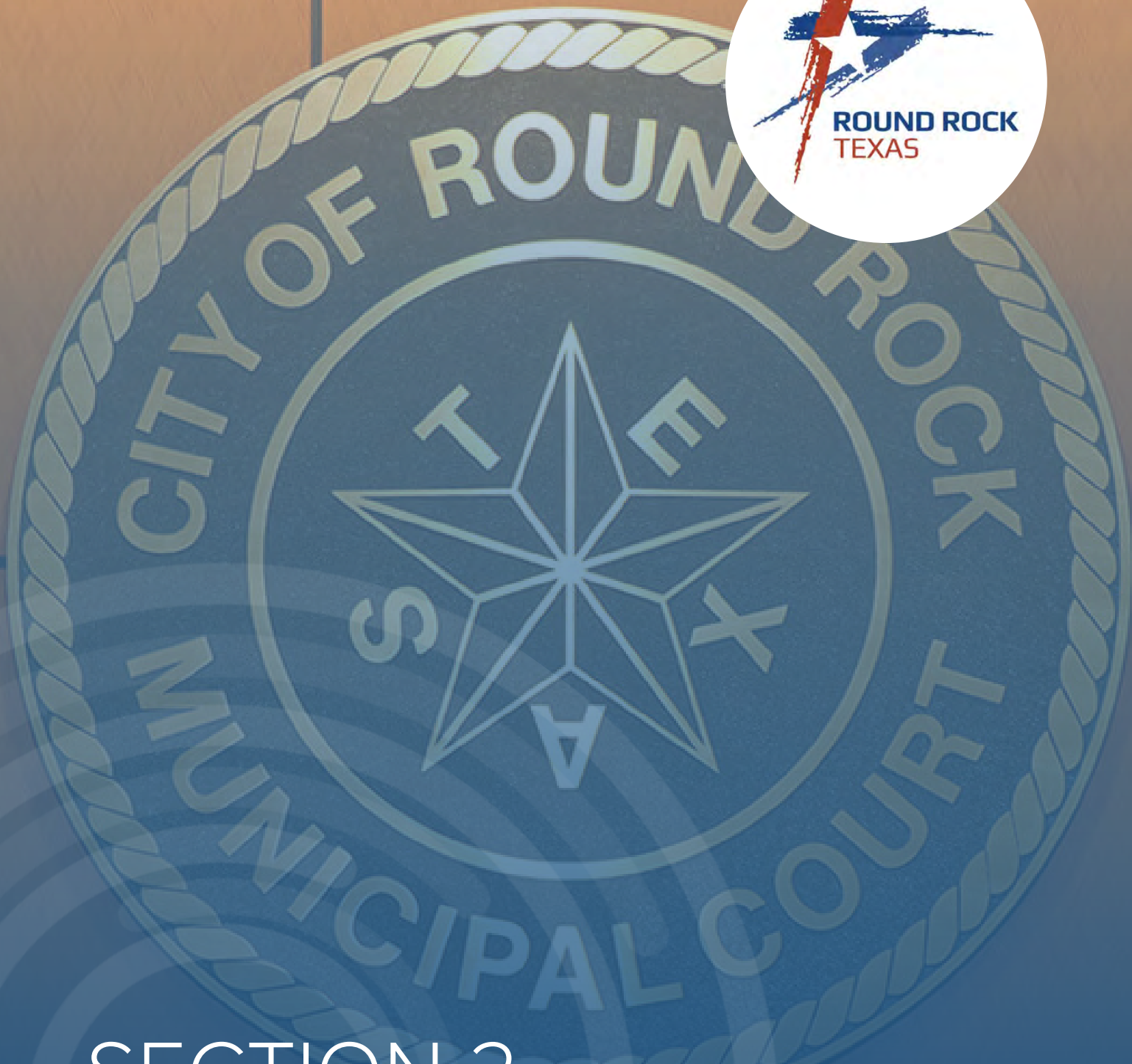
Sections 1 and 2 of the Plan Update outline the Plan's purpose and development, including how Planning Team members, stakeholders, and members of the general public were involved in the planning process. Section 3 profiles the City of Round Rock's population and economy.

Sections 4 through 21 present a hazard overview and information on individual natural and human-caused hazards in the planning area. For each hazard, the Plan Update presents a description of the hazard, a list of historical hazard events, and the results of the vulnerability and risk assessment process.

Section 22 presents hazard mitigation goals and objectives. Section 23 gives an analysis for the previous actions and Section 24 presents hazard mitigation actions for the City of Round Rock. Section 25 identifies Plan maintenance mechanisms.

The list of planning team members and stakeholders is located in Appendix A. Public survey results are analyzed and presented in Appendix B. Appendix C contains a detailed list of critical facilities for the area. Appendix D contains information regarding Dam locations within the City of Round Rock. Appendix E contains information regarding workshops and meeting documentation. Capability Assessment results for the City of Round Rock are in Appendix F. Appendix G includes State and Federal Funding Opportunities.[3]

[3] Information contained in some of these appendices are exempt from public release under the Freedom of Information Act (FOIA).



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SECTION 2

PLANNING PROCESS

SECTION 2: PLANNING PROCESS

PLAN PREPARATION AND DEVELOPMENT

Hazard mitigation planning involves coordination with various constituents and stakeholders to develop a more disaster-resistant community. Section 2 provides an overview of the planning process including the identification of key steps and a detailed description of how stakeholders and the public were involved.

OVERVIEW OF THE PLAN

The City of Round Rock hired H2O Partners, Inc. (Consultant Team), to provide technical support and oversee the development of the City of Round Rock Hazard Mitigation Action Plan Update 2025. The Consultant Team used the FEMA “Local Mitigation Planning Policy Guide” (April 2023), and the “Local Mitigation Planning Handbook” (May 2023) to develop the Plan Update. The overall planning process is shown in Figure 2-1 below.

Figure 2-1. Mitigation Planning Process

The City of Round Rock and the Consultant Team met in March 2024, to begin organizing resources, identify Planning Team members, and conduct a Capability Assessment.

PLANNING TEAM

Key members of H2O Partners, Inc. developed the Plan Update in conjunction with the Planning Team. The Planning Team was established using a direct representation model. Some of the responsibilities of the Planning Team included: completing Capability Assessment surveys, providing input regarding the identification of hazards, identifying mitigation goals, and developing mitigation strategies. An Executive Planning Team consisting of key personnel from the Office of Emergency Management involved in hazard mitigation activities, shown in Table 2-1, was formed to coordinate planning efforts and request input and participation in the planning process. Participation in this planning process is defined as being engaged in the process through attending meetings, providing data and related information, providing updates on previous actions, and reviewing and commenting on draft versions of the plan.

Table 2-2 reflects the Advisory Planning Team, consisting of additional representatives from City departments that participated throughout the planning process. All Executive and Advisory Planning Team members are involved in hazard mitigation activities; those with the authority to regulate development are identified with an asterisk next to their title.

Table 2-1. Executive Planning Team

ORGANIZATION / DEPARTMENT	TITLE
City of Round Rock - Fire	Assistant Fire Chief - Fire
City of Round Rock - Fire	Assistant Fire Chief - Fire[1]
City of Round Rock - Fire	Fire Chief
City of Round Rock – Homeland Security and Emergency Management	Emergency Management Coordinator

[1] Please note these city representatives have the same title and are not duplicated entries.

Table 2-2. Advisory Planning Team[2]

ORGANIZATION / DEPARTMENT	TITLE
City of Round Rock - Administration	Assistant City Manager
City of Round Rock - Administration	Assistant City Manager[3]
City of Round Rock - Administration	City Manager*
City of Round Rock - Administration	Deputy City Clerk
City of Round Rock – City Council	Mayor*
City of Round Rock – Communications and Marketing	Director - Communications
City of Round Rock - Community and Neighborhood Services	Director*
City of Round Rock - Finance	Deputy Chief Financial Officer
City of Round Rock – Fire	Captain - Community Risk Reduction
City of Round Rock – Fire	Program Manager – Crisis Response
City of Round Rock - General Services	Assistant Director
City of Round Rock - General Services	Director*
City of Round Rock - Information Technology Department	GIS Technician
City of Round Rock - Information Technology Department	Systems Analyst
City of Round Rock - Parks and Recreation	Assistant Director
City of Round Rock - Parks and Recreation	Director
City of Round Rock - Parks and Recreation	Manager - Forestry
City of Round Rock - Parks and Recreation	Manager – Parks and Recreation Development
City of Round Rock - Parks and Recreation	Manager – Parks Development
City of Round Rock - Planning and Development Services	Director*
City of Round Rock - Police	Assistant Chief
City of Round Rock - Police	Police Chief
City of Round Rock - Transportation	Assistant Director

[2] *Authority to regulate development
[3] Please note these city representatives have the same title and are not duplicated entries

ORGANIZATION / DEPARTMENT	TITLE
City of Round Rock - Transportation	Director
City of Round Rock - Transportation	Superintendent
City of Round Rock - Utilities and Environmental Services	Assistant Director - Utilities
City of Round Rock - Utilities and Environmental Services	Executive Director – Public Works
City of Round Rock - Utilities and Environmental Services	Supervisor - Utilities GIS

Additionally, a Stakeholder Group was invited via email to participate in the planning process by attending meetings, commenting on draft versions of the plan, and/or by providing data to inform the planning process. The Consultant Team, Planning Teams, and Stakeholder Group coordinated to identify mitigation goals, and develop mitigation strategies and actions for the Plan Update. Appendix A provides a complete listing of all participating Planning Team members and stakeholders by organization and title. Stakeholder involvement is discussed further below.

Based on results of the completed Capability Assessment survey, the City of Round Rock described methods for achieving future hazard mitigation measures by expanding existing capabilities. For example, the City of Round Rock has the opportunity to identify opportunities for cross-training or increasing the technical expertise of staff by attending free training available through FEMA and the Texas Division of Emergency Management (TDEM). In addition, the City of Round Rock has an opportunity to establish Planning Team members with the authority to monitor the Plan and identify grant funding opportunities for expanding staff. Other options for improving capabilities include the following:

- Integrate risk information into future updates of the City of Round Rock Comprehensive Plan.
- Integrate risk information into future updates of the City of Round Rock Capital Improvement Plan.
- Review current floodplain ordinances for opportunities to increase resiliency, (above current standards) such as modifying permitting or building codes.
- Review current land use and building ordinances that will require all new developments to conform to the higher mitigation standards, exceeding current requirements.

Sample hazard mitigation actions developed with similar hazard risk were shared at the meetings. These important discussions resulted in the development of multiple mitigation actions that are included in the Plan Update to further mitigate risk from natural hazards in the future.

The Planning Team developed hazard mitigation actions for mitigating risk from all the identified hazards within this Plan Update; these actions include implementing education and awareness programs on hazards, identifying low-lying areas that are at high risk for flooding, and adopting regulations that all new construction will be built with lifelong foundations to mitigate future land subsidence risk.

SECTION 2: PLANNING PROCESS

PLANNING PROCESS

The process used to prepare the Plan Update followed the four major steps included at Figure 2-1. After the Planning Team was organized, a capability assessment was developed and distributed at the Kick-Off Workshop. Hazards were identified and assessed, and results associated with each of the hazards were provided at the Risk Assessment Workshop. Based on the City of Round Rock's identified vulnerabilities, specific mitigation strategies were discussed and developed at the Mitigation Strategy Workshop. Finally, Plan maintenance and implementation procedures were developed and are included in Section 25. Participation of Planning Team members, stakeholders, and the public at each of the workshops is documented in Appendix E.

At the Plan development workshops held throughout the planning process described herein, the following factors were taken into consideration:

- The nature and magnitude of risks currently affecting the city;
- Hazard mitigation goals to address current and expected conditions;
- Whether current resources will be sufficient for implementing the Plan Update;
- Implementation problems, such as technical, political, legal, and coordination issues that may hinder development;
- Anticipated outcomes; and
- How the City of Round Rock, agencies, and partners will participate in implementing the Plan Update.

KICKOFF WORKSHOP

The Kickoff Workshop was held virtually, via Microsoft Teams, on April 15, 2024. The initial workshop informed participating officials and key department personnel about how the planning process pertained to their distinct roles and responsibilities and engaged stakeholder groups that focus on vulnerable populations and underserved communities including, but not limited to the utility providers, local medical partners, local ISDs, and surrounding counties. In addition to the kickoff presentation, participants received the following information:

- Project overview regarding the planning process;
- Public survey access information;
- Hazard Ranking form; and
- Capability Assessment survey for completion.

A risk ranking exercise was conducted at the Kickoff Workshop to get input from the Planning Team and stakeholders pertaining to various risks from a list of natural hazards affecting the planning area. Participants ranked hazards high to low in terms of perceived level of risk, frequency of occurrence, and potential impact.

HAZARD IDENTIFICATION

At the Kickoff Workshop, and through email and phone correspondence, the Planning Team conducted preliminary hazard identification. The Planning Team in coordination with the Consultant Team reviewed and considered a full range of natural hazards. Once identified, the teams narrowed the list to significant hazards by reviewing hazards affecting the area, the 2023 State of Texas Hazard Mitigation Plan, and initial study results from reputable sources such as federal and state agencies. Based on this initial analysis, the teams identified a total of 12 natural hazards and 5 human-caused hazards which pose a significant threat to the planning area.

RISK ASSESSMENT

An initial risk assessment for the City of Round Rock was completed in May 2024 and results were presented to Planning Team members at the Risk Assessment Workshop held on May 22, 2024, virtually through Microsoft Teams. At the workshop, the characteristics and consequences of each hazard were evaluated to determine the extent to which the planning area would be affected in terms of potential danger to property and residents.

Property and crop damages were estimated by gathering data from the National Centers for Environmental Information (NCEI) and National Oceanic and Atmospheric Administration (NOAA). The assessment also examined the impact of various hazards on the built environment, including general building stock, critical facilities, lifelines, and infrastructure. The resulting risk assessment profiled hazard events provided information on previous occurrences, estimated probability of future events, and detailed the spatial extent and magnitude of impact on people and property. Following the risk assessment workshop, past event data from NCEI was provided to the planning team for their review and assistance in identifying significant events.

The assessments were also used to set priorities for hazard mitigation actions based on potential loss of lives and dollar losses. A hazard profile and vulnerability analysis for each of the hazards can be found in Sections 4 through 21.

MITIGATION REVIEW AND DEVELOPMENT

Developing the Mitigation Strategy for the Plan involved identifying mitigation goals and new mitigation actions. A Mitigation Workshop was held on June 18, 2024, virtually through Microsoft Teams. In addition to the Planning Team, stakeholder groups were invited to attend the workshop. The City was proactive in identifying mitigation actions to lessen the risk of all the identified hazards included in the Plan Update.

An inclusive and structured process was used to develop and prioritize new hazard mitigation actions for the Plan Update. The prioritization method was based on FEMA's STAPLE+E criteria and included social, technical, administrative, political, legal, economic, and environmental considerations. As a result, each Planning Team member assigned an overall priority to each hazard mitigation action. The overall priority of each action is reflected in the hazard mitigation actions found in Section 24.

Planning Team members then developed action plans identifying proposed actions, costs and benefits, the responsible organization(s), effects on new and existing buildings, implementation schedules, priorities, and potential funding sources.

Specifically, the process involved:

- Listing optional hazard mitigation actions based on information collected from previous plan reviews, studies, and interviews with federal, state, and local officials. Workshop participants reviewed the optional mitigation actions and selected actions that were most applicable to their area of responsibility, cost-effective in reducing risk, easily implemented, and likely to receive institutional and community support.
- Workshop participants inventoried federal and state funding sources that could assist in implementing the proposed hazard mitigation actions. Information was collected, including the program name, authority, purpose of the program, types of assistance and eligible projects, conditions on funding, types of hazards covered, matching requirements, application deadlines, and a point of contact.

- Planning Team members considered the benefits that would result from implementing the hazard mitigation actions compared to the cost of those projects. Although detailed cost-benefit analyses were beyond the scope of the Plan Update, Planning Team members utilized economic evaluation as a determining factor between hazard mitigation actions.
- Planning Team members then selected and prioritized mitigation actions.

Hazard mitigation actions identified in the process were made available to the Planning Team for review. The draft Plan Update was maintained on file by the City of Round Rock Office of Emergency Management and was made available to the general public for review.

REVIEW AND INCORPORATION OF EXISTING PLANS

REVIEW

Background information utilized during the planning process included various studies, plans, reports, and technical information from sources such as FEMA, the United States Army Corps of Engineers (USACE), the U.S. Fire Administration, National Oceanic and Atmospheric Administration (NOAA), the Texas Water Development Board (TWDB), the Texas Commission on Environmental Quality (TCEQ), the Texas State Data Center, Texas Forest Service, the Texas Division of Emergency Management (TDEM), and local hazard assessments and plans. Section 4 and the hazard-specific sections of the Plan (Sections 5-21) summarize the relevant background information.

Specific background documents, including those from FEMA, provided information on hazard risk, hazard mitigation actions currently being implemented, and potential mitigation actions. Previous hazard events, occurrences, and descriptions were identified through NOAA's National Centers for Environmental Information (NCEI). Results of past hazard events were found through searching the NCEI Storm Event Database. The USACE studies were reviewed for their assessment of risk and potential projects in the region. Information from the State Demographer was reviewed for population and other projections and included in Section 3 of the Plan. Data from the Texas Forest Service was used to appropriately rank the wildfire hazard, and to help identify potential grant opportunities. Materials from FEMA and TDEM were reviewed for guidance on Plan Update development requirements.

INCORPORATION OF EXISTING PLANS INTO THE HMAP PROCESS

A Capability Assessment was completed by key departments from the City of Round Rock which provided information pertaining to existing plans, policies, ordinances, and regulations to be integrated into the goals and objectives of the Plan Update. The relevant information was included in a master Capability Assessment, Appendix F.

Existing projects and studies were utilized as a starting point for discussing hazard mitigation actions among Planning and Consultant Team members. For example, mitigation projects completed by the City of Round Rock include:

- Implementing new or enlarging existing detention structures to reduce flooding
- Enlarging channels and/or culverts
- Armoring channel banks, flood-proofing structures and/or removing infrastructure or structures to reduce flooding impacts
- Utilizing new / updated models and a network of gauges and/or cameras for real-time and predictive mappings

- Utilizing a variety of large equipment to help minimize flooding by keeping drainage ways and culverts free of debris and limbs
- Evaluating and implementing expansion of the City reuse water system and alternative water sources to ease drought impacts
- Adding hail guards to existing A/C to minimize damage and downtime due to storms

For a comprehensive list of actions from the previous 2018 HMAP, please refer to Section 23.

Additionally, policies and ordinances were reviewed by the City of Round Rock. Other plans were reviewed, such as the Comprehensive Plan, Continuity of Operations Plan, and the Emergency Management Action Plan, to identify any additional mitigation actions. Finally, the 2023 State of Texas Hazard Mitigation Plan, developed by TDEM, was discussed in the initial planning meeting in order to develop a specific group of hazards to address in the planning effort. The 2023 State Plan was also used as a guidance document, along with FEMA materials, in the development of the City of Round Rock Hazard Mitigation Action Plan Update 2025.

INCORPORATION OF THE HMAP INTO OTHER PLANNING MECHANISMS

Planning Team members will integrate implementation of the Plan Update with other planning mechanisms for the City of Round Rock, such as the Emergency Management Action Plan and the Comprehensive Plan. This section discusses how the Plan will be implemented by the City of Round Rock. It also addresses how the Plan will be evaluated and improved over time, and how the public will continue to be involved in the hazard mitigation planning process.

The City of Round Rock will be responsible for implementing hazard mitigation actions contained in Section 24. Each hazard mitigation action has been assigned to a specific City department that is responsible for tracking and implementing the action.

A funding source has been listed for each identified hazard mitigation action and may be utilized to implement the action. An implementation time period has also been assigned to each hazard mitigation action as an incentive and to determine whether actions are implemented on a timely basis.

The City of Round Rock will integrate hazard mitigation actions contained in the Plan Update with existing planning mechanisms such as floodplain ordinances, the Emergency Management Action Plan, the Evacuation Plan, and other local and area planning efforts. The City of Round Rock will work closely with area organizations to coordinate implementation of hazard mitigation actions that benefit the planning area terms of financial and economic impact.

Upon formal adoption of the Plan Update, Planning Team members will review existing plans along with building codes to guide development and ensure that hazard mitigation actions are implemented. Each of the City departments will be responsible for coordinating periodic review of the Plan Update with members of the Advisory Planning Team to ensure integration of hazard mitigation strategies into these planning mechanisms and codes. The Planning Team will also conduct periodic reviews of various existing planning mechanisms and analyze the need for any revisions or updates in light of the approved Plan Update. The City of Round Rock will ensure that future long-term planning objectives will contribute to the goals of the Plan to reduce the long-term risk to life and property from moderate and high-risk hazards. Within one year of formal adoption of the Plan, existing planning mechanisms will be reviewed and analyzed as they pertain to the Plan Update.

Planning Team members will review and revise, as necessary, the long-range goals and objectives in its strategic plan and budgets to ensure that they are consistent with the Plan Update.

Furthermore, the City of Round Rock will work with neighboring jurisdictions to advance the goals of the Plan Update as it applies to ongoing, long-range planning goals and actions for mitigating risk to natural hazards throughout the planning area.

Table 2-3 identifies types of planning mechanisms and examples of methods for incorporating the Plan into other planning efforts.

Table 2-3. Examples of Methods of Incorporation

PLANNING MECHANISM	INCORPORATION OF PLAN
Annual Budget Review	Various departments and key personnel that participated in the planning process will review this Plan Update and mitigation actions therein when conducting their annual budget review. Allowances will be made in accordance with grant applications sought, and mitigation actions that will be undertaken, according to the implementation schedule of the specific action.
Capital Improvement Plans	Prior to any revisions to the Capital Improvement Plan (CIP), City departments will review the risk assessment and mitigation strategy sections of this HMAP, as limiting public spending in hazardous zones is one of the most effective long-term mitigation actions available to local governments.
Comprehensive Plans	The City of Round Rock has a Comprehensive Plan in place. Since comprehensive plans involve developing a unified vision for a community, the mitigation vision and goals of the HMAP will be reviewed in the development or revision of a Comprehensive Plan.
Floodplain Management Plans	Floodplain management plans include preventative and corrective actions to address the flood hazard. Therefore, the actions for flooding and information found in Section 9 of this Plan Update discussing the people and property at risk to flood, will be reviewed and revised when updating the flood management plans or developing new plans.
Grant Applications	This Plan Update will be evaluated when grant funding is sought for mitigation projects. If a project is not in the Plan Update, a Plan Revision may be necessary to include the action in the Plan.
Regulatory Plans	Currently, the City of Round Rock has regulatory plans in place, such as an Emergency Management Action Plan, Land Use Plan, and Evacuation Plan. The HMAP will be consulted when departments

PLANNING MECHANISM	INCORPORATION OF PLAN
	review or revise their current regulatory planning mechanisms, or in the development of regulatory plans that are not currently in place.

Appendix F Capability Assessment provides an overview of the City's existing planning and regulatory capabilities. These existing capabilities provide the mechanisms to implement the City's mitigation strategy. For example, the adoption of building codes and implementation of land use regulations have been demonstrated to help communities avoid losses from natural hazard events. Currently, the City of Round Rock has both building codes and land use regulations in place.

It should be noted for the purposes of the Plan Update that the HMAP has been used as a reference when reviewing and updating all plans and ordinances for the entire planning area. The Emergency Management Plan developed for the City of Round Rock is updated every five years and incorporates goals, objectives, and actions identified in the mitigation plan.

PLAN REVIEW AND PLAN UPDATE

As with the development of Plan Update, the City of Round Rock will oversee the review and update process for relevance and if necessary, make adjustments. At the beginning of each fiscal year, Planning Team Members will meet to evaluate the Plan and review other planning mechanisms to ensure consistency with long-range planning efforts. In addition, planning participants will also meet once a year, by conference call or presentation, to re-evaluate prioritization of the hazard mitigation actions. The plan may be amended to include additional hazard mitigation actions as they are developed.

TIMELINE FOR IMPLEMENTING MITIGATION ACTIONS

Both the Executive Planning Team (Table A-1, Appendix A) and the Advisory Planning Team (Table A-2, Appendix A) will engage in discussions regarding a timeframe for how and when to implement each hazard mitigation action. Considerations include when the action will be started, how existing planning mechanisms' timelines affect implementation, and when the action should be fully implemented. Timeframes may be general, and there will be short, medium, and long-term goals for implementation based on prioritization of each action, as identified on individual Hazard Mitigation Action worksheets included in the Plan Update for the City of Round Rock.

Both the Executive and Advisory Planning Team will evaluate and prioritize the most suitable hazard mitigation actions for the community to implement. The timeline for implementation of actions will partially be directed by the City's comprehensive planning process, budgetary constraints, and community needs. The City of Round Rock is committed to addressing and implementing hazard mitigation actions that may be aligned with and integrated into the Plan Update.

Overall, the Planning Team is in agreement that goals and actions of the Plan Update shall be aligned with the timeframe for implementation of hazard mitigation actions with respect to annual review and updates of existing plans and policies.

PUBLIC AND STAKEHOLDER INVOLVEMENT

An important component of hazard mitigation planning is public participation and stakeholder involvement. Input from individual citizens and the community as a whole provides the Planning Team with a greater understanding of local concerns and increases the likelihood of successfully implemented hazard mitigation actions. If citizens and stakeholders, such as local businesses, non-profits, hospitals, and schools are involved, they are more likely to gain a greater appreciation of the risks that hazards may present in their community and take steps to reduce or mitigate their impact.

The public was involved in the development of the City of Round Rock Hazard Mitigation Action Plan Update 2024 at different stages prior to official Plan approval and adoption. Public input was sought using three methods: (1) open public meetings; (2) survey instruments; and (3) making the draft Plan Update available for public review on the City of Round Rock's website.

The draft Plan Update was made available to the general public for review and comment on the City of Round Rock's website. The public was notified at the public meetings that the draft Plan Update would be available for review. No feedback was received on the draft Plan Update, although it was given on the public survey, and all relevant information was incorporated into the Plan Update. Public input was utilized to assist in identifying hazards that were of most concern to the citizens of the City and what actions they felt should be included and prioritized.

The Plan Update will be advertised and posted on the City of Round Rock's website upon approval from FEMA and a copy will be kept in the Office of Emergency Management.

UNDERSERVED COMMUNITIES / VULNERABLE POPULATIONS

A goal of the Planning Team was building equity into the planning process. Including organizations that aid underserved communities and socially vulnerable populations to participate in the plan helps ensure equitable access to the planning process and the meaningful participation of all residents. In addition, these groups can make sure that the interests of vulnerable populations are accurately represented and act as a valuable resource to share information with those vulnerable populations.

The Planning Team worked to identify local agencies, organizations and community leaders that focus on reaching vulnerable populations and underserved communities. These organizations were included in the planning process as stakeholders and were invited to participate in the planning process via email. These agencies were encouraged to post public planning meetings as well as solicit feedback via the public survey.

All stakeholders and planning team members were invited to participate in the development of the Plan during this process, including all public meetings, and surveys. All stakeholders are listed in Table 2-4 below. Some stakeholders have been detailed below along with the agency's mission, including:

- Project Linus – Central Texas – All-volunteer, non-profit organization who creates and donates new, handmade blankets to children in crisis situations. The Central Texas chapter serves Williamson, Travis, Bastrop, and Hays counties and has donated over 34,000 blankets since 2005.
- Maximizing Hope – Charity organization that works to bridge the gap between people experiencing homelessness and social services in Central Texas.

- Round Rock Area Serving Center – Non-profit corporation which carries out a community-wide mission of churches, other organizations, and individuals serving human needs in the City of Round Rock and surrounding areas. Services include a food pantry, Amazon home delivery program, clothing and furniture vouchers, *Keep Round Rock Warm* program, community gardens, and a suite of several financial assistance services.

In addition, public notices were posted on public bulletin boards at Round Rock's City Hall, in a KXAN news report, as well as posted on the City of Round Rock's website and social media platforms. For a sample of these postings, please see Appendix E. In addition to public meetings, the Planning and Consultant Teams developed a public survey designed to solicit public input during the planning process from citizens and stakeholders and to obtain input and feedback on the Plan Update. For each form of engagement, all efforts were made to reach the City of Round Rock's underserved communities and vulnerable populations throughout the planning process. Additional survey information is provided at the end of this section.

STAKEHOLDER INVOLVEMENT

Stakeholder involvement is essential to hazard mitigation planning since a wide range of stakeholders can provide input on specific topics and from various points of view. Throughout the planning process, members of community groups, local businesses, neighboring jurisdictions, schools, universities, and hospitals were invited to participate in development of the Plan Update. The Stakeholder Group (Table 2-4) included a broad range of representatives from both the public and private sector and served as a key component in the City's outreach efforts for development of the Plan Update. Documentation of stakeholder meetings is found in Appendix E. A list of organizations invited to attend via email is found in Table 2-4. Those that participated in the public meetings are identified with a plus symbol (+) next to their stakeholder type.

Table 2-4. Stakeholders

AGENCY	TITLE	STAKEHOLDER TYPE
Agape Ministry	General Representative	Religious Organization
American Red Cross	Chief Executive Officer	Community Organization
American Red Cross	Disaster Program Manager for Central Texas	Community Organization
Atmos	General Representative	Utility Provider+
Aventine at Rose	Maintenance Director	Residential Community - Vulnerable Populations
Bastrop County	Emergency Management Coordinator	Neighboring Community
Baylor Scott and White Hospital - Round Rock	Head of Public Safety	Healthcare Agency
Bell County	Emergency Management Coordinator	Neighboring Community
Brazos River Authority	Emergency Management	Community Organization / Utility Provider
Brazos River Authority	Service Manager	Community Organization / Utility Provider

AGENCY	TITLE	STAKEHOLDER TYPE
Burnet County	Emergency Management Coordinator	Neighboring Community
Capital Area Council of Governments	Executive Director	Regional Agency
CapMetro	Emergency Preparedness	Utility Provider
Central Texas Together	General Representative	Community Organization
City of Cedar Park	Emergency Management Coordinator	Neighboring Community
City of Georgetown	Emergency Management Coordinator	Neighboring Community
City of Leander	Emergency Management Coordinator	Neighboring Community
City of Round Rock - City Council	Place 1	Local Government
City of Round Rock - City Council	Place 2	Local Government
City of Round Rock - City Council	Place 3 / Mayor Pro Tem	Local Government
City of Round Rock - City Council	Place 4	Local Government
City of Round Rock - City Council	Place 5	Local Government
City of Round Rock - City Council	Place 6	Local Government
Community Christian Church	General Representative	Religious Organization
Cornerstone Hospital - Austin - Round Rock	Chief Executive Officer	Healthcare Agency
Cottages Chandler Creek	Executive Director	Residential Community - Vulnerable Populations
Court at Round Rock	Executive Director	Residential Community - Vulnerable Populations
Environmental Protection Agency (EPA) – Region 6	Deputy Regional Administration	Federal Agency
Environmental Protection Agency (EPA) – Region 6	Director of Superfund and Emergency Management Division	Federal Agency
Environmental Protection Agency (EPA) – Region 6	Regional Administration	Federal Agency
Fairway Vista	General Representative	Residential Community - Vulnerable Populations
FBG Church	General Representative	Religious Organization

AGENCY	TITLE	STAKEHOLDER TYPE
The Fellowship	General Representative	Religious Organization
The Greater Round Rock Community Foundation	General Representative	Community Organization
Habitat for Humanity	Media Coordinator	Non-Profit Organization
Hearthstone	Administrator	Residential Community - Vulnerable Populations
Hill Country Bible	General Representative	Religious Organization
ICNA Relief Austin	Chapter Coordinator	Community Organization
Lee County	Emergency Management Coordinator / Grants Writer	Neighboring Community
Life Church	General Representative	Religious Organization
Maximizing Hope	General Representative	Community Organization
Meal on Wheels	Director of Community Services	Non-Profit Organization
Milam County	Emergency Management Coordinator	Neighboring Community
Mission Accomplished	General Representative	Community Organization
Missions Church	General Representative	Religious Organization
Mobile Auto Clinic	General Representative	Community Organization
National Weather Services (NWS)	Austin/San Antonio Regional Contact	Federal Agency
NOAA	Regional Representative	Federal Agency
Park Valley Inn	Administrator	Residential Community - Vulnerable Populations
Pedernales Electric Cooperative	General Representative	Utility Provider
Project Linus - Central Texas	Chapter Coordinator	Community Organization
Restoration Covenant Church	Co-Pastor	Religious Organization
Round Rock Area Serving Center	Executive Director	Community Organization
Round Rock Assisted Living	Administrator	Residential Community - Vulnerable Populations
Round Rock Church of Christ	General Representative	Religious Organization
Round Rock First Baptist	General Representative	Religious Organization
Round Rock KXAN	News Representative	Media

AGENCY	TITLE	STAKEHOLDER TYPE
Round Rock Library	Director	Community Organization
Round Rock ISD	Director of Risk Management and Compliance	Academia
Sacred Heart Community Center	Representative	Community Organization+
San Gabriel	Executive Director	Residential Community - Vulnerable Populations
Serene Setting	General Representative	Residential Community - Vulnerable Populations
St. David's Medical Center and Hospital – Round Rock	Head of Security	Healthcare Agency
State Legislature	House District 20	State Legislature
State Legislature	House District 52	State Legislature
State Legislature	House District 136	State Legislature
State Senate	Senate District 5	State Senate
State Senate	Senate District 24	State Senate
Temple College - East Williamson County Higher Education Center	Chief of Operations	Academia
Texas A&M AgriLife Extension	District 8 Representative	State Agency
Texas A&M Forest Service	Mitigation and Prevention Program Coordinator for Williamson County	State Agency
Texas A&M Health Science Center - Round Rock	Security Manager	Academia
Texas Baptist Children's Home	General Representative	Community Organization
Texas Commission on Environmental Quality (TCEQ), Region 11	Executive Assistant	State Agency
Texas Commission on Environmental Quality (TCEQ), Region 11	Regional Director	State Agency
Texas Department of Health and Human Services, Region 7	Deputy Regional Director	State Agency
Texas Department of Health and Human Services, Region 7	Program Manager	State Agency

AGENCY	TITLE	STAKEHOLDER TYPE
Texas Department of Health and Human Services, Region 7	Regional Director	State Agency
Texas Department of Housing and Community Affair	Director of Single-Family and Homeless Program	State Agency
Texas Department of Housing and Community Affair	Manager of Single-Family Program	State Agency
Texas Department of Transportation (TXDOT)	District Engineer	State Agency
Texas Division of Emergency Management (TDEM)	County Liaison Officer	State Agency
Texas Floodplain Management Association, Region 5	Director	State Agency
Texas Parks and Wildlife	District Leader	State Agency
Texas State Technical College (TSTC)	Deputy Safety Officer	Academia
Texas State University – Round Rock Campus	Interim Vice President	Academia
Texas State University – Round Rock Campus	University Police Sergeant	Academia
Texas Water Development Board (TWDB)	Deputy Executive Administrative of the Planning Division	State Agency
Texas Windstorm Insurance Association	Chief Deputy Commissioner	State Agency
Touch of Home	Administrator	Residential Community - Vulnerable Populations
Travis County	Deputy Emergency Management Coordinator	Neighboring Community
Trinity Care	Administrator	Residential Community - Vulnerable Populations
Union Pacific	General Representative	Utility Provider
United Way – Williamson County	Executive Director	Community Organization
University Village	General Representative	Residential Community - Vulnerable Populations
U.S. Army Corps of Engineers / Texas Silver Jackets	Regional Representative for Fort Worth/Galveston Office	Federal Agency
U.S. Fish & Wildlife	Southwest Regional Representative	Federal Agency

AGENCY	TITLE	STAKEHOLDER TYPE
Williamson County	Deputy Director of OEM	Neighboring Community
Williamson County Cities Health District	Emergency Preparedness Director	Community Organization
Williamson County Cities Health District	Executive Director	Community Organization
Williamson County Conservation Foundation	WCCF Board President	Community Organization
Williamson County Landfill	General Representative	Community Organization / Utility Provider
Williamson County Regional Animal Shelter	Animal Services Director	Community Organization
Williamson County Regional Animal Shelter	Community Programs Coordinator	Community Organization
Williamson County Veterans Services	County VSO	Community Organization

Stakeholders and participants from neighboring communities that attended the Planning Team and public meetings played a key role in the planning process. For example, public meeting attendees expressed concern about potential terrorism incidents, so the City included a mitigation action to install surveillance cameras in high-risk areas and ensure they are monitored regularly, as well as implementing access control measures at critical infrastructures sites.

PUBLIC MEETINGS

A series of public meetings were held throughout the planning area to collect public and stakeholder input. Topics of discussion included the purpose of hazard mitigation, discussion of the planning process, and types of natural hazards. The City of Round Rock released information regarding the public meetings in their area to increase public participation in the Plan Update development process, through posting on their website, on social media sources, through the local media, and/or posting the information on bulletin boards in public facilities. A sampling of these notices can be found in Appendix E, along with the documentation on the public meetings. Representatives from area neighborhood associations and area residents were invited to participate.

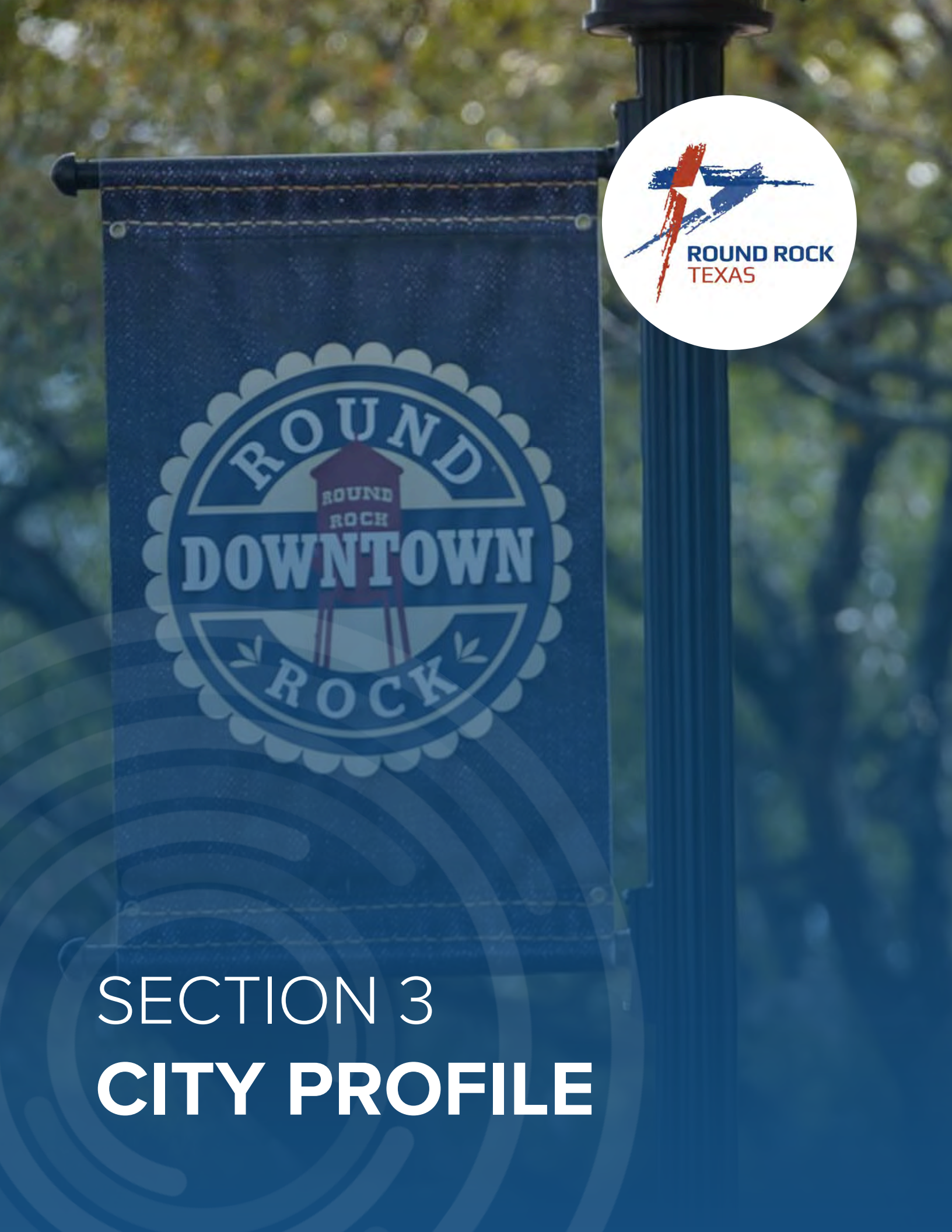
Public meetings were held on the following dates and locations:

- April 15, 2024, Public Safety Training Center
- May 22, 2024, Round Rock Public Library
- June 18, 2024, Public Safety Training Center

PUBLIC PARTICIPATION SURVEY

In addition to public meetings, the Planning and Consultant Teams developed a public survey designed to solicit public input during the planning process from citizens and stakeholders to obtain data regarding the identification of any potential hazard mitigation actions or problem areas. The survey was promoted by local officials and a link to the survey was posted on the City of Round Rock website. A total of 23 surveys were completed online. The survey results are analyzed in Appendix B. The Planning Team reviewed the input from the surveys and decided

which information to incorporate into the Plan as hazard mitigation actions. For example, many residents were concerned with protecting and improving reliability of utilities, preventing or restricting development in hazard-prone areas, protecting and strengthening critical facilities, and constructing, maintaining, or protecting infrastructure. Survey responses also showed the public has an interest in the City implementing mitigation projects related to improving emergency preparedness and enhancing disaster response. As a result, the Planning Team has included mitigation actions related to hardening / retrofitting critical facilities to hazard-resistant levels, identifying low-lying areas that are at high risk for flooding to ensure culverts and drainage systems are adequate for flood risk, and implementing procedures to assist the fire department with wildfire events.



SECTION 3

CITY PROFILE

SECTION 3: CITY PROFILE

OVERVIEW

The City of Round Rock is on Interstate Highway 35 in south central Williamson County, 15 miles north of Austin. It lies on the Balcones Escarpment, a Faultline east of Interstate 35. It is located 17 miles north of downtown Austin at an elevation of 709 feet. The City of Round Rock territory comprises roughly 38 square miles, with over 37 square miles being land and roughly 0.4 square miles being water.

The City of Round Rock has been the site of human habitation since 9,200 BCE. Based on evidence found at the Gault Site, the earliest inhabitants of Williamson County are linked to the Clovis Culture. The “Leanderthal Lady” was found in Leander, four miles west of Round Rock, dating back to the Pleistocene period around 10,500 years ago. Brushy Creek has signs of prehistoric and archaic period campsites and relics. The Tonkawa, Kiowa, Yojuane, Tawakoni, and Mayeye peoples were the first Native Americans to live in Williamson County.

Jacob Herrell, a former blacksmith in Austin, founded the city on the north bank of Brushy Creek in 1848. Round Rock was initially called Brushy Creek until 1851, when postal officials asked the postmaster, Thomas Oatts, to submit another name. Oatts and Herrell suggested the name Round Rock on August 24, 1854, inspired by a large anvil-shaped limestone rock they fished from in Brushy Creek.

During the Civil War, a wool carding factory was opened, and a gin factory followed in the 1870s. In 1867 the Greenwood Masonic Institute was opened and in 1881 the name was changed to Round Rock Institute when ownership changed hands. The International-Great Northern Railroad came through Williamson County in 1876, laying the tracks south and east of Round Rock. This caused the community to move more towards the railroad and the southern bank of Brushy Creek. The original site of Round Rock was abandoned and is referred to as Old Round Rock in official records. The town has developed in all directions since 1970, and the Old Town is now surrounded by the rest of the city.

Cotton crops brought the community initial wealth. In addition to cotton, they grew row crops and grapes with cattle, sheep, and goat ranching, rounding out their agricultural production. Cotton crops and cattle ranches can be seen in eastern Round Rock today.

Within a year of the railroad’s establishment, the city grew, with hotels, a broom factory, a lime plant, and newspaper companies taking root in the community. In 1878, the outlaw Sam Bass was drawn to the city and later died in a shootout. In 1879, the Round Rock Searchlight was established as the leading newspaper, but it later changed its name to the Round Rock Leader.

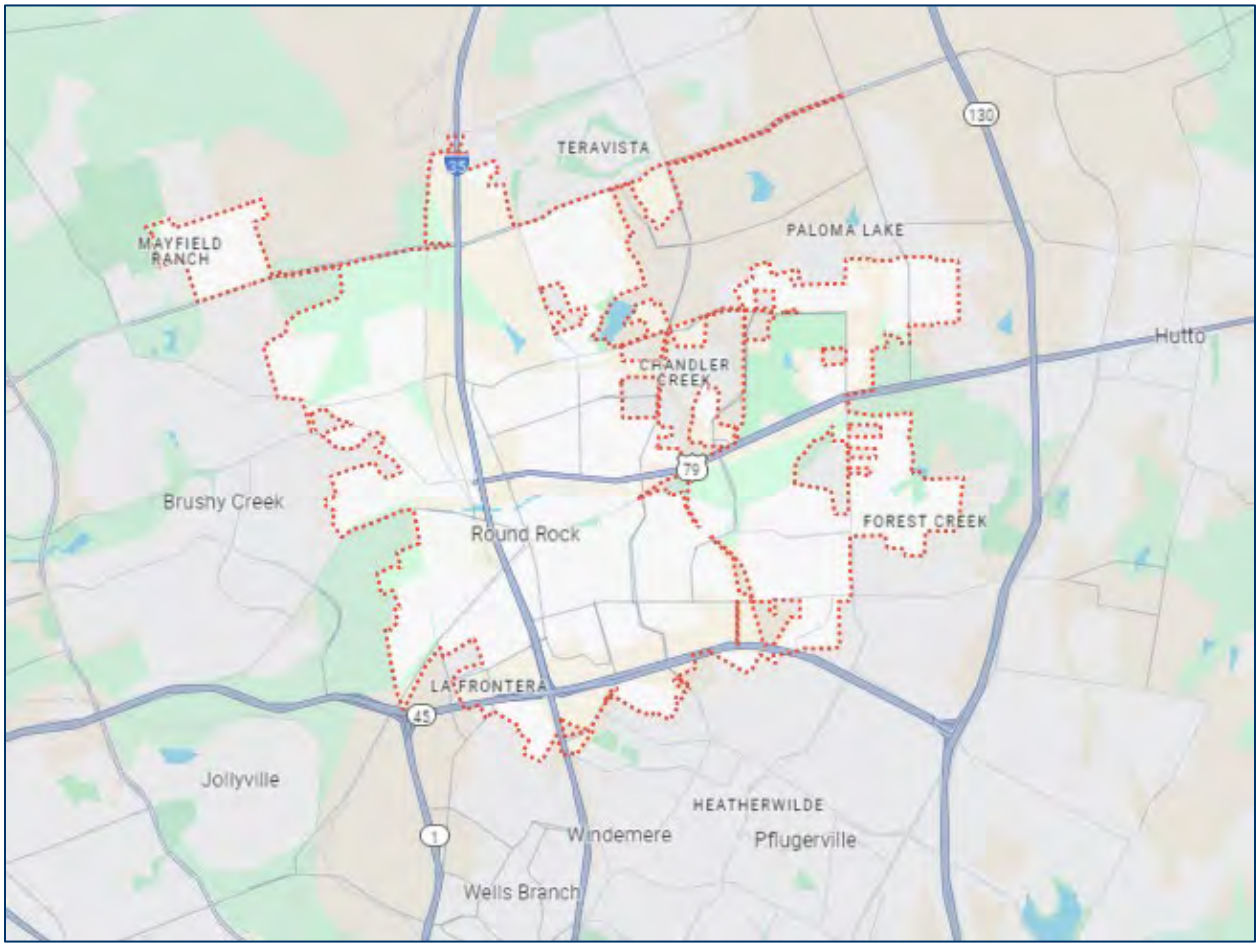
Educational institutes began to gain a foothold in the community by establishing Trinity Lutheran College in 1906. It later merged with the Lutheran College of Seguin in 1929.

During the first six decades, Round Rock had a population of between 1,000 and 1,400. In the 1960s, it began to grow and saw restoration and preservation of the historic establishments. In the 1970s, growth boomed as Austin expanded, and large-scale development was brought to Round Rock. The town became a site for manufacturing and industry, causing the population to grow from 2,400 to 11,812 between 1970 and 1980. Growth continued in the 1980s as the city became the home to several technology-related sectors and over 300 retail businesses.

Round Rock transformed from a small settlement to a suburb with a bustling industry. The forward-thinking economic development department leads the community to maintain its high quality of life and major economic development center. The city also has a bustling sports presence. At the last census, its population grew to over 119,000 residents.[1]

Figure 3-1 shows the general location of the City of Round Rock.

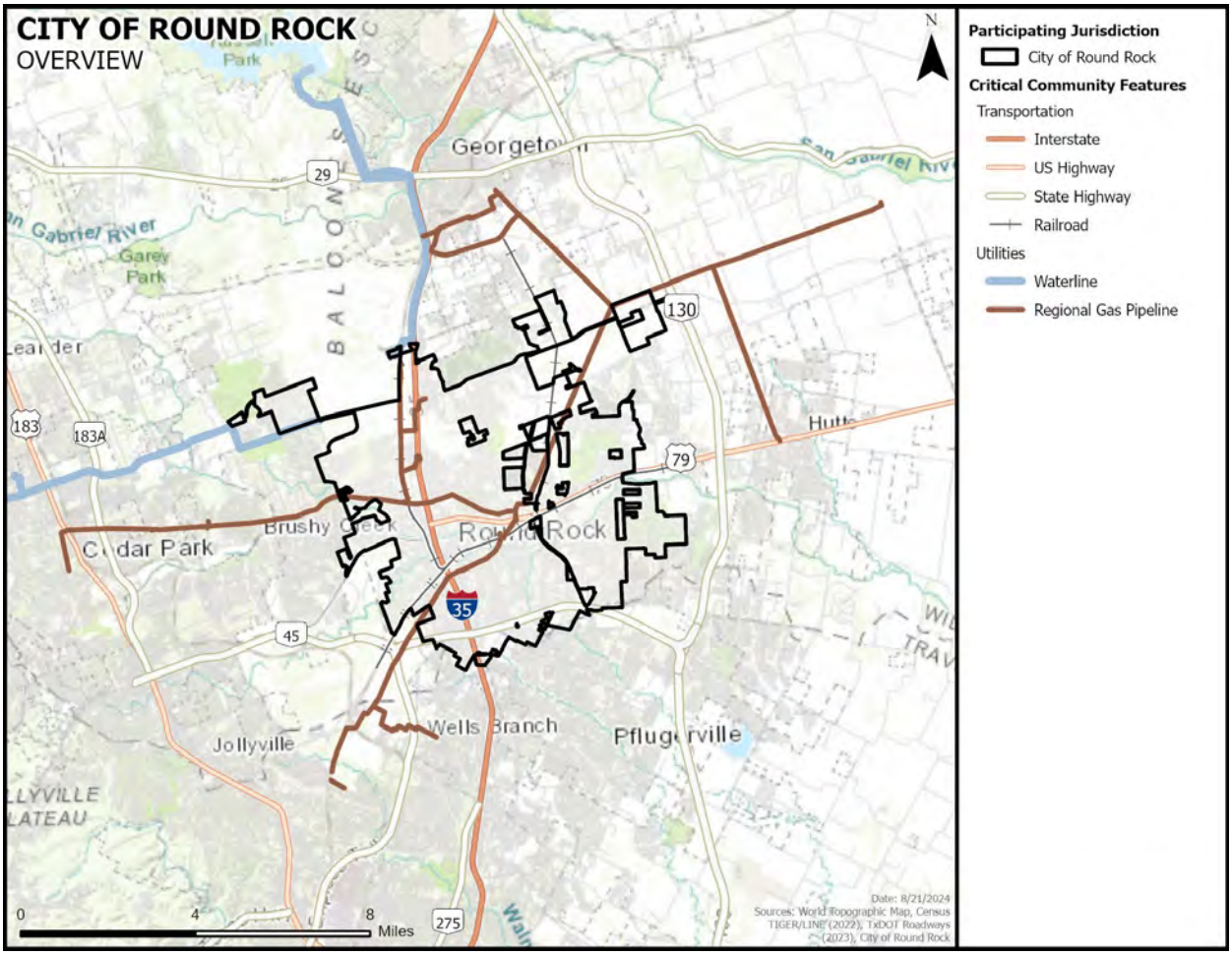
Figure 3-1. Location of the City of Round Rock



[1] Source: https://www.tshaonline.org/handbook/entries/round-rock-tx

Figure 3-2 shows the city limits of the City of Round Rock, which makes up the planning area. All areas of the city's corporate limits are covered in the risk assessment analysis of the Plan.

Figure 3-2. City of Round Rock Planning Area



POPULATION AND DEMOGRAPHICS

According to the 2020 Census population count, the City of Round Rock has an official population of 119,468 residents, a 20 percent increase since the 2010 census. Table 3-1 summarizes select characteristics of vulnerable or sensitive populations in the City of Round Rock using data from the U.S. Census Bureau 2022 American Community Survey (ACS) five-year estimates Note that in some cases, the 2022 ACS estimates may differ from the 2020 census counts: the ACS estimates are used throughout this section for consistency.[2]

Between official U.S. Census population counts, the estimate uses a formula based on new residential building permits and household size. It is simply an estimate, and many variables are involved in achieving an accurate estimation of the number of people living in a given area at a given time.

[2] Source: https://demographics.texas.gov/Data/Decennial/2010/, https://www.census.gov/en.html and https://www.census.gov/acs/www/data/data-tables-and-tools/data-profiles/2022/

Table 3-1. City of Round Rock Vulnerable and Sensitive Populations, 2022

TOTAL 2022 POPULATION	ESTIMATED VULNERABLE OR SENSITIVE POPULATIONS				
	ELDERLY (over 65)	YOUTH (under 5)	WITH A DISABILITY	BELOW POVERTY LEVEL	NON-ENGLISH SPEAKING
120,465	12,356	7,219	12,927	9,276	30,183

POPULATION GROWTH

The official 2020 City of Round Rock population is 119,468. Overall, the city experienced a population increase of 286 percent between 1990 and 2020, or 88,545 residents. Between 2010 and 2020, the city continued to experience population growth, seeing an increase of 20 percent (19,581 residents). Table 3-2 provides historical growth rates for the City of Round Rock.

Table 3-2. Population Growth for City of Round Rock, 1990-2020[3]

1990	2000	2010	2020	POP CHANGE 1990-2020	PERCENT OF CHANGE	POP CHANGE 2010-2020	PERCENT OF CHANGE
30,923	61,136	99,887	119,468	88,545	286%	19,581	20%

ECONOMIC IMPACT

Building and maintaining infrastructure depends on the economy, and therefore, protecting infrastructure from risk due to natural hazards in the planning area is important to the City of Round Rock. Whether it's expanding culverts under a road that washes out during flash flooding, shuttering a fire station, or flood-proofing a wastewater facility, infrastructure must be mitigated from natural hazards in order to continue providing essential utility and emergency response services in a fast-growing planning area.

Based on the American Community Survey 2022 estimates, 70 percent of the population 16 years and over is employed in the labor force. The per capita income is $44,507, and the median household income citywide is $91,888. It is estimated that 22 percent of households have incomes below $50,000. Families with incomes below the poverty level in 2022 made up 5.1 percent of all families. Of families that have children under 18 years old, 7.4 percent are below the poverty level.[4]

Tables 3-3 and 3-4 show the various occupations and industries within the City of Round Rock, according to the 2022 estimates by the American Community Survey.

[3] U.S. Census Bureau

[4] 2022 American Community Survey 5-Year Estimates Economic Data Profile. https://data.census.gov/table/ACSDP5Y2022.DP03?g=160XX00US4863500_040XX00US48&tid=ACSDP5Y2022.DP03

Table 3-3. Occupations of Employed Population in the City of Round Rock[5]

OCCUPATION	ESTIMATE	PERCENT
Civilian employed population 16 years and over	66,377	-
Management, business, science, and arts occupations	30,395	45.8%
Sales and office occupations	16,196	24.4%
Service occupations	9,554	14.4%
Production, transportation, and material moving occupations	6,439	9.7%
Natural resources, construction, and maintenance occupations	3,793	5.7%

Table 3-4. Industries of Employed Population in the City of Round Rock[6]

INDUSTRY	ESTIMATE	PERCENT
Civilian employed population 16 years and over	66,377	-
Educational services, and health care, and social assistance	12,885	19.4%
Professional, scientific, and management, and administrative and waste management services	11,428	17.2%
Retail trade	7,874	11.9%
Manufacturing	6,630	10%
Arts, entertainment, and recreation, and accommodation and food services	5,879	8.9%
Finance and insurance, and real estate and rental and leasing	4,908	7.4%
Public administration	3,802	5.7%
Construction	3,592	5.4%
Other services, except public administration	3,160	4.8%
Transportation and warehousing, and utilities	3,143	4.7%
Information	1,763	2.7%
Wholesale trade	1,183	1.8%
Agriculture, forestry, fishing and hunting, and mining	130	0.20%

[5] 2022 American Community Survey 5-Year Estimates Data Profiles.
[6] 2022 American Community Survey 5-Year Estimates Data Profiles.

NATURAL, CULTURAL, AND HISTORIC RESOURCES

The City of Round Rock territory comprises roughly 38 square miles, with over 37 square miles being land and roughly 0.4 square miles being water. The Balcones Escarpment, also known as the Balcones Fault, runs under the city. The fault has been inactive for over 15 million years and runs under Interstate 35. The Blackland Prairie runs through the area with its rich, fertile, clay-containing soils. This soil was used for agriculture in the past and present.

Among the native animals in the area are eastern fox squirrels, white-tail deer, the American beaver, and bobcats. The Texas Bluebonnet, cedar elm, and upright prairie coneflower are just a few native plants and flowers throughout the community. The city has hot, humid summers and mild, cool winters. Temperatures range from 41°F in the winter to 95°F in the summer, making the area ideal for farming. Rain falls throughout the year, with May being the rainiest month.

The natural environment in Round Rock has led to a diverse array of parks and other recreational destinations. The city has 37 developed parks and numerous trails that span over 2,305 acres. In addition to the parks, Old Settlers Park has 640 acres of countryside for local events and festivals. There are also specialty parks for animals, skating, and a park where children of all abilities can play together. The City of Round Rock has three outdoor municipal pools that are open seasonally, one indoor pool that is open year-round, and a splash fountain.

To further understand natural resources that may be vulnerable to a hazard event and those that need consideration when implementing mitigation activities, it is important to identify at-risk species (i.e., endangered species) in the planning area. A federally endangered species is any species of fish, plant life, or wildlife that is in danger of extinction throughout all or most of its range. A threatened species is a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Both endangered and threatened species are protected by federal law, and any future hazard mitigation projects are subject to these laws. Candidate species are plants and animals that have been proposed as endangered or threatened but are not currently listed.

According to the U.S. Fish and Wildlife Service, as of July 2024, there are 18 federally endangered, threatened, or candidate species in Williamson County, including the City of Round Rock planning area, listed in Table 3-5. Additionally, one species is listed as being resolved (plains spotted skunk), two species in recovery (bald eagle and black-capped vireo), and one is listed as under review (western chicken turtle).

Table 3-5. Endangered Species in Williamson County[7]

TYPE of SPECIES	COMMON NAME	SCIENTIFIC NAME	SPECIES STATUS
Arachnid	Tooth Cave spider	Tayshaneta myopica	Endangered
Arachnid	Bone Cave harvestman	Texella reyesi	Endangered
Birds	Whooping crane	Grus americana	Endangered
Birds	Golden-cheeked warbler	Setophaga chrysoparia	Endangered

[7] Source: https://ecos.fws.gov/ecp/report/species-listings-by-current-range-county?fips=48491

TYPE of SPECIES	COMMON NAME	SCIENTIFIC NAME	SPECIES STATUS
Clams	Texas fatmucket	Lampsilis bracteate	Endangered
Clams	Texas pimpleback	Cyclonaias petrina	Endangered
Clams	False spike	Fusconaia mitchelli	Endangered
Insect	Tooth Cave ground beetle	Rhadine persephone	Endangered
Insects	Coffin Cave mold beetle	Batrisodes texanus	Endangered
Mammals	Tricolored bat	Perimyotis subflavus	Proposed Endangered
Amphibians	Salado Salamander	Eurycea chisholmensis	Threatened
Amphibians	Georgetown Salamander	Eurycea naufragia	Threatened
Amphibians	Jollyville Plateau Salamander	Eurycea tonkawar	Threatened
Clams	Texas fawnsfoot	Truncilla macrodon	Threatened
Flowering Plants	Bracted twistflower	Steptanthus bracreatus	Threatened
Birds	Rufa red knot	Calidris canutus rufa	Threatened
Birds	Piping Plover	Charadrius melodus	Threatened
Insects	Monarch butterfly	Danaus plexippus	Candidate

The City of Round Rock has designated historic buildings and sites to preserve its rich history. The city has three buildings, one district, and one site on the National Register of Historic Places. Historic buildings are vulnerable to natural hazards as their construction pre-dates modern building codes. There are also historic preservation considerations and requirements for historic structures when they are included in mitigation or recovery projects.

Table 3-6. Historic Properties on the National Register[8]

PROPERTY NAME	LOCATION	ADDRESS
Inn at Bushy Creek	Old Round Rock	Taylor Exit off U.S. 79, off I-35
Kenney's Fort Site	Round Rock	Address Restricted
Capt. Merrell Nelson House	Round Rock	NE of Round Rock on U.S. 79
Round Rock Commercial Historic District	Round Rock	100 and 200 blocks E. Main St.
Round Rock Post office and William M. Owen House	Round Rock	Chisholm Trail and Emanuel St.

[8] National Register of Historic Places

EXISTING LAND USE AND DEVELOPMENT TRENDS

A zoning ordinance sets forth regulations and standards related to the extent of land and structure uses that are allowed in certain areas. A zoning map shows the areas within a community where the various zoning districts and standards are located and gives an overall picture of what types of development are located in a community and how a community intends to continue to grow. The City of Round Rock currently has zoning ordinances in place.

A review of building permits can also give a picture of the built environment and the number of buildings being constructed in the City of Round Rock. Table 3-7 lists the number of residential buildings and total units authorized through a permit from the City of Round Rock, between 2019 and 2023. The data includes total buildings and total units permitted. Permits are reported annually in September, and the data includes that from 2019 through 2023 to demonstrate growth. Of the residential building permits issued in this period, over 97 percent (3,799 buildings) were for single-family buildings and 3 percent (107 buildings, containing 3,038 individual housing units) for multi-family buildings. Housing type can also be an indication of an individual's ability to recover from a disaster.

Table 3-7. Building Permits Issued in the City of Round Rock, 2019-2023[9]

2019		2020		2021		2022		2023	
Total Buildings	Total Units	Total Buildings	Total Units	Total Buildings	Total Units	Total Buildings	Total Units	Total Buildings	Total Units
666	1,010	503	1,105	830	1,931	843	1,457	1,064	1,334

Certain housing types found in Round Rock's planning area are more vulnerable than typical site-built, newly constructed residential structures. This includes mobile or manufactured homes, of which 29 (0.06 percent of total housing stock) are in the planning area. Additionally, single-family residences (SFR) built before 1980 are typically built to lower or less stringent construction standards than newer construction, making these homes more susceptible to damage during hazard events. These older homes comprise 12 percent (approximately 5,539 structures) of housing stock in the planning area. Table 3-8 includes housing inventory data for the City of Round Rock per the American Community Survey five-year estimates.

Table 3-8. Housing Inventory and Vulnerable Structures in the City of Round Rock[10]

TOTAL HOUSING UNITS	BUILT PRIOR TO 1980	MOBILE HOME
47,502	5,539	29

CHANGES IN VULNERABILITY

The City of Round Rock experienced an overall population increase of 20 percent between 2010 and 2020. The American Community Survey estimates the 2022 total housing units for the planning area to be 47,502. The total building permits issued between 2019 and 2023 represent

[9] U.S. Census Bureau, Building Permit Survey, 1992-2023, https://www.census.gov/construction/bps/

[10] The Housing Inventory and Vulnerable Structures are based off the 2022 American Community Survey 5-Year Estimates Data Profiles.

approximately 8 percent of the total housing units available in the planning area. The overall population increase, combined with the increase in housing units, indicates an increase in vulnerability to all hazards in terms of populations and the built environment.

Table 3-9. Changes in Vulnerability

JURISDICTION	POPULATION TREND	HOUSING TREND	OVERALL VULNERABILITY CHANGES
City of Round Rock	Increasing	Increasing	Increase

Changes in vulnerability are applicable to all natural hazards except when discussing dam failure as vulnerability for this hazard is discussed in relation to changes in the estimated inundation areas for profiled dams. For the seven dams profiled in Section 5, there are no known changes in vulnerability in the estimated inundation areas. While flood and wildfire hazards feature geographical boundaries, increases in population and building inventory can increase overall vulnerability for these hazards even when the trends occur outside of the known hazard boundary. Development decreases permeable surface areas and increases runoff, increasing flood risk. As population density increases, the Wildland Urban Interface (WUI) typically increases. WUI growth often results in more wildfire ignitions, which puts more houses and lives at risk.

The Community Risk Reduction program has identified a cluster of elderly residents in Round Rock West. Round Rock West is also the location of homes built in the 1970s and 1980s. This portion of the population is vulnerable to power outages that can have great impacts on those who rely on medical devices. In addition, this population may not be as familiar with technology, which increases their vulnerability during disasters. Some other vulnerable communities in the City of Round Rock include those who speak native languages other than English and those in the hearing-impaired community. The Community Risk Reduction program has noted that there has been an increase in Spanish speakers as well as those who speak other languages, including Chinese, Korean, and Languages of India.

FUTURE GROWTH AND DEVELOPMENT

To better understand how future growth and development in the City of Round Rock might affect hazard vulnerability, it is useful to consider population growth, occupied and vacant land, the potential for future development in hazard areas, and current planning and growth management efforts. This section includes an analysis of the projected population change and economic impacts.

Population projections from 2010 to 2050 are listed in Table 3-10, provided by the Office of the State Demographer, Texas State Data Center, and the Institute for Demographic and Socioeconomic Research. Population projections are based on a 0.5 scenario growth rate, which is 50 percent of the population growth rate from 2000-2010. This information is only available at the county level; however, the City of Round Rock is a major driver of growth and the most populous city in Williamson County. Therefore, it can be assumed that projected growth rates for Williamson County would be mirrored, or even exceeded, within the City of Round Rock.

Table 3-10. Williamson County Population Projections[11]

LAND AREA (SQ MI)	2010		2020		2030		2040		2050	
	Population									
	Total Number	Density (Land Area, SQ MI)	Total Number	Density (Land Area, SQ MI)	Total Number	Density (Land Area, SQ MI)	Total Number	Density (Land Area, SQ MI)	Total Number	Density (Land Area, SQ MI)
1,116	422,679	378.8	609,017	545.8	715,401	641.1	823,219	737.7	929,938	833.4

Comprehensive Plans are guiding documents in a community that set forth a vision, goals, policies, and guidelines to direct future physical, social, and economic development within a jurisdiction. They are part of a continuous process to provide an environment for citizens and consider the general desire of the community to conserve, preserve, and protect the natural environment of their jurisdiction. These plans guide staff, decision-makers, and citizens in making decisions that affect the community with an understanding of the long-term effects.

Round Rock 2030 serves as the Comprehensive Plan for the City of Round Rock. It was adopted on June 25, 2020, and creates a vision for what the city will be like in the next ten years. The plan's vision statement is "Round Rock is a safe, desirable, family-oriented community that balances progress and prosperity with its history, by prioritizing quality of life, mobility, economic development and thoughtful land use planning." The plan contains recommendations on growth and community character, sustainability, updated infrastructure and critical services, land use and development, economic development, zoning opportunities, mobility, and community facilities and services. Refer to the Capability Assessment in Appendix F for a complete list of the plans, ordinances, and other resources for City of Round Rock.

[11] Office of the State Demographer, Texas State Data Center, and the Institute for Demographic and Socioeconomic Research

SECTION 4

RISK OVERVIEW

HAZARD DESCRIPTION

Section 4 is the first phase of the Risk Assessment, providing background information for the hazard identification process and descriptions of the hazards identified. The Risk Assessment continues with Sections 5 through 21, which include hazard descriptions and vulnerability assessments.

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, the City of Round Rock identified 12 natural hazards and 5 human-caused hazard that are addressed in the Hazard Mitigation Plan Update, and were identified as significant, as shown in Table 4-1. The hazards were identified through input from Planning Team members and a review of the current 2023 State of Texas Hazard Mitigation Plan (State Plan). Readily available online information from reputable sources such as federal and state agencies was also evaluated and utilized to supplement information as needed.

There are three main categories of natural hazards: atmospheric, hydrologic, and technological. Atmospheric hazards are events or incidents associated with weather-generated phenomena. The atmospheric hazards that have been identified as significant for the planning area include extreme heat, hail, tornado, lightning, thunderstorm wind, and winter storm (Table 4-1).

Hydrologic hazards are events or incidents associated with water-related damage and account for over 75 percent of federal disaster declarations in the United States. Hydrologic hazards identified as significant for the planning area include flood and drought.

Technological hazards refer to the origins of incidents that can arise from human activities, such as the construction and maintenance of dams. They are distinct from natural hazards primarily because they originate from human activity. The risks presented by natural hazards may be increased or decreased due to human activity. However, they are not inherently human-induced. Therefore, dam failure is classified as a quasi-technological hazard and referred to as “technological” in Table 4-1 for description purposes.

For the Risk Assessment, earthquake, wildfire, and land subsidence hazards are considered “other” since they are not considered atmospheric, hydrologic, or technological.

Human-caused hazards are events or incidents caused by human intent, human error, or failed systems. They can be caused or exacerbated by either accidental or intentional human actions that result in the loss of life or property. The human-caused hazards identified as significant for the city include pipeline failure, cyber-attacks, terrorism, hazardous materials, and infectious diseases.

Table 4-1. Hazard Descriptions

HAZARD	DESCRIPTION
ATMOSPHERIC	
Extreme Heat	Extreme heat is the condition whereby temperatures hover ten degrees or more above the average high temperature in a region for an extended period of time.
Hail	Hailstorms are a potentially damaging outgrowth of severe thunderstorms. Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and subsequent cooling of the air mass.
Lightning	Lightning is a sudden electrostatic discharge that occurs during an electrical storm. This discharge occurs between electrically charged regions of a cloud, between two clouds, or between a cloud and the ground.
Thunderstorm Wind	A thunderstorm occurs when an observer hears thunder. Radar observers use the intensity of the radar echo to distinguish between rain showers and thunderstorms. Lightning detection networks routinely track cloud-to-ground flashes, and therefore thunderstorms.
Tornado	A tornado is a violently rotating column of air that has contact with the ground and is often visible as a funnel cloud. Its vortex rotates cyclonically with wind speeds ranging from as low as 40 mph to as high as 300 mph. The destruction caused by tornadoes ranges from light to catastrophic, depending on the location, intensity, size, and duration of the storm.
Winter Storm	Severe winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Blizzards, the most dangerous of all winter storms, combine low temperatures, heavy snowfall, and winds of at least 35 mph, reducing visibility to only a few yards. Ice storms occur when moisture falls and freezes immediately upon impact on trees, power lines, communication towers, structures, roads, and other hard surfaces. Winter storms and ice storms can down trees, cause widespread power outages, damage property, and cause fatalities and injuries to human life.
HYDROLOGIC	
Drought	A prolonged period of less than normal precipitation such that the lack of water causes a serious hydrologic imbalance. Common effects of drought include crop failure, water supply shortages, and fish and wildlife mortality.

HAZARD	DESCRIPTION
Flood	The accumulation of water within a body of water, which results in the overflow of excess water onto adjacent lands, usually floodplains. The floodplain is the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that is susceptible to flooding. Most floods fall into the following three categories: riverine flooding, coastal flooding, and shallow flooding.
OTHER	
Earthquake	An earthquake is the sudden, rapid, shaking of the earth, caused by the breaking and shifting of subterranean rock as it releases strain that has accumulated over a long time. Initial mild shaking may strengthen and become violent within seconds.
Land Subsidence	Land subsidence occurs when land sinks into underground voids. These voids may occur naturally or through human-driven or technologically exacerbated circumstances. When the void can no longer support the weight of the earth above it, it collapses, causing a sinkhole depression in the landscape.
Wildfire	A wildfire is an uncontrolled fire burning in an area of vegetative fuels such as grasslands, brush, or woodlands. Heavier fuels with high continuity, steep slopes, high temperatures, low humidity, low rainfall, and high winds all work to increase the risk for people and property located within wildfire hazard areas or along the urban/wildland interface. Wildfires are part of the natural management of forest ecosystems, but most are caused by human factors.
TECHNOLOGICAL	
Dam Failure	Dam failure is the collapse, breach, or other failure of a dam structure resulting in downstream flooding. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and severe property damage if development exists downstream of the dam.
HUMAN-CAUSED	
Cyberattack	A cyber-attack is any type of offensive maneuver employed by individuals or whole organizations that targets computer information systems, infrastructures, computer networks, and/or personal computer devices by various means of malicious acts usually originating from an anonymous source that either steals, alters, or destroys a specified target by hacking into a susceptible system.

HAZARD	DESCRIPTION
Hazardous Materials	Hazardous materials come in the form of explosives, flammable and combustible substances, poisons, and radioactive materials. A hazardous material (HAZMAT) incident involves a substance outside normal safe containment in sufficient concentration to pose a threat to life, property, or the environment.
Infectious Disease	A clinically evident disease resulting from the presence of pathogenic microbial agents. These infecting agents may be transmitted through liquids, food, bodily fluids, contaminated objects, airborne inhalation, or through vector-borne dissemination.
Pipeline Failure	Fuel pipeline breach or pipeline failure addresses the rare, but serious hazard of an oil or natural gas pipeline. An estimated 2.2 million miles of pipelines in the United States carry hazardous materials. Natural gas pipelines transport natural gas. Oil or liquid petroleum pipelines transport crude oil and refined products from crude oils, such as gasoline, home heating oil, jet fuel and kerosene in addition to liquefied propane, ethylene, butane and some petrochemical products.
Terrorism	Terrorism is the unlawful use of violence and intimidation, especially against civilians, in the pursuit of political aims. Terrorism can be classified as either domestic, which involves groups or individuals without foreign direction, or international terrorism, those whose actions are foreign-based and/or directed. Terrorist incidents can be of many types, including biological or chemical weapons, the use of firearms or explosives, cyber-attacks, or various other means that post a threat to civilians, property, and the environment.

Hazards that were not considered significant and were not included in the Plan Update are located in Table 4-2, along with the evaluation process used for determining the significance of each of these hazards. Hazards not identified for inclusion at this time may be addressed during future evaluations and updates.

Table 4-2. Other Hazards Deferred

HAZARD CONSIDERED	REASON FOR DETERMINATION
Coastal Erosion	The planning area is not located on the coast. Therefore, coastal erosion does not pose a risk.
Hurricane/Tropical Storm	The planning area is located over 150 miles from the Gulf Coast and is not subject to direct hurricane wind impacts. The remnants of tropical systems passing across the planning area may cause significant thunderstorm winds, lightning, and excessive rainfall. Impacts associated with these historical events are covered under thunderstorm wind, lightning or flood hazard profiles.

HAZARD CONSIDERED	REASON FOR DETERMINATION
Expansive Soils	There are no historical occurrences of expansive soils in the planning area, and it is in an area where occurrences are considered rare. There is no history of impact on critical structures, systems, populations, or other community assets or vital services due to expansive soils, and none is expected in the future.

DISASTER DECLARATION HISTORY

One method of understanding hazards that pose a risk to the City of Round Rock is to identify past hazard events that triggered federal or state disaster declarations. Federal and state declarations may be granted when the severity and magnitude of an event surpass the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. Table 4-3 list state and federal disaster declarations received by Williamson County. Many of the disaster events were regional or statewide.

Between 1953 and 2023, Williamson County received 25 federal disaster declarations. The largest share (8) was related to wildfire, followed by declarations for severe storm (4), hurricane[1] (4), winter storm (3), biological (2), flood (2), drought (1), and one classified as "other" was related to the loss of the Space Shuttle Columbia.

In addition to the 25 federally declared disaster there have been 33 U.S. Department of Agriculture (USDA) Secretarial disaster designations between 2012 and 2023. The Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans available to producers suffering losses in those counties and in counties that are contiguous to a designated county.[2] Of the 33 USDA designations for Williamson County, many listed multiple factors as having caused the disaster area designation. The leading cause was drought, which was included in 30 designations. Other factors listed include excessive heat (13 designations), high wind (12), fire/wildfire (11), insects (11), excessive rain (1), and winter storm (1).

Table 4-3. Disaster Declaration History of Williamson County, 1953-2023

YEAR	DECLARATION TITLE	HAZARD	DECLARATION TYPE[3]	DISASTER No.
1974	Severe Storms, Flooding	Flood	DR	DR-454
1989	Severe Storms, Tornadoes, Flooding	Severe Storms	DR	DR-828
1991	Severe Storms, Thunderstorms	Flood	DR	DR-930

[1] The City of Round Rock / Williamson County does not experience direct impacts from hurricanes. Tropical storm and hurricane disaster declarations typically include multiple inland counties due to the excessive precipitation, thunderstorm wind, and lightning associated with the remnants of tropical systems as they track inland before dissipating.
[2] United States Department of Agriculture https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/emergency_disaster_designation_declaration_process-factsheet.pdf
[3] Major Disaster Declaration (DR); Emergency Declaration (EM); Fire Management Assistance Declaration (FM)

YEAR	DECLARATION TITLE	HAZARD	DECLARATION TYPE[3]	DISASTER No.
1993	Extreme Fire Hazard	Drought	EM	EM-3113
1998	Tropical Storm Charley	Severe Storms	DR	DR-1239
1999	Extreme Fire Hazards	Wildfire	EM	EM-3142
2003	Loss of Space Shuttle Columbia	Other	EM	EM-3171
2005	Hurricane Katrina	Hurricane	EM	EM-3216
2005	Hurricane Rita	Hurricane	EM	EM-3261
2005	Hurricane Rita	Hurricane	DR	DR-1606
2006	Extreme Wildfire Threat	Wildfire	DR	DR-1624
2007	Severe Storms, Tornadoes, Flooding	Severe Storms	DR	DR-1709
2008	Wildfires in Texas	Wildfire	EM	EM-3284
2008	Florence Fire	Wildfire	FM	FM-2785
2008	Hurricane Ike	Hurricane	EM	EM-3294
2011	Grand Mesa Fire	Wildfire	FM	FM-2922
2011	Horseshoe Fire	Wildfire	FM	FM-2949
2011	Moonglow Fire	Wildfire	FM	FM-2963
2011	Wildfire in Texas	Wildfire	DR	DR-4029
2015	Severe Storms, Tornadoes, Straight-Line Winds, and Flooding	Severe Storms	DR	DR-4223
2020	Texas Covid-19	Biological	EM	EM-3458
2020	Covid-19 Pandemic	Biological	DR	DR-4485
2021	Severe Winter Storm	Winter Storm	EM	EM-3554
2021	Severe Winter Storm	Winter Storm	DR	DR-4586
2023	Severe Winter Storm	Winter Storm	DR	DR-4705

NATURAL HAZARDS AND CLIMATE CHANGE

Climate change is defined as a long-term shift in temperature and weather patterns. These shifts can increase or decrease the risk of natural hazards. Global climate change is expected to exacerbate the risks of certain types of natural hazards impacted by rising sea levels, warmer ocean temperatures, higher humidity, the possibility of stronger storms, and an increase in wind

and flood damage due to storm surges. Texas is considered one of the more vulnerable states in the U.S. to both abrupt climate changes and the impact of gradual climate changes on the natural and built environments.

Climate change is expected to lead to an increase in average temperatures as well as an increase in the frequency, duration, and intensity of extreme heat events. With no reductions in emissions worldwide, the state of Texas is projected to experience an additional 30 to 60 days per year above 100°F than what is experienced now.[4]

The State Climatologist's *Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900-2036* identifies ongoing and likely future trends through 2036 based on analysis of historic observations of temperatures, precipitation, and extreme weather. Table 4-4 highlights future trends in extreme weather from the report.

Table 4-4. Future Trends in Extreme Weather in Texas[5][6]

HAZARDS	EXPECTED TRENDS
Extreme Temperatures	• The average annual surface temperature in 2036 is expected to be 3.0°F warmer than the 1950-1999 average and 1.8°F warmer than the 1991-2020 average. • Nearly double the number of 100°F days by 2036 compared to 2001-2020. • Higher frequency of 100°F days in urban areas. • The number of nighttime temperatures below 32°F are expected to decrease. • The number of frost days per year are expected to decrease. • The coolest days of the summer are expected to continue becoming warmer. • The number of heatwaves per year and number of days per year classified as heatwaves are expected to increase.
Precipitation	• Precipitation has increased by 10 percent or more in eastern Texas, but little trend is present in western Texas. • Precipitation trends to 2036 are likely to be dominated by natural variability. • Extreme precipitation is expected to increase in intensity on average statewide by 6-10 percent compared to the 1950-1999 averages and 2-3 percent relative to the 2001-2020 averages.

[4] Kloesel, K., B. Bartush, J. Banner, D. Brown, J. Lemery, X. Lin, C. Loeffler, G. McManus, E. Mullens, J. Nielsen-Gammon, M. Shafer, C. Sorensen, S. Sperry, D. Wildcat, and J. Ziolkowska, 2018: Southern Great Plains. In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 987–1035. doi: 10.7930/NCA4.2018.CH23. https://nca2018.globalchange.gov/chapter/23/

[5] Nielsen-Gammon, John, Holman, Sara, Buley, Austin and Jorgensen, Savannah. Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900-2036, 2021 Update. Texas A&M University Office of the Texas State Climatologist. October 7, 2021. https://climatexas.tamu.edu/files/ClimateReport-1900to2036-2021Update

[6] University of Texas at Austin, February 2023, Austin Future Climate, Climate Change Predictions for the City of Austin 2022, Technical Report.

HAZARDS	EXPECTED TRENDS
	• This translates to an increase in the frequency of extreme rain of 30-50 percent relative to the climatological expected frequency in 1950-1999 and 10-15 percent relative to 2001-2020. • Annual precipitation is projected to increase while the number of extreme precipitation (>2") will remain relatively consistent.
Drought	• Increasing temperatures, rainfall variability, and other factors will decrease water availability, but impact changes will vary strongly across applications. • Impact trends to be highly sector-specific, with the impacts possibly smaller for agriculture than for surface water supply.
Flood	• No long-term river flooding trend has been identified in the observations, nor is such a trend projected at this point, except perhaps for the most extreme floods and areas with normally high rainfall. • Urban flooding is projected to increase, both as a simple matter of urban population increase and because of the projected increase of precipitation intensity, which drives flooding in fast-response drainages like those usually found in urban areas. • The climate-driven trend in urban flood frequency should be similar to the climate-driven trend in extreme precipitation frequency: 30-50 percent in 2036 relative to 1950-1999 and 10-15 percent relative to 2001-2020. • Areas already experiencing flooding are likely to see an increase in the frequency and magnitude of events.
Winter Weather	• As the climate warms, the likelihood of winter weather decreases. • Both extreme cold and snowfall either become less frequent or are expected to do so. • Widespread snowfall events in Texas, such as the one that took place in February 2021, are extremely rare. • Fewer cold spells are projected to occur per year, but the length of cold spells will be longer when they do occur.
Thunderstorms (Wind, Hail, Lightning)	• Historical trend data is unreliable. • Indirect evidence supports an increase in the number of days capable of producing severe thunderstorms and an increase in the frequency of very large hail in early springtime. Still, these possible trends are too uncertain to quantify.
Wildfire	• Weather and climate drivers of wildfire risk are projected to increase the risk of wildfires throughout the state, primarily due to increased drying rates and fuel load.

OVERVIEW OF HAZARD ANALYSIS

The methodologies utilized to develop the Risk Assessment are a historical analysis and a statistical approach. Both methodologies provide an estimate of potential impact by using a common, systematic framework for evaluation.

Records retrieved from the National Centers for Environmental Information (NCEI) and the National Oceanic and Atmospheric Administration (NOAA) were reported for the City of Round Rock. The remaining records identifying the occurrence of hazard events in the planning area and the maximum recorded magnitude of each event were also evaluated.

Geographic information system (GIS) technology was used to identify and assess risks for the City of Round Rock and evaluate community assets and their vulnerability to hazards.

The four general parameters that are described for each hazard in the Risk Assessment include frequency of return, approximate annualized losses, a description of general vulnerability, and a statement of the hazard's impact.

The frequency of return was calculated by dividing the number of events in the recorded time period for each hazard by the overall time period that the resource database was recording events. Frequency of return statements are defined in Table 4-5, and impact statements are defined in Table 4-6 below.

Table 4-5. Frequency of Return Statements

PROBABILITY	DESCRIPTION
Highly Likely	Event is probable in the next year.
Likely	Event is probable in the next three years.
Occasional	Event is probable in the next five years.
Unlikely	Event is probable in the next ten years.

Table 4-6. Impact Statements

POTENTIAL SEVERITY	DESCRIPTION
Substantial	Multiple deaths. Complete shutdown of facilities for 30 days or more. More than 50 percent of property destroyed or with major damage.
Major	Injuries and illnesses resulting in permanent disability. Complete shutdown of critical facilities between one and four weeks. More than 25 percent of property destroyed or with major damage.
Minor	Injuries and illnesses do not result in permanent disability. Complete shutdown of critical facilities for up to one week. More than 10 percent of property destroyed or with major damage.

POTENTIAL SEVERITY	DESCRIPTION
Limited	Injuries and illnesses are treatable with first aid. Shutdown of critical facilities and services for 24 hours or less. Less than 10 percent of property destroyed or with major damage.

Each of the hazard profiles includes a description of a general Vulnerability Assessment. Vulnerability is the total of assets that are subject to damage from a hazard based on historic recorded damages. Assets in the region were inventoried and defined in hazard zones where appropriate. The total amount of damage, including property and crop damages, for each hazard is divided by the total number of assets (building value totals) in that community to determine the percentage of damage that each hazard can cause to the community. Risk and consequences will be addressed and covered within each hazard profile under the Vulnerability and Impact section as well as under the Assessment of Impact sections, where applicable.

To better understand how future growth and development in the City of Round Rock might affect hazard vulnerability, it is useful to consider population growth, occupied and vacant land, the potential for future development in hazard areas, and current planning and growth management efforts. Hazard vulnerability for the City of Round Rock was reviewed based on recent development changes that occurred throughout the planning area. The population of the City of Round Rock has grown by 20 percent between 2010 and 2020, according to the U.S. Census Bureau. Therefore, the vulnerability to the population, infrastructure, and buildings has increased for hazards that do not have a geographical boundary.

Once loss estimates and vulnerability were known, an impact statement was applied to relate the potential impact of the hazard on the assets within the area of impact.

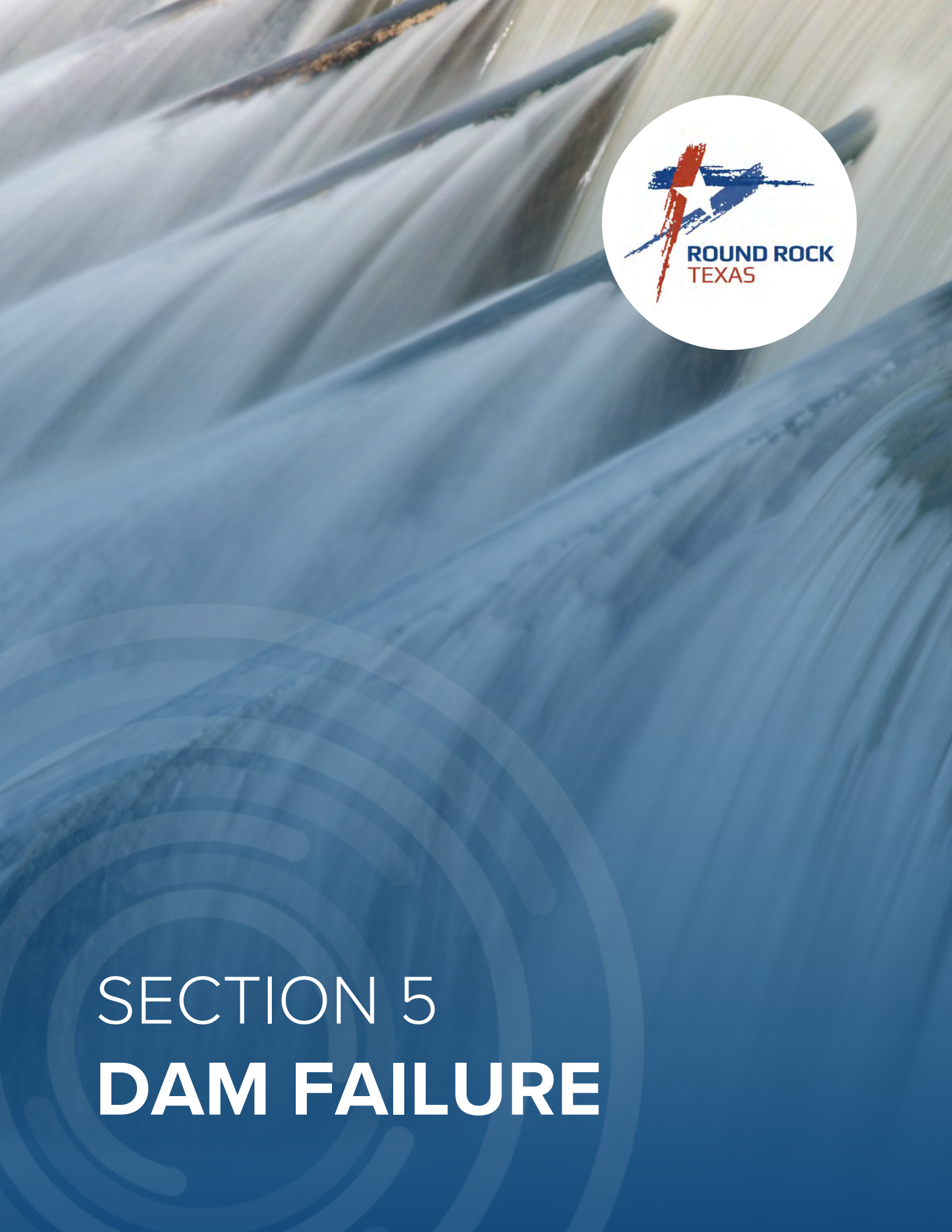
HAZARD RANKING

During the 2024 planning process, the Planning Team conducted a risk ranking exercise to get input from the Planning Team and stakeholders. Table 4-7 portrays the results of the risk assessment analysis, including the frequency of occurrence and potential severity and the Planning Team's self-assessment for hazard ranking based on local knowledge of past hazard events and impacts for each identified hazard. The definitions for frequency of occurrence and potential severity can be found in Table 4-5 and Table 4-6.

Table 4-7. Hazard Risk Ranking

HAZARD	FREQUENCY OF OCCURRING	POTENTIAL SEVERITY	RANKING
Natural Hazards			
Extreme Heat	Highly Likely	Substantial	High
Flood	Likely	Limited	High
Drought	Highly Likely	Limited	Moderate

HAZARD	FREQUENCY OF OCCURRING	POTENTIAL SEVERITY	RANKING
Hail	Highly Likely	Minor	Moderate
Lightning	Highly Likely	Limited	Moderate
Thunderstorm Wind	Highly Likely	Limited	Moderate
Tornado	Unlikely	Substantial	Moderate
Winter Storm	Highly Likely	Minor	Moderate
Dam Failure	Unlikely	Limited	Low
Earthquake	Unlikely	Limited	Low
Land Subsidence	Unlikely	Limited	Low
Wildfire	Highly Likely	Minor	Low
Human-Caused Hazards			
Cyber Attack	Unlikely	Major	High
Hazardous Materials	Occasional	Limited	Low
Infectious Disease	Unlikely	Substantial	Low
Pipeline Failure	Unlikely	Minor	Low
Terrorism	Unlikely	Substantial	Low



SECTION 5
DAM FAILURE

SECTION 5: DAM FAILURE

HAZARD DESCRIPTION

Dams are water storage, control, or diversion structures that impound water upstream in reservoirs. Dam failure can take several forms, including a collapse of or breach in the structure. While most dams have storage volumes small enough that failures have few or no repercussions, dams storing large amounts can cause significant flooding downstream. Dam failures can result from any one or a combination of the following causes:

- Prolonged periods of rainfall and flooding, which cause most failures;
- Inadequate spillway capacity, resulting in excess overtopping of the embankment;
- Internal erosion caused by embankment or foundation leakage or piping;
- Improper maintenance, including failure to remove trees, repair internal seepage problems, or maintain gates, valves, and other operational components;
- Improper design or use of improper construction materials;
- Failure of upstream dams in the same drainage basin;
- High winds, which can cause significant wave action and result in substantial erosion;
- Destructive acts of terrorism; and,
- Earthquakes, which typically cause longitudinal cracks at the tops of the embankments, leading to structural failure.

Benefits provided by dams include water supplies for drinking; irrigation and industrial uses; flood control; hydroelectric power; recreation; and navigation. Dams in Texas serve many purposes, some of which include recreation, flood mitigation, irrigation, water supply, and fire protection. About 1 in 3 of the state's dams are for flood risk mitigation and 1 in 7 dams are for irrigation or water supply.[1]

While dams serve a role in helping communities' function, dams also represent a risk to public safety. Dams require ongoing maintenance, monitoring, safety inspections, and sometimes even rehabilitation to continue safe service.

In the event of a dam failure, the energy of the water stored behind the dam is capable of causing rapid and unexpected flooding downstream, resulting in loss of life and substantial property damage. A devastating effect on water supply and power generation could be expected as well.

[1] American Society of Civil Engineers. "2021 Report Card for America's Infrastructure: Infrastructure Texas Report Card." 2021. https://infrastructurereportcard.org/state-item/texas/

SECTION 5: DAM FAILURE

The terrorist attacks of September 11, 2001, generated increased focus on protecting the country's infrastructure, including ensuring the safety of dams.

One major issue with the safety of dams is their age. The average age of the United States' more than 90,000 dams is 57 years.[2] According to estimates released in 2022 by the Association of State Dam Safety Officials, the total cost of rehabilitating non-federal dams is $75.69 billion. Of non-federal dams, the high-hazard potential dams are estimated at a total of $24.04 billion for rehabilitation.[3] In addition to the continual aging of dams, there have not been significant increases in the number of safety inspectors resulting in haphazard maintenance and inspection. Within Texas there are over 3,200 dams exempt from dam safety requirements by State legislation.[4] The current maintenance budget does not match the scale of the United States' long-term modifications of its watersheds. People continue to move into these areas and as the population grows, dams that once could have failed without major repercussions are now upstream of cities and development.

[2] American Society of Civil Engineers. "2021 Report Card for America's Infrastructure." 2021. https://infrastructurereportcard.org/

[3] Association of State Dam Safety Officials, "The Cost of Rehabilitating Our Nation's Dams". March 2022. https://damsafety-stag.s3.amazonaws.com/s3fs-public/files/Cost%20of%20Rehab%20Report-2022%20FINAL_0.pdf

[4] American Society of Civil Engineers. "2021 Report Card for America's Infrastructure: Infrastructure Texas Report Card." 2021. https://infrastructurereportcard.org/state-item/texas/

LOCATION

The State of Texas has 7,413 dams, all regulated by the Texas Commission on Environmental Quality (TCEQ). The National Dam Safety Review Board (in coordination with FEMA) and the National Inventory of Dams (NID) list a total of 15 dams in and near the City of Round Rock. Each of these dams were analyzed individually by location, volume, elevation, and condition (where available) when determining the risk, if any, for each dam. Each dam site was further analyzed for potential risks utilizing FEMA's National Flood Hazard Layer to map locations and fully understand development near the dam and topographical variations that may increase risk.

Most of the dams listed were embankments for typically dry detention drainage areas or shored up stream embankments. These types of structures are utilized for flood control and do not pose a dam failure risk. Other dams in the planning area feature such limited storage capacity that they pose no risk to structures, infrastructure, or citizens. Dams that were deemed to pose no past, current, or future risk to the planning area are not profiled in the plan as no loss of life or impact to critical facilities or infrastructure is expected in the event of a breach. Based on this detailed analysis, the planning team was able to determine that only 7 of the 15 dams identified pose a potential risk to the planning area. All 7 of these dams are listed in Table 5-1 with regulation information.

Figure 5-1 illustrates the general location for the critical dams in the planning area, while Figures 5-2 through 5-8 give a closer look at each individual dam. While inundation maps are not available for the profiled dams, an estimated inundation radius has been included on the individual maps for each profiled dam (indicated by the red circle). For dams with a maximum storage capacity of less than 10,000 acre-feet, all structures within one mile are considered to be at risk to potential dam or levee failure hazards.

Figure 5-1. Planning Area Dams with Potential Risk

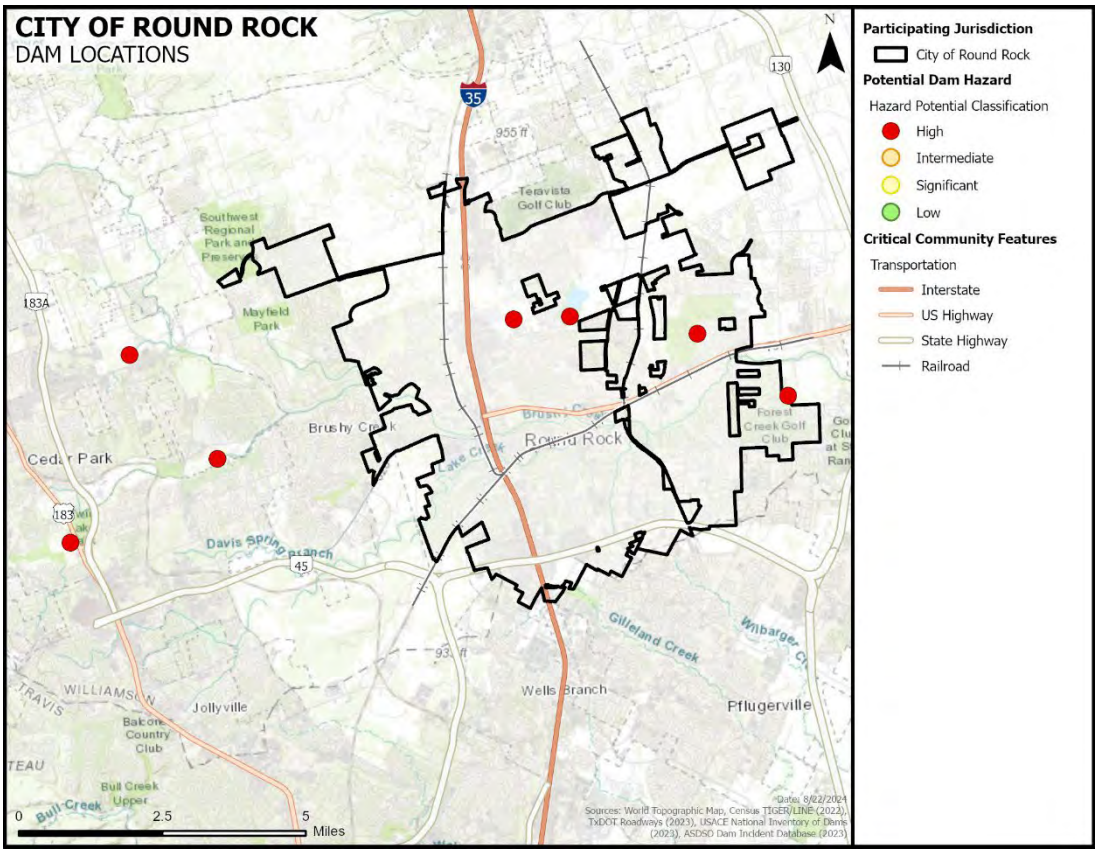


Table 5-1. City of Round Rock Dam Survey

DAM NAME	HEIGHT (feet)	STORAGE (acre feet)	CONDITION	HAZARD CLASSIFICATION
Upper Brushy Creek WS SCS Site 4 Dam	56.5	3,226	High	Satisfactory
Upper Brushy Creek WS SCS Site 6 Dam	49	3,488	High	Satisfactory
Upper Brushy Creek WS SCS Site 7 Dam	54	5,587	High	Satisfactory
Upper Brushy Creek WS SCS Site 11 Dam	41	5,844	High	Satisfactory
Upper Brushy Creek WS SCS Site 14 Dam	24.8	2,549	High	Satisfactory
Upper Brushy Creek WS SCS Site 17 Dam	34	739	High	Satisfactory
Upper Brushy Creek WS SCS Site 19 Dam	41	970	High	Satisfactory

EXTENT

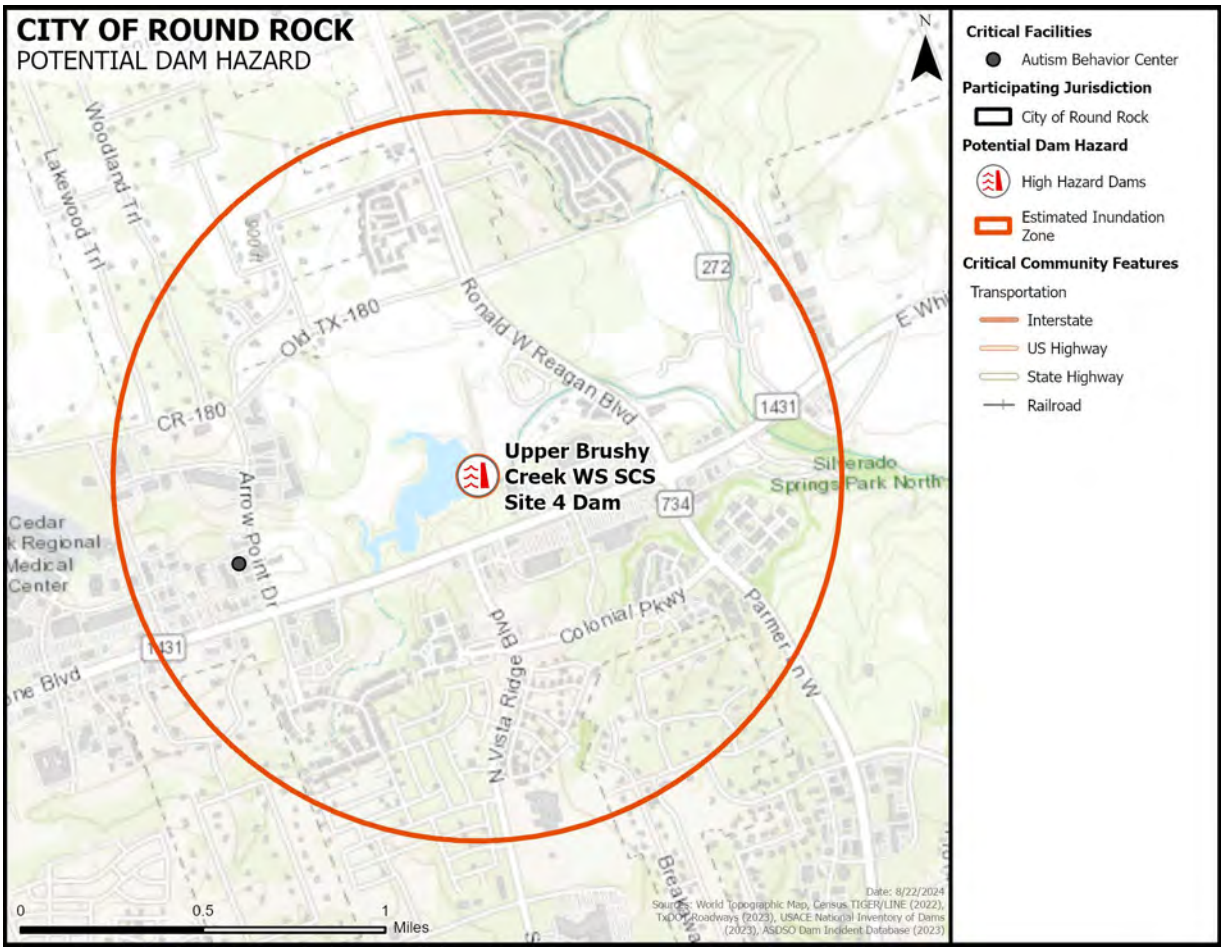
The extent or magnitude of a dam failure event is described in terms of the classification of damages that could result from a dam's failure, not the probability of failure. For dams with a maximum storage capacity of 100,000 acre-feet or more, all census blocks within five miles are considered to be at risk to potential dam failure hazards. For dams with a maximum storage capacity between 10,000 and 100,000 acre-feet, all census blocks within three miles are considered to be at risk to potential dam failure hazards. For dams with a maximum storage capacity of less than 10,000 acre-feet, all census blocks within one mile are considered to be at risk to potential dam or levee failure hazards. Each profiled dam describes the structures or infrastructure considered to be at risk in the event of a breach based on each estimated inundation zone. An estimated depth for dam breach is indicated for each profiled dam.[5]

[5] Dam breach depth is an estimate based on best available data, not statistical data.

Upper Brushy Creek WS SCS Site 4 Dam

Upper Brushy Creek WS SCS Site 4 Dam is located in the City of Round Rock on the Spanish Oak Creek. The earthen dam is owned by the Taylor Soil and Water Conservation District and the Upper Brushy Creek Control and Improvement District. The dam was constructed in 1960 for the primary purpose of flood risk reduction. The area located near the dam is a densely populated area with a mix of residential and commercial development. More than 400 residential and commercial structures are within one mile of the dam but are not expected to be significantly impacted in the event of a breach. Extensive damages are not anticipated in the event of a breach due to the limited capacity of the dam. It is anticipated that the breach flow would primarily follow the course of the creek, exceeding the banks of the creek and inundating areas along the path. In the event of a breach, it is estimated that the average breach width would be 196 feet with a maximum breach flow of 58,330 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet, with the highest depth in the immediate area of the dam.

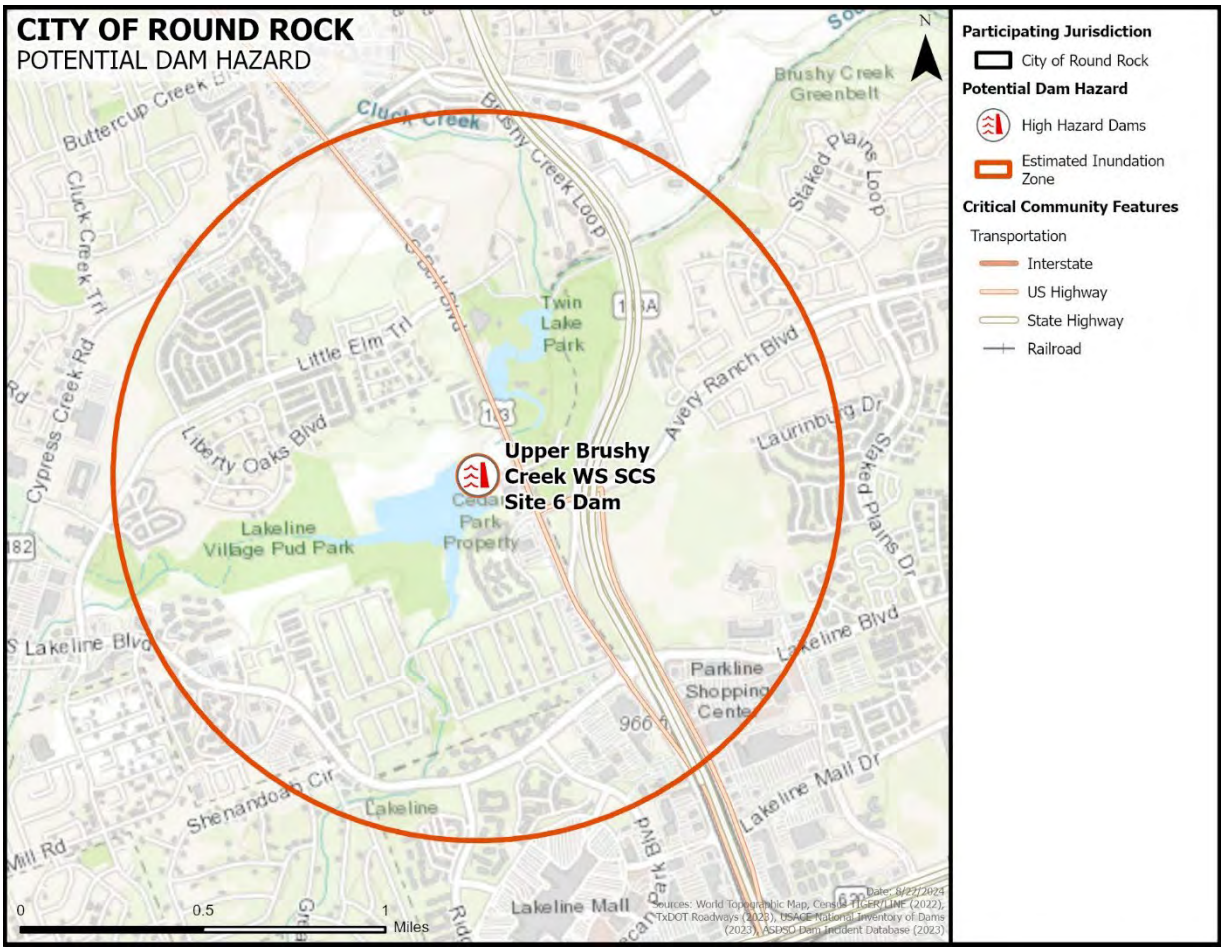
Figure 5-2. Upper Brushy Creek WS SCS Site 4 Dam



Upper Brushy Creek WS SCS Site 6 Dam

Upper Brushy Creek WS SCS Site 6 Dam is located in the City of Round Rock on Buttercup Creek. The earthen dam is owned by the Taylor Soil and Water Conservation District and the Upper Brushy Creek Control and Improvement District. The dam was constructed in 1959 for the primary purpose of flood risk reduction. The area located near the dam is a densely populated area with mostly residential development. More than 600 residential and commercial structures are within one mile of the dam and may be impacted in the event of a breach. Extensive damages are not anticipated due to the limited capacity of the dam. It is anticipated that the breach flow would primarily follow the course of the creek, exceeding the banks of the creek and inundating areas along the path. In the event of a breach, it is estimated that the average breach width would be 193 feet with a maximum breach flow of 53,404 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet, with the highest depth in the immediate (primarily undeveloped) area of the dam. Water depths would drop dramatically as the flow travels away from the dam.

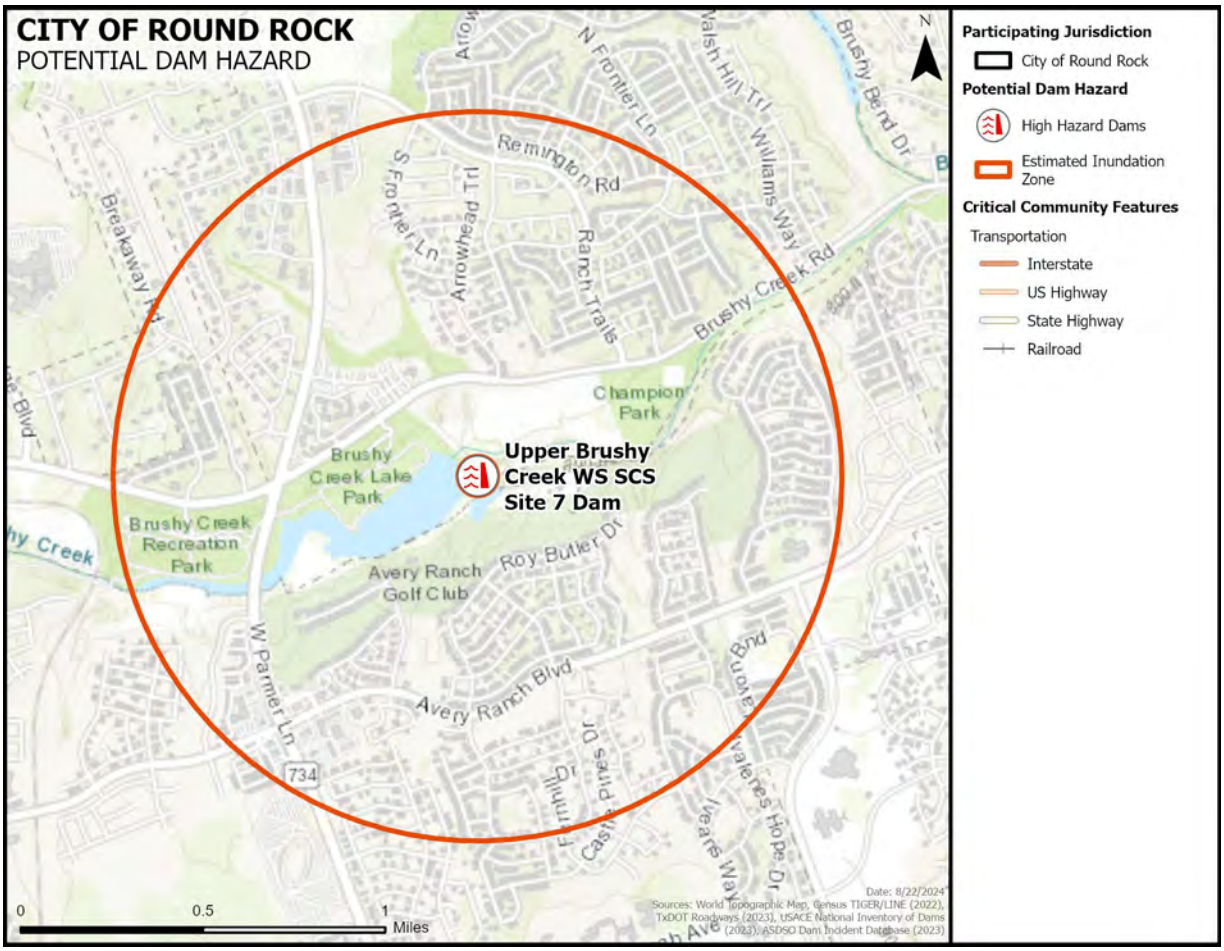
Figure 5-3. Upper Brushy Creek WS SCS Site 6 Dam



Upper Brushy Creek WS SCS Site 7 Dam

Upper Brushy Creek WS SCS Site 7 Dam is located in the City of Round Rock on the South Brushy Creek. The earthen dam is owned by the Taylor Soil and Water Conservation District and the Upper Brushy Creek Control and Improvement District. The dam was constructed in 1965 for the primary purpose of flood risk reduction. The area located near the dam is a densely populated area with mostly residential development. More than 600 residential structures are within one mile of the dam and may be impacted in the event of a breach. Extensive damages are not anticipated in the event of a breach due to the limited capacity of the dam. It is anticipated that the breach flow would primarily follow the course of the creek, exceeding the banks of the creek and inundating areas along the path. In the event of a breach, it is estimated that the average breach width would be 222 feet, with a maximum breach flow of 74,889 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet, with the highest depth in the immediate area of the dam. Water depths would drop dramatically as the flow travels away from the dam.

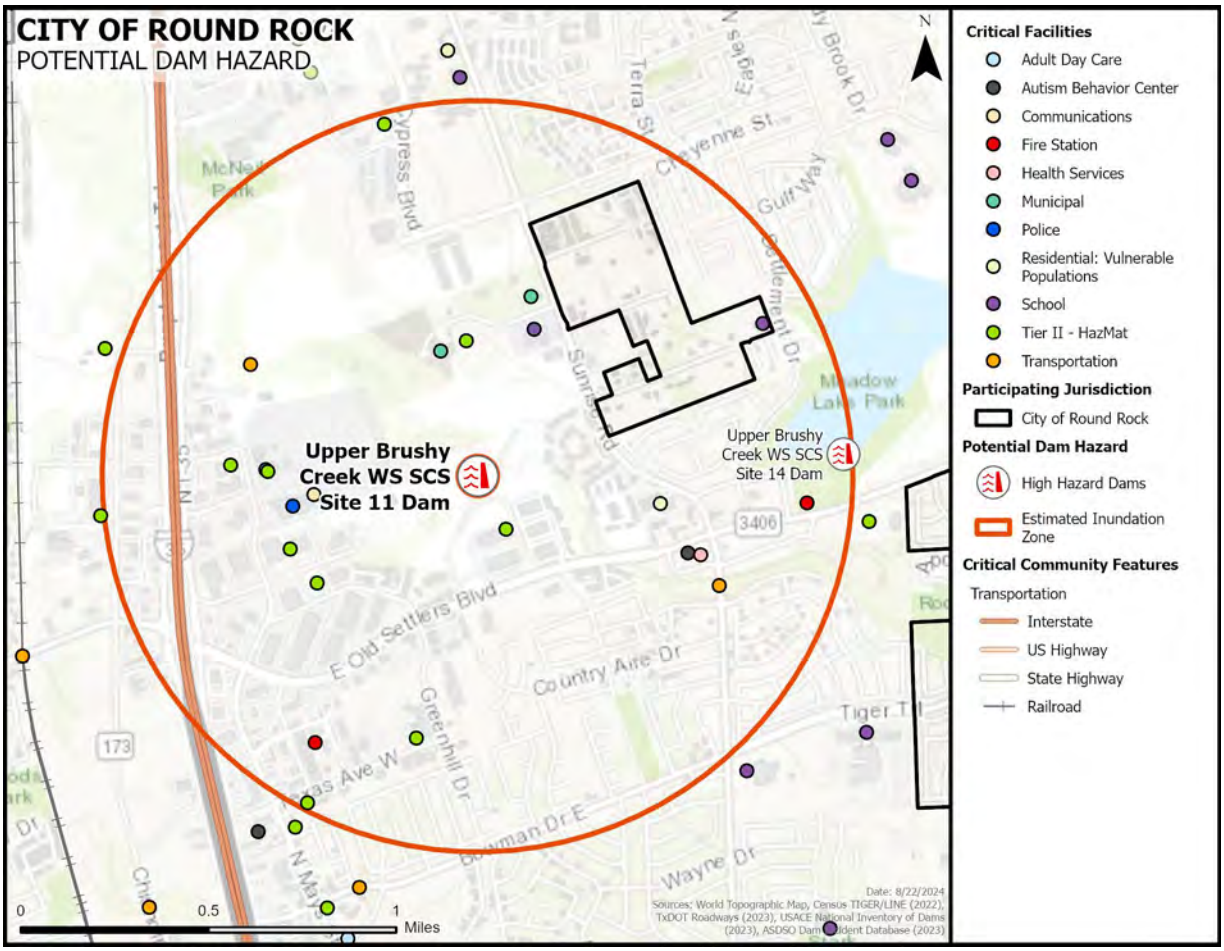
Figure 5-4. Upper Brushy Creek WS SCS Site 7 Dam



Upper Brushy Creek WS SCS Site 11 Dam

Upper Brushy Creek WS SCS Site 11 Dam is located in the City of Round Rock on Chandler Branch. The earthen dam is owned by the Taylor Soil and Water Conservation District and the Upper Brushy Creek Control and Improvement District. The dam was constructed in 1967 for the primary purpose of flood risk reduction. The area located near the dam is a densely populated area with a mix of residential and commercial development. More than 400 residential and commercial structures are within one mile of the dam and may be impacted in the event of a breach. Extensive damages are not anticipated in the event of a breach due to the limited capacity of the dam. It is anticipated that the breach flow would primarily follow the course of the branch, exceeding the banks of the branch and inundating areas along the path. In the event of a breach, it is estimated that the average breach width would be 210 feet, with a maximum breach flow of 59,693 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet, with the immediate area of the dam. Water depths would drop dramatically as the flow travels away from the dam.

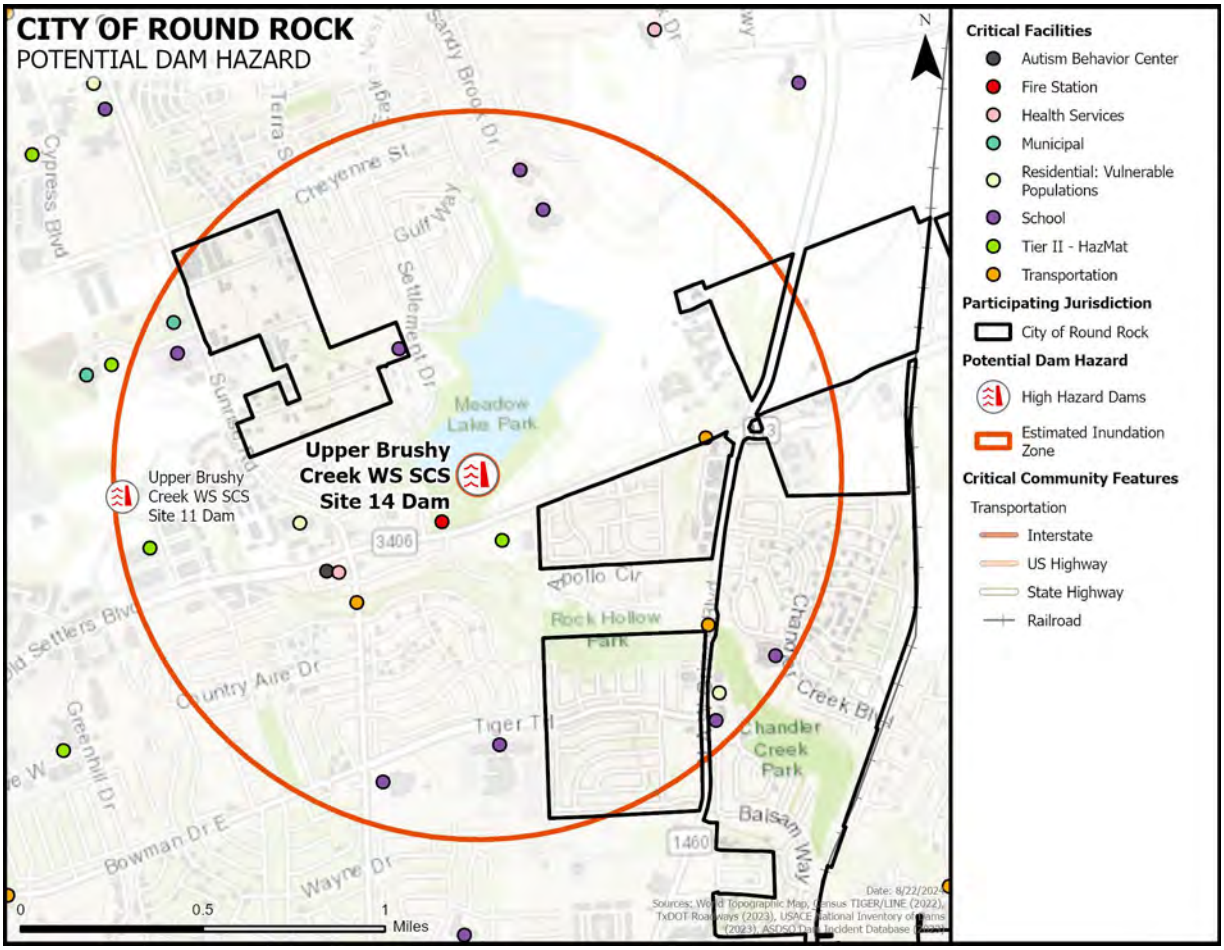
Figure 5-5. Upper Brushy Creek WS SCS Site 11 Dam



Upper Brushy Creek WS SCS Site 14 Dam

Upper Brushy Creek WS SCS Site 14 Dam is located in the City of Round Rock on Chandler Branch. The earthen dam is owned by the Taylor Soil and Water Conservation District and the Upper Brushy Creek Control and Improvement District. The dam was constructed in 1966 for the primary purpose of flood risk reduction. The area located near the dam is a densely populated area with mostly residential development, including a nearby elementary and middle school. More than 500 residential and commercial structures are within one mile of the dam and may be impacted in the event of a breach. Extensive damages are not anticipated in the event of a breach due to the limited capacity of the dam. It is anticipated that the breach flow would primarily follow the course of the branch, exceeding the banks of the branch and inundating areas along the path. In the event of a breach, it is estimated that the average breach width would be 150 feet, with a maximum breach flow of 24,515 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet with the highest depth in the immediate area of the dam. Water depths would drop dramatically as the flow travels away from the dam.

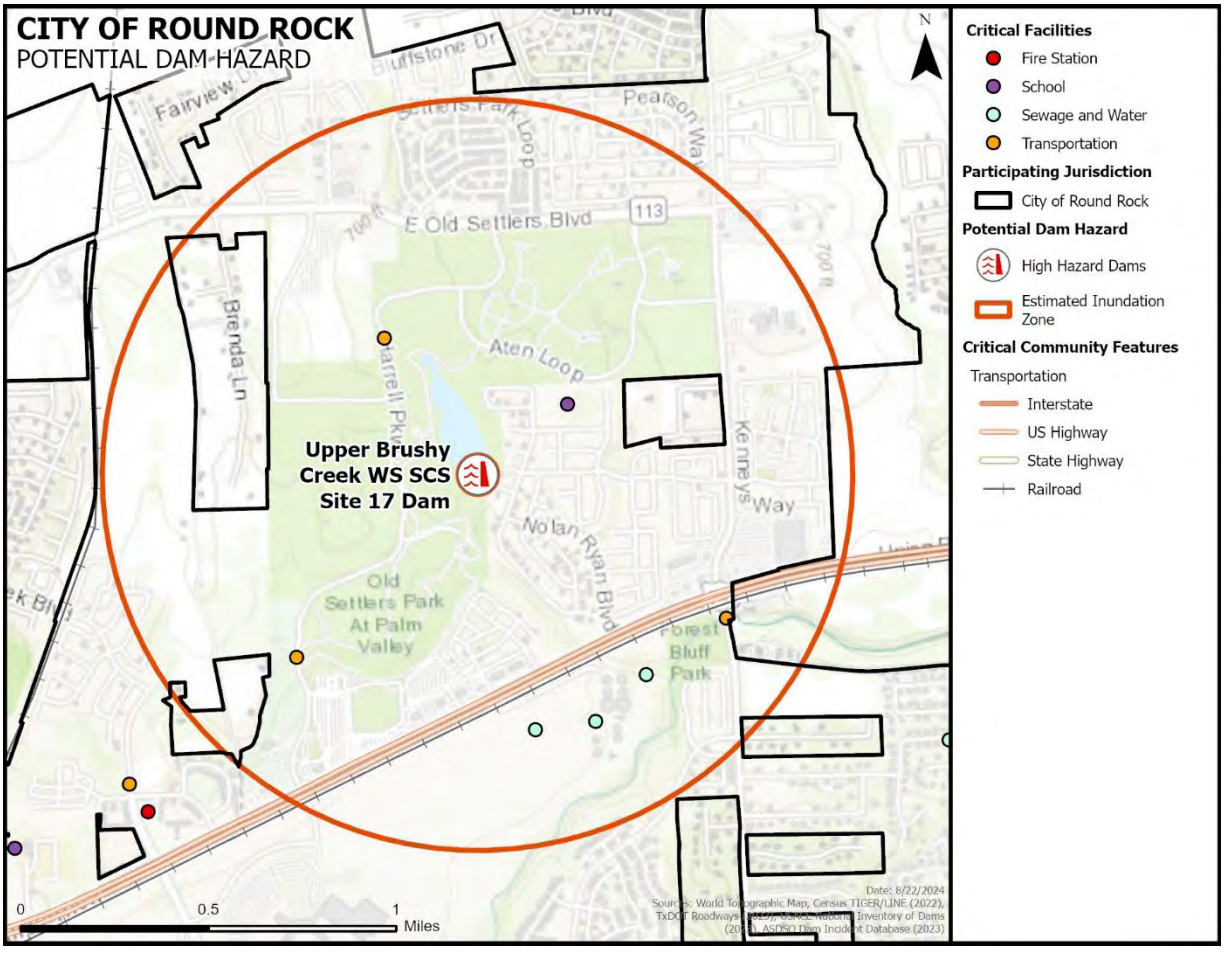
Figure 5-6. Upper Brushy Creek WS SCS Site 14 Dam



Upper Brushy Creek WS SCS Site 17 Dam

Upper Brushy Creek WS SCS Site 17 Dam is located in the City of Round Rock on a tributary of Chandler Branch. The earthen dam is owned by the Taylor Soil and Water Conservation District and the Upper Brushy Creek Control and Improvement District. The dam was constructed in 1966 for the primary purpose of flood risk reduction. The area located near the dam is a densely populated area with mostly residential development. More than 200 residential and commercial structures are within one mile of the dam and may be impacted in the event of a breach. Extensive damages are not anticipated in the event of a breach due to the limited capacity of the dam. In the event of a breach, it is estimated that the average breach width would be 119 feet, with a maximum breach flow of 16,825 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet with the highest depth in the immediate area of the dam. Water depths would drop dramatically as the flow travels away from the dam.

Figure 5-7. Upper Brushy Creek WS SCS Site 17 Dam



Upper Brushy Creek WS SCS Site 19 Dam

Upper Brushy Creek WS SCS Site 19 Dam is located in the City of Round Rock on a tributary of Chandler Branch. The earthen dam is owned by the Taylor Soil and Water Conservation District and the Upper Brushy Creek Control and Improvement District. The dam was constructed in 1960 for the primary purpose of flood risk reduction. The area located near the dam is a densely populated area with mostly residential development. More than 300 residential structures are within one mile of the dam and may be impacted in the event of a breach. Extensive damages are not anticipated in the event of a breach due to the limited capacity of the dam. In the event of a breach, it is estimated that the average breach width would be 134 feet, with a maximum breach flow of 23,044 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 15 feet with the highest depth in the immediate area of the dam. Water depths would drop dramatically as the flow travels away from the dam.

Figure 5-8. Upper Brushy Creek WS SCS Site 19 Dam

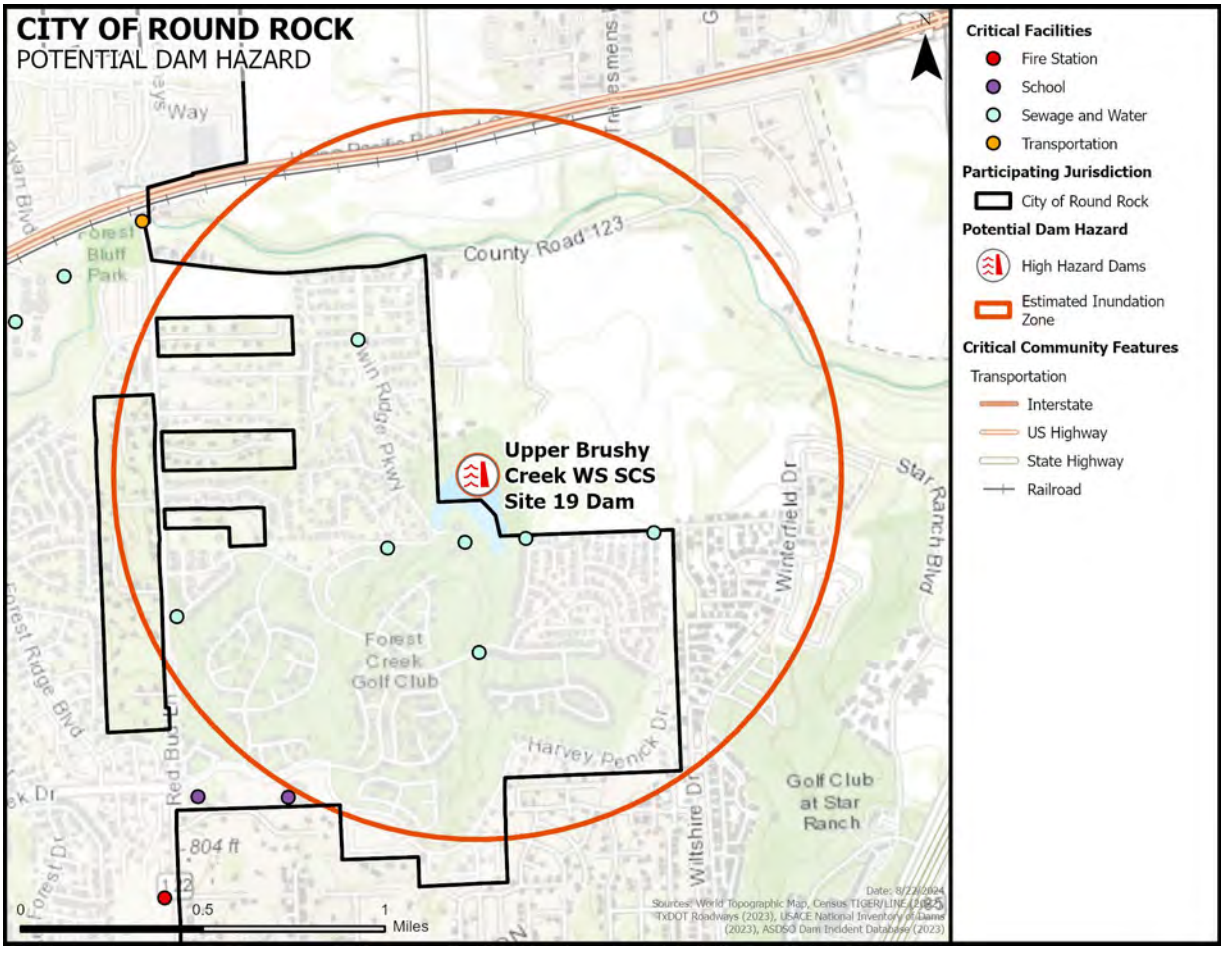


Table 5-2 represents the extent or magnitude of a dam failure event that could be expected for the City of Round Rock, per profiled dam.

Table 5-2. Extent for the City of Round Rock per Profiled Dam

PROFILED DAM	EXTENT (flow depth)	LEVEL OF INTENSITY TO MITIGATE
Upper Brushy Creek WS SCS Site 4 Dam	0-15 Feet	Dam failure presents a low threat for the city. Loss of life is not expected, no critical facilities or infrastructure would be impacted, and economic loss would be minimal in the event of a dam failure.
Upper Brushy Creek WS SCS Site 6 Dam	0-15 Feet	Dam failure presents a low threat for the city. Loss of life is not expected, no critical facilities or infrastructure would be impacted, and economic loss would be minimal in the event of a dam failure.
Upper Brushy Creek WS SCS Site 7 Dam	0-15 Feet	Dam failure presents a low threat for the city. Loss of life is not expected, no critical facilities or infrastructure would be impacted, and economic loss would be minimal in the event of a dam failure.
Upper Brushy Creek WS SCS Site 11 Dam	0-15 Feet	Dam failure presents a low threat for the city. Loss of life is not expected, no critical facilities or infrastructure would be impacted, and economic loss would be minimal in the event of a dam failure.
Upper Brushy Creek WS SCS Site 14 Dam	0-15 Feet	Dam failure presents a low threat for the city. Loss of life is not expected, no critical facilities or infrastructure would be impacted, and economic loss would be minimal in the event of a dam failure.
Upper Brushy Creek WS SCS Site 17 Dam	0-15 Feet	Dam failure presents a low threat for the city. Loss of life is not expected, no critical facilities or infrastructure would be impacted, and economic loss would be minimal in the event of a dam failure.
Upper Brushy Creek WS SCS Site 19 Dam	0-15 Feet	Dam failure presents a low threat for the city. Loss of life is not expected, no critical facilities or infrastructure would be impacted, and economic loss would be minimal in the event of a dam failure.

HISTORICAL OCCURRENCES

While there have been no reported dam failures in City of Round Rock, in the State of Texas there have been 171 dam failures since 1900, although the State has not experienced loss of life or extensive economic damage due to a dam failure since the first half of the twentieth century. However, there may be many incidents that are not reported and, therefore, the actual number of incidents is likely to be greater.

PROBABILITY OF FUTURE EVENTS

Based on historical occurrences of dam failures, the probability for future events is “Unlikely” for the City of Round Rock, meaning an event is possible in the next ten years.

VULNERABILITY AND IMPACT

There are 15 dams in or near the City of Round Rock. All dams were evaluated in-depth to determine the risk, if any, associated with each dam. This analysis indicated 7 dams that present a risk to structures or infrastructure in the planning area.

Flooding is the most prominent effect of dam failure. If the dam failure is extensive, a large amount of water would enter the downstream waterways, forcing them out of their banks. There may be significant environmental effects, resulting in flooding that could disperse debris and hazardous materials downstream that can damage local ecosystems. If the event is severe, debris carried downstream can block traffic flow, cause power outages, and disrupt local utilities, such as water and wastewater, which could result in school closures. For specific vulnerability, please refer to the narrative for each dam under the Extent section of this profile.

The City of Round Rock identified the following critical facilities (Table 5-3) as assets that are considered the most important to the planning area and are susceptible to a range of potential impacts caused by dam failure events. All the identified critical facilities were located outside of estimated dam inundation zones except as noted below. For a comprehensive list of identified critical facilities, please see Appendix C.

Table 5-3. Critical Facilities Vulnerable to Dam Failure Events

CRITICAL FACILITIES	CRITICAL FACILITIES AT RISK	POTENTIAL IMPACTS
Emergency Response Services (EOC, Fire, Police, EMS), Hospitals and Medical Centers	1 Health Services, 1 Police Station, 2 Fire Stations	• Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications. • Structures, and emergency vehicles, including critical equipment, can be damaged by rising flood waters and floating debris. • Power outages could disrupt communications, delaying emergency response times. Power outages could disrupt critical care. • Critical staff may be injured or otherwise unable to report for duty, limiting response capabilities. • Debris can impede emergency response vehicle access to areas. • Washed out roads and bridges can impede emergency response vehicle access to areas. • Flood-related rescues may be necessary at swift and low water crossing or in flooded neighborhoods where roads have become impassable, placing first responders in harm’s way. • Evacuations may be required for entire neighborhoods because of rise of floodwaters, or at hospitals due to extended power outages, gas

CRITICAL FACILITIES	CRITICAL FACILITIES AT RISK	POTENTIAL IMPACTS
		line ruptures, or structural damages to facilities, further taxing limited response capabilities and increasing sheltering needs for displaced residents. • Increased number of structure fires due to gas line ruptures and downed power lines, further straining the capacity and resources of emergency personnel. • First responders are exposed to downed power lines, unstable and unusual debris, hazardous materials, and generally unsafe conditions. • Extended power outages may lead to possible looting, destruction of property, and theft, further burdening law enforcement resources.
Airport, Academic Institutions, Animal Shelter, Evacuation Centers & Shelters, Governmental Facilities, Residential/ Assisted Living Facilities	2 Residential Vulnerable Populations, 2 Community Facilities for Vulnerable Populations, 7 Transportation, 3 Municipal, 9 Schools	• Structures can be damaged by rising flood waters. • Power outages could disrupt critical care. • Backup power sources could be damaged, inundated or otherwise inoperable. • Critical staff may be impacted and unable to report for duty, limiting response capabilities. • Evacuations may be necessary due to extended power outages, gas line ruptures, or inundation of facilities. • Additional emergency responders and critical aid workers may not be able to reach the area for days. • Power outages and infrastructure damage may prevent larger airports from acting as temporary command centers for logistics, communications, and emergency operations. • Temporary break in operations may significantly inhibit post event evacuations. • Damaged or destroyed highway infrastructure may substantially increase the need for airport operations.
Commercial Supplier (food, fuel, etc.)	N/A	• Facilities, infrastructure, or critical equipment including communications may be damaged, destroyed or otherwise inoperable. • Essential supplies like medicines, water, food, and equipment deliveries may be delayed. • Economic disruption due to power outages and fires negatively impact airport services as well as area businesses reliant on airport operations.

CRITICAL FACILITIES	CRITICAL FACILITIES AT RISK	POTENTIAL IMPACTS
Utility Services and Infrastructure (electric, water, wastewater, communications)	11 Sewage and Water, 10 Hazardous Materials, 1 Communications	• Emergency operations and critical services may be significantly impacted due to damaged facilities and/or loss of communications. • Emergency service vehicles can be damaged by rising flood waters. • Flood-related rescues may be necessary at swift and low water crossings or in flooded neighborhoods where roads have become impassable, placing emergency service workers in harm's way. • Increased number of structure fires due to gas line ruptures and downed power lines, further straining the capacity and resources of emergency personnel. • Service responders are exposed to downed power lines, contaminated and unusual debris, hazardous materials, and generally unsafe conditions. • Extended power outages and evacuations may lead to possible looting, destruction of property, and theft, further burdening law enforcement resources.

Annualized loss-estimates for dam failure are not available; neither is there a breakdown of potential dollar losses for critical facilities, infrastructure and lifelines, or hazardous-materials facilities. If a major dam should fail, the severity of impact could be substantial.

Historically, the overall severity of impact from a dam breach would be considered "Limited," meaning it could result in injuries that can be treated with first-aid, critical facilities being shut down for 24-hours or less and less than 10 percent of the property in the estimated breach inundation area destroyed or with major damage.

ASSESSMENT OF IMPACTS

Any individual dam has a very specific area that will be impacted by a catastrophic failure. Dams identified with potential risk can directly threaten the lives of individuals living or working in the inundation zone below the dam. The impact from any catastrophic failure would be similar to that of a flash flood. Potential impacts for the City of Round Rock include:

- Lives could be lost.
- There could be injuries from impacts with debris carried by the flood.
- Swift-water rescue of individuals trapped by the water puts the immediate responders at risk for their own lives.
- Individuals involved in the cleanup may be at risk from the debris left behind.
- Continuity of operations for any jurisdiction outside the direct impact area could be very limited.
- Roads and bridges could be destroyed.
- Homes and businesses could be damaged or destroyed.
- Emergency services may be temporarily unavailable.

- Disruption of operations and the delivery of services in the impacted area.
- A large dam with a high head of water could effectively scour the terrain below it for miles, taking out all buildings, and other infrastructure.
- Scouring force could erode soil and any buried pipelines.
- Scouring action of a large dam will destroy all vegetation in its path.
- Wildlife and wildlife habitat caught in the flow will likely be destroyed.
- Fish habitat will likely be destroyed.
- Topsoil will erode, slowing the return of natural vegetation.
- The destructive high velocity water flow may include substantial debris and hazardous materials, significantly increasing the risks to life and property in its path.
- Debris and hazardous material deposited downstream may cause further pollution of areas far greater than the inundation zone.
- Destroyed businesses and homes may not be rebuilt, reducing the tax base and impacting long term economic recovery.
- Historical or cultural resources may be damaged or destroyed.
- Recreational activities and tourism may be temporarily unavailable or unappealing, slowing economic recovery.

The economic and financial impacts of dam failure on the area will depend entirely on the location of the dam, scale of the event, what is damaged, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by the community, local businesses, and citizens will also contribute to the overall economic and financial conditions in the aftermath of any dam failure event.

CLIMATE CHANGE CONSIDERATIONS

A direct connection between climate change and dam failure events is unclear. As air temperatures increase, so does the amount of moisture the atmosphere can hold leading to more frequent and intense rain and flooding. Additionally, the aging dams increase the possibility of dam failure and the risk of catastrophic flooding inside estimated dam inundation zones. Safety features, known as spillways, are put in place on dams as a safety measure in the event of the reservoir filling too quickly. Spillway overflow events can result in increased discharges downstream and increased flooding potential. Climate change is likely to increase the probability of spillway overflows.

SECTION 6
DROUGHT

SECTION 6: DROUGHT

HAZARD DESCRIPTION

Drought is a period of time without substantial rainfall that persists from one year to the next. Drought is a normal part of virtually all climatic regions, including areas with high and low average rainfall. Drought is the consequence of anticipated natural precipitation reduction over an extended period of time, usually a season or more in length. Droughts can be classified as meteorological, hydrologic, agricultural, and socioeconomic. Table 6-1 presents definitions for these different types of droughts.

Droughts are one of the most complex of all natural hazards as it is difficult to determine their precise beginning or end. In addition, droughts can lead to other hazards such as extreme heat and wildfires. Their impact on wildlife and area farming is enormous, often killing crops, grazing land, edible plants, and even in severe cases, trees. A secondary hazard to drought is wildfire because dying vegetation serves as a prime ignition source. Therefore, a heat wave combined with a drought is a very dangerous situation.

Table 6-1. Drought Classification Definitions[1]

METEOROLOGICAL DROUGHT	The degree of dryness or departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.
HYDROLOGIC DROUGHT	The effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels.
AGRICULTURAL DROUGHT	Soil moisture deficiencies relative to water demands of plant life, usually crops.
SOCIOECONOMIC DROUGHT	The effect of demands for water exceeding the supply as a result of a weather-related supply shortfall.

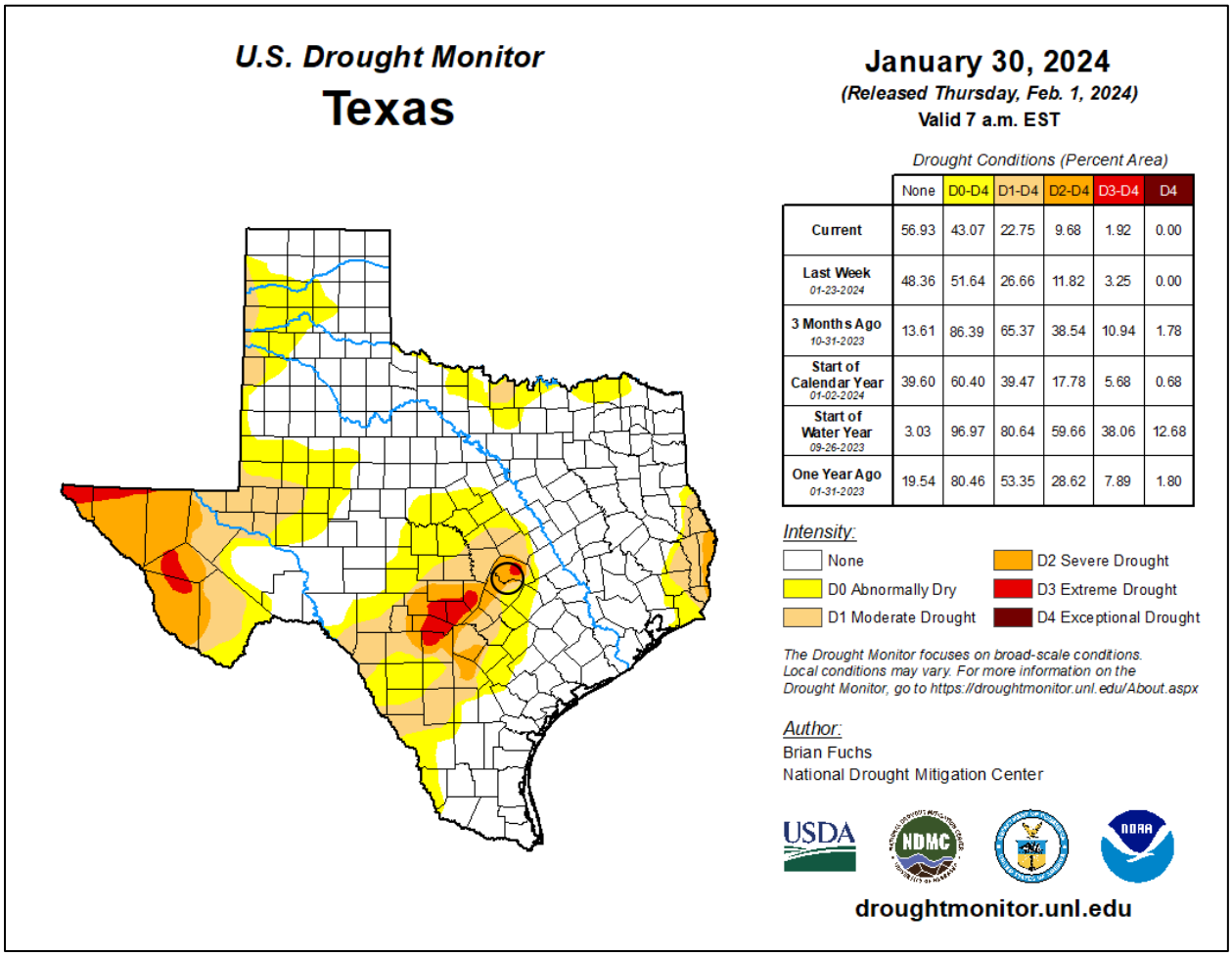
LOCATION

Droughts occur regularly throughout Texas and the City of Round Rock and are considered a normal condition. However, they can vary greatly in their intensity and duration. The U.S. Drought Monitor, produced through a partnership between the National Drought Mitigation Center at the

[1] Source: Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy, FEMA

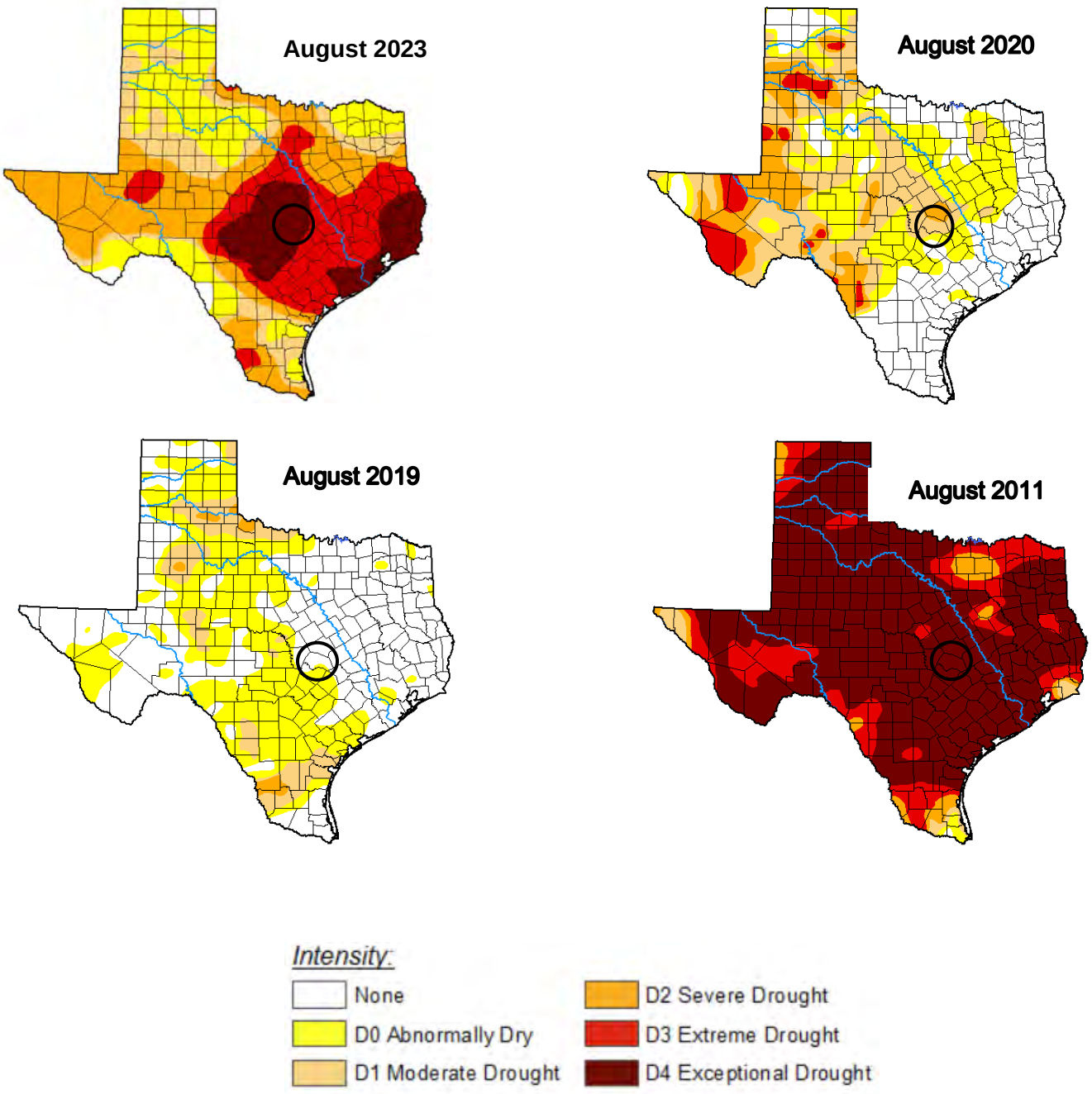
University of Nebraska-Lincoln, U.S. Department of Agriculture, and the National Oceanic and Atmospheric Administration, shows that as of January 2024, the planning area is experiencing severe to extreme drought conditions (Figure 6-1) but has experienced a range of conditions from normal to exceptional drought conditions over the last decade (Figure 6-2). There is no distinct geographic boundary to drought; therefore, it can occur anywhere throughout the City of Round Rock planning area.

Figure 6-1. U.S. Drought Monitor, January 2024[2]



[2] The City of Round Rock planning area falls within the black circle.

Figure 6-2. U.S. Drought Monitor, August 2011, August 2019, August 2022, August 2023[3]



[3] The City of Round Rock planning area falls within the black circles.

EXTENT

The Palmer Drought Index is used to measure the extent of drought by measuring the duration and intensity of long-term drought-inducing circulation patterns. Long-term drought is cumulative, with the intensity of drought during the current month dependent upon the current weather patterns plus the cumulative patterns of previous months. The hydrological impacts of drought (e.g., reservoir levels, groundwater levels, etc.) take longer to develop. Table 6-2 depicts magnitude of drought, while Table 6-3 describes the classification descriptions.

Table 6-2. Palmer Drought Index

DROUGHT INDEX	DROUGHT CONDITION CLASSIFICATIONS						
	Extreme	Severe	Moderate	Normal	Moderately Moist	Very Moist	Extremely Moist
Z Index	-2.75 and below	-2.00 to -2.74	-1.25 to -1.99	-1.24 to +.99	+1.00 to +2.49	+2.50 to +3.49	n/a
Meteorological	-4.00 and below	-3.00 to -3.99	-2.00 to -2.99	-1.99 to +1.99	+2.00 to +2.99	+3.00 to +3.99	+4.00 and above
Hydrological	-4.00 and below	-3.00 to -3.99	-2.00 to -2.99	-1.99 to +1.99	+2.00 to +2.99	+3.00 to +3.99	+4.00 and above

Table 6-3. Palmer Drought Category Descriptions[4]

CATEGORY	DESCRIPTION	POSSIBLE IMPACTS	PALMER DROUGHT INDEX
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures; fire risk above average. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.	-1.0 to -1.9
D1	Moderate Drought	Some damage to crops, pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing or imminent, voluntary water use restrictions requested.	-2.0 to -2.9
D2	Severe Drought	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed.	-3.0 to -3.9
D3	Extreme Drought	Major crop/pasture losses; extreme fire danger; widespread water shortages or restrictions.	-4.0 to -4.9
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies.	-5.0 or less

[4] Source: National Drought Mitigation Center

SECTION 6: DROUGHT

Drought is monitored nationwide by the National Drought Mitigation Center (NDMC). Indicators are used to describe broad scale drought conditions across the U.S. and correspond to the intensity of drought.

Based on the historical occurrences for drought and the location of the City of Round Rock, the area can anticipate the full range of drought from abnormally dry to exceptional drought, or D0 to D4, based on the Palmer Drought Category. The City of Round Rock has experienced exceptional drought conditions. This is the highest level of drought severity and the most extreme drought conditions the planning area can anticipate in the future.

The City of Round Rock has adopted specific regulations and restrictions on the delivery and consumption of water during drought events. These regulations can be found in the City of Round Rock's Code of Ordinances, Part II, Chapter 44, Article VIII (Drought Contingency and Water Use Management). There are three stages to the drought contingency regulations, which are briefly outlined in Table 6-4.

Table 6-4. Stages of the Drought Contingency and Water Use Management Regulations

STAGE	SUPPLY BASED TRIGGERS[5]	CONSERVATION REGULATION
Stage 1	• Lake Georgetown Reservoir is below 775 feet above mean sea level for three consecutive days; or • The combined storage of Lake Georgetown, and Lake Stillhouse Hollow is less than 162,752 acre feet of water; and • The combined storage of Lake Buchanan and Lake Travis is less than 1,502,037 acre feet of water.	• Outdoor automatic irrigation systems prohibited (does not apply to handheld bucket/hose) • The washing of vehicles and mobile equipment is prohibited (does not apply to handheld bucket/hose, on commercial service stations, or when protecting health, safety, and welfare) • Power washing is prohibited (day/time regulations do not apply to commercial companies) • Foundation watering • Filling nongovernmental owned swimming pools is prohibited • Operation of fountains is prohibited • Water irrigation for golf fairways is prohibited • Use of water from fire hydrants is prohibited except for firefighting-related activities or other activities necessary to maintain the health, safety and welfare • Street washing is prohibited • Landowners are encouraged to postpone instillation of new landscaping
Stage 2	• Lake Georgetown Reservoir is below 775 feet above mean sea level for three consecutive days; or • The combined storage of Lake Georgetown, and Lake Stillhouse Hollow is less	• Outdoor automatic irrigation systems prohibited (does not apply to handheld bucket/hose) • The washing of vehicles and mobile equipment is prohibited (does not apply to handheld bucket/hose, on commercial service stations, or when protecting health, safety, and welfare) • Power washing is prohibited (day/time regulations do not apply to commercial companies)

[5] To view the full list of Drought Contingency and Water Use Management triggers, visit https://library.municode.com/tx/round_rock/codes/code_of_ordinances?nodeId=PTIICOOR_CH44UT_ARTVIIIDRCOWAUSMA.

STAGE	SUPPLY BASED TRIGGERS[5]	CONSERVATION REGULATION
Stage 2 (continued)	than 1005,001 acre feet of water; and • The combined storage of Lake Buchanan and Lake Travis is less than 1,302,179 acre feet of water.	• Foundation watering • Filling nongovernmental owned swimming pools is prohibited • Operation of fountains is prohibited • Water irrigation for golf fairways is prohibited • Use of water from fire hydrants is prohibited except for firefighting-related activities or other activities necessary to maintain the health, safety and welfare • Street washing is prohibited • Landowners are encouraged to postpone instillation of new landscaping
Stage 3	• The combined storage of Lake Georgetown, and Lake Stillhouse Hollow is less than 52,501 acre feet of water; and • The combined storage of Lake Buchanan and Lake Travis is less than 60,000 acre feet of water.	• All outdoor irrigation is prohibited (handheld hoses/cans prohibited with watering schedule) • The washing of vehicles and mobile equipment is prohibited unless occurring on commercial wash/service station between hours of 8:00AM and 5:00PM • Power washing is prohibited • Foundation watering • Filling nongovernmental owned swimming pools is prohibited • Operation of fountains is prohibited • Potable water irrigation for golf courses is prohibited • Use of water from fire hydrants is prohibited except for firefighting-related activities or other activities necessary to maintain the health, safety and welfare • Street washing is prohibited • All new landscaping is prohibited • Water may not be served in restaurants unless requested by customer

HISTORICAL OCCURRENCES

The City of Round Rock may experience an extreme drought in any given year. According to the U.S. Drought Monitor, between January 2000 and April 2024, Williamson County, which includes the City of Round Rock, spent 817 total weeks (65%) in some level of drought as defined as Abnormally Dry (D0) or worse conditions. The City of Round Rock was included in 30 USDA disaster declarations made by the Secretary of Agriculture for drought from 2012 through 2023, which are reported on a county-wide basis.

Figure 6-3. City of Round Rock Drought Intensity, 2000-2024[6]

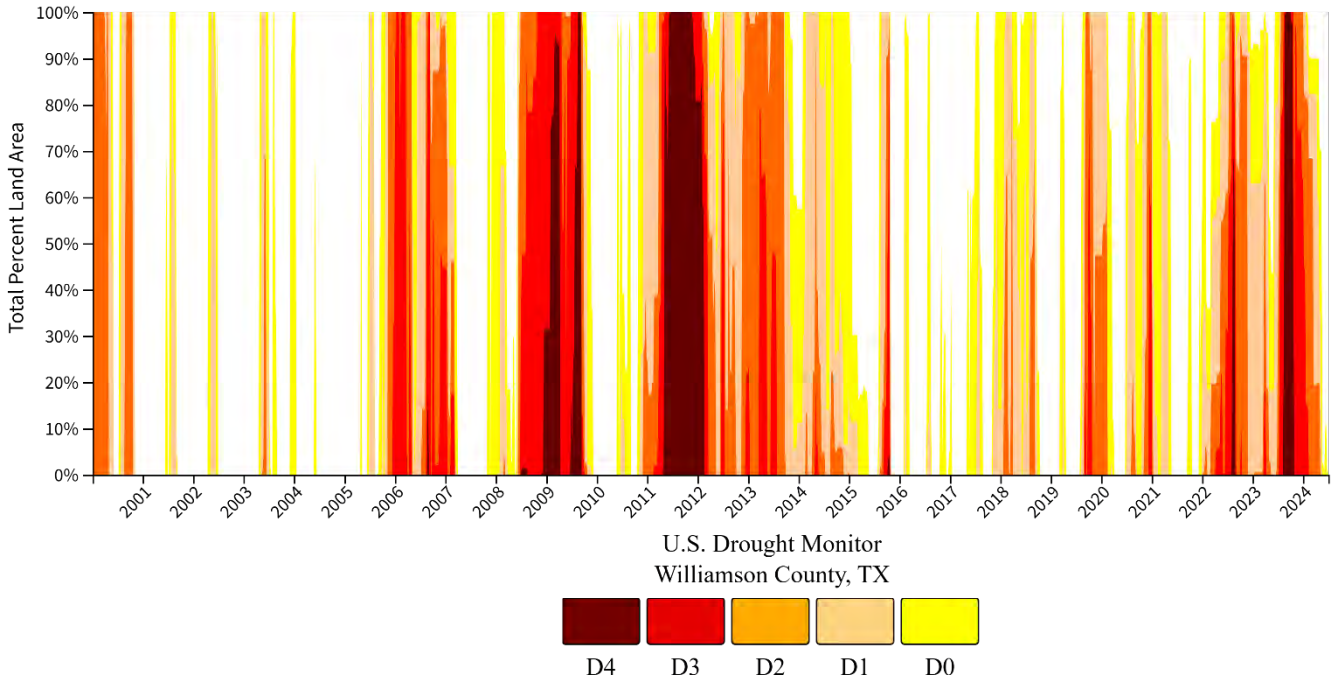


Table 6-5 lists historical events that have occurred in Williamson County as reported in the National Centers for Environmental Information Storm Events Database (NCEI). A total of 53 drought impacts were reported in the NCEI over 22 unique drought periods impacting Williamson County, including the City of Round Rock, from 2000 through 2023. Historical drought events reported in the NCEI database for Williamson County and the City of Round Rock over the 24-year reporting period has resulted in no reported injuries, fatalities, or damages.

Historical drought information shows drought activity across a multi-county forecast area for each event and does not provide data for single jurisdictions since these events are widespread. The appropriate percentage of the total property and crop damage reported for the entire forecast area has been allocated to each county impacted by the event. Historical drought data is provided on a county-wide basis per the NCEI Storm Events database.

Table 6-5. Historical Drought Events, 2000-2023

JURISDICTION	DATE	INJURIES	DEATHS	PROPERTY DAMAGE	CROP DAMAGE
City of Round Rock	7/1/2000	0	0	$0	$0
City of Round Rock	8/1/2000	0	0	$0	$0
City of Round Rock	9/1/2000	0	0	$0	$0

[6] U.S. Drought Monitor

JURISDICTION	DATE	INJURIES	DEATHS	PROPERTY DAMAGE	CROP DAMAGE
City of Round Rock	10/1/2000	0	0	$0	$0
City of Round Rock	5/1/2011	0	0	$0	$0
City of Round Rock	6/1/2011	0	0	$0	$0
City of Round Rock	7/1/2011	0	0	$0	$0
City of Round Rock	8/1/2011	0	0	$0	$0
City of Round Rock	9/1/2011	0	0	$0	$0
City of Round Rock	10/1/2011	0	0	$0	$0
City of Round Rock	11/1/2011	0	0	$0	$0
City of Round Rock	12/1/2011	0	0	$0	$0
City of Round Rock	1/1/2012	0	0	$0	$0
City of Round Rock	2/1/2012	0	0	$0	$0
City of Round Rock	3/1/2012	0	0	$0	$0
City of Round Rock	6/1/2012	0	0	$0	$0
City of Round Rock	11/1/2012	0	0	$0	$0
City of Round Rock	12/1/2012	0	0	$0	$0
City of Round Rock	1/1/2013	0	0	$0	$0
City of Round Rock	2/1/2013	0	0	$0	$0
City of Round Rock	3/1/2013	0	0	$0	$0
City of Round Rock	4/1/2013	0	0	$0	$0
City of Round Rock	5/1/2013	0	0	$0	$0
City of Round Rock	6/1/2013	0	0	$0	$0
City of Round Rock	7/1/2013	0	0	$0	$0
City of Round Rock	8/1/2013	0	0	$0	$0
City of Round Rock	9/1/2015	0	0	$0	$0
City of Round Rock	10/1/2015	0	0	$0	$0
City of Round Rock	8/1/2018	0	0	$0	$0

JURISDICTION	DATE	INJURIES	DEATHS	PROPERTY DAMAGE	CROP DAMAGE
City of Round Rock	9/1/2018	0	0	$0	$0
City of Round Rock	9/1/2019	0	0	$0	$0
City of Round Rock	10/1/2019	0	0	$0	$0
City of Round Rock	11/1/2019	0	0	$0	$0
City of Round Rock	1/1/2020	0	0	$0	$0
City of Round Rock	2/1/2020	0	0	$0	$0
City of Round Rock	11/1/2020	0	0	$0	$0
City of Round Rock	12/1/2020	0	0	$0	$0
City of Round Rock	1/1/2021	0	0	$0	$0
City of Round Rock	5/1/2022	0	0	$0	$0
City of Round Rock	6/1/2022	0	0	$0	$0
City of Round Rock	7/1/2022	0	0	$0	$0
City of Round Rock	8/1/2022	0	0	$0	$0
City of Round Rock	9/1/2022	0	0	$0	$0
City of Round Rock	10/1/2022	0	0	$0	$0
City of Round Rock	11/1/2022	0	0	$0	$0
City of Round Rock	3/1/2023	0	0	$0	$0
City of Round Rock	4/1/2023	0	0	$0	$0
City of Round Rock	7/11/2023	0	0	$0	$0
City of Round Rock	8/1/2023	0	0	$0	$0
City of Round Rock	9/1/2023	0	0	$0	$0
City of Round Rock	10/1/2023	0	0	$0	$0
City of Round Rock	11/1/2023	0	0	$0	$0
City of Round Rock	12/1/2023	0	0	$0	$0
TOTALS		**0**	**0**	**$0**	**$0**

Based on the historical drought events for the City of Round Rock, 23 drought impacts were reported during 6 drought periods since the 2018 Plan.

SIGNIFICANT EVENTS

May 2011 – March 2012

One of the most severe droughts on record impacted Williamson County and City of Round Rock planning area. The dry, parched conditions caused billions of dollars in crop and livestock losses[7], sparked wildfires, pushed power grids to the limit, and reduced reservoirs to dangerously low levels. The City of Round Rock was not spared from these drought conditions and remained at some level of drought (between D2 and D4) for an extended period of time.

The first report of dry conditions for the City of Round Rock was in May of 2011. Most of the southern Texas area was in exceptional drought conditions (D4). The fire danger in South Central Texas remained moderate to high and burn bans were in effect for Williamson County. The Texas A&M agricultural program report indicated the agricultural situation was rapidly deteriorating. Forage availability remained below average, many stock tanks remained extremely low, and some were in danger of drying up. Area lakes and reservoirs remained below normal with Lake Travis around 55 feet below normal by the month of September. These conditions remained over the next few months, with high fire risk and water conservation efforts ongoing. By March of 2012, an ongoing La Nina event brought above average rainfall to the area and helped bring drought conditions down to state D2.

May 2022 – November 2022

Exceptional (D4) to severe (D2) drought conditions affected the City of Round Rock from May to November of 2022. Despite a few instances of soaking rains, drought continued to plague much of the region as precipitation was low. All public water systems in the Central Texas region encouraged voluntary water restrictions and many had mandatory restrictions in effect. Area reservoirs continued to fall farther below normal conservation pool levels. Williamson County also had a burn ban in place, which included the City of Round Rock. This is the second most severe drought to impact the planning area, following the 2011 drought.

PROBABILITY OF FUTURE EVENTS

Based on available records of historic events, there have been 53 reported drought impacts reported in the NCEI over 22 drought periods (ranging in length from approximately 1 month to just over 2 years) within a 24-year reporting period, which provides a probability of approximately one event every year. This frequency supports a “Highly Likely” probability of future events for the City of Round Rock. The impact of climate change could produce longer, more severe droughts, exacerbating the current drought impacts.

VULNERABILITY AND IMPACT

Loss estimates were based on 24 years of statistical data from the NCEI and the U.S. Drought Monitor. A drought event frequency-impact was then developed to determine an impact profile on agriculture products and estimate potential losses due to drought in the area. All existing and future buildings, facilities, and populations are exposed to this hazard and could potentially be

[7] Detailed information on drought losses was unavailable.

impacted. However, drought impacts are mostly experienced in water shortages or crop and livestock losses on agricultural lands and typically have minimal impact on buildings.

The City of Round Rock Planning Team identified the following critical facilities as assets that are considered the most important to the planning area and are susceptible to a range of impacts caused by drought events. For a comprehensive list of critical facilities, please see Appendix C.

Table 6-6. Critical Facilities Vulnerable to Drought Events

CRITICAL FACILITIES	POTENTIAL IMPACTS
Emergency Response Services (EOC, Fire, Police, EMS, Hospitals)	• Increased law enforcement activities may be required to enforce water restrictions. • Firefighters may have limited water resources to aid in firefighting and suppression activities, increasing risk to lives and property. • Potential for increased number of emergency calls as drought events can lead to cascading hazard events such as wildfires and flash flooding.
Airport, Academic Institutions, Community Residential Facilities, Day Care Facilities, Evacuation Centers & Shelters, Governmental Facilities	• Strain on staff as drought may cause health problems related to low water flows and poor water quality. • Operations dependent on water supply may be adversely impacted.
Commercial Suppliers (food, gas, etc.)	• Operations dependent on water supply may be adversely impacted.
Utility Services and Infrastructure (electric, water, wastewater, communications)	• Potential for increased number of emergency calls as drought events can lead to cascading hazard events such as wildfires and flash flooding. • Operations dependent on water supply may be adversely impacted.

Even with the planning area relying on multiple water utility providers as well as local and private service, high demand can still deplete these resources during extreme drought conditions. As resources are depleted, potable water is in short supply and overall water quality can be impacted, elevating health concerns for all residents but especially vulnerable populations.

Potable water is used for drinking, sanitation, patient care, sterilization, equipment, heating and cooling systems, and many other essential functions. During summer drought, or hot and dry conditions, elderly persons, small children, infants, those with disabilities or chronic medical conditions and those who do not have adequate cooling units in their homes may become more vulnerable to injury and/or death. In addition, people who speak a language other than English may face increased vulnerability due to language barriers that limit their access to important information such as weather-related warnings and instructions regarding safety measures. The population over 65 in the City of Round Rock planning area is estimated at 10 percent of the total

population and children under the age of 5 are estimated at 6 percent. Individuals with a disability are estimated at 11 percent of the total population. An estimated 8 percent of the planning area population live below the poverty level and 25 percent of the populations speaks a language other than English (Table 6-7).

Table 6-7. Populations at Greater Risk

ELDERLY (over 65)	YOUTH (under 5)	WITH A DISABILITY	BELOW POVERTY LEVEL	NON-ENGLISH SPEAKING
12,356	7,219	12,927	9,276	30,183

The economic impact of droughts can be significant as they produce a complex web of impacts that spans many sectors of the economy and reach well beyond the area experiencing physical drought. This complexity exists because water is integral to our ability to produce goods and provide services. If droughts extend over several years, the direct and indirect economic impact can be significant.

Crop production can also suffer greatly during extreme drought conditions, limiting fresh local food supplies, driving up costs, and negatively impacting the local economy. Drought conditions could adversely affect the agricultural industry throughout the City of Round Rock planning area.

Impacts of past droughts experienced in the City of Round Rock have not resulted in injuries or fatalities. This supports a “Limited” severity of impact meaning injuries and/or illnesses do not result in permanent disability, shutdown of facilities and services for 24 hours of less, and more than 10 percent of property is impacted. There is no reported crop or property damage due to drought over the 24-year reporting period in the City of Round Rock.

ASSESSMENT OF IMPACTS

The Drought Impact Reporter was developed in 2005 by the University of Nebraska-Lincoln to provide a national database of drought impacts. Droughts can have an impact on agriculture, business and industry; energy; fire; plants and wildlife; relief, response, and restrictions; society and public health; tourism and recreation; and water supply and quality. The reports are submitted from individuals to Federal, State, and local agencies, as well as the general public. Table 6-8 lists the drought impacts to the City of Round Rock from 2005 to 2023 based on reports received by the Drought Impact Reporter.

Table 6-8. Drought Impacts, 2005-2023

DROUGHT IMPACTS 2005-2023	
Agriculture	111
Business & Industry	3
Energy	0
Fire	33
Plants & Wildlife	72

DROUGHT IMPACTS 2005-2023	
Relief, Response & Restrictions	63
Society & Public Health	9
Tourism & Recreation	2
Water Supply & Quality	68

Drought has the potential to impact people in the City of Round Rock. While it is rare that drought, in and of itself, leads to a direct risk to the health and safety of people in the U.S., severe water shortages could result in inadequate supply for human needs. According to the City of Round Rock Population Projections Report, the population will grow by almost 75,000 people over the next 20 years.[8] This level of future growth can cause concern for the current water infrastructure and demand for the planning area. Severe drought conditions can be frequently associated with a variety of impacts, including:

- The number of health-related low-flow issues (e.g., diminished sewage flows, increased pollution concentrations, reduced firefighting capacity, and cross-connection contamination) will increase as the drought intensifies.
- Public safety from forest / range / wildfires will increase as water availability and/or pressure decreases.
- Respiratory ailments may increase as the air quality decreases.
- There may be an increase in disease due to wildlife concentrations (e.g., rabies, Rocky Mountain spotted fever, Lyme disease).
- Residents may disagree with the City over water use / water rights, creating conflict.
- Political conflicts may increase between municipalities, counties, states, and regions.
- Water management conflicts may arise between competing interests.
- Increased law enforcement activities may be required to enforce water restrictions.
- Severe water shortages could result in inadequate supply for human needs as well as lower quality of water for consumption.
- Firefighters may have limited water resources to aid in firefighting and suppression activities, increasing risk to lives and property.
- During drought there is an increased risk for wildfires and dust storms.
- The community may need increased operational costs to enforce water restriction or rationing.
- Prolonged drought can lead to increases in illness and disease related to drought.
- Utility providers can see decreases in revenue as water supplies diminish.
- Utilities providers may cut back energy generation and service to their customers to prioritize critical service needs.
- Hydroelectric power generation facilities and infrastructure would have significantly diminished generation capability. Dams simply cannot produce as much electricity from low water levels as they can from high water levels.

[8] Round Rock 2030: 2020-2040 Population Projections Report. https://www.roundrocktexas.gov/wp-content/uploads/2022/08/2020-2040-Population-Projections-Report.pdf

- Fish and wildlife food and habitat will be reduced or degraded over time during a drought and disease will increase, especially for aquatic life.
- Wildlife will move to more sustainable locations creating higher concentrations of wildlife in smaller areas, increasing vulnerability, and further depleting limited natural resources.
- There are 18 federally endangered, threatened or candidate species in the City of Round Rock. Severe and prolonged drought can result in the reduction of a species or cause the extinction of a species altogether.
- Plant life will suffer from long-term drought. Wind and erosion will also pose a threat to plant life as soil quality will decline. The urban tree canopy, including city parks, are vulnerable to the impacts of prolonged drought.
- Dry and dead vegetation will increase the risk of wildfire.
- Drought poses a significant risk to annual and perennial crop production and overall crop quality leading to higher food costs.
- Drought-related declines in production may lead to an increase in unemployment.
- Drought may limit livestock grazing resulting in decreased livestock weight, potential increased livestock mortality, and increased cost for feed.
- Negatively impacted water suppliers may face increased costs resulting from the transport water or develop supplemental water resources.
- Long term drought may negatively impact future economic development.

The overall extent of damage caused by periods of drought is dependent on its extent and duration. The level of preparedness and pre-event planning done by the community, local businesses, and citizens will contribute to the overall economic and financial conditions in the aftermath of a drought event.

CLIMATE CHANGE CONSIDERATIONS

With the range of factors influencing drought conditions, it is impossible to make quantitative statewide projections of drought trends; however, many factors point toward increased drought severity. Drought will continue to be driven largely by precipitation variability over multiple decades, with long-term precipitation trends expected to be relatively small. Other factors affecting drought impacts, such as increased temperatures and improved plant water use efficiency, decrease water availability but will cause drought impact trends to be highly sector-specific, with the impacts possibly smaller for agriculture than for surface water supply.[9]

It is projected that future changes to the City of Round Rock will include increased temperatures, which according to the U.S. Climate Explorer, the planning area may experience a 6°F increase in the average extreme heat temperatures. Historically, extreme temperatures averaged 100°F in the City of Round Rock, but between 2035 and 2064 the average will be 106°F, increasing the severity and frequency of drought events. The increase in temperature could be higher but will depend on overall future emissions.

[9] Cleaveland, M. K., T. H. Votteler, D. K. Stahle, R. C. Casteel, and J. L. Banner, 2011: Extended Chronology of Drought in South Central, Southeastern and West Texas. Texas Water Journal, 2, 54-96, as cited in as cited in Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900-2036, Texas A&M University Office of the Texas State Climatologist, 2021 update.

SECTION 7
EARTHQUAKE

SECTION 7: EARTHQUAKE

HAZARD DESCRIPTION

An earthquake is the sudden movement of the Earth's surface caused by the release of stress accumulated within or along the edge of the Earth's tectonic plates, volcanic eruption, or by a manmade explosion. The majority of earthquakes occur along faults; however, earthquakes can occur within plate interiors. Over geologic time, plates move and plate boundaries change, pushing weakened boundary regions to the interior part of the plates. These areas of weakness within the continents can cause earthquakes in response to stresses that originate at the edges of the plate or in the deeper crust.

Earthquake locations are described by the focal depth and geographic position of the epicenter. The focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the focus or hypocenter). The epicenter is the point on the Earth's surface directly above the hypocenter. Earthquakes usually occur without warning, with their effects impacting great distances away from the epicenter.

According to the U.S. Geological Society (USGS) Earthquake Hazards Program, an earthquake hazard is anything associated with an earthquake that may influence an individual's normal activities. Table 7-1 describes definition of examples.

Table 7-1. Definitions of Earthquake Hazards[1]

HAZARD	DESCRIPTION
Surface Faulting	Displacement that reaches the earth's surface during slip along a fault. Commonly occurs with shallow earthquakes, those with an epicenter less than 20 kilometers.
Ground Motion (shaking)	The movement of the earth's surface from earthquakes or explosions. Ground motion or shaking is produced by waves that are generated by sudden slip on a fault or sudden pressure at the explosive source and travel through the earth and along its surface.
Landslide	A movement of surface material down a slope.
Liquefaction	A process by which water-saturated sediment temporarily loses strength and acts as a fluid, like when you wiggle your toes in the wet sand near the water at the beach. This effect can be caused by earthquake shaking.

[1] Source: USGS, 2012

HAZARD	DESCRIPTION
Tectonic Deformation	A change in the original shape of a material due to stress and strain.
Tsunami	A sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major submarine slides, or exploding volcanic islands.
Seiche	The sloshing of a closed body of water from earthquake shaking.

LOCATION

Earthquake hazard areas are mapped by the USGS's National Seismic Hazard Model (NSHM). Figure 7-1 shows the most recent 2023 iteration of this USGS model. The NSHM defines the potential for earthquake ground shaking for various probability levels across the United States. The 2023 NSHM is an update to the previous 2018 version, and compiles data and findings from a number of sources including earthquake catalogs, geodetic- and geologic-based fault and deformation models, and ground motion models (GMMs), among others.[2] The map shows the percent chance that a given area will experience a category VI (or stronger) earthquake in 100 years, as defined by the Modified Mercalli Intensity (MMI) Scale (Table 7-3). The likelihood of a significant earthquake event is signified by the color-coding on the map. Densely populated areas are also highlighted on the map (purple and black dotting) to indicate areas of elevated vulnerability in relation to higher seismic risk. The City of Round Rock planning area, as identified in Figure 7-1, is located in a low hazard area, with less than five percent chance of experiencing a strong earthquake every 100 years.

[2] A comprehensive overview of the modelling process can be found at the USGS website, https://www.usgs.gov/programs/earthquake-hazards/science/2023-50-state-long-term-national-seismic-hazard-model-0#overview

Figure 7-1. U.S. Map of Peak Ground Acceleration[3]

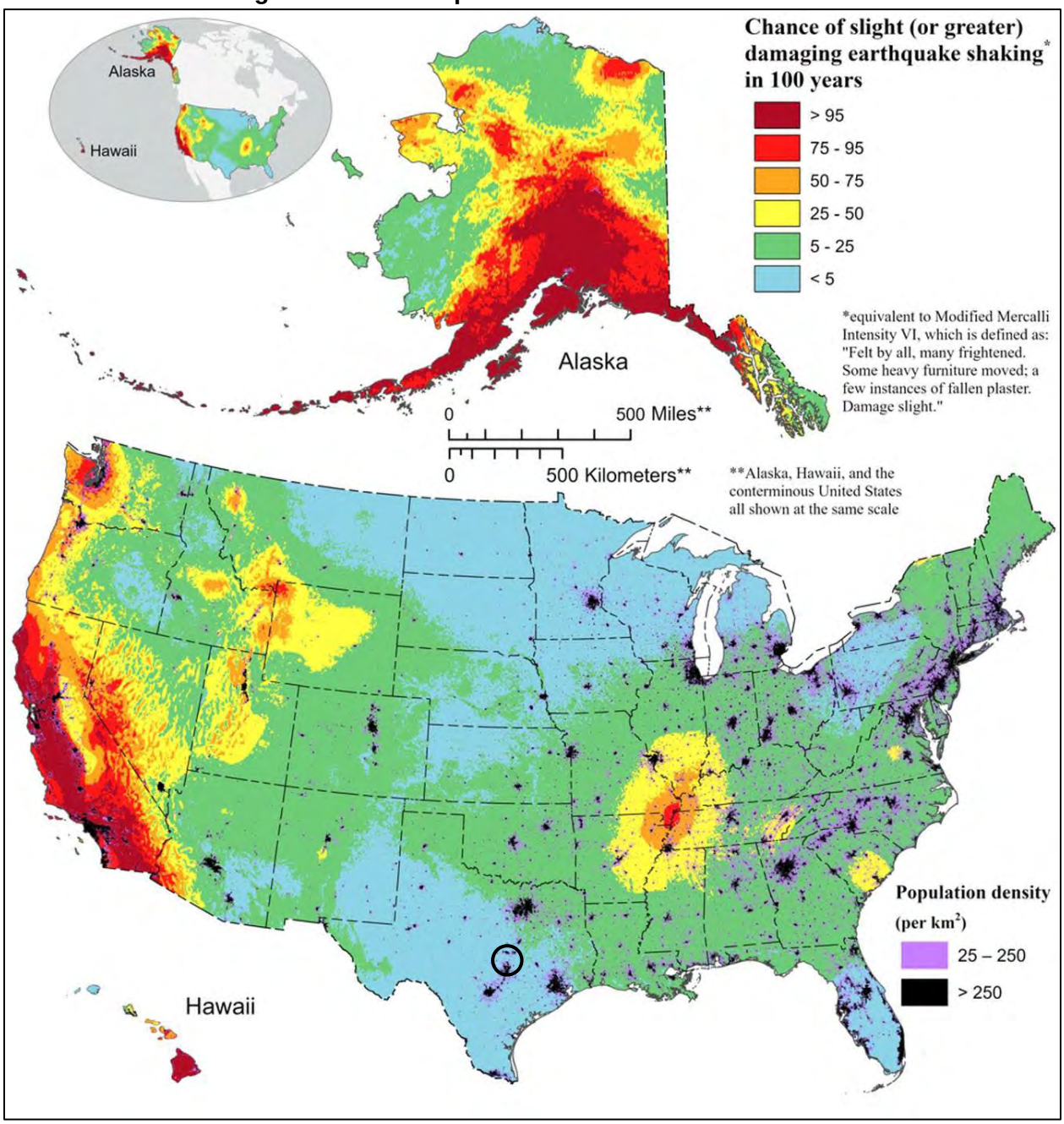
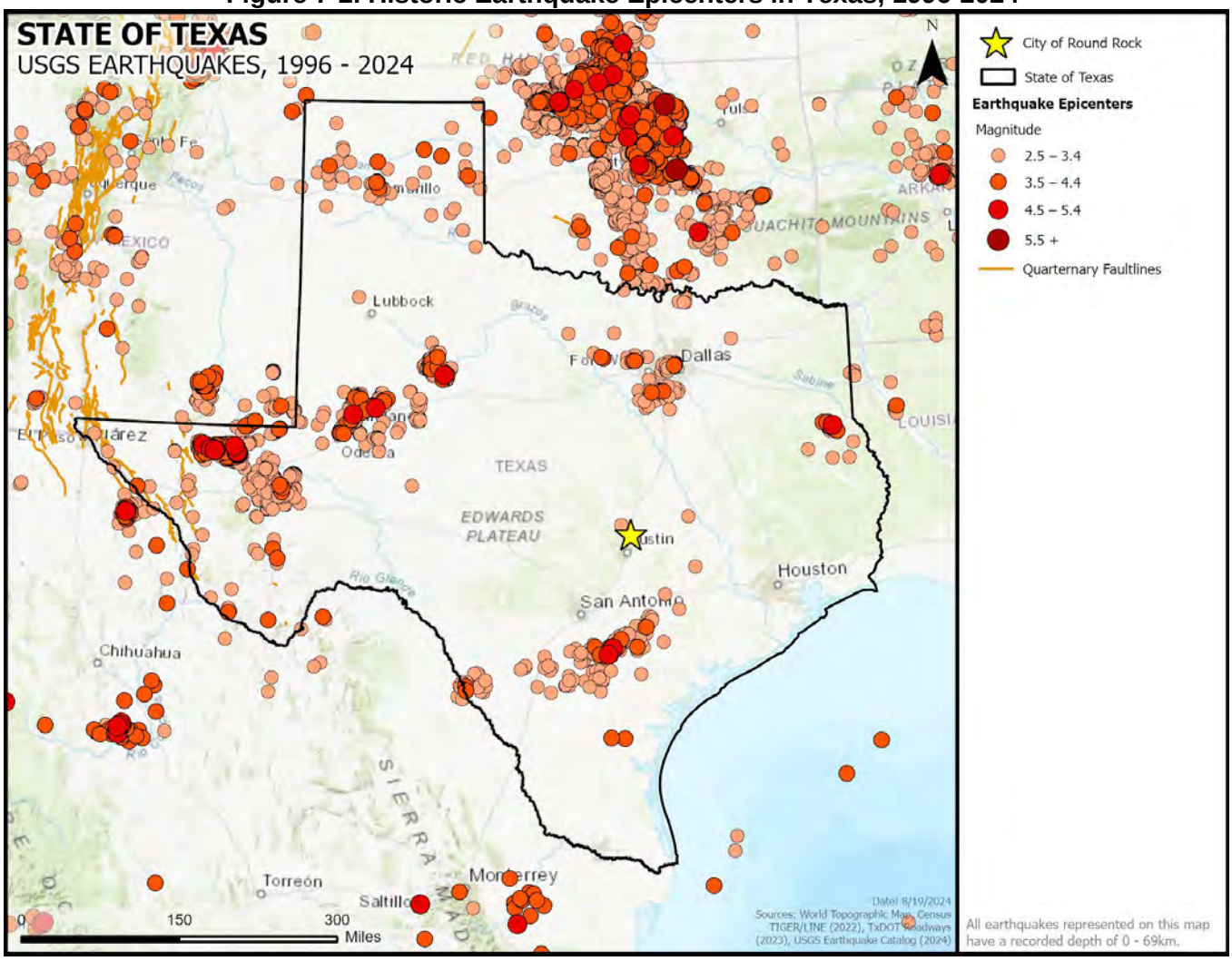


Figure 7-2 maps historic earthquake epicenters across Texas between 1973 and 2012.

[3] City of Round Rock is indicated by the black circle.

Figure 7-2. Historic Earthquake Epicenters in Texas, 1996-2024



EXTENT

Earthquakes are measured in terms of magnitude and intensity. The prevalent magnitude measurement in use today is based on the Moment Magnitude Scale (MMS). MMS measures the movement of rock along the fault. It accurately measures larger earthquakes, which can last for minutes, affect a much larger area, and cause more damage. Magnitudes are based on a logarithmic scale (base 10), meaning that for each whole number you go up on the magnitude scale, the amplitude of the ground motion recorded by a seismograph goes up ten times. Using this scale, a magnitude 5 earthquake would result in ten times the level of ground shaking as a magnitude 4 earthquake (and about 32 times as much energy would be released).[4] The USGS reports earthquake magnitudes above 4.0 as “moment magnitude,” often described in the press as "Richter” magnitude. Table 7-2 shows the magnitude levels for the current Richter/Moment Magnitude scale.

[4] (n.d.). How Do We Measure Earthquake Magnitude? Michigan Tech. https://www.mtu.edu/geo/community/seismology/learn/earthquake-measure/#:~:text=The%20moment%20magnitude%20scale%20is,the%20earthquake%20at%20multiple%20stations.

Table 7-2. Richter / Moment Magnitude Scale[5]

MAGNITUDE	CATEGORY	DESCRIPTION OF EFFECTS	EVENTS PER YEAR
< 3.0	Micro	Usually not felt, but can be recorded by seismograph	+100,000
3.0 – 3.9	Minor	Often felt, but causes no damage	12,000 - 100,000
4.0 – 4.9	Light	Felt by all, minor breakage of objects	2,000 - 12,000
5.0 – 5.9	Moderate	Some damage to weak structures	200 – 2,000
6.0 – 6.9	Strong	Moderate damage in populated areas	20 – 200
7.0 – 7.9	Major	Serious damage over large areas with loss of life expected	3 – 20
> 7.9	Great	Severe destruction and loss of life over large areas	Less than 3

Earthquake Intensity measurement is an on-the-ground description. The measurement qualitatively explains the severity of earthquake shaking and its effects on people and their environment. Intensity measurements will differ depending on each location's proximity to the epicenter or point on the surface of the earth directly above the focus where the earthquake started. The intensity scale consists of a series of certain key responses such as people awakening, movement of furniture, damage to chimneys, and total destruction. There can be multiple intensity measurements associated with an earthquake as opposed to one magnitude measurement.[6] The Modified Mercalli Intensity value assigned to a specific site after an earthquake has a more meaningful measure of severity to the nonscientist than the magnitude because intensity refers to the effects actually experienced at a specific location. The scale provides the intensity of the earthquake in values ranging from I to X. Table 7-3 describes the typical effects and intensities associated with earthquakes of various magnitudes. The intensity and effects depend on multiple factors (earthquake depth, epicenter location, site geology, population density, to name a few) and can vary widely.

[5] (n.d.). Earthquakes. Britannica. https://www.britannica.com/science/earthquake-geology
[6] Wood, H. O., and Neumann, Frank (1931). Modified Mercalli Intensity Scale of 1931: Seismological Society of America Bulletin, v. 21, no. 4, p. 277-283.

Table 7-3. Magnitude and Modified Mercalli Intensity (MMI) Scale[7]

INTENSITY	CATEGORY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER MAGNITUDE
I	Not Felt	Not felt except by a very few under especially favorable conditions	< 2.0
I	Not Felt	Felt only by a few persons at rest, especially on upper floors of buildings.	2.0 – 2.9
II – III	Weak	Felt quite noticeably by persons indoors, with shaking of indoor objects. Rarely causes damages.	3.0 – 3.9
IV – V	Light to Moderate	Noticeable shaking of indoor objects and rattling noises. Felt by most people in the affected area. Generally, no to minimal damage	4.0 – 4.9
VI – VII	Strong to Very Strong	Significant damages to poorly constructed buildings. Limited to moderate damages to well-built structures.	5.0 – 5.9
VIII – IX	Severe to Violent	Damage slight in specially designed structures; considerable damage in ordinary buildings with partial collapse. Damage great in poorly built structures.	6.0 – 6.9
VIII +	Severe to Extreme	Damage considerable in specially designed structures. Damage substantial to most buildings, with partial or complete collapse. Felt across great distances with major damage mostly limited to 250 km from Epicenter.	7.0 – 7.9
VIII – IX	Severe to Violent	Major damage to buildings, structures likely to be destroyed; will cause moderate to heavy damage to sturdy or earthquake-resistant buildings; damaging in large areas; felt in extremely large regions.	8.0 – 8.9
VIII +	Severe to Extreme	At or near total destruction. Severe damage or collapse to all buildings; heavy damage and shaking extends to distant locations and permanent changes in ground topography.	9.0+

[7] Source: USGS

Taking into consideration the possible extent of an earthquake for the area, by reviewing Tables 7-2 and 7-3 in conjunction with no significant previous occurrences, as depicted in Figure 7-2, the City of Round Rock planning area experiences on average less than 3.0 magnitude or Levels II-III (weak impact) on the Modified Mercalli intensity scale. This is the greatest extent the entire planning area can anticipate in the future, based on historic records.

HISTORICAL OCCURRENCES

According to USGS, and the National Geophysical Data Center (NGDC), there are no "significant" earthquakes on record for the State of Texas and the entire City of Round Rock planning area from 2150 B.C. to present. A significant earthquake, as defined by NGDC, is one that has caused at least moderate damage (approximately $1 million or more), has resulted in 10 or more deaths, has registered as a magnitude 7.5 or greater, has registered as Modified Mercalli Intensity (MMI) Scale X or greater, or generated a tsunami. None of these criteria have been met by any seismic activity known to have impacted the planning area.

PROBABILITY OF FUTURE EVENTS

Earthquake Hazard Maps show the distribution of earthquake shaking levels that have a certain probability of occurring over a given period. According to the USGS, the entire City of Round Rock planning area has a less than five percent chance of a slightly damaging (or greater) earthquake within 100 years. Based on historical records, the probability of an earthquake affecting the planning area is "Unlikely", meaning that an event is probable in the next 10 years.

VULNERABILITY AND IMPACT

Little warning is usually associated with earthquakes and can impact areas a great distance away from the epicenter. The amount of damage depends on the density of population and buildings, and infrastructure construction in the affected area. Some places may be more vulnerable than others based on soil type, building age, and building codes in the City of Round Rock planning area.

The City of Round Rock Planning Team identified the following critical facilities as assets that are considered the most important to the planning area and are susceptible to a range of impacts caused by earthquake events. For a comprehensive list, please see Appendix C.

Table 7-4. Critical Facilities Vulnerable to an Earthquake

CRITICAL FACILITIES	POTENTIAL IMPACTS
Emergency Response Services (EOC, Fire, Police, EMS), Hospitals and Medical Centers	• Emergency operations and services may be significantly impacted due to power outages, damaged facilities, fires and/or loss of communications. Impact can impede emergency response vehicle access to areas. • Power outages could disrupt communications, delaying emergency response times. • Extended power outages may lead to possible looting, destruction of property, and theft, further burdening law enforcement resources.

CRITICAL FACILITIES	POTENTIAL IMPACTS
Airport, Academic Institutions, Animal Shelter, Evacuation Centers & Shelters, Governmental Facilities, Residential/ Assisted Living Facilities	• Power outages could disrupt critical care. • Backup power sources could be damaged. • Evacuations may be necessary due to extended power outages or other associated damages to facilities. • Economic disruption due to power outages negatively impact airport services as well as area businesses reliant on airport operations.
Commercial Supplier (food, fuel, etc.)	• Facilities, infrastructure, or critical equipment including communications may be damaged, destroyed or otherwise inoperable. • Essential supplies like medicines, water, food, and equipment deliveries may be delayed.
Utility Services and Infrastructure (electric, water, wastewater, communications)	• Emergency operations and critical services may be significantly impacted due to power outages, damaged facilities, and/or loss of communications. Impact can impede emergency service vehicle access to areas. • Power outages could disrupt communications, delaying emergency response times further straining the capacity and resources of emergency service personnel.

With no historical events recorded, neither annualized loss-estimates or a breakdown of potential dollar losses of critical facilities and infrastructure from earthquakes are available. The potential severity of impact from an earthquake for the entire City of Round Rock planning area is classified as “Limited”, meaning injuries and illnesses are treatable with first aid, less than 10 percent of property destroyed or with major damage, and critical facilities being shut down for 24 hours or less.

CLIMATE CHANGE CONSIDERATIONS

Damaging earthquakes are rare within the State of Texas, including the City of Round Rock planning area. Changing conditions of weather patterns and climate change has not been established as having a direct impact on earthquake intensity or frequency.

According to the USGS, statistically there is an approximately equal distribution of earthquakes in all cold weather, hot weather, rainy weather, etc. Very large low-pressure changes associated with major storm systems, like typhoons and hurricanes, are known to trigger episodes of fault slip or slow earthquakes in the Earth’s crust and may also play a role in triggering some damaging earthquakes. However, the numbers are small and are not statistically significant.[8]

The City of Round Rock planning area is located outside of any known earthquake hazard areas and is not located on or near any fault lines. Climate change is assumed to have no impact on the probability or intensity of potential earthquakes in the planning area.

[8] (n.d.). *Natural Hazards*. United Stated Geological Survey. https://www.usgs.gov/faqs/there-earthquake-weather

SECTION 8
EXTREME HEAT

SECTION 8: EXTREME HEAT

HAZARD DESCRIPTION

Extreme heat is a prolonged period of excessively high temperatures and exceptionally humid conditions. Extreme heat during the summer months is a common occurrence throughout the State of Texas, and the City of Round Rock is no exception. The City typically experiences extended heat waves or an extended period of extreme heat and is often accompanied by high humidity.

Although heat can damage buildings and facilities, it presents a more significant threat to the safety and welfare of citizens. The major human risks associated with extreme heat include heat cramps; sunburn; dehydration; fatigue; heat exhaustion; and even heat stroke. The most vulnerable population to heat casualties are children and the elderly or infirmed who frequently live on low fixed incomes and cannot afford to run air-conditioning on a regular basis. This population is sometimes isolated, with no immediate family or friends to look out for their well-being.

Critical infrastructure can also be damaged or impacted by extreme heat. High temperatures may cause a rise in electricity consumption as homes, schools, and businesses try to regulate the temperature. This may lead to energy shortages and possible blackouts.

LOCATION

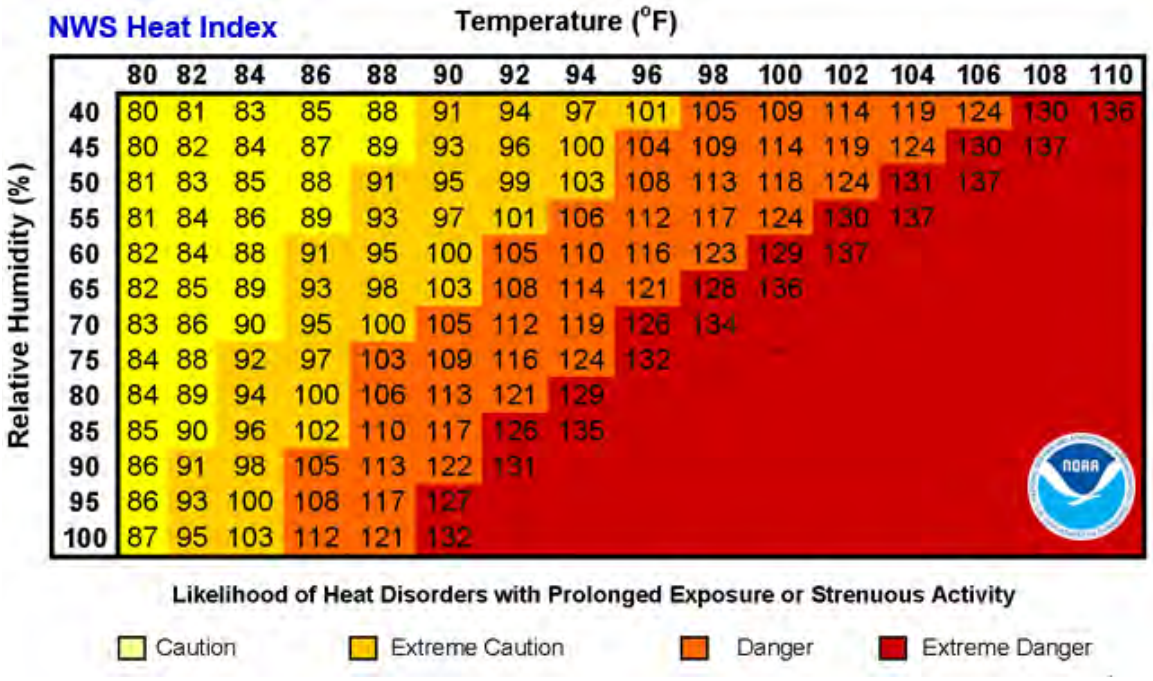
Extreme heat events can occur throughout the entire City of Round Rock planning area as there is no specific geographic boundary to the extreme heat hazard.

EXTENT

The magnitude or intensity of an extreme heat event is measured according to temperature in relation to the percentage of humidity. According to the National Oceanic Atmospheric Administration (NOAA), this relationship is referred to as the “Heat Index” and is depicted in Figure 8-1. This index measures how hot it feels outside when humidity is combined with high temperatures.

SECTION 8: EXTREME HEAT

Figure 8-1. Extent Scale for Extreme Heat[1]



The index in Figure 8-1 displays varying categories of caution depending on the relative humidity combined with the temperature. For example, when the temperature is at 90 degrees Fahrenheit (°F) or lower, caution should be exercised if the humidity level is at or above 40 percent. The shaded zones on the chart indicate varying symptoms or disorders that could occur depending on the magnitude or intensity of the event. Table 8-1 correlates to the above figure, outlining the category type and possible impacts related to extreme heat exposure. The National Weather Service (NWS) initiates alerts based on the Heat Index as shown in Table 8-1.

Table 8-1. Heat Index and Warnings

CATEGORY	HEAT INDEX	POSSIBLE HEAT DISORDERS	WARNING TYPE
Extreme Danger	125°F and higher	Heat stroke or sun stroke likely.	An Excessive Heat Warning is issued if the Heat Index rises above 105°F at least 3 hours during the day or above 80°F at night.
Danger	103 – 124°F	Sunstroke, muscle cramps, and/or heat exhaustion are likely. Heatstroke possible with prolonged exposure and/or physical activity.	An Excessive Heat Warning is issued if the Heat Index rises above 105°F at least 3 hours during the day or above 80°F at night.

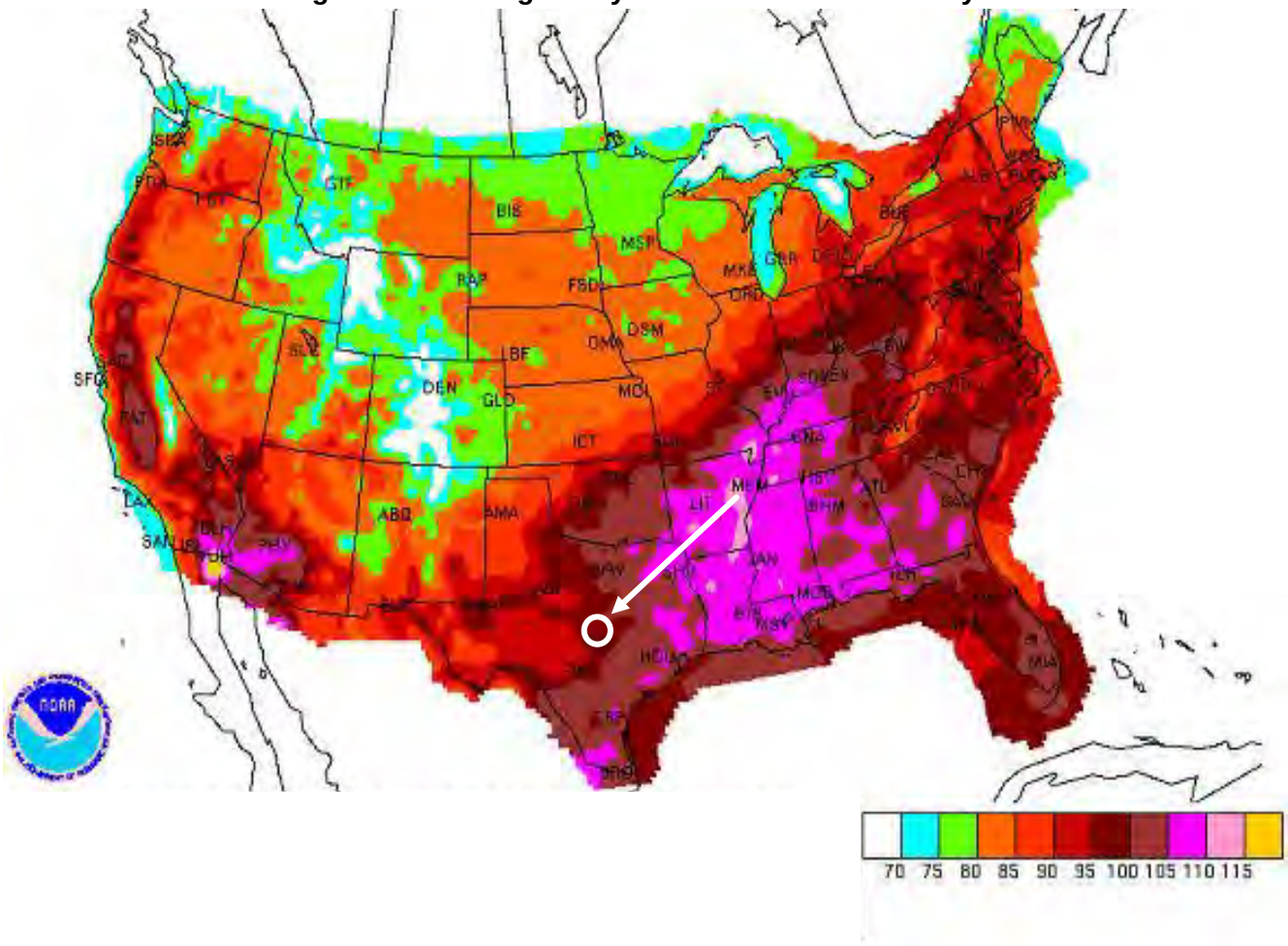
[1] Source: NOAA

CATEGORY	HEAT INDEX	POSSIBLE HEAT DISORDERS	WARNING TYPE
Extreme Caution	90 – 103°F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.	A Heat Advisory will be issued to warn that the Heat Index may exceed 105°F.
Caution	80 – 90°F	Fatigue is possible with prolonged exposure and/or physical activity.	A Heat Advisory will be issued to warn that the Heat Index may exceed 105°F.

Due to its geography and its warm, sunny, and humid subtropical climate, the City of Round Rock planning area can expect an extreme heat event each summer. Citizens, especially children and the elderly, should exercise caution by staying out of the heat for prolonged periods when a heat advisory or excessive heat warning is issued. In addition, those working or remaining outdoors for extended periods of time are at greater risk.

Figure 8-2 displays the daily maximum heat index as derived from NOAA based on data compiled from 1838 to 2015. The white circle shows the City of Round Rock planning area. The planning area is represented in dark red across the City. The dark red color indicates an average daily heat index of 95°F to 100°F. Therefore, City of Round Rock could experience dangerous heat from 95°F to 100°F and should mitigate to the extent of “Extreme Caution,” which can include sunstroke, muscle cramps, and possible heat exhaustion. This is the average maximum temperature the planning area can anticipate based on historical events.

Figure 8-2. Average Daily Maximum Heat Index Days[2]



HISTORICAL OCCURRENCES

The National Centers for Environmental Information (NCEI) Storm Events database is a national data source organized under the National Oceanic and Atmospheric Administration (NOAA). The NCEI is the largest archive available for historic storm events data. Previous occurrences for extreme heat are derived from the NCEI database, which identifies extreme heat events at the county level for each event. According to heat-related incidents located solely within Williamson County, which includes the City of Round Rock, there have been 5 reported extreme heat events (Table 8-2). Historical extreme heat information, as provided by the NCEI, shows extreme heat activity across a multi-county forecast area for each event, the appropriate percentage of the total property and crop damage reported for the entire forecast area has been allocated to each county impacted by the event.

[2] NRDC; the white circle indicates the City of Round Rock planning area.

SECTION 8: EXTREME HEAT

Historical extreme heat data for the City of Round Rock is provided on a County-wide basis per the NCEI database from 1996 through 2023. There has been one reported death due to an extreme heat event, but no additional injuries or damages. Only extreme heat events that have been reported have been factored into this Risk Assessment. It is highly likely additional extreme heat occurrences have gone unreported before and during the recording period. Due to the limited number of reported events, average high temperatures have been analyzed in order to determine the probability of future events.

Table 8-2. Historical Extreme Heat Events, 1996-2023[3]

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
City of Round Rock	7/25/2000	1	0	$0	$0
City of Round Rock	7/19/2018	0	0	$0	$0
City of Round Rock	6/15/2023	0	0	$0	$0
City of Round Rock	7/12/2023	0	0	$0	$0
City of Round Rock	8/7/2023	0	0	$0	$0
TOTALS		**1**	**0**	**$0**	**$0**

Based on the list of historical extreme heat events for the City of Round Rock, 3 events were reported to the NCEI since the 2018 Plan.

SIGNIFICANT EVENTS

July 25, 2000

The City of Round rock experienced extreme heat temperatures, which lead to one fatality during this reported event. The victim was found in their home in front of an open refrigerator. The home had no central air conditioning, only a window fan.

August 7, 2023

Excessive heat was observed nearly every day of August across parts of South Central Texas. Temperatures for the area reached a high of 112°F. All the National Weather Service climate sites set or tied numerous daily record high temperatures and record high low temperatures during this heat wave event.

PROBABILITY OF FUTURE EVENTS

According to historical records, the City of Round Rock has experienced 5 reported events in a 28-year reporting period. Although there are no records of events between the year 2000 and 2018 for the planning area, it can be assumed that events have gone unreported due to the average daily temperatures throughout the summer. Historical records in combination with an analysis of maximum average temperatures provides a probability of at least one event every year. This frequency supports a “Highly Likely” probability of future events.

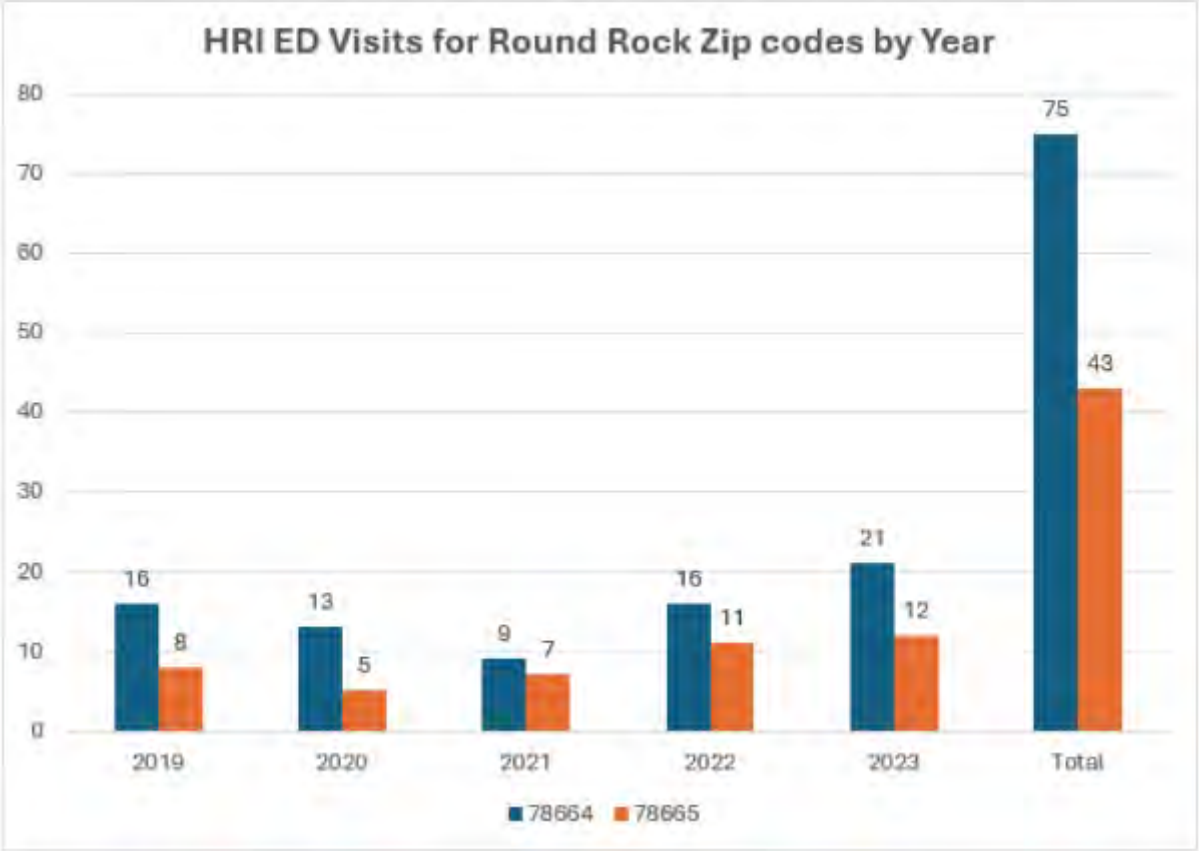
[3] NOAA, NCEI Storm Events Database

VULNERABILITY AND IMPACT

While the entirety of the City of Round Rock is exposed to extreme temperatures, existing buildings, infrastructure, and critical facilities are not likely to sustain significant damage from extreme heat events. Therefore, any estimated property losses associated with the extreme heat hazard are anticipated to be minimal across the area.

Every summer, the hazard of heat-related illness becomes a significant public health issue throughout much of the United States. Mortality rates increase during heat waves, and excessive heat is an important contributing factor to deaths from other causes, particularly among the elderly. Extreme temperatures present a significant threat to life and safety for the population of the city as a whole. Heat casualties, for example, are typically caused by a lack of adequate air-conditioning or heat exhaustion. The most vulnerable population to heat casualties are the elderly or infirmed who frequently live on fixed incomes and cannot afford to run air-conditioning on a regular basis. This population is sometimes isolated, with no immediate family or friends to look out for their well-being. Children may also be more vulnerable if left unattended in vehicles. Populations living below the poverty level are often unable to run air-conditioning on a regular basis and are limited in their ability to seek medical treatment. Figure 8-3 below provides the number of reported heat-related illnesses in the City of Round Rock by zip code between 2019 and 2023.

Figure 8-3. Reported Heat Illnesses 2019-2023[4]



The population over 65 in the City of Round Rock planning area is estimated at 10 percent of the total population and children under the age of 5 are estimated at 6 percent. Individuals with a disability are estimated at 11 percent of the total population. An estimated 8 percent of the planning area population live below the poverty level and 25 percent of the populations speaks a language other than English (Table 8-3). Vulnerable and underserved populations are disproportionately impacted by extreme heat events as they may be more susceptible to health risks. The population below the poverty level are less likely to be able to afford air conditioning during the hot summer months as well as less likely to have access to medical care. In addition, people who speak a language other than English may face increased vulnerability due to language barriers that limit their access to important information such as weather-related warnings and instructions regarding safety measures.

Table 8-3. Populations at Greater Risk

ELDERLY (over 65)	**YOUTH** (under 5)	**WITH A DISABILITY**	**BELOW POVERTY LEVEL**	**NON-ENGLISH SPEAKING**
12,356	7,219	12,927	9,276	30,183

[4] Williamson County and Cities Health District, Emergency Preparedness and Response.

SECTION 8: EXTREME HEAT

Extremely high temperatures can have significant secondary impacts, leading to droughts, water shortages, increased fire danger, and prompt excessive demands for energy. The possibility of rolling blackouts increases with unseasonably high temperatures in what is a normally mild month with low power demands. Typically, more than 12 hours of warning time would be given before the onset of an extreme heat event.

In terms of vulnerability to structures, the impact from extreme heat is considered negligible. It is possible that critical facilities and infrastructure could be shut down for 24 hours if cooling units are running constantly, leading to a temporary power outage (Table 8-4). Less than ten percent of residential and commercial property could be damaged if extreme heat events lead to structure fires. Based on historical records, annualized property and crop losses for the City of Round Rock are negligible. However, due to one reported death, the impact of extreme heat is considered "Substantial" with multiple deaths possible depending on the intensity and duration of the event.

The City of Round Rock Planning Team identified the following critical facilities as assets that are considered the most important to the planning area and are susceptible to a range of impacts caused by extreme heat events. The following critical facilities would be vulnerable to extreme heat events in the City of Round Rock. For a comprehensive list of critical facilities, please see Appendix C.

Table 8-4. Critical Facilities Vulnerable to Extreme Heat Events

CRITICAL FACILITIES	POTENTIAL IMPACTS
Emergency Response Services (EOC, Fire, Police, EMS, Hospitals)	• Emergency operations, services and response times may be significantly impacted due to power outages, and/or loss of communications. • Exposure to heat can cause heat illnesses in first responders, especially for those in heavy equipment. • Roads may become impassable due to excessive heat causing asphalt roads to soften and concrete roads to shift or buckle impacting response times by emergency services. • Extended power outages due to increased usage may lead to possible looting, destruction of property, and theft, further burdening law enforcement resources.
Airport, Academic Institutions, Community Residential Facilities, Day Care Facilities, Evacuation Centers & Shelters, Governmental Facilities	• Facilities, infrastructure, or critical equipment including communications may be damaged, destroyed or otherwise inoperable. • Power outages due to increased usage could disrupt critical care. • Backup power sources could be damaged. • Evacuations may be necessary due to extended power outages, breaks in water main lines or other associated damage to facilities. • Facilities, infrastructure, or critical equipment including communications may be damaged, destroyed or otherwise inoperable. • Economic disruption due to power outages negatively impact airport services as well as area businesses reliant on airport operations.

CRITICAL FACILITIES	POTENTIAL IMPACTS
Commercial Suppliers (food, gas, etc.)	• Facilities, infrastructure, or critical equipment including communications may be damaged, destroyed or otherwise inoperable. • Essential supplies like medicines, water, food, and equipment deliveries may be delayed.
Utility Services and Infrastructure (electric, water, wastewater, communications)	• Emergency operations, services and response times may be significantly impacted due to power outages, and/or loss of communications. • Roads may become impassable due to excessive heat causing asphalt roads to soften and concrete roads to shift or buckle impacting response times by emergency services. • Breaks in water main lines or other associated damage to facilities.

ASSESSMENT OF IMPACTS

The greatest risk from extreme heat is to public health and safety. Extreme heat conditions can be frequently associated with a variety of impacts, including:

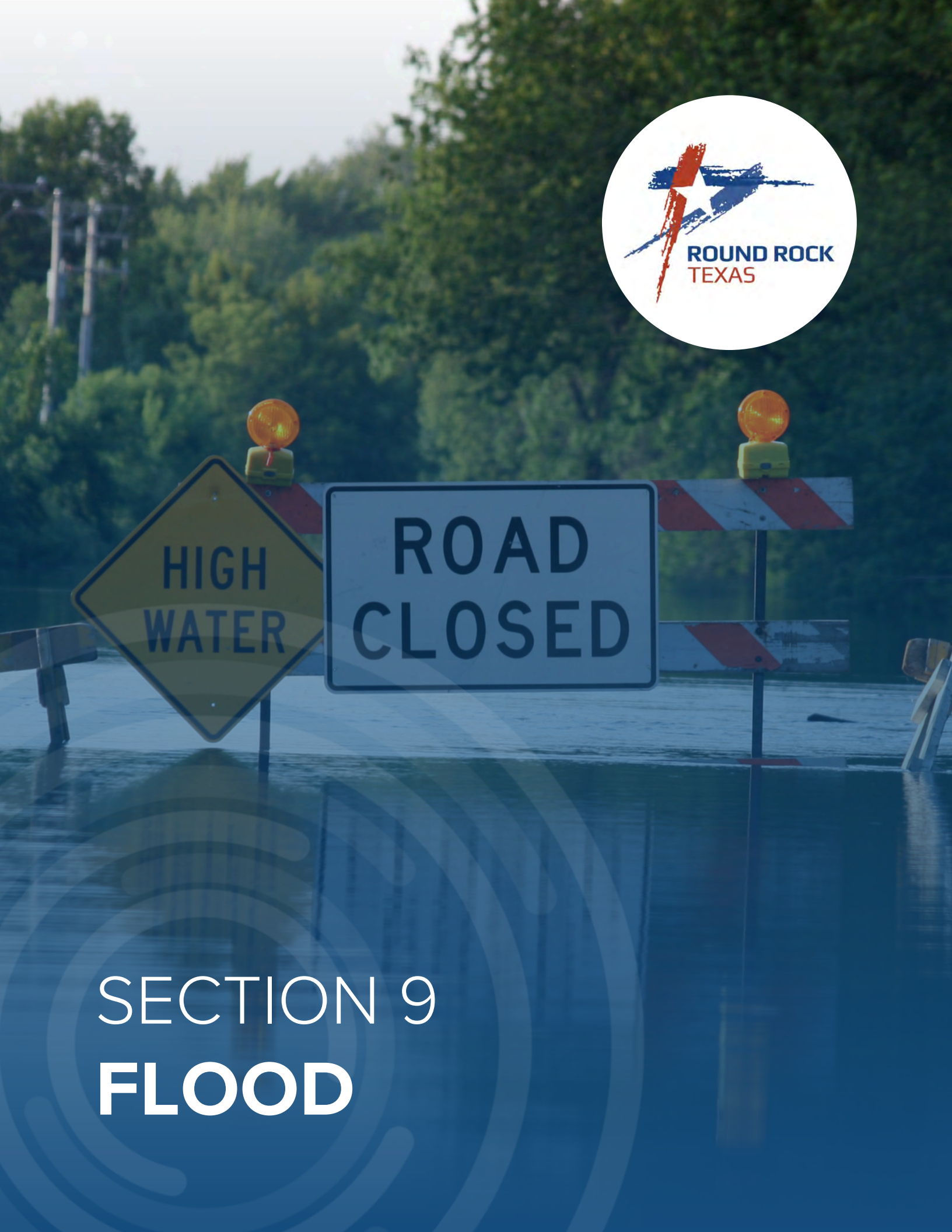
- Vulnerable populations, particularly the elderly (10 percent of total population), children under 5 (6 percent of total population), and those with a disability (11 percent of total population) can face serious or life-threatening health problems from exposure to extreme heat including hyperthermia, heat cramps, heat exhaustion, and heat stroke (or sunstroke).
- Response personnel, including utility workers, public works personnel, and any other professions where individuals are required to work outside, are more subject to extreme heat related illnesses since their exposure would typically be greater.
- High energy demand periods can outpace the supply of energy, potentially creating the need for rolling brownouts which would elevate the risk of illness to vulnerable residents.
- Highways and roads may be damaged by excessive heat causing asphalt roads to soften and concrete roads to shift or buckle.
- Vehicle engines and cooling systems typically run harder during extreme heat events resulting in increases in mechanical failures.
- Extreme heat events during times of drought can exacerbate the environmental impacts associated with drought, decreasing water and air quality and further degrading wildlife habitat.
- Extreme heat increases ground-level ozone (smog), increasing the risk of respiratory illnesses.
- Negatively impacted water suppliers may face increased costs resulting from the transport of water resources or development of supplemental water resources.
- Tourism and recreational activities at places may be negatively impacted during extreme heat events, reducing seasonal revenue.
- Outdoor activities may see an increase in school injury or illness during extreme heat events.

The economic and financial impacts of extreme heat on the community will depend on the duration of the event, demand for energy, drought associated with extreme heat, and many other factors. The level of preparedness and the amount of planning done by the community, local businesses, and citizens will impact the overall economic and financial conditions before, during, and after an extreme heat event.

CLIMATE CHANGE CONSIDERATIONS

Climate change is expected to lead to an increase in average temperatures as well as an increase in frequency, duration, and intensity of extreme heat events. With no reductions in emissions worldwide, the state of Texas is projected to experience an additional 30 to 60 days per year above 100°F than what is experienced now.[5] In addition, it is projected that future changes to the City of Round Rock will include increased temperatures, which according to the U.S. Climate Explorer, the planning area may experience a 6°F increase in the average extreme heat temperatures. Historically, extreme temperatures averaged 100°F in the City of Round Rock, but between 2035 and 2064 the average will be 106°F, increasing the severity and frequency of extreme heat events. The increase in temperature could be higher but will depend on overall future emissions.

[5] Nielsen-Gammon, John, Holman, Sara, Buley, Austin and Jorgensen, Savannah. Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900-2036, 2021 Update. Texas A&M University Office of the Texas State Climatologist. October 7, 2021. https://climatexas.tamu.edu/files/ClimateReport-1900to2036-2021Update



SECTION 9
FLOOD

SECTION 9: FLOOD

HAZARD DESCRIPTION

Floods generally result from excessive precipitation and may be a long-term event lasting for several days. The severity of a flood event is determined by a combination of several major factors, including stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and the degree of vegetative clearing and impervious surfaces.

The primary types of general flooding are inland and coastal flooding. Due to the City of Round Rock's inland location, only inland flooding is profiled in this section. Inland or riverine flooding is a result of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. Inland or riverine flooding is overbank flooding of rivers and streams, typically resulting from large-scale weather systems that generate prolonged rainfall over a wide geographic area. Therefore, it is a naturally occurring and inevitable event. Some river floods occur seasonally when winter or spring rainfalls fill river basins with too much water, too quickly. Torrential rains from decaying hurricanes or tropical systems can also produce river flooding.

The City of Round Rock is subject to extreme rainfall events, often in short durations, leading to dangerous flash flooding events. Floods are a natural and recurrent event and take place every year, in all seasons.

LOCATION

The Flood Insurance Rate Maps (FIRMs) prepared by FEMA provide an overview of flood risk but can also be used to identify the areas of the City that are vulnerable to flooding. FIRMs are used to regulate new development and to control the substantial improvement and repair of substantially damaged buildings. Flood Insurance Studies (FIS) are often developed in conjunction with FIRMs. The FIS typically contains a narrative of the flood history of a community and discusses the engineering methods used to develop the FIRMs. The FIS also contains flood profiles for studying flooding sources and can be used to determine Base Flood Elevations (BFEs) for some areas.

The FIS for Williamson County, which includes the City of Round Rock, is dated December 20, 2019. This FIS is composed of several volumes and compiles all previous flood information including data collected on numerous waterways. Identified flooding sources for the City of Round Rock include Brushy Creek, Chandler Branch, Dam 14 Tributary, Dry Branch, Dry Fork, Dyer Branch, Honey Bear Creek, Lake Creek, McNutt Creek, McNutt Fork, Onion Branch, Rattan Creek, and the Round Rock Reservoir. The study indicates that the principal flood problems for the City of Round Rock relate mostly to Brushy Creek, which has closed roads on numerous occasions. These streams with larger drainage areas and rolling topography can result in rapid runoff, short duration, and high peak discharge flooding. Small culverts and bridges under the roads and railroads aggravate the flooding issue. The City of Round Rock is also included in the Travis County FIS, which is dated January 22, 2020. Flooding sources identified for the City of Round Rock in this study include Gilleland Creek, Gilleland Creek Tributary 3, and the Lower Colorado / Cummins Rivers Watershed.

The Digital Flood Insurance Rate Map (DFIRM) data provided by FEMA for City of Round Rock shows the following flood hazard areas:

- Zone A: Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. Mandatory flood insurance requirements and floodplain management standards apply.
- Zone AE: Areas subject to inundation by 1-percent-annual-chance shallow flooding. It is the base floodplain where BFEs are provided. AE zones are now used on new format FIRMs instead of A1-30 zones.
- Zone X: Moderate risk areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by a levee. No BFEs or base flood depths are shown within these zones.

Locations of flood zones in the City of Round Rock based on the Digital Flood Insurance Rate Map (DFIRM) from FEMA are illustrated in Figure 9-1. Figures 9-2 through 9-4 provide a closer view of flood hazard areas throughout the planning area in relation to identified critical facilities.

Figure 9-1. Estimated Flood Zones in the City of Round Rock

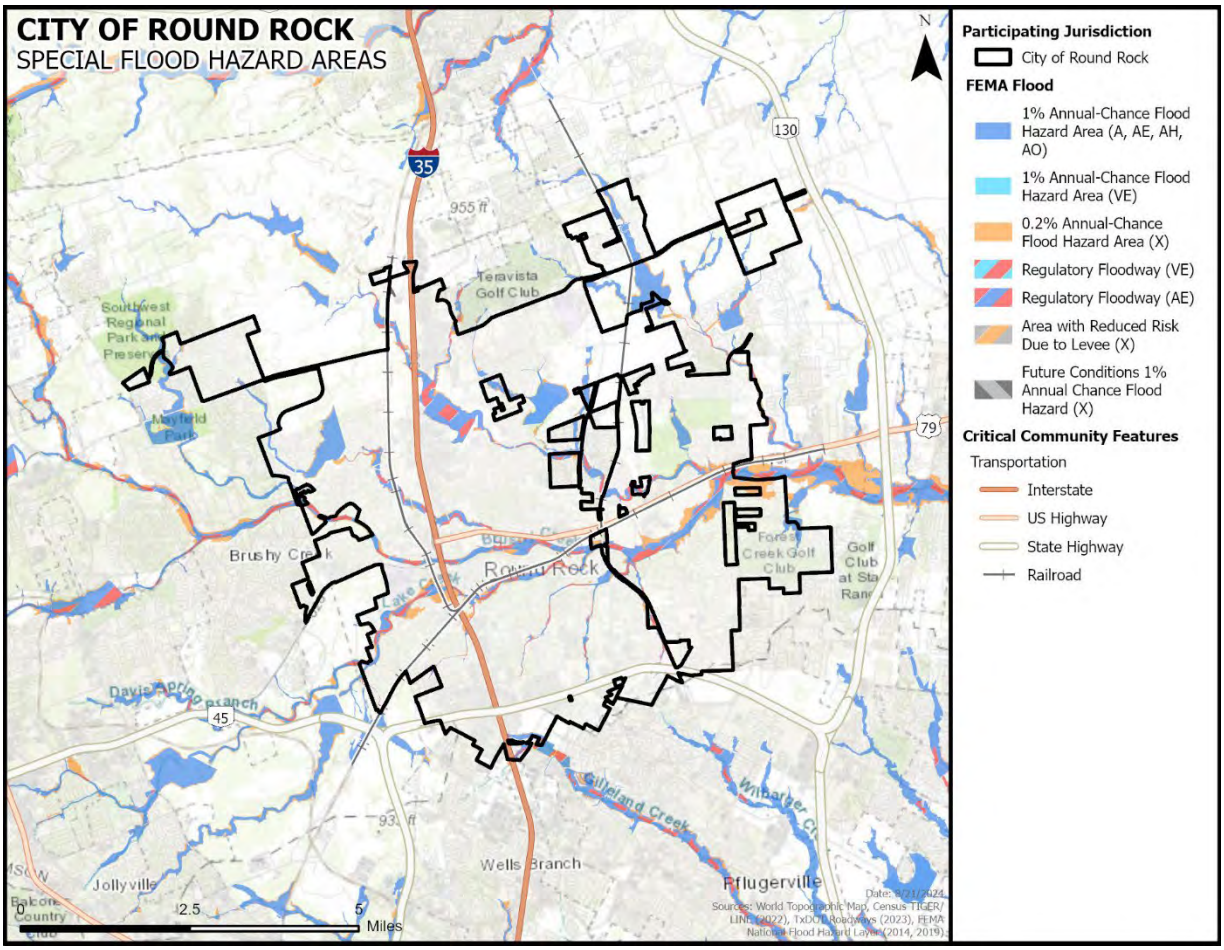


Figure 9-2. Estimated Flood Zones in the City of Round Rock - West with Critical Facilities

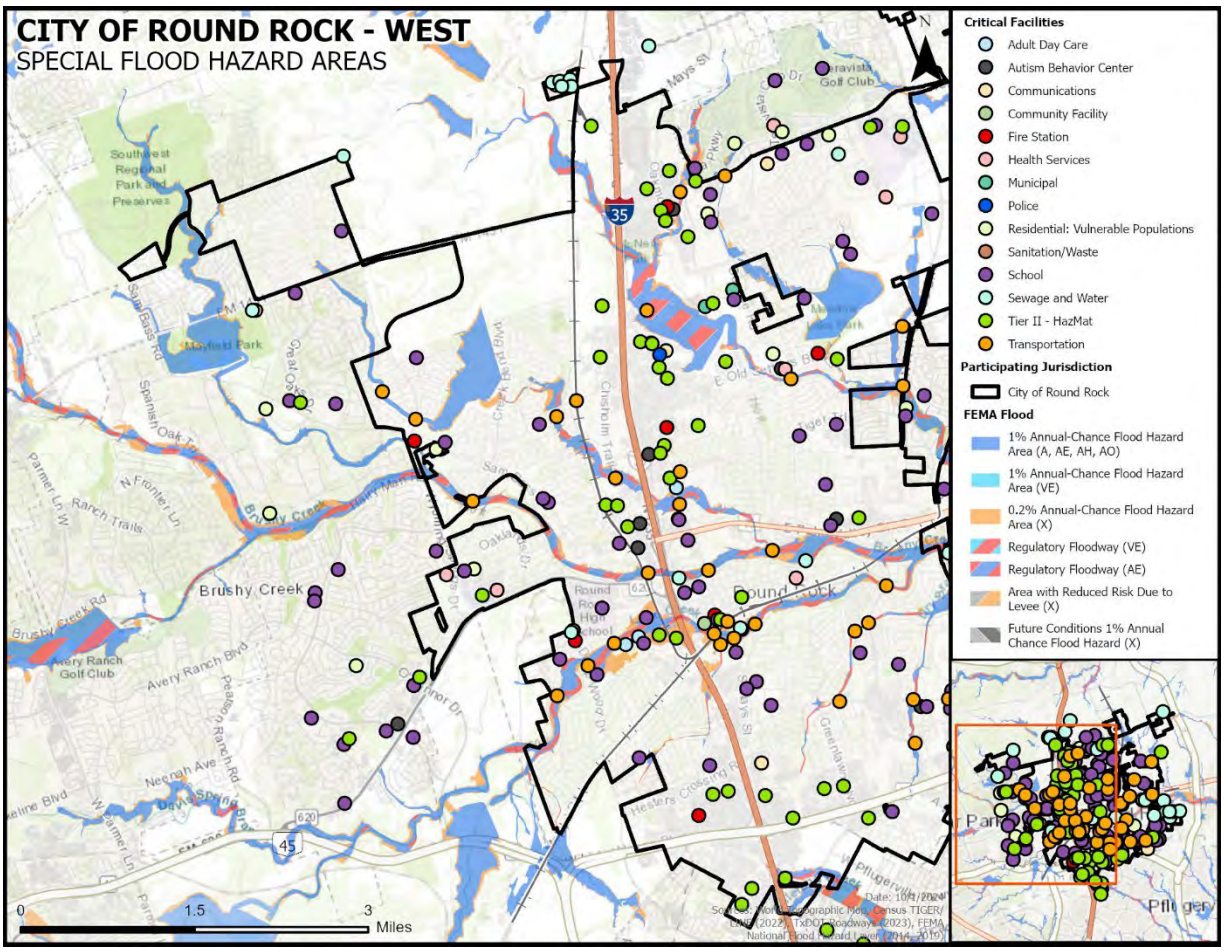


Figure 9-3. Estimated Flood Zones in the City of Round Rock - Northeast with Critical Facilities

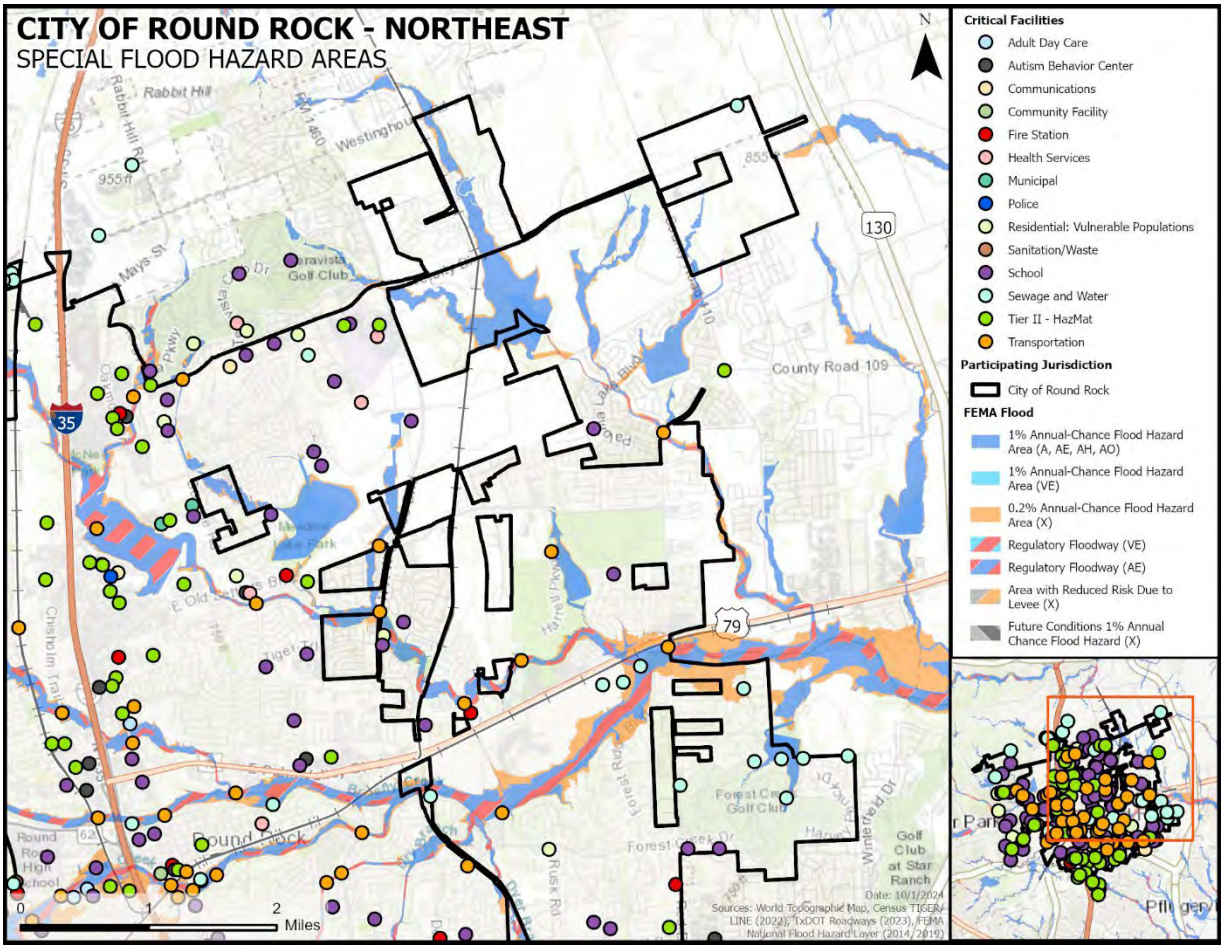
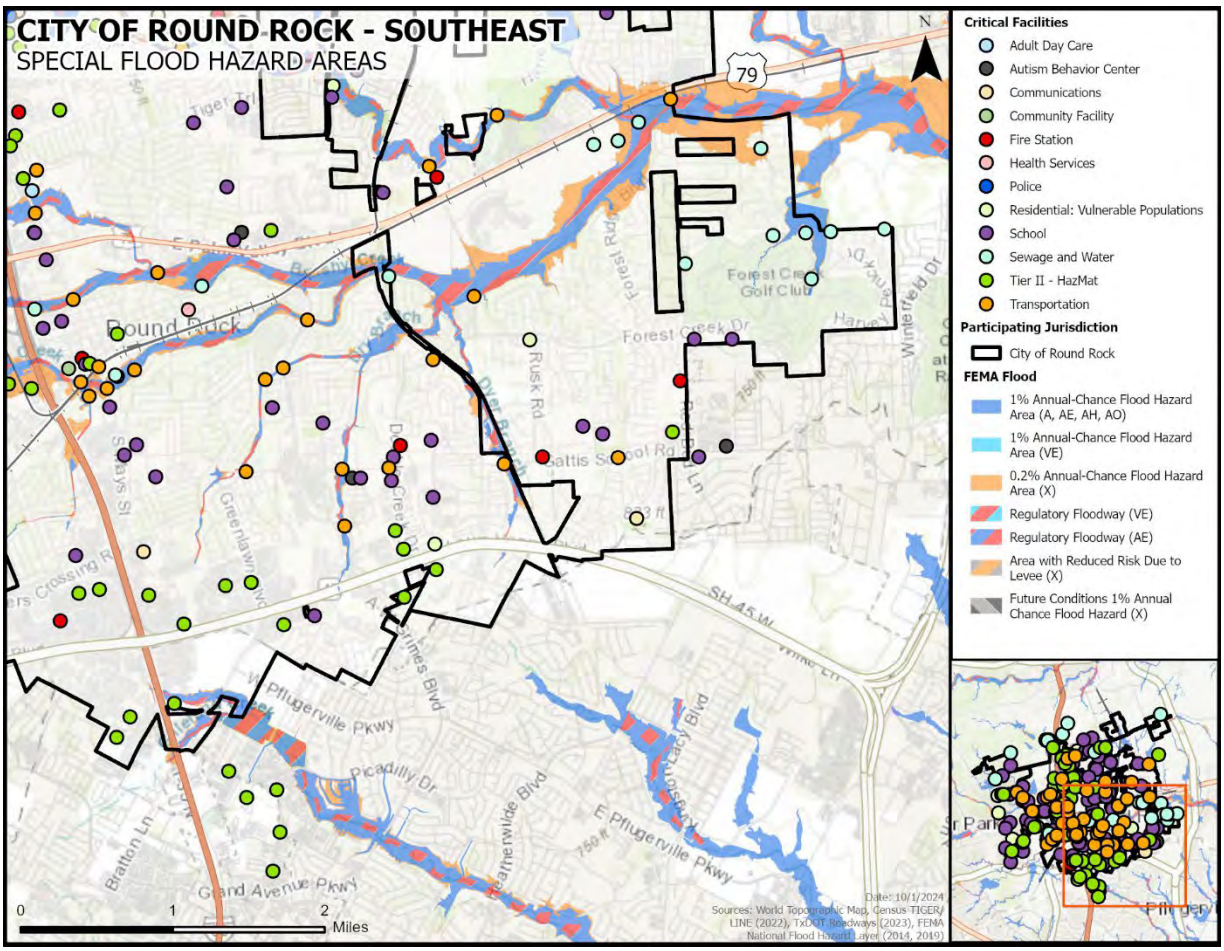


Figure 9-4. Estimated Flood Zones in the City of Round Rock - Southeast with Critical Facilities



EXTENT

The severity of a flood event is determined by a combination of several major factors, including stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and the degree of vegetative clearing and impervious surfaces. Typically, floods are long-term events that may last for several days.

Determining the intensity and magnitude of a flood event is dependent upon the flood zone and location of the flood hazard area in addition to the depths of flood waters. The extent of flood damages can be expected to be more damaging in the areas that will convey a base flood. FEMA categorizes areas on the terrain according to how the area will convey flood water. Flood zones are the categories that are mapped on FIRMs. Table 9-1 provides a description of FEMA flood zones and the flood impact in terms of severity or potential harm. Flood Zones A, AE, and X are the hazard areas mapped in the planning area. Figures 9-1 though 9-4 should be read in conjunction with the extent for flooding in Tables 9-1, and 9-2 to determine the intensity of a potential flood event.

Table 9-1. Flood Zones

INTENSITY	ZONE	DESCRIPTION
HIGH	ZONE A	Areas with a 1-percent-annual-chance of flooding and a 26 percent chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas, no depths or base flood elevations are shown within these zones.
	ZONE A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a Base Flood Elevation (BFE) (old format).
	ZONE AE	The base floodplain where BFEs are provided. AE Zones are now used on the new format FIRMs instead of A1-A30 Zones.
	ZONE AO	River or stream flood hazard areas and areas with a 1-percent-annual-chance or greater of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26 percent chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
	ZONE AH	Areas with a 1-percent-annual-chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26 percent chance of flooding over the life of a 30-year mortgage. BFEs derived from detailed analyses are shown at selected intervals within these zones.
	ZONE A99	Areas with a 1-percent-annual-chance of flooding that will be protected by a federal flood control system where construction has reached specified legal requirements. No depths or BFEs are shown within these zones.
	ZONE AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
MODERATE to LOW	ZONE X 500	An area inundated by 500-year flooding; an area inundated by 100-year flooding with average depths of less than 1 foot or with drainage areas less than 1 square mile; or an area protected by levees from 100-year flooding.

Zone A is interchangeably referred to as the 100-year flood, the 1-percent-annual-chance flood, the Special Flood Hazard Area (SFHA), or more commonly, the base flood. This is the area that will convey the base flood and constitutes a threat to the planning area. The impact from a flood event can be more damaging in areas that will convey a base flood.

Structures built in the SFHA are subject to damage by rising waters and floating debris. Moving flood water exerts pressure on everything in its path and causes erosion of soil and solid objects. If not elevated above Base Flood Elevation, utility systems, such as heating, ventilation, air conditioning, fuel, electrical systems, sewage maintenance systems and water systems, may also be damaged.

The intensity and magnitude of a flood event is also determined by the depth of flood water. Table 9-2 describes the stream gauge data provided by the United States Geological Survey (USGS). Peak flood data at the locations available in the planning area indicate a peak flood depth range of 2 to 11 feet above average peak flows.

Table 9-2. Extent for the City of Round Rock[1]

JURISDICTION[2]	PEAK FLOOD EVENT
City of Round Rock	Lake Creek at O'Connor Drive in Round Rock, Texas reached an overflow elevation of 770 feet in 2015. The average peak for Lake Creek is 768 at this site. This indicates a maximum flood depth of 2 feet above the average peak flow at this site.
City of Round Rock	Brushy Creek at IH35 in Round Rock, Texas reached an overflow elevation of 9 feet in 2016. The average peak for Brushy Creek is 7 feet at this site. This indicates a maximum flood depth of 2 feet above the average peak flow at this site.
City of Round Rock	Brushy Creek at Kenney Fort Blvd. at Round Rock, Texas reached an overflow elevation of 24 feet in 2015. The average peak for Bushy Creek is 13 feet at this site. This indicates a maximum flood depth of 11 feet above the average peak flow at this site.

The range of flood intensity that the city can experience is high, or Zone A. Based on historical occurrences, the planning area could expect to experience anywhere from 1 to 6 inches of rain within a 1-hour period, resulting in flash flooding.

The data described in Tables 9-1 and 9-2, together with Figure 9-1, and historical occurrences for the area, provides an estimated potential magnitude and severity for the City of Round Rock.

HISTORICAL OCCURRENCES

Historical evidence indicates that areas within the planning area are susceptible to flooding, especially in the form of flash flooding. It is important to note that only flood events that have been

[1] Severity estimated by averaging floods at certain stage level over the history of flood events. Severity and peak events are based on USGS data.
[2] Severity is provided where peak data was provided throughout the city.

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 9-3 identifies historical flood events as well as any associated damages, injuries, or fatalities within the City of Round Rock. Historical Data is provided by the Storm Prediction Center (NOAA), National Centers for Environmental Information (NCEI) database for the City of Round Rock. There have been 9 recorded flood events in the City of Round Rock.

Table 9-3. Historical Flood Events, 1996-2023[3]

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
City of Round Rock	7/4/2006	0	0	$0	$0
City of Round Rock	6/3/2007	0	0	$14,900	$0
City of Round Rock	9/12/2009	0	0	$0	$0
City of Round Rock	9/8/2010	0	0	$0	$0
City of Round Rock	7/15/2012	0	0	$0	$0
City of Round Rock	7/15/2012	0	0	$0	$0
City of Round Rock	7/15/2012	0	0	$0	$0
City of Round Rock	10/30/2013	0	0	$1,461,700	$0
City of Round Rock	6/23/2020	0	0	$0	$0
TOTALS		**0**	**0**	**$1,476,600**	**$0**

Based on the list of historical flood events for the City of Round Rock, one event has occurred since the 2018 Plan.

SIGNIFICANT EVENTS

Flash Flood on June 3, 2007

Thunderstorms moved over South Central Texas and produced general accumulations of 2 to 3 inches of rain over southern Williamson County, with up to 5 inches of rain reported in the City of Round Rock area. Water was reported to be over Parmer Road near Kings Village and FM620 was also closed due to high water in the City of Round Rock. An estimated $14,900 (2024 dollars) in property damages were reported for this event.

Flash Flood on October 30, 2013

Across the City of Round Rock and the northern sections of Williamson County, heavy rainfall resulted in 10 inches of rain in some areas. At the peak of this flood event, there were 23 areas closed due to high water. Several homes along Brushy Creek were evacuated. Houses were damaged over the eastern portions along the Highway 79 corridor including Forest Creek, Hutto, and the County Road 123 area. Voluntary evacuations were called for in the eastern part of the

[3] Values are in 2024 dollars.

City of Round Rock and 88 homes were evacuated. Several swift water rescues were performed, including 8 vehicle rescues. Overall, 19 homes were affected by flooding in Williamson County with overall reported damages of $1,461,700 (2024 dollars) in uninsured losses to public infrastructure.

PROBABILITY OF FUTURE EVENTS

Based on 9 recorded historical occurrences over a 28-year reporting period in the City of Round Rock, flooding is considered "Likely," meaning an event is probable within the next three years.

VULNERABILITY AND IMPACT

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. The City of Round Rock encourages development outside of the floodplain, and the impact for flood for the entire planning area would be considered "Limited", with injuries and illnesses treatable with first aid, critical facilities and services shutdown for 24-hours or less, and less than 10 percent of properties destroyed or with major damage.

Table 9-4 includes the comprehensive critical facilities identified in Appendix C that were considered the most important to the planning area and are susceptible to a range of impacts from a variety of natural hazards, including those facilities located in the regulatory floodplain. For a comprehensive list of identified critical facilities, please see Appendix C.

Table 9-4. Critical Facilities in the Floodplain

CRITICAL FACILITY TYPES	CRITICAL FACILITIES AT RISK	POTENTIAL IMPACTS
Emergency Response Departments (EOC, Fire, Police, EMS), Hospitals	N/A	• Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications. • Emergency vehicles can be damaged by rising flood waters. • Flood-related rescues may be necessary at swift and low water crossings or in flooded neighborhoods where roads have become impassable, placing first responders in harm's way. • Evacuations may be required for entire neighborhoods because of rising floodwaters, further taxing limited response capabilities and increasing sheltering needs for displaced residents. • Power outages could disrupt communications, delaying emergency response times. • Critical staff may be injured or otherwise unable to report for duty, limiting response capabilities. • Washed out roads and bridges can impede emergency response vehicle access to areas. • Increased number of structure fires due to gas line ruptures and downed power lines, further straining the capacity and resources of emergency personnel.

CRITICAL FACILITY TYPES	CRITICAL FACILITIES AT RISK	POTENTIAL IMPACTS
		• First responders are exposed to downed power lines, contaminated and unusual debris, hazardous materials, and generally unsafe conditions. • Extended power outages and evacuations may lead to possible looting, destruction of property, and theft, further burdening law enforcement resources.
Airport, Academic Institutions, Community Residential Facilities, Day Care Facilities, Evacuation Centers & Shelters, Governmental Facilities	1 Residential for Vulnerable Populations, 2 Schools, 26 Transportation	• Structures can be damaged by rising flood waters. • Power outages could disrupt critical care. • Backup power sources could be damaged, inundated or otherwise inoperable. • Critical staff may be impacted and unable to report for duty, limiting response capabilities. • Evacuations may be necessary due to extended power outages, gas line ruptures, or inundation of facilities. • Additional emergency responders and critical aid workers may not be able to reach the area for days. • Power outages and infrastructure damage may prevent larger airports from acting as temporary command centers for logistics, communications, and emergency operations. • Temporary break in operations may significantly inhibit post event evacuations. • Damaged or destroyed highway infrastructure may substantially increase the need for airport operations.
Commercial Suppliers (food, gas, etc.)	N/A	• Facilities or infrastructure may be damaged, destroyed or otherwise inaccessible. • Essential supplies like medicines, water, food, and equipment deliveries may be significantly delayed.
Utility Services and Infrastructure (electric, water, wastewater, communications)	City of Round Rock: 5 Sewage and Water, 2 Hazardous Materials	• Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications. • Emergency service vehicles can be damaged by rising flood waters. • Flood-related rescues may be necessary at swift and low water crossings or in flooded neighborhoods where roads have become impassable, placing emergency service workers in harm's way. • Increased number of structure fires due to gas line ruptures and downed power lines, further straining the capacity and resources of emergency personnel. • Service responders are exposed to downed power lines, contaminated and unusual debris, hazardous materials, and generally unsafe conditions. • Extended power outages and evacuations may lead to possible looting, destruction of property, and theft, further burdening law enforcement resources.

Historic loss estimates due to flood are presented in Table 9-5 below. Considering 9 flood events over a 28-year period, frequency is approximately one event every three years.

Table 9-5. Average Annualized Losses, 1996-2023

NUMBER OF EVENTS	PROPERTY & CROP LOSS	AVERAGE ANNUAL LOSS ESTIMATES
9	$1,476,600	$52,700

While all citizens are at risk of the impacts of a flood, forced relocation and disaster recovery disproportionately impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to rebuild or repair their homes. In addition, due to factors like limited mobility, communication difficulties, medical needs, reliance on support services, transportation challenges, housing accessibility issues, and possible shortages in emergency shelter accommodations, the elderly, children, and people with disabilities are also disproportionately affected by flooding events. People who speak a language other than English may face increased vulnerability due to language barriers that limit their access to important information such as weather-related warnings and instructions regarding safety measures.

The population over 65 in the City of Round Rock planning area is estimated at 10 percent of the total population and children under the age of 5 are estimated at 6 percent. Individuals with a disability are estimated at 11 percent of the total population. An estimated 8 percent of the planning area population live below the poverty level and 25 percent of the populations speaks a language other than English.

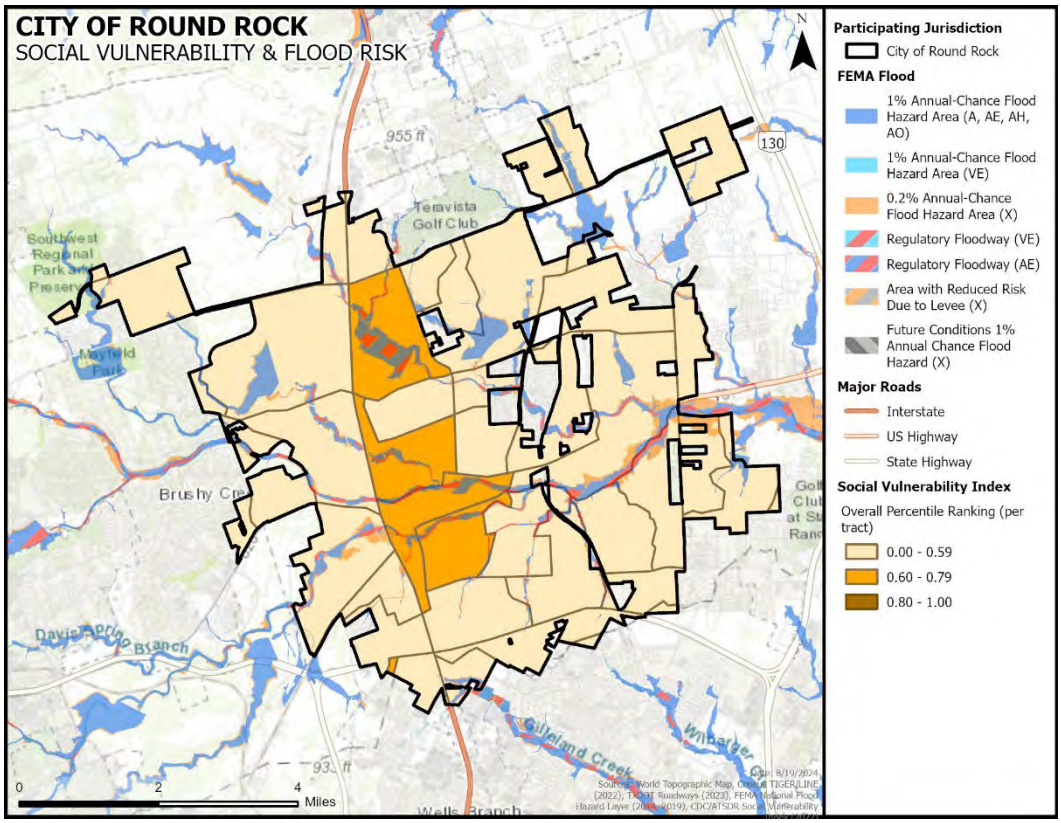
Table 9-6. Populations at Greater Risk[4]

ELDERLY (over 65)	YOUTH (under 5)	WITH A DISABILITY	BELOW POVERTY LEVEL	NON-ENGLISH SPEAKING
12,356	7,219	12,927	9,276	30,183

The Center for Disease Control (CDC) created a Social Vulnerability Index (SVI) which includes a database and mapping application that identifies and quantifies communities experiencing social vulnerability. The current CDC SVI uses 16 U.S. census variables from the 5-year American Community Survey (ACS) to identify communities that may need support before, during, or after disasters. All 16 variables fall under four broad categories including socioeconomic status (population in poverty, unemployment, etc.), household characteristics (age, disability status, etc.), racial and ethnic minority status, and housing type and transportation (mobile homes, no vehicles, etc.). Populations experiencing social vulnerability may be adversely impacted by natural hazards, disasters, and other community-level stressors. Figure 9-5 identifies areas of social vulnerability using the CDC's SVI and where these areas overlap the City of Round Rock's flood hazard areas.

[4] U.S. Census Bureau Five-Year estimates

Figure 9-5. The City of Round Rock's Social Vulnerability and Flood Hazard Areas



ASSESSMENT OF IMPACTS

Flooding is the deadliest natural disaster that occurs in the U.S. each year, and it poses a constant and significant threat to the health and safety of the people in the City of Round Rock. Impacts to the planning area can include:

- Flood-related rescues may be necessary at swift water and low water crossings or in flooded neighborhoods where roads have become impassable, placing first responders in harm's way.
- Evacuations may be required for entire neighborhoods because of rising floodwaters, further taxing limited response capabilities and increasing sheltering needs for displaced residents.
- Health risks and threats to residents are elevated after the flood waters have receded due to contaminated flood waters (untreated sewage and hazardous chemicals) and mold growth typical in flooded buildings and homes.
- Significant flood events often result in widespread power outages, increasing the risk to more vulnerable portions of the population who rely on power for health and/or life safety.
- Extended power outages can result in an increase in structure fires and/or carbon monoxide poisoning, as individuals attempt to cook or heat their home with alternate, unsafe cooking or heating devices, such as grills.
- Floods can destroy or make residential structures uninhabitable, requiring shelter or relocation of residents in the aftermath of the event.

- First responders are exposed to downed power lines, contaminated and potentially unstable debris, hazardous materials, and generally unsafe conditions, elevating the risk of injury to first responders and potentially diminishing emergency response capabilities.
- Emergency operations and services may be significantly impacted due to damaged facilities.
- Significant flooding can result in the inability of emergency response vehicles to access areas of the community.
- Critical staff may suffer personal losses or otherwise be impacted by a flood event and be unable to report for duty, limiting response capabilities.
- City departments may be flooded, delaying response and recovery efforts for the entire community.
- Private sector entities that the planning area and its residents rely on, such as utility providers, financial institutions, and medical care providers, may not be fully operational and may require assistance from neighboring communities until full services can be restored.
- Damage to infrastructure may slow economic recovery since repairs may be extensive and lengthy.
- Some businesses not directly damaged by the flood may be negatively impacted while utilities are being restored or water recedes, further slowing economic recovery.
- When the community is affected by significant property damage it is anticipated that funding would be required for infrastructure repair and restoration, temporary services and facilities, overtime pay for responders, as well as normal day-to-day operating expenses.
- Displaced residents may not be able to immediately return to work, further slowing economic recovery.
- Residential structures substantially damaged by a flood may not be rebuilt for years and uninsured or underinsured residential structures may never be rebuilt, reducing the tax base for the community.
- Large floods may result in a dramatic population fluctuation, as people are unable to return to their homes or jobs and must seek shelter and/or work outside of the affected area.
- Businesses that are uninsured or underinsured may have difficulty reopening, which results in a net loss of jobs for the community and a potential increase in the unemployment rate.
- Recreation activities may be unavailable, and tourism can be unappealing for years following a large flood event, devastating directly related local businesses and negatively impacting economic recovery.
- Flooding may cause significant disruptions of clean water and sewer services, elevating health risks and delaying recovery efforts.
- The psychosocial effects on flood victims and their families can traumatize them for long periods of time, creating long term increases in medical treatment and services.
- Extensive or repetitive flooding can lead to decreases in property value for the affected community.
- Flood poses a potential catastrophic risk to annual and perennial crop production and overall crop quality, leading to higher food costs.
- Flood related declines in production may lead to an increase in unemployment.

- Large floods may result in loss of livestock, potential increased livestock mortality due to stress and water borne disease, and increased cost for feed.

The overall extent of damage caused by floods is dependent on the extent, depth, and duration of flooding, in addition to the velocities of flows in the flooded areas. The level of preparedness and pre-event planning done by the community, local businesses, and citizens will contribute to the overall economic and financial conditions in the aftermath of a flood event.

CLIMATE CHANGE CONSIDERATIONS

River flooding in Texas is projected to have no substantial change through 2036. This is in large part due to the construction of dams and reservoirs for flood management in the 20th century. There is a mixture of historical trends categorized by season, with no one clear trend to project. In addition, meteorological drivers of river flooding (increased rainfall intensity, decreased soil moisture) are projected to have competing influences. On balance, if an increasing trend is present in river flooding, it will be at the most extreme flood events or in the wettest parts of the state where there is so much rainfall that a decrease in soil moisture would have little mitigating impact.[5]

According to the U.S. Climate Explorer, which analyzes the top regional hazards for the City of Round Rock, according to the National Climate Assessment and compares projections for the middle third of this century (2035-2064) with average conditions observed from 1961-1990, the planning area may see a slight increase in precipitation events. Annual counts of intense rainstorms, those that drop two or more inches in one day, are projected to increase up to 6%. However, these changing conditions are dependent on overall future emissions.

NATIONAL FLOOD INSURANCE PROGRAM (NFIP) PARTICIPATION

Flood insurance offered through the National Flood Insurance Program (NFIP) is the best way for home and business owners to protect themselves financially against the flood hazard. The City of Round Rock is participating in the NFIP and is in good standing.

As an additional indicator of floodplain management responsibility, communities may choose to participate in FEMA's Community Rating System (CRS). This is an incentive-based program that allows communities to undertake flood mitigation activities that go beyond NFIP requirements. Currently, the City of Round Rock does not participate in the CRS.

The City of Round Rock currently has in place a standard flood damage prevention ordinance that includes minimum NFIP standards for new construction and substantial Improvements of structures. The City of Round Rock is considering adopting higher regulatory NFIP standards to limit or further regulate floodplain development.

The flood hazard areas throughout the City of Round Rock are subject to periodic inundation, which may adversely affect public safety, resulting in loss of life and property, health and safety hazards, disruption of commerce and governmental services, and extraordinary public

[5] Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900-2036, Texas A&M University Office of the Texas State Climatologist, 2021 update.

expenditures for flood protection and relief. 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. Mitigation actions are included to address flood maintenance issues as well, including routinely clearing debris from roadside ditches and bridges, and expanding drainage culverts and storm water structures to convey flood water more adequately.

It is the purpose of the City of Round Rock to continue to promote public health, safety, and general welfare by minimizing public and private losses due to flood conditions in specific areas. The city is guided by their local Flood Damage Prevention Ordinance. The City of Round Rock will continue to comply with NFIP requirements through their local permitting, inspection, and record-keeping requirements for new and substantially developed construction. Further, the NFIP program promotes sound development in floodplain areas and includes provisions designed to:

- Protect human life and health;
- Minimize expenditure of public money for costly flood control projects;
- Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- Minimize prolonged business interruptions;
- Minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets, and bridges located in floodplains;
- Help maintain a stable tax base by providing for the sound use and development of flood-prone areas in such a manner as to minimize future flood blight areas; and
- Ensure that potential buyers are notified that property is in a flood area.

In order to accomplish these tasks, the City of Round Rock seeks to observe the following guidelines to achieve flood mitigation:

- Restrict or prohibit uses that are dangerous to health, safety, or property in times of flood, such as filling or dumping, that may cause excessive increases in flood heights or velocities;
- Require that uses vulnerable to floods, including facilities, which serve such uses, be protected against flood damage at the time of initial construction, as a method of reducing flood losses;
- Control the alteration of natural floodplains, stream channels, and natural protective barriers, which are involved in the accommodation of floodwaters;
- Control filling, grading, dredging, and other development, which may increase flood damage; and
- Prevent or regulate the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards to other lands.

NFIP COMPLIANCE AND MAINTENANCE

The City of Round Rock has developed mitigation actions that relate to either NFIP maintenance or compliance. Compliance and maintenance actions can be found in Section 24.

Flooding was identified as a high-risk hazard during hazard ranking activities at the Risk Assessment Workshop by the majority of the planning team. As such, many of the mitigation actions were developed with flood mitigation in mind. A majority of these flood actions address compliance with the NFIP and implementing flood awareness programs. The city recognizes the need and is working towards adopting higher NFIP regulatory standards to further minimize flood risk in their community. In addition, the city is focusing on public flood awareness activities.

The City of Round Rock has a designated floodplain administrator. The floodplain administrator will continue to maintain compliance with the NFIP, including continued floodplain administration, zoning ordinances, and development regulation. The flood damage prevention ordinance outlines the minimum requirements for development in Special Flood Hazard Areas.

The city has a permitting process in place and the local floodplain administrator is responsible for coordinating inspections of damaged homes located in the floodplain. Following a flood event, local officials inspect damaged homes to make a substantial damage determination. Substantially damaged homes must be brought into compliance. Similarly, proposed improvements to homes located in the floodplain are reviewed by local building officials to determine if a substantial improvement is proposed. Substantially improved properties must also be brought into compliance per NFIP requirements. The floodplain administrator oversees permitted repairs and improvements to ensure compliance during the rebuilding or improvement process.

REPETITIVE LOSS

The Flood Mitigation Assistance (FMA) Grant Program under FEMA provides federal funding to assist states and communities in implementing mitigation measures to reduce or eliminate the long-term risk of flood damage to buildings that are insured under the National Flood Insurance Program. The Texas Water Development Board (TWDB) administers the FMA grant program for the State of Texas. One of the goals of the FMA program is to reduce the burden of repetitive loss and severe repetitive loss properties on the NFIP through mitigation activities that significantly reduce or eliminate the threat of future flood damages.

Repetitive Loss (RL) properties are defined as structures that are:

- Any insurable building for which 2 or more claims of more than $1,000 each, paid by the National Flood Insurance Program (NFIP) within any 9-year period, since 1978;
- May or may not be currently insured under the NFIP.

Severe Repetitive Loss (SRL) properties are defined as structures that are:

- Covered under the NFIP and have at least 4 flood related damage claim payments (building and contents) over $5,000.00 each, and the cumulative amount of such claims payments exceed $20,000; or
- At least 2 separate claim payments (building payments only) have been made, with the cumulative amount of the building portion of such claims exceeding the market value of the building.

In either scenario, at least 2 of the referenced claims must have occurred within any 9-year period and must be greater than 10 days apart.[6] Table 9-7 shows repetitive loss and severe repetitive loss properties for the City of Round Rock. According to the most current data from FEMA, the City of Round Rock currently has 28 repetitive loss structures with a combined total of 92 flood insurance claims. In addition, the city has 6 Severe Repetitive Loss structures with a combined total of 28 flood insurance claims.

Table 9-7. Repetitive Loss and Severe Repetitive Loss Properties

BUILDING TYPE[7]	REPETITIVE LOSS STRUCTURES	RL NUMBER OF LOSSES	SEVERE REPETITIVE LOSS STRUCTURES	SRL NUMBER OF LOSSES
Single Family	28	92	6	28

FEMA may provide grant funds to state and local governments to help NFIP-insured property owners with mitigation projects. Property owners can contact their local floodplain manager or state hazard mitigation officer for more information about the FMA Program and other mitigation grant programs.

[6] Source: Texas Water Development Board.
[7] Some building types assumed to be single family residential.

SECTION 10
HAIL

SECTION 10: HAIL

HAZARD DESCRIPTION

Hailstorm events are a potentially damaging outgrowth of severe thunderstorms. During the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere, and the subsequent cooling of the air mass. Frozen droplets gradually accumulate into ice crystals until they fall as precipitation that is round or irregularly shaped masses of ice typically greater than 0.75 inches in diameter. The size of hailstones is a direct result of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a by-product of heating on the Earth's surface. Higher temperature gradients above Earth's surface result in increased suspension time and hailstone size.

According to the National Insurance Crime Bureau (NICB), between 2018 and 2020 the State of Texas had the greatest number of hail loss claims in the U.S. with 605,866 loss claims (23 percent of total hail claims in the U.S.) due to hail events. In this two-year period Texas experienced a total of 584 severe hail days. Five of the top ten cities for hail loss claims between 2017 and 2019 were in Texas, three of which were in the Dallas-Fort Worth metropolitan area.[1]

In 2021, 6.8 million properties in the U.S. experienced one or more damaging hail events, resulting in a total of $16.5 billion in insured losses. Texas had the highest number of properties affected by hail with over 1.5 million properties or 17 percent of total properties in the state affected; an increase of 80,000 properties affected between 2020 and 2021. Texas hailstorms accounted for almost a quarter of total U.S. properties affected by hail in 2021.

LOCATION

Hailstorms are an extension of severe thunderstorms that could potentially cause severe damage. Hailstorms are not confined to any specific geographic location and can vary greatly in size, location, intensity, and duration. Therefore, the entire City of Round Rock planning area is equally

[1] Manasek, Thomas, "2018-2020 United States Hail Loss Claims and Questionable Claims" (National Insurance Crime Bureau, March 15, 2021). http://www.rmiia.org/downloads/PUBLIC%202018%20-%202020%20Hail%20foreCAST-%20TJM.pdf

at risk to the hazard of hail. Refer to Figure 10-1 for the location of past hail events in the planning area.

EXTENT

The National Weather Service (NWS) classifies a storm as "severe" if there is hail three-quarters of an inch in diameter (approximately the size of a penny) or greater, based on radar intensity or as seen by observers. The intensity category of a hailstorm depends on hail size and the potential damage it could cause, as depicted in the National Centers for Environmental Information (NCEI) Intensity Scale in Table 10-1.

Table 10-1. Hail Intensity and Magnitude[2]

SIZE CODE	INTENSITY CATEGORY	SIZE (diameter inches)	DESCRIPTIVE TERM	TYPICAL DAMAGE
H0	Hard Hail	Up to 0.33	Pea	No damage
H1	Potentially Damaging	0.33 – 0.60	Marble	Slight damage to plants and crops
H2	Potentially Damaging	0.60 – 0.80	Dime	Significant damage to plants and crops
H3	Severe	0.80 – 1.20	Nickel	Severe damage to plants and crops
H4	Severe	1.2 – 1.6	Quarter	Widespread glass and auto damage
H5	Destructive	1.6 – 2.0	Half Dollar	Widespread destruction of glass, roofs, and risk of injuries
H6	Destructive	2.0 – 2.4	Ping Pong Ball	Aircraft bodywork dented and brick walls pitted
H7	Very Destructive	2.4 – 3.0	Golf Ball	Severe roof damage and risk of serious injuries
H8	Very Destructive	3.0 – 3.5	Hen Egg	Severe damage to all structures
H9	Super Hailstorms	3.5 – 4.0	Tennis Ball	Extensive structural damage, could cause fatal injuries
H10	Super Hailstorms	4.0 +	Baseball	Extensive structural damage, could cause fatal injuries

The intensity scale in Table 10-1 ranges from H0 to H10, with increments of intensity or damage potential in relation to hail size (distribution and maximum), texture, fall speed, speed of storm translation, and strength of the accompanying wind. Based on the best available data regarding the previous occurrences for the area, the City of Round Rock planning area may experience

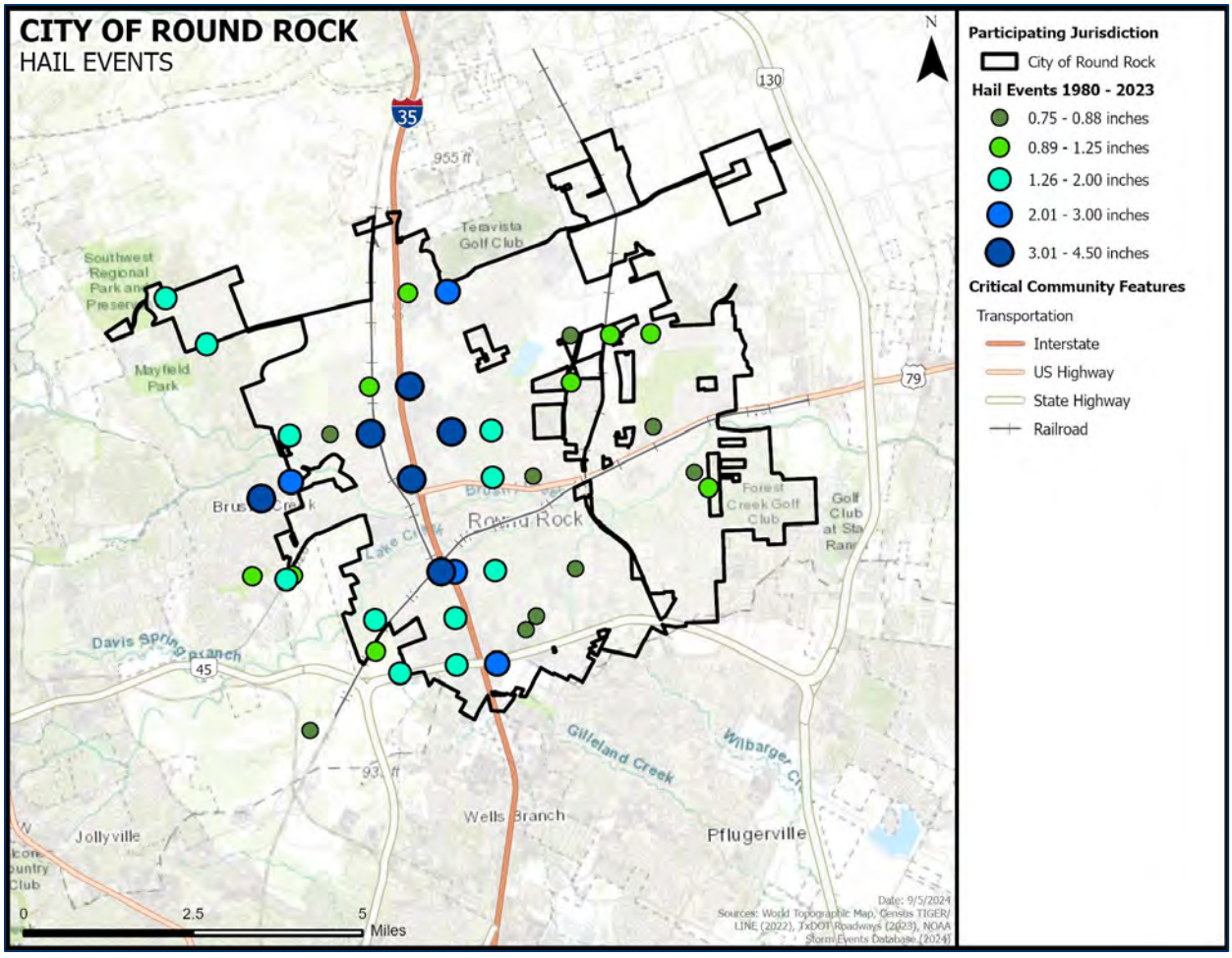
[2] NCEI Intensity Scale, based on the TORRO Hailstorm Intensity Scale.

hailstorms ranging from an H0 (pea size) to an H10 (baseball size). The largest size hail to be reported was 4 inches in diameter, or a H10, which is considered a super hailstorm that can cause extensive infrastructure damage and potentially fatal injuries. Events of this magnitude occurred on May 14, 2008[3], and September 24, 2023. Refer to the Historical Occurrences section below for more details on these events. This is likely the greatest extent the planning area can anticipate in the future, based on historical events.

HISTORICAL OCCURRENCES

Historical evidence shown in Figure 10-1 demonstrates that the planning area is vulnerable to hail events overall. Historical events with reported damages, injuries, or fatalities are shown in Table 10-2. A total of 65 reported historical hail events impacted the City of Round Rock planning area between 1980 and 2023; these events were reported to NCEI and NOAA databases and may not represent all hail events to have occurred during the past 44 years. Only those events for the City of Round Rock planning area with latitude and longitude available were plotted (Figure 10-1).

Figure 10-1. Spatial Historical Hail Events, 1980-2023



[3] Reported damages, injuries and fatalities were not available within the NCEI and NOAA databases for this event.

Table 10-2. Damaging Historical Hail Events, 1980-2023[4]

JURISDICTION	DATE	MAGNITUDE (inches)	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
City of Round Rock	10/17/1996	1.5	0	0	$29,500	$0
City of Round Rock	5/20/2001	3.5	0	0	$349,300	$0
City of Round Rock	9/24/2023	4	0	0	$302,472,800	$0
TOTALS		**(Max Extent)**	**0**	**0**	**$302,851,600**	**$0**

Based on the list of historical hail events for the City of Round Rock planning area, 28 of the events have occurred since the 2018 Plan according to reports in the NCEI database. The most recent event matched the historical extent (4 inches in diameter) on September 24, 2023. This was also the most significant event in relation to damages, resulting in over $302 million in damages (2024 dollars).

SIGNIFICANT EVENTS

October 17, 1996

In the late afternoon, amateur radio spotters reported hail up to golf ball-size near I-35. No injuries were reported due to this hail event, but $29,500 (2024 dollars) worth of property damage was reported. The specific nature of the property damages incurred were not reported.

May 20, 2001

A thunderstorm complex which began over Llano and Burnet counties, damaging trees and homes in those areas, moved east over the City of Round Rock and surrounding communities. Very large hail, reported at 3.5 inches in diameter, or tennis ball size, damaged the roofs of homes and broke the windows of homes and vehicles. The storm, which also included strong thunderstorm winds, left some 20,000 residents of the Austin metroplex without power for several hours. In the City of Round Rock, property damage was estimated at $349,300 (2024 dollars).

May 14, 2008

A thunderstorm formed quickly across Val Verde County, after which the line of convection moved to the northeast, bringing severe weather to much of the hill country, including the City of Round Rock. Several long track supercells moved across the area, and hail as big as 4 inches, or baseball size, was reported. No injuries or damages were reported for the City of Round Rock due to this event, but this occurrence created some of the largest hail the planning area has experienced.

September 24, 2023

Thunderstorms developed along a cold front as a major storm system moved south through South Central Texas. One supercell formed over the City of Georgetown, the City of Austin, and the City of Round Rock. In the City of Round Rock, hail as big as four inches in diameter, or baseball size, was reported. Damages to property in the planning area included an estimated $70 million in damages to 62 facilities belonging to Round Rock ISD. In the NCEI database, 19 separate event reports were made for hail during this storm system across the City of Round Rock planning area.

[4] Only recorded events with damages are listed. No reports of injuries or fatalities were recorded in the NCEI database.

No injuries were reported, but a total of $302,472,800 (2024 dollars) in hail damage was estimated for the City of Round Rock. Damages in the cities of Georgetown, Round Rock, and Austin were the most impactful from this storm system; estimates also indicate that $700 million in damages occurred throughout the State of Texas during these storms.

PROBABILITY OF FUTURE EVENTS

Based on available records of historic events, 65 events in a 44-year reporting period for the City of Round Rock provides an average annual occurrence of one to two events per year. This frequency supports a “Highly Likely” probability of future events for the City of Round Rock planning area.

VULNERABILITY AND IMPACT

Much of the damage inflicted by hail is to crops. Even relatively small hail can shred plants to ribbons in a matter of minutes. Vehicles, roofs of buildings and homes, and landscaping are typically where hail damages are most prevalent.

Utility systems on roofs of buildings and critical facilities would be vulnerable and could be damaged. Hail could cause a significant threat to people, as they could be struck by hail and falling trees and branches. Outdoor activities and events may elevate the risk to residents and visitors when a hailstorm strikes with little warning. Portable buildings typically utilized by schools and commercial sites such as construction areas would be more vulnerable to hail events than the typical site-built structures.

The City of Round Rock planning area features mobile or manufactured home parks throughout the planning area. These parks are often more vulnerable to hail events than typical site-built structures. In addition, manufactured homes are located sporadically throughout the planning area which would also be more vulnerable. The U.S. Census data indicates a total of 29 (less than one percent of total housing stock) manufactured homes located in the City of Round Rock planning area. In addition, 12 percent (approximately 5,539 structures) of the housing structures in the City of Round Rock planning area were built before 1980. These structures would typically be built to lower or less stringent construction standards than newer construction and may be more susceptible to damage during significant wind events.

Table 10-3. Structures at Greater Risk

SFR STRUCTURES BUILT BEFORE 1980	MANUFACTURED HOMES
5,539	29

While all citizens are at risk of the impacts of hail, forced relocation and disaster recovery disproportionately impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to rebuild or repair their homes. An estimated 8 percent of the planning area population live below the poverty level (Table 10-4). While warning times for this type of hazard event may provide time for individuals to seek shelter, the elderly, children, and people with a disability may have trouble taking shelter due to mobility issues or a lack of awareness, making them more susceptible to injury or harm. In addition, people who speak a language other than English may face increased vulnerability due to language barriers that limit

their access to important information such as weather-related warnings and instructions regarding safety measures.

Table 10-4. Populations at Greater Risk[5]

ELDERLY (over 65)	YOUTH (under 5)	WITH A DISABILITY	BELOW POVERTY LEVEL	NON-ENGLISH SPEAKING
12,356	7,219	12,927	9,276	30,183

The City of Round Rock Planning Team identified the following critical facilities (Table 10-5) as assets that are considered the most important to the planning area and are susceptible to a range of impacts caused by hail events. For a comprehensive list of critical facilities, please see Appendix C.

Table 10-5. Critical Facilities Vulnerable to Hail

CRITICAL FACILITY TYPE	POTENTIAL IMPACTS
Emergency Response Services (EOC, Fire, Police, EMS), Hospitals and Medical Centers	• Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications. • Emergency vehicles can be damaged by hailstones. • Power outages could disrupt communications, delaying emergency response times. • Accumulated hail on the streets may impede emergency response vehicle access to areas. • Extended power outages and evacuations may lead to possible looting, destruction of property, and theft, further burdening law enforcement resources.
Airport, Academic Institutions, Animal Shelter, Evacuation Centers & Shelters, Governmental Facilities, Residential/ Assisted Living Facilities	• Structures can be damaged by hailstones. • Power outages could disrupt critical care. • Backup power sources could be damaged. • Evacuations may be necessary due to extended power outages, gas line ruptures, or structural damage to facilities. • Power outages and infrastructure damage may prevent larger airports from acting as temporary command centers for logistics, communications, and emergency operations. • Temporary break in operations may significantly inhibit post event evacuations. • Damaged or destroyed highway infrastructure may substantially increase the need for airport operations.
Commercial Supplier (Food, fuel, etc.)	• Facilities or infrastructure may be damaged, destroyed or otherwise inaccessible. • Essential supplies like medicines, water, food, and equipment deliveries may be significantly delayed.
Utility Services and Infrastructure (electric, water,	• Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications.

[5] US Census Bureau 2022 data for City of Round Rock

CRITICAL FACILITY TYPE	POTENTIAL IMPACTS
wastewater, communications)	• Power outages could disrupt communications, delaying emergency response times. • Accumulated hail on the streets may impede service response vehicle access to areas. • Extended power outages and evacuations may lead to possible looting, destruction of property, and theft, further burdening law enforcement resources.

Hail has been known to cause injury to humans and occasionally has been fatal. Overall, the total loss estimate of property and crops in the planning area is $302,851,600 with an average annualized loss of $6,883,000. Due to significant historic loss and damages to property, the impact of hail damages on the City of Round Rock planning area can be considered “Minor” severity of impact, meaning injuries and illnesses do not result in permanent disability, critical facilities and services shut down for up to one week, and more than 10 percent of property destroyed or with major damage.

Table 10-6. Estimated Annualized Losses

TOTAL PROPERTY & CROP LOSS	AVERAGE ANNUAL LOSS ESTIMATES
$302,851,600	$6,883,000

ASSESSMENT OF IMPACTS

Hail events have the potential to pose a significant risk to people and can create dangerous situations Hail conditions can be frequently associated with a variety of impacts, including:

- Hail may create hazardous road conditions during and immediately following an event, potentially delaying critical staff from reporting for duty as well as delaying first responders from providing for or preserving public health and safety and.
- Individuals and first responders who are exposed to the storm may be struck by hail, falling branches, or downed trees resulting in injuries or possible fatalities.
- Large hail events will likely cause extensive roof damage to residential structures along with siding damage and broken windows, creating a spike in insurance claims and a rise in premiums, and potentially result in physical harm to occupants.
- Automobile damage may be extensive depending on the size of the hail and length of the storm.
- Hail events can result in power outages over widespread areas increasing the risk to more vulnerable portions of the population who rely on power for health and/or life safety.
- Extended power outage can result in an increase in structure fires and/or carbon monoxide poisoning, as individuals attempt to cook or heat their home with alternate, unsafe cooking or heating devices, such as grills.
- First responders are exposed to downed power lines, damaged structures, hazardous spills, and debris that often accompany hail events, elevating the risk of injury to first responders and potentially diminishing emergency response capabilities.

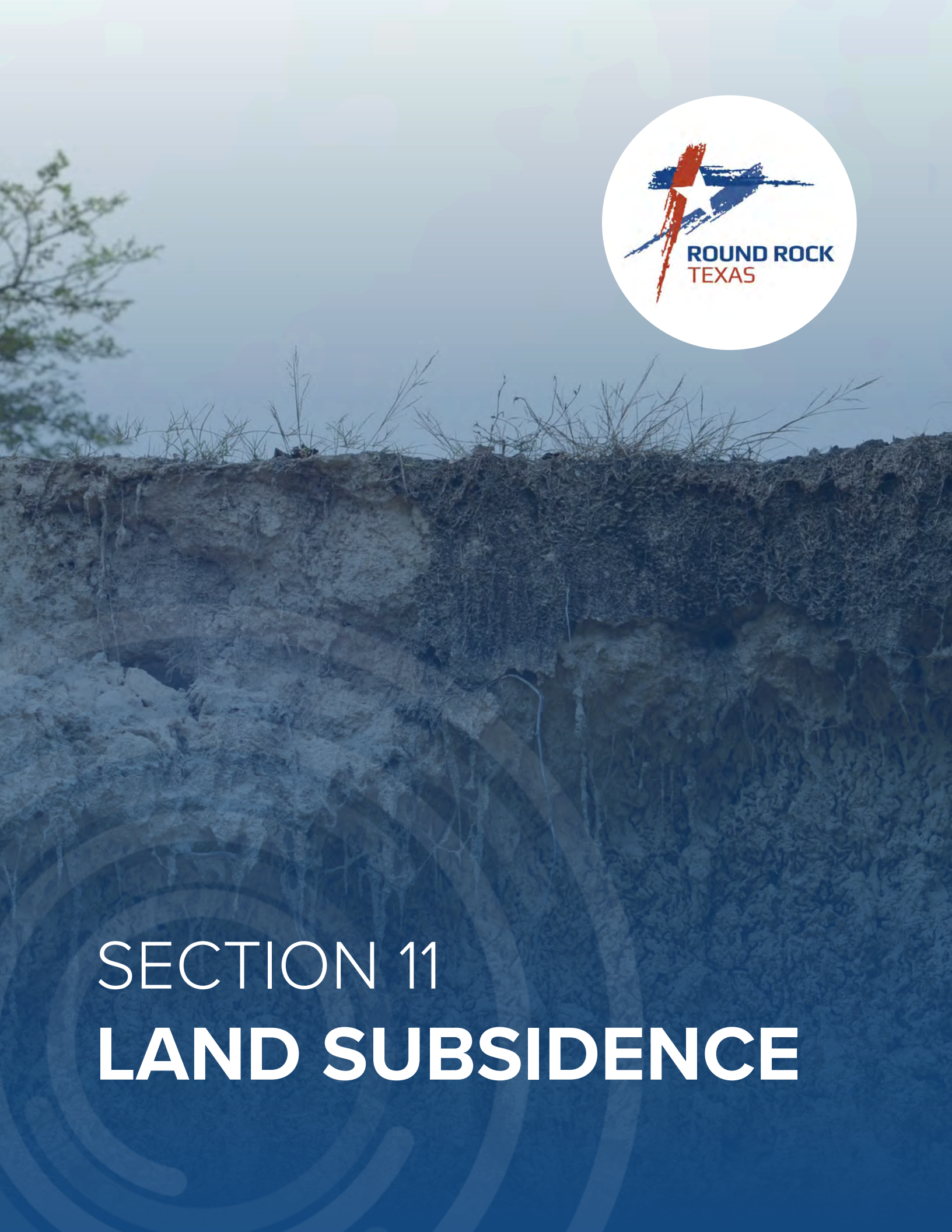
- Some businesses not directly damaged by the hail event may be negatively impacted while roads are cleared and utilities are being restored, further slowing economic recovery.
- Businesses that are more reliant on utility infrastructure than others may suffer greater damage without a backup power source.
- Depending on the severity and scale of damage caused by large hail events, damage to power transmission and distribution infrastructure can require days or weeks to repair.
- A significant hail event could significantly damage agricultural crops, resulting in extensive economic losses for the community and surrounding area.
- Hail events may injure or kill livestock and wildlife or destroy wildlife habitat.
- A large hail event could impact the accessibility of recreational areas and parks due to extended power outages or debris clogged access roads.
- Historical sites and properties are placed at a higher risk of impact due to materials used and the inability to change properties due to their historic status. There are five historical site listed on the National Register of Historic Places for the City of Round Rock.

The economic and financial impacts of hail will depend entirely on the scale of the event, what is damaged, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning conducted by the community, local businesses, and citizens will contribute to the overall economic and financial conditions in the aftermath of any hail event.

CLIMATE CHANGE CONSIDERATIONS

Although the impact of climate change on the frequency and severity of hail events is uncertain, some climate studies attempt to give insight on the future conditions of hailstorms. As ocean temperatures rise due to climate change, more moisture is evaporating into the atmosphere. The warm and moist air masses that fuel severe weather may become more unstable on average, which could favor the increased development of thunderstorms and hail. However, it is also suggested that in a warming climate, the average melting level will rise in thunderstorms, meaning small hailstones will have more of a chance to melt as they fall to the ground. Therefore, hail may become less frequent, but large hail can be expected when it does occur, leading to the possibility of increased damages.[6]

[6] Yale Climate Connections, Hailstorms and Climate Change, March 17, 2022.



SECTION 11

LAND SUBSIDENCE

SECTION 11: LAND SUBSIDENCE

HAZARD DESCRIPTION

Land subsidence is often described as the gradual or sudden sinking of the Earth's surface. Land subsidence typically happens slowly and goes unnoticed unless it reaches extreme levels, as seen in rare catastrophic sinkhole events. According to the United States Geological Survey (USGS), subsidence is a global problem, and in the United States more than 17,000 square miles in 45 States have been directly affected by subsidence.

Most subsidence is caused by human behavior such as mining, oil and gas extraction, and groundwater pumping from major and minor aquifer systems. The excessive removal of groundwater from aquifers that possess soluble or compressible layers may undergo an increase in erosion, compaction, and subsurface collapse. Even if the groundwater is returned to their average levels, most of land subsidence consequences are irreversible.

Land surfaces above shallow aquifer systems or areas adjacent to particularly porous earth have an increased risk of experiencing subsidence. Buildings and other infrastructure, such as roads, building foundations, and highways, are extremely susceptible to damage in the event of a land surface collapse.

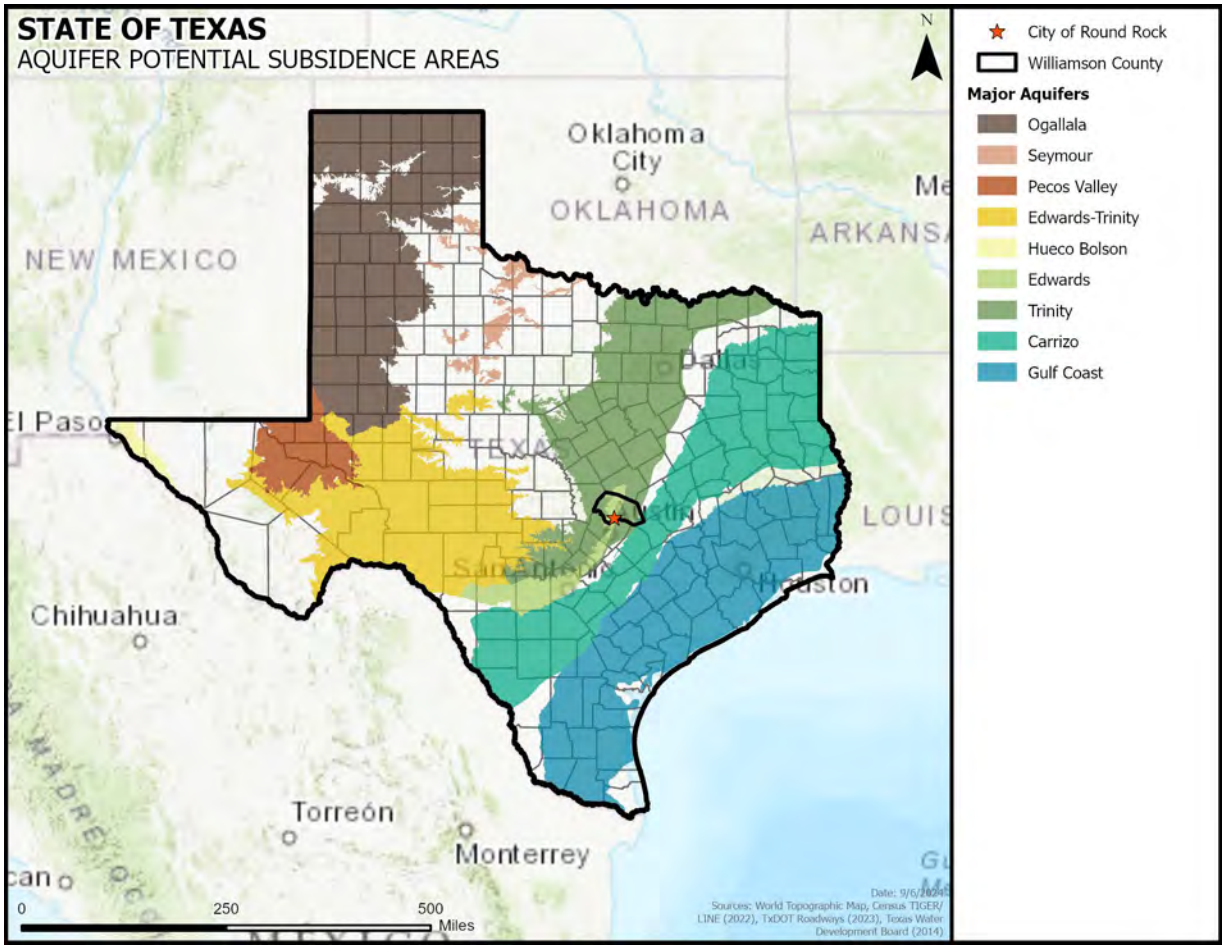
More than 80 percent of land subsidence in the United States is a caused by groundwater use. Subsidence is an often-overlooked environmental consequence of land and water-use practices.[1] The City of Round Rock's water supply comes from both surface water and groundwater surfaces. The Edwards Aquifer is the city's only groundwater source. Heavily populated cities in Texas can drain aquifer systems in excess which greatly raises the likelihood of land subsidence events. Increased development and population growth in the City of Round Rock increases the demand for groundwater, and therefore, can increase land subsidence risk.

[1] United States Geological Survey (USGS). Land Subsidence. https://www.usgs.gov/mission-areas/water-resources/science/land-subsidence

LOCATION

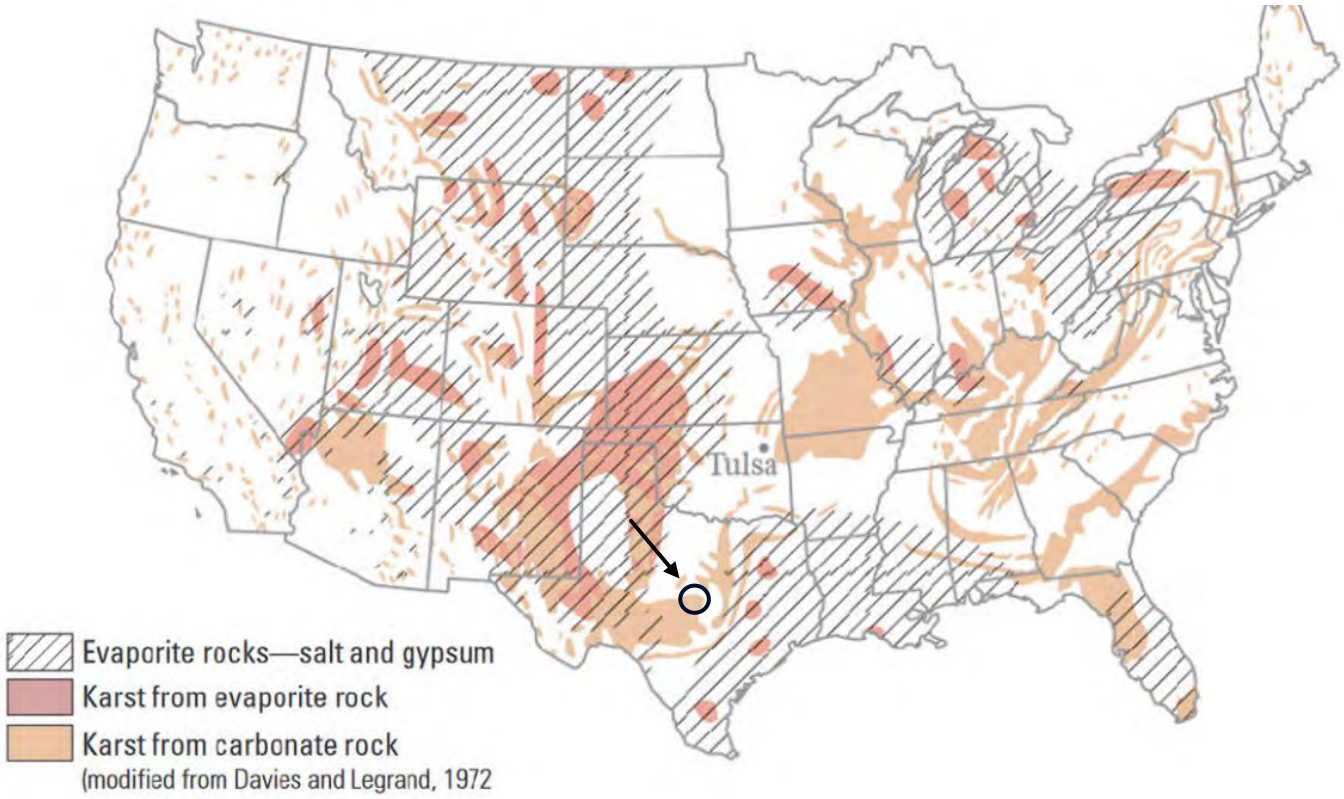
Land subsidence can be widespread and impact entire states, or it can be small and localized. The City of Round Rock is located on the Edwards Aquifer and is in a potential subsidence area, meaning the entire planning area is at some level of risk (Figure 11-1). While land subsidence is commonly caused by groundwater pumping, collapse features, like sinkholes, tend to be associated with different rock types such as evaporites (salt, gypsum, and anhydrite) and carbonates (limestone and dolomite). Evaporite rocks make up an estimated 40 percent of the United States and are more susceptible to dissolution. The map below shows prominent areas of the United States made up of these rock types. Land subsidence can occur anywhere, but these areas, including the City of Round Rock, are at higher risk of larger underground cavities and sinkholes (Figure 11-2).

Figure 11-1. Texas Aquifer Potential Subsidence Areas[2]



[2] The City of Round Rock planning area is marked by the red star.

Figure 11-2. Areas Prone to Collapse[3]



EXTENT

The extent of land subsidence in Texas varies by region and factors such as soil composition, groundwater withdrawal, drought, erosion, oil or gas extraction, or mining can impact the extent of subsidence. Areas may historically appear free of subsidence threats or occurrences but can suddenly be vulnerable to dramatic events. In some rare cases, extreme land subsidence can lead to sinkholes when the subsurface land cannot support the surface land any longer. A sinkhole is described as a portion of the ground that possesses no natural external surface drainage, typically draining water into the subsurface[4].The development of sinkholes can range from a slow to dramatic collapse which may result in property damages or injury and loss of life. These events can differ in size from a few feet to many acres with equal variety in depth.

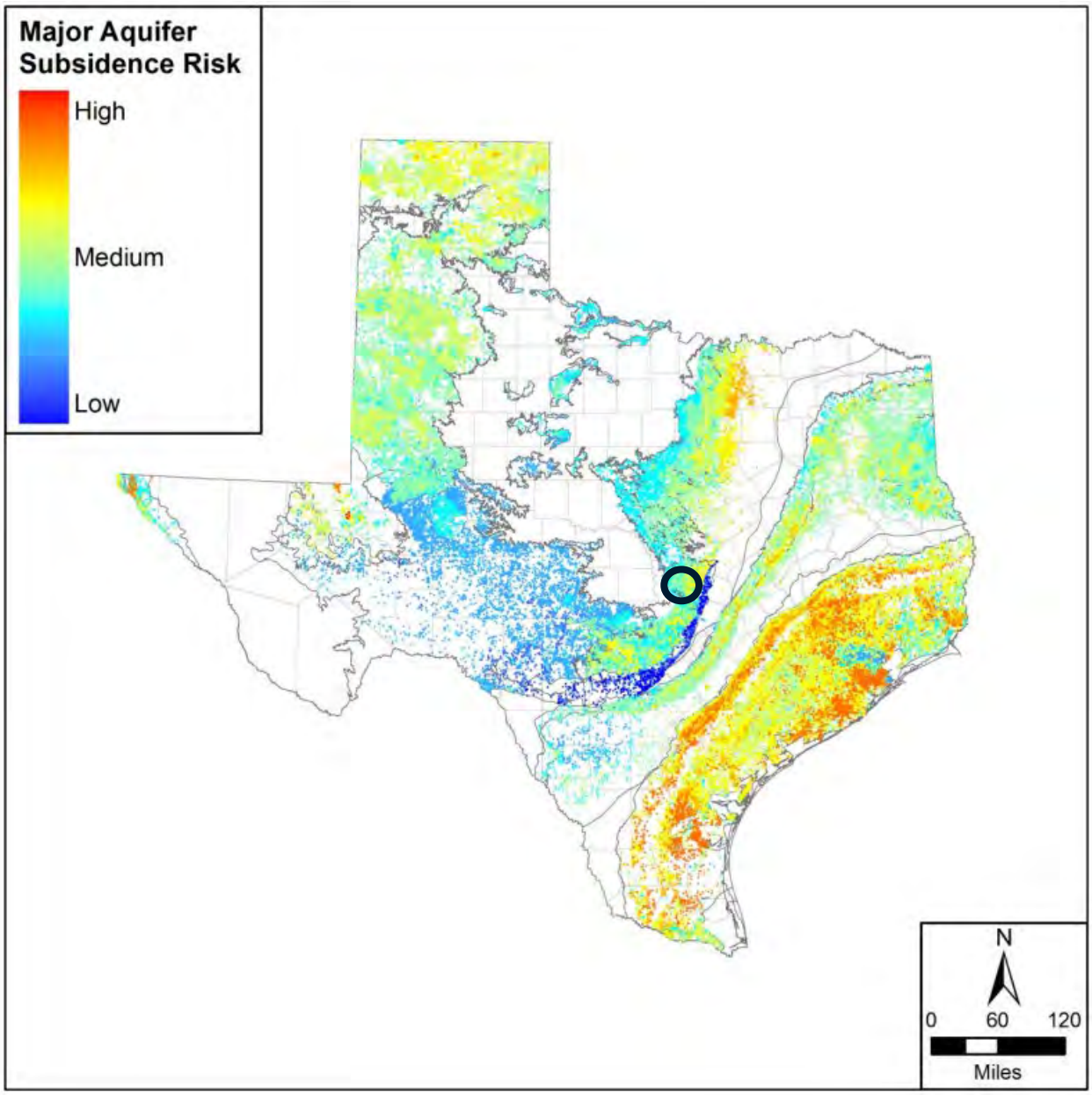
Extent is typically measured by the number of feet of land loss or sunk, however detailed studies specific to the City of Round Rock are limited at this time. The Texas Water Development Board (TWDB) calculated subsidence risk at each of the wells evaluated within major and minor aquifers, as shown in Figure 11-3, with risk levels ranging from low to high. According to this assessment, the City of Round Rock is at a low to medium level of subsidence risk. This may indicate some

[3] United States Geological Survey (USGS). Land Subsidence in the United States. https://water.usgs.gov/ogw/pubs/fs00165/

[4] United States Geological Survey (USGS). Water Science School (2018). Sinkholes. https://www.usgs.gov/special-topics/water-science-school/science/sinkholes

level of concern for potential land sinking overtime. For context, high risk areas, like the Texas coastal region, have experienced several feet of land sinking, causing infrastructure damage and increased flood risks.

Figure 11-3. TWDB Major Aquifer Subsidence Risk[5]



[5] Texas Water Development Board (TWDB). Final Report: Identification of the Vulnerability of the Major and Minor Aquifers of Texas to Subsidence with Regard to Groundwater Pumping. March 21, 2017. https://www.twdb.texas.gov/groundwater/models/research/subsidence/Final_Subsidence_Vulnerability_Report_final.pdf.

HISTORICAL OCCURRENCES

Sinkholes are more likely to occur in areas with earth that can naturally dissolve with groundwater. Incidents occurring in Central Texas are a result of the predominance of subsurface limestone. Areas of karst (areas of land made up of limestone) are particularly sensitive to subsurface cavities and sinkhole development (Figure 11-2).

There are instances of subsidence known to have occurred in the City of Round Rock, however, data on these occurrences is limited. There is no comprehensive database available to provide information on the extent and magnitude of specific land subsidence events. Information about known subsidence events primarily depends on local knowledge and local news sources. The following section provides a description of one known significant event, though it's likely that many instances remain unreported.

SIGNIFICANT EVENTS

February 8, 2018

A sinkhole opened on February 8, 2018, in the City of Round Rock and exposed a 22-foot-deep cave. The sinkhole appeared in the Brushy Creek area of the city, in a residential neighborhood. An estimated ten homes in the area had their water services disrupted due to this event and several natural gas lines were exposed. There are numerous known caves in the Brushy Creek area, but this one was not discovered until the sinkhole.

Figure 11-4. Sink Hole in Round Rock, Texas[6]

[6] Texas Hill Country News. Cave Opens Up and Swallows the Road in Round Rock Neighborhood. April 12, 2018. https://texashillcountry.com/cave-opens-up-swallows-road-in-round-rock-neighborhood/

PROBABILITY OF FUTURE EVENTS

With limited reporting of subsidence, it can be difficult to calculate the probability of future events. However, land subsidence may continue to develop from below-ground withdrawals or from natural or man-made forces. Additionally, increasing population trends in the planning area will lead to increasing groundwater withdrawals from surface aquifers, and this can lead to more incidences of land subsidence / sinkholes. Major occurrences of future land subsidence events are considered “Unlikely” with an event probable in the next 10 years.

VULNERABILITY AND IMPACT

Vulnerability is difficult to evaluate since land subsidence events can occur at any time, in random locations, and soil conditions can be very difficult and costly to monitor. Due to the randomness of these events, all existing and future structures, and facilities within the City of Round Rock planning area, could potentially be impacted and remain vulnerable to possible damage and property loss. The amount of monetary damage associated with previous events is unknown, but costs related to property damage can be expected in the future.

Damage is likely to occur to underground utility systems including water, sewage, and electrical which can lead to water and power outages, disrupting critical services. Land subsidence can also cause significant damage to roads, buildings, houses, and any other standing structure. Historically in the City of Round Rock planning area, damage has occurred to water and gas lines, as well as transportation infrastructure. While all structures in the planning may be susceptible, those structures built above major aquifers or otherwise closest to groundwater removal sites may be at highest risk.

Land subsidence typically poses limited risk to people. While all citizens are vulnerable to the impacts of subsidence, forced relocation and disaster recovery drastically impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to rebuild or repair their homes. An estimated 8 percent of the planning area population live below the poverty level (Table 11-2). The elderly, children, and people with a disability may have trouble evacuating if needed, making them more susceptible to injury or harm. In addition, people who speak a language other than English may face increased vulnerability due to language barriers that limit their access to important information regarding safety measures.

Table 11-2. Populations at Greater Risk[7]

ELDERLY (over 65)	YOUTH (under 5)	WITH A DISABILITY	BELOW POVERTY LEVEL	NON-ENGLISH SPEAKING
12,356	7,219	12,927	9,276	30,183

The City of Round Rock Planning Team identified the following critical facilities (Table 11-3) as assets that are considered the most important to the planning area and are potentially susceptible to land subsidence. The critical infrastructure with the greatest vulnerability are utility services,

[7] US Census Bureau 2022 data for City of Round Rock.

transportation structures, and municipal infrastructure. Failures of these facilities can result in loss of service and cascading impacts. For a comprehensive list of critical facilities see Appendix C.

Table 11-3. Critical Facilities Vulnerable to Land Subsidence

CRITICAL FACILITY TYPE	POTENTIAL IMPACTS
Emergency Response Services (EOC, Fire, Police, EMS), Hospitals and Medical Centers	• Emergency operations and services may be significantly impacted due to damaged facilities. • Damaged roads or transportation structures can impede emergency response vehicle access to areas. • Fire stations, police stations, and hospitals may suffer structural damage, affecting their ability to function effectively during emergencies. • Subsidence related emergencies may require the deployment of additional resources and personnel to impacted areas, and personnel may be exposed to unsafe conditions.
Airport, Academic Institutions, Animal Shelter, Evacuation Centers & Shelters, Governmental Facilities, Residential/ Assisted Living Facilities	• Structures can be damaged by the shifting of the Earth. • Power outages could disrupt critical care. • Critical staff may be injured or otherwise unable to report for duty, limiting response capabilities. • Evacuations may be necessary due to structural damage to facilities. • Infrastructure damage may prevent larger airports from acting as temporary command centers for logistics, communications, and emergency operations. • Temporary break in operations may significantly inhibit post event evacuations. • Damaged or destroyed highway infrastructure may substantially increase the need for airport operations.
Commercial Supplier (Food, fuel, etc.)	• Facilities, infrastructure, or critical equipment including communications may be damaged, destroyed or otherwise inoperable. • Essential supplies like medicines, water, food, and equipment deliveries may be delayed. • Economic disruption due to infrastructure damage negatively impact commercial services and distribution.
Utility Services and Infrastructure (electric, water, wastewater, communications)	• Damage to underground utility systems including water, sewage, and electrical can lead to a disruption of essential services. • Emergency operations and services may be significantly impacted due to damaged facilities. • Damaged roads or transportation structures can impede emergency response vehicle access to areas. • Subsidence related emergencies may require the deployment of additional resources and personnel to impacted areas, and personnel may be exposed to unsafe conditions.

There are no reported damage estimates, injuries, or fatalities from land subsidence events in the City of Round Rock. The impact on the planning area is considered “Limited”, meaning injuries or illnesses are treatable with first aid, critical facilities and services shut down for 24 hours or less, and less than 10 percent of property destroyed or with major damage.

SECTION 11: LAND SUBSIDENCE

ASSESSMENT OF IMPACTS

Land subsidence has the potential to pose a significant risk to people and can create dangerous and difficult situations for public health and safety officials. Land subsidence can be associated with a variety of impacts, including:

- Response personnel, including utility workers, public works personnel, debris removal staff, tow truck operators, and other first responders, are subject to injury or illness.
- Response personnel would be required to travel in potentially hazardous conditions, elevating the life safety risk due to accidents and potential contact with downed power lines.
- Power and water outages are possible throughout the planning area due to damaged power lines, underground water pipes, and other damaged utility infrastructure.
- Emergency response and service operations may be impacted by limitations on access and mobility if roadways are closed, or obstructed.
- Depending on the severity and scale of damage caused by ground movement, damage to critical infrastructure can require weeks to repair.
- Older structures built to less stringent building codes may suffer greater damage as they are typically more vulnerable to impacts of subsidence. 12 percent (approximately 5,539 structures) of homes in the planning area were built before 1980.
- Buildings, homes, and other structures can collapse or sink, potentially trapping residents.
- Significant subsidence can result in emergency response vehicles being unable to access areas of the community.
- Emergency operations and services may be significantly impacted due to damaged facilities, loss of communications, and damaged emergency vehicles and equipment.
- Private sector entities such as utility providers, financial institutions, and medical care providers may not be fully operational and may require assistance from neighboring communities until full services can be restored.
- Some businesses not directly damaged by subsidence may be negatively impacted while roads are restored, further slowing economic recovery.
- Historical sites and properties are placed at a higher risk of impact due to materials used and the inability to change properties due to their historic status. There are five historical sites listed on the National Register of Historic Places for the City of Round Rock.

The economic and financial impacts of land subsidence on the area will depend entirely on the scale of the event, what is damaged, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by the community, local businesses, and citizens will also contribute to the overall economic and financial conditions in the aftermath of any land subsidence event.

CLIMATE CHANGE CONSIDERATIONS

While data regarding the direct impact of climate change on land subsidence in non-coastal areas is limited, certain climate change conditions can increase land subsidence risk. As climate change causes higher temperatures, more severe drought, and changes in overall precipitation, the demand for water increases. In communities reliant on groundwater, the increase in groundwater pumping directly increases the risk of land subsidence.

SECTION 12
LIGHTNING

SECTION 12: LIGHTNING

HAZARD DESCRIPTION

Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a "bolt" when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes the thunder which often accompanies lightning strikes. While most often affiliated with severe thunderstorms, lightning often strikes outside of heavy rain and might occur as far as 10 miles away from any rainfall.

According to the National Weather Service (NWS), the 10-year (2012–2021) average for fatalities is 23 people with an average of 300 injuries in the United States each year by lightning. Lightning can occur as cloud to ground flashes or as intra-cloud lightning flashes. Direct lightning strikes can cause significant damage to buildings, critical facilities, infrastructure, and communication equipment affecting emergency response. Lightning is also responsible for igniting wildfires that can result in widespread damages to property before firefighters have the ability to contain and suppress the resultant fire.

LOCATION

Lightning can strike in any geographic location and is considered a common occurrence in Texas. The City of Round Rock planning area is in a region of the country that is moderately susceptible to lightning strikes. Therefore, lightning could occur at any location within the entire planning area. It is assumed that the entire City of Round Rock planning area is uniformly exposed to the threat of lightning.

EXTENT

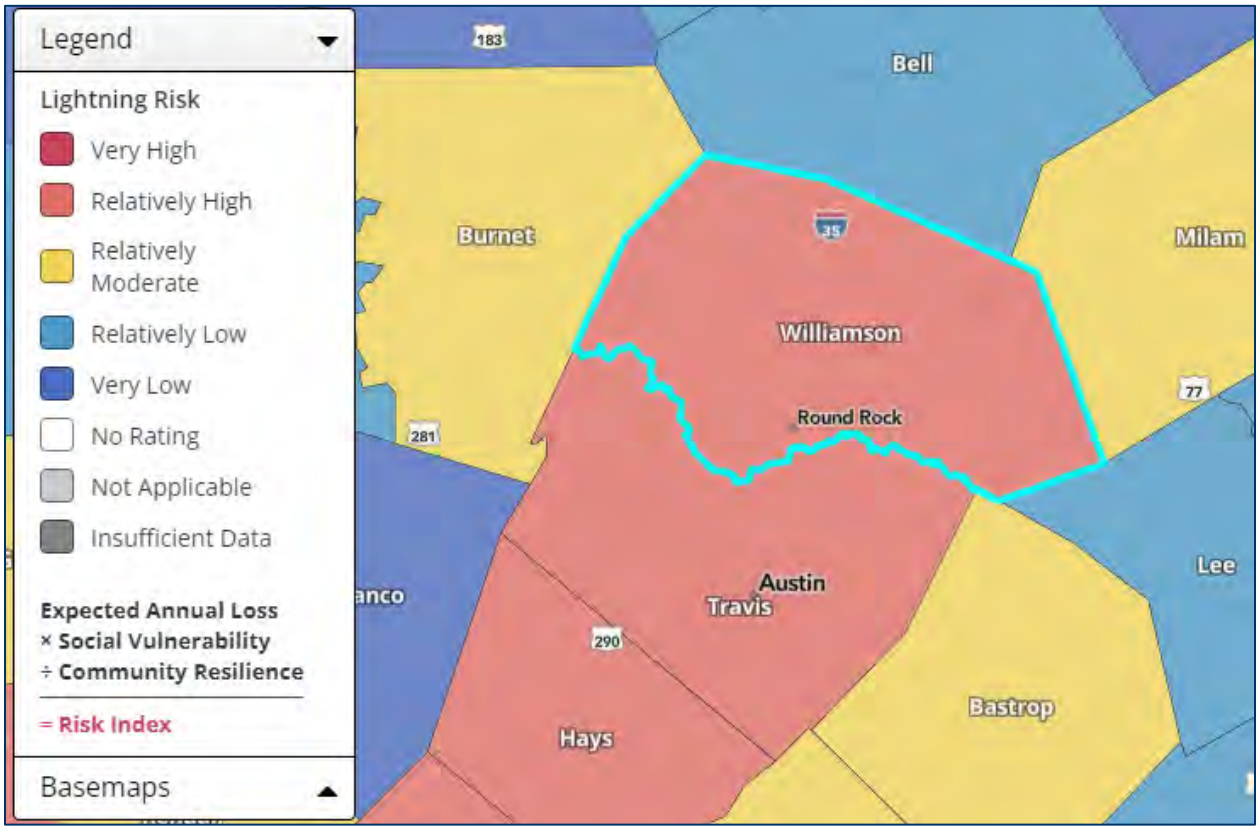
According to the 2023 Annual Lightning Report by Vaisala, the State of Texas ranks tenth in the U.S. for lightning strike density with an average of 157.7 flashes per square mile.[1] Vaisala's U.S. National Lightning Detection Network lightning flash density map shows an average of 181.3 lightning events per square mile per year for Williamson County, which includes the City of Round

[1] Source: https://www.xweather.com/annual-lightning-report

Rock planning area. This rate equates to approximately 6,900 flashes per year for the entire City of Round Rock planning area, or five to six flashes per 15-minute interval during storm events.

FEMA's National Risk Index includes an analysis of the planning area's expected annual loss and the community's risk factor which incorporates social vulnerability as well as community resilience to determine the lightning risk for the area, compared to the rest of the United States. The City of Round Rock planning area, located within Williamson County, is located in an area where the extent is classified as relatively high (Figure 12-1).

Figure 12-1. City of Round Rock Lightning Risk, National Risk Index, July 2024[2]



HISTORICAL OCCURRENCES

Since January 1996, there has been one recorded lightning event for the City of Round Rock planning area, based upon NCEI records. It is highly likely multiple lightning occurrences have gone unreported before and during the recording period. The NCEI is a national data source organized under the National Oceanic and Atmospheric Administration and considered a reliable resource for hazards. However, the flash density for the planning area along with input from local team members indicates regular lightning occurrences across the planning area that simply have not been reported. Table 12-1 lists damages associated with the one historical lightning event that has been reported for the City of Round Rock planning area.

[2] Source: Map | National Risk Index, https://hazards.fema.gov/nri/map

Table 12-1. Historical Lightning Events, 1996-2023[3]

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
City of Round Rock	4/17/2008	0	0	$43,400	$0
TOTALS		**0**	**0**	**$43,400**	

Based on the list of historical lightning events for the City of Round Rock planning area, there have been no reported events since the 2018 Plan.

SIGNIFICANT EVENTS

April 17, 2008

Several intense to severe thunderstorms formed along a cold-front moving south through Central Texas. Along with hail being reported in the City of Round Rock and across the surrounding region, lightning struck a house within the planning area causing considerable damage. Reports estimate that this lightning event caused $43,400 (2024 dollars) in property damage.

April 28, 2023

Severe storms during the night led to lightning striking a home in the City of Round Rock. This lightning strike caused a housefire, with fire department personnel stating that flames could be seen through the roof when they arrived. The fire was put out quickly upon the arrival of firefighters, and no injuries were reported. This event was not captured in the NCEI database and property damage estimates are not available, however media coverage of the event stated the house sustained minimal damage. Figure 12-2 shows the damaged roof of the home after the fire was put out.

Figure 12-2. Damaged Home Resulting from Lightning Strike, April 28, 2023[4]

[3] Values are in 2024 dollars. Database was searched for events between 1996 and 2023.
[4] CBS AUSTIN. PHOTO: *Round Rock house lightning strike.* April 28, 2023. https://cbsaustin.com/news/local/round-rock-house-fire-sparked-by-lightning-strike-during-severe-weather-hail-storm-friday-night

September 24, 2023
On the evening of September 24, the City of Round Rock experienced a hailstorm that impacted the planning area. The City's vehicle fleet had significant damages, and several departments had to utilize alternative means to ensure normal operations would not be interrupted and services can be provided to the community. There is no reported damage loss value, injuries or fatalities as a result of this event[5].

April 28, 2024
During a series of Sunday morning storms over the City of Round Rock planning area, lightning struck the roof of a home shortly before 9:00 AM. The lightning strike sparked a house fire, which firefighters were able to get under control within 20 minutes. At the time of the lightning strike and resulting housefire, no one was inside the home and no injuries are reported for this event.[6] This event was not captured in the NCEI database and property damage estimates are not available.

PROBABILITY OF FUTURE EVENTS

Based on historical records and input from the planning team the probability of occurrence for future lightning events in the City of Round Rock planning area is considered "Highly Likely", or an event probable in the next year. The planning team stated that lightning occurs regularly in the area. According to the 2023 Annual Lightning Report by Vaisala, the City of Round Rock planning area is located in an area of the country that experiences approximately 181.3 lightning flashes per square mile per year (approximately 6,900 flashes per year). Given this estimated probability of events, it can be expected that future lightning events will continue to threaten life and cause minor property damage throughout the planning area. Impacts of climate change are not expected to increase the average frequency of lightning events but may lead to an increase in the intensity of events when they do occur.

VULNERABILITY AND IMPACT

Vulnerability is difficult to evaluate since lightning events can occur at different strength levels, in random locations, and can create a broad range of damage depending on the strike location. Due to the randomness of these events, all existing and future structures and facilities in the City of Round Rock planning area could potentially be impacted and remain vulnerable to possible injury and property loss from lightning strikes.

The direct and indirect losses associated with these events include injury and loss of life, damage to structures and infrastructure, agricultural losses, utility failure (power outages), and stress on community resources. The entire population of the City of Round Rock planning area is considered exposed to the lightning hazard. The peak lightning season in the State of Texas is from June to August; however, the most fatalities occur in July. Fatalities occur most often when people are outdoors and/or participating in some form of recreation. The population located outdoors during a lightning event is considered at risk and more vulnerable to a lightning strike

[5] City of Round Rock. "City of Round Rock assessing impact of storm to City fleet, facilities." September 25, 2024, https://www.roundrocktexas.gov/news/city-of-round-rock-assessing-impact-of-storm-to-city-fleet-facilities/

[6] Fox 7 Austin. "Lightning strike sets house on fire in Round Rock." April 28, 2024, https://www.fox7austin.com/news/round-rock-house-fire-sunrise-road-lightning

compared to those inside a structure. Moving to a lower risk location will decrease a person's vulnerability.

The entire general building stock and all infrastructure of the City of Round Rock planning area, are considered exposed to the lightning hazard. Lightning can be responsible for damages to buildings, cause electrical, forest and/or wildfires, and damage infrastructure such as power transmission lines and communication towers.

While all citizens are at risk to the impacts of lightning, forced relocation and disaster recovery drastically impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to rebuild or repair their homes. An estimated 8 percent of the planning area population live below the poverty level. In addition, people who speak a language other than English may face increased vulnerability due to language barriers that limit their access to important information such as weather-related warnings and instructions regarding safety measures. Table 12-2 lists these vulnerable populations and several others for the City of Round Rock.

Table 12-2. Populations at Greater Risk[7]

ELDERLY (over 65)	YOUTH (under 5)	WITH A DISABILITY	BELOW POVERTY LEVEL	NON-ENGLISH SPEAKING
12,356	7,219	12,927	9,276	30,183

The City of Round Rock Planning Team identified the following critical facilities (Table 12-3) as assets that are considered the most important to the planning area and are susceptible to a range of impacts caused by lightning events. For a comprehensive list of critical facilities, please see Appendix C.

Table 12-3. Critical Facilities Vulnerable to Lightning Events

CRITICAL FACILITIES	POTENTIAL IMPACTS
Emergency Response Services (EOC, Fire, Police, EMS), Hospitals and Medical Centers	• Emergency operations and services may be significantly impacted due to power outages, damaged facilities, fires and/or loss of communications as a result of lightning strikes. • Emergency vehicles, including critical equipment, can be damaged by lightning strikes or by falling trees damaged by lightning. • Power outages could disrupt communications, delaying emergency response times. • Downed trees due to lightning strikes can impede emergency response vehicle access to areas. • Lightning strikes can be associated with structure fires and wildfires, further straining the capacity and resources of emergency personnel.

[7] US Census Bureau, American Community Survey Five-Year Estimates, 2022

CRITICAL FACILITIES	POTENTIAL IMPACTS
	• Extended power outages may lead to possible looting, destruction of property, and theft, further burdening law enforcement resources.
Airport, Academic Institutions, Animal Shelter, Evacuation Centers & Shelters, Governmental Facilities, Residential/ Assisted Living Facilities	• Structures can be damaged by falling trees damaged by lightning. • Power outages could disrupt critical care. • Backup power sources could be damaged. • Evacuations may be necessary due to extended power outages, fires, or other associated damages to facilities.
Commercial Supplier (food, fuel, etc.)	• Facilities, infrastructure, or critical equipment including communications may be damaged, destroyed or otherwise inoperable. • Essential supplies like medicines, water, food, and equipment deliveries may be delayed. • Economic disruption due to power outages and fires negatively impact airport services as well as area businesses reliant on airport operations.
Utility Services and Infrastructure (electric, water, wastewater, communications)	• Emergency operations and critical services may be significantly impacted due to power outages, damaged facilities, fires and/or loss of communications as a result of lightning strikes. • Emergency vehicles, including critical equipment, can be damaged by lightning strikes or by falling trees damaged by lightning. • Power outages could disrupt communications, delaying emergency response times. • Downed trees due to lightning strikes can impede emergency response vehicle access to areas. • Lightning strikes can be associated with structure fires and wildfires, further straining the capacity and resources of emergency personnel. • Extended power outages may lead to possible looting, destruction of property, and theft, further burdening law enforcement resources.

There are no recorded fatalities or injuries within the City of Round Rock planning area due to lightning events. There is one recorded lightning event in the planning area historically, per NCEI data, which resulted in a total of $43,400 (2024 dollars) in property damage. This yields an average annualized loss of $1,600 over the past 28 years. The limited recorded impacts on the City of Round Rock planning area indicate a "Limited" severity of impact, meaning minimal quality of life lost, critical facilities and services shut down for 24 hours or less, and less than 10 percent of property destroyed.

ASSESSMENT OF IMPACTS

Lightning events have the potential to pose a significant risk to people and can create dangerous and difficult situations for public health and safety officials. Additional impacts to the planning area can include:

- The City of Round Rock planning area features developed parks and green spaces. Lightning events could impact recreational activities, placing residents and visitors in imminent danger, potentially requiring emergency services or park evacuation.
- Older structures built to less stringent building codes may suffer greater damage from a lightning strike as they are typically built with less fire-resistant materials and often lack any fire mitigation measures such as sprinkler systems. An estimated 12 percent of homes in the City of Round Rock were built before 1980. Similarly, historic buildings may lack fire mitigation materials or measures due to their historic status. Five historic places in the planning area are listed on the National Register of Historic Places.
- Vegetation in urban parks may be destroyed by lightning caused brush fires and result in poor air quality impacting public health.
- Individuals exposed to the storm can be directly struck, posing significant health risks and potential death.
- Lightning strikes can result in widespread power outages increasing the risk to more vulnerable portions of the population who rely on power for health and/or life safety.
- Extended power outage often results in an increase in structure fires and carbon monoxide poisoning as individuals attempt to cook or heat their homes with alternate, unsafe cooking or heating devices, such as grills.
- Lightning strikes can be associated with structure fires and wildfires, creating additional risk to residents and first responders.
- Emergency operations and services may be significantly impacted due to power outages and/or loss of communications.
- City departments may be damaged, delaying response and recovery efforts for the entire community.
- Economic disruption due to power outages and fires negatively impacts the programs and services provided by the community due to short- and long-term loss in revenue.
- Some businesses not directly damaged by lightning events may be negatively impacted while utilities are being restored, further slowing economic recovery.
- Businesses that are more reliant on utility infrastructure than others may suffer greater damage without a backup power source.

The economic and financial impacts of lightning on the area will depend entirely on the scale of the event, what is damaged, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by the community, local businesses, and citizens will also contribute to the overall economic and financial conditions in the aftermath of any significant lightning event.

CLIMATE CHANGE CONSIDERATIONS

As CO_2 increases and the land surface warms, stronger updrafts are more likely to produce lightning. In a climate with double the amount of CO_2, we may see fewer lightning storms overall, but 25 percent stronger storms, with a 5 percent increase in lightning. Lightning damage is also likely to increase because of its role in igniting forest fires, where dry vegetation, also caused by rising temperatures, creates more ‘fuel’ for fires, so even a small climate change may have huge consequences. While the impact climate change will have on our weather still remains uncertain,

researchers agree that implementing simple measures like lightning detection systems and installing grounding systems in buildings could go a long way in avoiding deaths and injuries.[8]

Lightning events have the potential to pose a significant risk to people and property throughout the planning area. While no increase in the number of hazard events is anticipated, the impact of the hazard may see an increase in losses. As populations grow and urban development continues to rise, the overall vulnerability and impact are expected to increase in the next five years.

[8] Environmental Journal, Nathan Neal, January 11, 2021.

ROUND ROCK
TEXAS

SECTION 13

THUNDERSTORM WIND

SECTION 13: THUNDERSTORM WIND

HAZARD DESCRIPTION

Thunderstorms create extreme wind events which includes straight line winds. Wind is the horizontal motion of the air past a given point, beginning with differences in air pressures. Pressure that is higher at one place than another sets up a force pushing from high toward low pressure; the greater the difference in pressures, the stronger the force. The distance between the area of high pressure and the area of low pressure also determines how fast the moving air accelerates.

Thunderstorms are created when heat and moisture near the Earth's surface are transported to the upper levels of the atmosphere. By-products of this process are the clouds, precipitation, and wind that become the thunderstorm.

According to the National Weather Service (NWS), a thunderstorm occurs when thunder accompanies rainfall. Radar observers use the intensity of radar echoes to distinguish between rain showers and thunderstorms.

Straight line winds are responsible for most thunderstorm wind damages. One type of straight-line wind, the downburst, is a small area of rapidly descending air beneath a thunderstorm. A downburst can cause damage equivalent to a strong tornado and make air travel extremely hazardous.

LOCATION

Thunderstorm wind events can develop in any geographic location and are considered a common occurrence in Texas. Therefore, a thunderstorm wind event could occur at any location within the City of Round Rock planning area. These storms develop randomly and are not confined to any geographic area within the planning area. It is assumed that the entire City of Round Rock planning area is uniformly exposed to the threat of thunderstorm winds.

EXTENT

The extent or magnitude of a thunderstorm wind event is measured by the Beaufort Wind Scale. Table 13-1 describes the different intensities of wind in terms of speed and effects, from calm to violent and destructive.

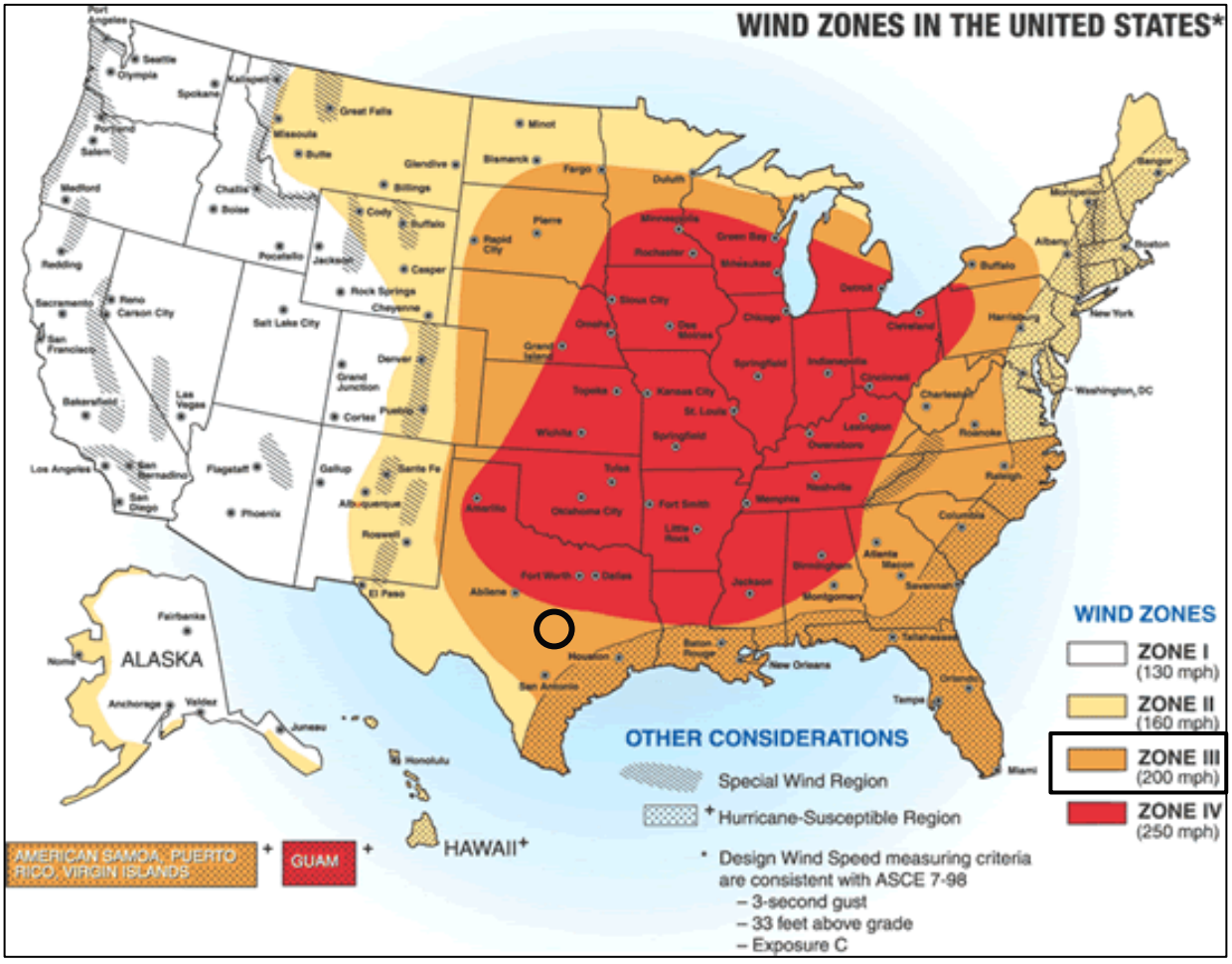
Table 13-1. Beaufort Wind Scale[1]

FORCE	WIND (mph)	WIND (knots)	WMO CLASSIFICATION	APPEARANCE OF WIND EFFECTS
0	Less than 1	Less than 1	Calm	Calm, smoke rises vertically
1	1-3	1-3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4-7	4-6	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	8-12	7-10	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	13-18	11-16	Moderate Breeze	Dust, leaves and loose paper lifted, small tree branches move
5	19-24	17-21	Fresh Breeze	Small trees in leaf begin to sway
6	25-31	22-27	Strong Breeze	Larger tree branches moving, whistling in wires
7	32-38	28-33	Near Gale	Whole trees moving, resistance felt walking against wind
8	39-46	34-40	Gale	Whole trees in motion, resistance felt walking against wind
9	47-54	41-47	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	55-63	48-55	Storm	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	64-72	56-63	Violent Storm	If experienced on land, widespread damage
12	72-83	64-71	Hurricane	Violence and destruction

Figure 13-1 displays the wind zones as derived from NOAA.

[1] Source: World Meteorological Organization

Figure 13-1. Wind Zones in the United States[2]



On average, the planning area experiences a thunderstorm wind event every one to two years. The City of Round Rock planning area is located within Wind Zone III. This means the planning area can experience winds up to 200 mph. The City of Round Rock planning area has experienced a significant wind event, or an event with winds in the range of "Force 12" on the Beaufort Wind Scale with winds above 72 mph. This is the worst to be anticipated for the entire planning area based on historic events.

Based on a search of past events between 1994 through 2023, the greatest magnitude wind event that the City of Round Rock planning area experienced was 65 knots, or 75 mph, during an event occurring on May 23, 2017.

HISTORICAL OCCURRENCES

The National Centers for Environmental Information (NCEI) Storm Events database is a national data source organized under the National Oceanic and Atmospheric Administration. The NCEI is the largest archive available for historic storm events data; however, it is important to note that only incidents recorded in the NCEI have been factored into this risk assessment unless otherwise

[2] The City of Round Rock planning area is indicated by the black circle.

noted. It is likely that a high number of occurrences have gone unreported over the past 30 years. Tables 13-2 and 13-3 depict historical occurrences of thunderstorm wind events for the City of Round Rock planning area according to the NCEI database.

Since 1994, 18 thunderstorm wind events are known to have occurred in the City of Round Rock planning area. Table 13-3 presents information on known historical events impacting the City of Round Rock planning area, as well as any reported damages. The strongest event reported occurred on May 23, 2017, with reported wind speeds of 65 knots, or 75 mph.

It is important to note that high wind events associated with other hazards, such as tornadoes, are not accounted for in this section. Property damage estimates are not always available. Where an estimate has been provided in a table for losses, the dollar amounts have been modified for inflation to indicate the damage in 2024 dollars.

Table 13-2. Historical Thunderstorm Wind Speeds, 1994-2023

MAXIMUM WIND SPEED RECORDED (knots)	NUMBER OF REPORTED EVENTS
0-30	0
31-40	1
41-50	0
51-60	11
61-70	4
71-80	0
81-90	0
91-100+	0
Unknown	2

Table 13-3. Historical Thunderstorm Wind Events, 1994-2023[3]

JURISDICTION	DATE	MAGNITUDE (knots)	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
City of Round Rock	5/29/1994	52	0	0	$10,600	$10,600
City of Round Rock	5/27/1997	52	0	0	$0	$0
City of Round Rock	4/11/2000	-	0	0	$27,200	$0
City of Round Rock	9/2/2000	-	0	0	$35,800	$0
City of Round Rock	5/20/2001	53	0	0	$0	$0
City of Round Rock	10/12/2001	58	0	0	$174,700	$0

[3] Magnitude is listed when available. Damage values are in 2024 dollars.

JURISDICTION	DATE	MAGNITUDE (knots)	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
City of Round Rock	5/22/2007	60	0	0	$74,700	$0
City of Round Rock	8/27/2009	52	0	0	$14,400	$0
City of Round Rock	7/9/2012	52	0	0	$0	$0
City of Round Rock	7/9/2012	39	0	0	$300	$0
City of Round Rock	5/29/2015	61	0	0	$0	$0
City of Round Rock	4/27/2016	52	0	0	$0	$0
City of Round Rock	4/2/2017	61	0	0	$0	$0
City of Round Rock	5/23/2017	65	0	0	$1,300	$0
City of Round Rock	5/8/2019	52	0	0	$0	$0
City of Round Rock	3/21/2022	56	0	0	$0	$0
City of Round Rock	5/24/2022	56	0	0	$2,200	$0
City of Round Rock	9/24/2023	61	0	0	$2,100	$0
TOTALS		**(MAX EXTENT)**	**0**	**0**	**$353,900**	

Based on the list of historical thunderstorm wind events for the City of Round Rock planning area, four events have occurred since the 2018 Plan.

SIGNIFICANT EVENTS

October 12, 2001

Thunderstorms late in the night led to strong winds over Williamson County including the City of Round Rock planning area. In the City of Round Rock, damage was reported to multiple roofs of homes due to the severe winds. In total, this property damage was estimated at $174,700 (2024 dollars).

May 22, 2007

A severe thunderstorm formed over the City of Round Rock planning area, leading to severe thunderstorm winds which were reported at close to 70 mph. These winds damaged the roofs of five homes in a small division just east of the City of Round Rock. The monetary damages caused by these winds were estimated at $74,700 (2024 dollars).

May 24, 2022

An upper-level trough moving across the southern plains pushed a cold front into South Central Texas, including the City of Round Rock planning area. Thunderstorms with severe winds gusts, as well as large hail, formed along this cold front. The thunderstorm winds, which were reported at roughly 65 mph in the City of Round Rock, downed a tree approximately eight inches in diameter near the intersection of Emerald Hill Drive and Curtis Drive. Property damages from this event were estimated at $2,200 (2024 dollars).

September 24, 2023
Thunderstorms developed along a south-moving cold front entering South Central Texas. These storms produced large hail and damaging wind gusts, particularly severe in the region from the City of Georgetown to the City of Austin, including the City of Round Rock. The City of Round Rock experienced winds estimated at 70 mph, which knocked down a large tree off Chisholm Valley Drive. Property damages from these thunderstorm winds were estimated at $2,100 (2024 dollars).

PROBABILITY OF FUTURE EVENTS

Most thunderstorm winds occur during the spring and fall seasons and during the months of March, April, May, and September. Based on available records of historic events, there have been a total of 18 events in a 30-year reporting period, which provides an estimated annual frequency of an event every one to two years. Even though the intensity of thunderstorm wind events is not always damaging for the City of Round Rock planning area, the frequency of occurrence for a thunderstorm wind event is “Highly Likely”. This means that an event is probable within the next year for the City of Round Rock planning area.

VULNERABILITY AND IMPACT

Vulnerability is difficult to evaluate since thunderstorm wind events can occur at different strength levels, in random locations, and can create relatively narrow paths of destruction. Due to the randomness of these events, all existing and future structures, and facilities within the City of Round Rock planning area, could potentially be impacted and remain vulnerable to possible injury and property loss from strong winds.

Trees, power lines and poles, signage, manufactured housing, radio towers, concrete block walls, storage barns, windows, garbage recepticles, brick facades, and vehicles, unless reinforced, are vulnerable to thunderstorm wind events. More severe damage involves windborne debris; in some instances, patio furniture and other lawn items may be blown around. Often debris from damaged structures have caused damage to other buildings not directly impacted by the event. In more severe instances roofs may be torn off of buildings. The portable buildings typically used at schools and construction sites would be more vulnerable to thunderstorm wind events than typical site-built structures and could potentially pose a greater risk for wind-blown debris.

According to the American Community Survey (ACS) five-year estimates for 2022, a total of 29 manufactured homes are located in the City of Round Rock planning area (less than one percent of total housing stock). In addition, 12 percent (approximately 5,539 structures) of the housing units were built before 1980. These structures would typically be built to lower or less stringent construction standards than newer construction and may be more susceptible to damage during significant wind events.

Table 13-4. Structures at Greater Risk

SFR STRUCTURES BUILT BEFORE 1980	MANUFACTURED HOMES
5,539	29

While all citizens are vulnerable to the impacts of thunderstorm wind, forced relocation and disaster recovery disproportionately impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to rebuild or repair their homes. An estimated 8 percent of the planning area population live below the poverty level (Table 13-5). While warning times for these types of hazard events is typically long enough for these individuals to seek shelter, the elderly, children, and people with a disability may have trouble taking shelter due to mobility issues or a lack of awareness, making them more susceptible to injury or harm. In addition, people who speak a language other than English may face increased vulnerability due to language barriers that limit their access to important information such as weather-related warnings and instructions regarding safety measures.

Table 13-5. Populations at Greater Risk[4]

ELDERLY (over 65)	YOUTH (under 5)	WITH A DISABILITY	BELOW POVERTY LEVEL	NON-ENGLISH SPEAKING
12,356	7,219	12,927	9,276	30,183

The City of Round Rock Planning Team identified the following critical facilities (Table 13-6) as assets that are considered the most important to the planning area and are susceptible to a range of impacts caused by thunderstorm wind events. The critical infrastructure with the greatest vulnerability to thunderstorms are power and communications facilities. Failures of these facilities can result in a loss of service and cascading impacts such as posing enormous risk to individuals dependent on electricity as a medical necessity. For a comprehensive list of critical facilities, please see Appendix C.

[4] US Census Bureau 2022 data for the City of Round Rock.

Table 13-6. Critical Facilities Vulnerable to Thunderstorm Wind Event

CRITICAL FACILITY TYPE	POTENTIAL IMPACTS
Emergency Response Services (EOC, Fire, Police, EMS), Hospitals and Medical Centers	• Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications. • Emergency vehicles can be damaged by falling trees or flying debris. • Power outages could disrupt communications, delaying emergency response times. • Critical staff may be injured or otherwise unable to report for duty, limiting response capabilities. • Debris/downed trees can impede emergency response vehicle access to areas. • Increased number of structure fires due to gas line ruptures and downed power lines, further straining the capacity and resources of emergency personnel. • First responders are exposed to downed power lines, unstable and unusual debris, hazardous materials, and generally unsafe conditions.
Airport, Academic Institutions, Animal Shelter, Evacuation Centers & Shelters, Governmental Facilities, Residential/ Assisted Living Facilities	• Structures can be damaged by falling trees or flying debris. • Power outages could disrupt critical care. • Backup power sources could be damaged. • Critical staff may be injured or otherwise unable to report for duty, limiting response capabilities. • Evacuations may be necessary due to extended power outages, gas line ruptures, or structural damage to facilities. • Power outages and infrastructure damage may prevent larger airports from acting as temporary command centers for logistics, communications, and emergency operations. • Temporary break in operations may significantly inhibit post event evacuations. • Damaged or destroyed highway infrastructure may substantially increase the need for airport operations.
Commercial Supplier (food, fuel, etc.)	• Facilities, infrastructure, or critical equipment including communications may be damaged, destroyed or otherwise inoperable. • Essential supplies like medicines, water, food, and equipment deliveries may be delayed. • Economic disruption due to power outages and fires negatively impact airport services as well as area businesses reliant on airport operations.
Utility Services and Infrastructure (electric, water, wastewater, communications)	• Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications. • Emergency vehicles can be damaged by falling trees or flying debris. • Power outages could disrupt communications, delaying emergency response times. • Critical staff may be injured or otherwise unable to report for duty, limiting response capabilities.

CRITICAL FACILITY TYPE	POTENTIAL IMPACTS
	• Debris/downed trees can impede emergency response vehicle access to areas. • Increased number of structure fires due to gas line ruptures and downed power lines, further straining the capacity and resources of emergency personnel.

A thunderstorm wind event can also result in traffic disruptions, injuries and in rare cases, fatalities. The impact of thunderstorm winds experienced in the City of Round Rock planning area have resulted in no injuries or fatalities. The limited recorded impacts on the City of Round Rock planning area indicate a "Limited" severity of impact, meaning minimal quality of life lost, critical facilities and services shut down for 24 hours or less, and less than 10 percent of property destroyed. Overall, in the past 30 years there has been an estimated total of $353,900 damages (2024 dollars) in the City of Round Rock planning area due to thunderstorm wind events. The estimated average annual loss from thunderstorm wind events is $11,800 (2024 dollars).

Table 13-7. Estimated Annualized Losses

TOTAL PROPERTY & CROP LOSS	AVERAGE ANNUAL LOSS ESTIMATES
$353,900	$11,800

ASSESSMENT OF IMPACTS

Thunderstorm wind events have the potential to pose a significant risk to people and can create dangerous and difficult situations for public health and safety officials. Thunderstorm wind conditions can be frequently associated with a variety of impacts, including:

- Individuals exposed to the storm can be struck by flying debris, falling limbs, or downed trees causing serious injury or death.
- Structures can be damaged or crushed by falling trees, which can result in physical harm to the occupants.
- Significant debris and downed trees can result in emergency response vehicles being unable to access areas of the community.
- Downed power lines may result in roadways being unsafe for use, which may prevent first responders from answering calls for assistance or rescue.
- Thunderstorm wind events often result in widespread power outages increasing the risk to more vulnerable portions of the population who rely on power for health and/or life safety.
- Extended power outage often results in an increase in structure fires and carbon monoxide poisoning, as individuals attempt to cook or heat their homes with alternate, unsafe cooking or heating devices, such as grills.
- Critical staff may be unable to report for duty, limiting response capabilities.
- Private sector entities that residents rely on, such as utility providers, financial institutions, and medical care providers may not be fully operational and may require assistance from neighboring communities until full services can be restored.

- Economic disruption negatively impacts the programs and services provided by the community due to short- and long-term loss in revenue.
- Some businesses not directly damaged by thunderstorm wind events may be negatively impacted while roads are cleared and utilities are being restored, further slowing economic recovery.
- Older structures, specifically those built before 1980 (12 percent of the planning area), were built to less stringent building codes and may suffer greater damage as they are typically more vulnerable to thunderstorm winds.
- Recreational areas such as community parks and green spaces may be damaged or inaccessible due to downed trees or debris, causing temporary impacts to associated businesses in the area.
- Historical sites and properties are placed at a higher risk of impact due to materials used and the inability to change properties due to their historic status. Five historical places are listed on the National Register of Historic Places for the City of Round Rock.

The economic and financial impacts of thunderstorm winds on the area will depend entirely on the scale of the event, what is damaged, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by the community, local businesses, and citizens will also contribute to the overall economic and financial conditions in the aftermath of any thunderstorm wind event.

CLIMATE CHANGE CONSIDERATIONS

The impacts on the frequency and severity of severe thunderstorm wind events due to climate change are unclear. According to the Texas A&M 2021 Climate Report Update, changes in severe thunderstorm reports over time have been more closely linked to changes in population than changes in the hazard event. At this time there is low confidence of an ongoing trend in the overall frequency and severity of thunderstorm events, due to the lack of climate data records for severe thunderstorms. Based on climate models that are available, the environmental conditions needed for severe thunderstorms are estimated to become more likely, resulting in an overall increase in the number of days capable of producing a severe thunderstorm event.[5]

[5] Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900-2036, Texas A&M University Office of the Texas State Climatologist, 2021 Update.

SECTION 14
TORNADO

SECTION 14: TORNADO

HAZARD DESCRIPTION

Tornadoes are among the most violent storms on the planet. A tornado is a rapidly rotating column of air extending between, and in contact with, a cloud and the surface of the earth. The most violent tornadoes are capable of tremendous destruction and have wind speeds of 250 miles per hour (mph) or more. In extreme cases, winds may approach 300 mph. Damage paths can be in excess of one mile wide and 50 miles long.

The most powerful tornadoes are produced by "Supercell Thunderstorms." These thunderstorms are created when horizontal wind shears (winds moving in different directions at different altitudes) begin to rotate the storm. This horizontal rotation can be tilted vertically by violent updrafts, and the rotation radius can shrink, forming a vertical column of very quickly swirling air. This rotating air can eventually reach the ground, forming a tornado**.**

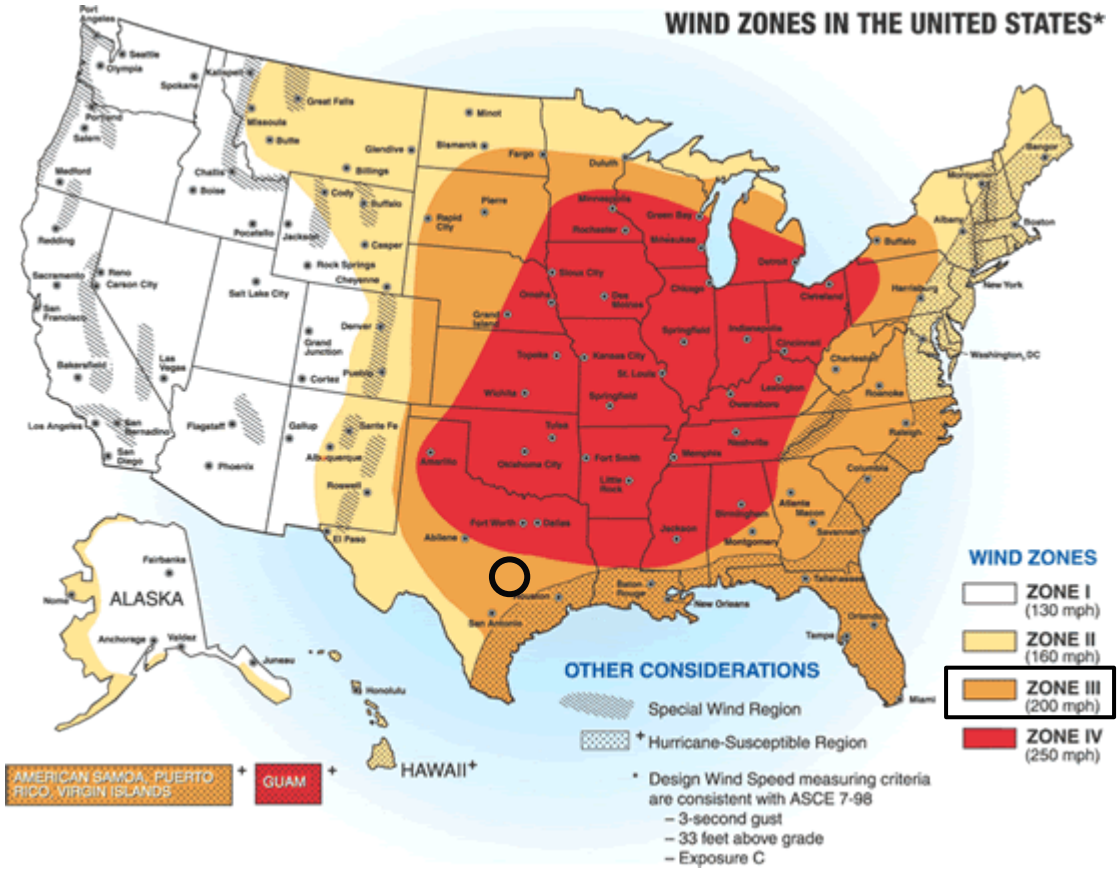
Table 14-1. Variations among Tornadoes

WEAK TORNADOES	STRONG TORNADOES	VIOLENT TORNADOES
• 69% of all tornadoes • Less than 5% of tornado deaths • Lifetime 1-10+ minutes • Winds less than 110 mph	• 29% of all tornadoes • Nearly 30% of all tornado deaths • May last 20 minutes or longer • Winds 110 – 205 mph	• 2% of all tornadoes • 70% of all tornado deaths • Lifetime can exceed one hour • Winds greater than 205 mph

LOCATION

Tornadoes do not have any specific geographic boundary and can occur throughout the city uniformly. It is assumed that the entire City of Round Rock planning area is uniformly exposed to tornado activity. The entire City of Round Rock planning area is in Wind Zone III (Figure 14-1), where tornado winds can be as high as 200 mph.

Figure 14-1. FEMA Wind Zones in the United States[1]



EXTENT

The destruction caused by tornadoes ranges from light to inconceivable, depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction, such as residential homes (particularly mobile homes).

Tornado magnitudes prior to 2007 were determined using the traditional version of the Fujita Scale, which estimated tornado wind speeds based on the damage caused by an event. Since February 2007, the Enhanced Fujita Scale has been utilized to classify tornadoes, which included improvements to the original scale. The original Fujita scale had limitations, such as a lack of damage indicators, no account for construction quality and variability, and no definitive correlation between damage and wind speed. These limitations led to some tornadoes being rated in an inconsistent manner and, in some cases, an overestimate of tornado wind speeds. The Enhanced Fujita scale retains the same basic design and six strength categories as the previous scale. The newer scale reflects more refined assessments of tornado damage surveys, standardization, and damage consideration to a wider range of structures. Table 14-2 includes both scales for reference when analyzing historical tornados since tornado events prior to 2007 will follow the original Fujita Scale.

[1] City of Round Rock is indicated by the circle

Table 14-2. The Fujita and Enhanced Fujita Tornado Scale[2]

Enhanced Fujita Scale				Fujita Scale			
Category	**Wind Speed**	**Damage Level**	**Damage**	**Category**	**Wind Speed**	**Intensity**	**Damage**
EF0	65-85 MPH	Gale	The environment sustained minor damage: tree branches are broken, some shallow-rooted trees are uprooted, and some chimneys are damaged.	**F0**	45-78 MPH	Gale	Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
EF1	86-110 MPH	Weak	The environment sustained moderate damage: mobile homes are tipped over, windows are broken, roof tiles may be blown off, and some tree trunks have snapped.	**F1**	79-117 MPH	Moderate	Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
EF2	111-135 MPH	Strong	The environment sustained considerable damage: mobile homes are destroyed, roofs are damaged, debris flies in the air, and large trees are snapped or uprooted.	**F2**	118-161 MPH	Significant	Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136-165 MPH	Severe	The environment sustained severe damage: roofs and walls are ripped off buildings, small buildings are destroyed, and most trees are uprooted.	**F3**	162-209 MPH	Severe	Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
EF4	166-200 MPH	Devastating	The environment sustained devastating damage: well-built homes are destroyed, buildings are lifted off their foundations, cars are blown away, and large debris flies in the air.	**F4**	210-261 MPH	Devastating	Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown, and large missiles generated.
EF5	200+ MPH	Incredible	The environment sustained incredible damage: well-built homes are lifted from their foundations, reinforced concrete buildings are damaged, the bark is stripped from trees, and car-sized debris flies through the air.	**F5**	262-317 MPH	Incredible	Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yds); trees debarked; incredible phenomena will occur.

[2] Source: http://www.tornadoproject.com/fscale/fscale.htm

Both the Fujita Scale and Enhanced Fujita Scale should be referenced in reviewing previous occurrences since tornado events that occurred before 2007 will follow the original Fujita Scale. The greatest magnitude reported within the planning area is an F3, a severe tornado. Based on the planning area's location in Wind Zone III, the planning area has the potential to experience anywhere from an EF0 to an EF5 depending on the wind speed. Previous tornado events in the City of Round Rock planning area have been between F0 and F3 (Figure 15-2).

HISTORICAL OCCURRENCES

The National Centers for Environmental Information (NCEI) Storm Events database is a national data source organized under the National Oceanic and Atmospheric Administration (NOAA). The NCEI is the largest archive available for historic storm events data; however, it is important to note that only incidents recorded in the NCEI have been factored into this risk assessment unless otherwise noted. It is likely that a high number of occurrences have gone unreported over time.

Figure 14-2 identifies the locations of previous occurrences in the City of Round Rock planning area from 1964 through 2023. A total of five events have been recorded by NOAA's Storm Prediction Center and the NCEI Storm Events databases for the City of Round Rock planning area. The strongest event reported in the planning area was an F3 tornado on April 7, 1980, which is also the only historical tornado event in the planning area with a reported fatality. The most significant event in terms of injuries and reported property damages occurred on March 21, 2022, causing 16 injuries and an estimated $34,968,600 (2024 dollars) in property damage.[3]

[3] Damage estimates are sourced from media reports and local officials immediately following the event. Source: https://www.statesman.com/story/news/local/round-rock/2022/03/30/round-rock-officials-say-32-million-damage-caused-tornado/7192947001/

Figure 14-2. Spatial Historical Tornado Events, 1964-2023[4]

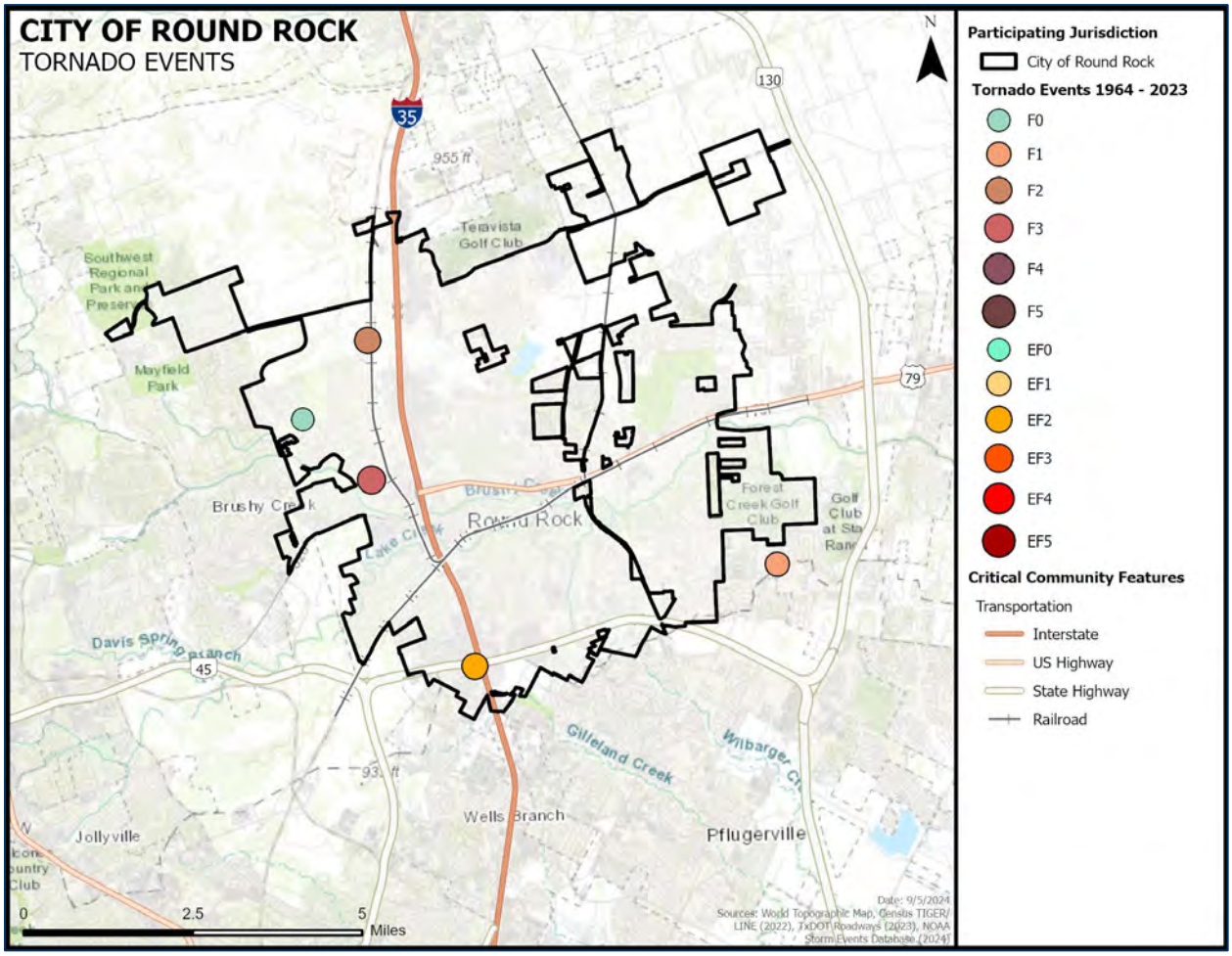


Table 14-3. Historical Tornado Events, 1964-2023

JURISDICTION	DATE	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
City of Round Rock	4/26/1964	F2	0	0	$25,200	$0
City of Round Rock	4/7/1980	F3	1	2	$957,800	$0
City of Round Rock	7/4/1998	F1	0	0	$57,100	$0
City of Round Rock	11/23/2004	F0	0	0	$0	$0
City of Round Rock	3/21/2022	EF2	0	16	$34,968,600[5]	$0
TOTALS		**(MAX EXTENT)**	**1**	**18**	**$36,008,700**	**$0**

[4] Source: NOAA Storm Prediction Center
[5] Monetary damages for this event were not available per the NCEI database. Damage estimates are sourced from media reports and local officials immediately following the event. Source: https://www.statesman.com/story/news/local/round-rock/2022/03/30/round-rock-officials-say-32-million-damage-caused-tornado/7192947001/

SECTION 14: TORNADO

Based on the list of historical tornado events for the City of Round Rock planning area, there has been one recorded event since the 2018 Plan.

SIGNIFICANT EVENTS

April 7, 1980

In the afternoon, an F3 tornado formed southeast of the City of Round Rock, quickly traveling west into the planning area. The tornado remained on the ground for 6.5 miles and the width of its destructive path was 100 feet wide. One fatality and two injuries were reportedly caused by the tornado, and estimates of property damage were reported at $957,800 (2024 dollars).

July 4, 1998

A small and very brief mid-day tornado touched down near a group of people picnicking at a ranch just east of the City of Round Rock. The tornado knocked trailers into nearby vehicles and scattered wood pieces from piles before dissipating. No fatalities or injuries were reported, and the property damages caused by this tornado were estimated at $57,100 (2024 dollars).

March 21, 2022

A warm, moist airmass over South Central Texas early in the day led to the generation of thunderstorms, which led to the outbreak of a tornado, which peaked at wind speeds of EF2, over the City of Round Rock. This tornado was long-lived and began a little over a mile southwest of the Interstate 35 / Highway 45 interchange. The tornado tracked to that interchange and moved into Williamson County and the City of Round Rock planning area.

Along the tornado's path, there was widespread debris and downed trees, damaged vehicles, and power poles. In the City of Round Rock, more than 680 homes sustained damage with 13 of those being completely destroyed. Affected neighborhoods included Kensington, Windy Terrace, Greenlawn Place, Windy Park, South Creek, Turtle Creek, Concord at Brushy Creek, Forest Grove, and Forest Bluff. In addition to structural damage, 16 injuries were caused by the tornado within the City of Round Rock; no fatalities were reported as a result of the event. City of Round Rock officials estimated that the total property damage caused by the tornado was $36,008,700 (2024 dollars).[6]

[6] Figueroa, Fernanda. "*7 before and after photos show Round Rock tornado rebuilding process a year later."* Austin American-Statesman, March 22, 2023. https://www.statesman.com/story/news/local/2023/03/22/round-rock-tornado-homes-damage-before-after-photos/70038399007/. Accessed July 31, 2024.

Figure 14-3. Tornado-Damaged Home in City of Round Rock, March 21, 2022[7]

PROBABILITY OF FUTURE EVENTS

Tornadoes can occur at any time of year and at any time of day, but they are typically more common in the spring months during the late afternoon and evening hours. A smaller, high frequency period can emerge in the fall during the brief transition between the warm and cold seasons. With five historical events over a 60-year reporting period, the City of Round Rock planning area can anticipate a tornado touchdown approximately once every ten or more years. This frequency supports an “Unlikely” probability of future events for the City of Round Rock planning area.

VULNERABILITY AND IMPACT

Because of the randomness and variation in tornado events, all existing and future buildings, facilities, and populations in the entire City of Round Rock planning area are considered to be exposed to this hazard and could potentially be impacted. The damage caused by a tornado is typically a result of high wind velocity, wind-blown debris, lightning, and large hail.

The average tornado moves from southwest to northeast, but tornadoes have been known to move in any direction. Consequently, vulnerability of humans and property is difficult to evaluate since tornadoes form at different strengths, in random locations, and create relatively narrow

[7] Birchum, Jana. PHOTO: *Tornado Damage in Round Rock.* March 22, 2022. https://www.austinchronicle.com/photos/tornado-damage-in-round-rock/13/. Accessed July 31, 2024.

paths of destruction. Although tornadoes strike at random, making all buildings vulnerable, three types of structures are more likely to suffer damage:

- Manufactured Homes;
- Homes built of pier and beam construction (more susceptible to lift); and
- Buildings with large spans, such as shopping malls, gymnasiums, and factories.

Tornadoes can cause a significant threat to people as they could be struck by flying debris, falling trees / branches, utility lines, and poles. Blocked roads could prevent first responders from responding to calls. Tornadoes commonly cause power outages which could cause health and safety risks to residents and visitors, as well as to patients in hospitals.

The City of Round Rock planning area features mobile or manufactured homes throughout the planning area. These homes are typically more vulnerable to tornado events than typical site-built structures. In addition, manufactured homes are located sporadically throughout the planning area, which would also be more vulnerable. The U.S. Census data indicates a total of 29 (less than one percent of total housing stock) manufactured homes located in the City of Round Rock planning area. In addition, 12 percent (approximately 5,539 structures) of the single family residential (SFR) structures in the entire planning area were built before 1980. These structures would typically be built to lower or less stringent construction standards than newer construction and may be more susceptible to damage during significant wind events (Table 14-4).

Table 14-4. Structures at Greater Risk

SFR STRUCTURES BUILT BEFORE 1980	MANUFACTURED HOMES
5,539	29

While all citizens are at risk to the impacts of a tornado, forced relocation and disaster recovery drastically impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to rebuild or repair their homes. The elderly, children, and people with a disability may have trouble taking shelter due to mobility issues or a lack of awareness, making them more susceptible to injury or harm. In addition, people who speak a language other than English may face increased vulnerability due to language barriers that limit their access to important information such as weather-related warnings and instructions regarding safety measures. The population over 65 in the City of Round Rock planning area is estimated at 10 percent of the total population and children under the age of 5 are estimated at 6 percent. The population with a disability is estimated at 11 percent of the total population. An estimated 8 percent of the planning area population live below the poverty level and 25 percent of the populations speaks a language other than English (Table 14-5).

Table 14-5. Populations at Greater Risk[8]

ELDERLY (over 65)	YOUTH (under 5)	WITH A DISABILITY	BELOW POVERTY LEVEL	NON-ENGLISH SPEAKING
12,356	7,219	12,927	9,276	30,183

The City of Round Rock Planning Team identified the following critical facilities as assets that are considered the most important to the planning area and are susceptible to a range of impacts caused by tornado events (Table 14-6). The critical infrastructure with the greatest vulnerability to tornadoes are power and communications facilities. Failures of these facilities can result in a loss of service and cascading impacts such as posing enormous risk to individuals dependent on electricity as a medical necessity. For a comprehensive list of critical facilities, please see Appendix C.

Table 14-6. Critical Facilities Vulnerable to Tornado Event

CRITICAL FACILITIES	POTENTIAL IMPACTS
Emergency Response Services (EOC, Fire, Police, EMS), Hospitals and Medical Centers	• Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications. • Emergency vehicles can be damaged by falling trees or flying debris. • Power outages could disrupt communications, delaying emergency response times. • Critical staff may be injured or otherwise unable to report for duty, limiting response capabilities. • Debris/downed trees can impede emergency response vehicle access to areas. • Increased number of structure fires due to gas line ruptures and downed power lines, further straining the capacity and resources of emergency personnel. • First responders are exposed to downed power lines, unstable and unusual debris, hazardous materials, and generally unsafe conditions. • Extended power outages and evacuations may lead to possible looting, destruction of property, and theft, further burdening law enforcement resources.
Airport, Academic Institutions, Animal Shelter, Evacuation Centers & Shelters, Governmental Facilities, Residential/ Assisted Living Facilities	• Structures can be damaged by falling trees damaged by lightning. • Power outages could disrupt critical care. • Backup power sources could be damaged. • Evacuations may be necessary due to extended power outages, fires, or other associated damage to facilities. • Power outages and infrastructure damage may prevent larger airports from acting as temporary command centers for logistics, communications, and emergency operations. • Temporary break in operations may significantly inhibit post event evacuations.

[8] U.S. Census Bureau 2022 data for City of Round Rock

CRITICAL FACILITIES	POTENTIAL IMPACTS
	• Damaged or destroyed highway infrastructure may substantially increase the need for airport operations.
Commercial Supplier (Food, fuel, etc.)	• Facilities or infrastructure may be damaged, destroyed or otherwise inaccessible. • Essential supplies like medicines, water, food, and equipment deliveries may be significantly delayed. • Additional emergency responders and critical aid workers may not be able to reach the area for days.
Utility Services and Infrastructure (electric, water, wastewater, communications)	• Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications. • Emergency vehicles can be damaged by falling trees or flying debris. • Power outages could disrupt communications, delaying emergency response times. • Critical staff may be injured or otherwise unable to report for duty, limiting response capabilities. • Debris/downed trees can impede emergency response vehicle access to areas. • Increased number of structure fires due to gas line ruptures and downed power lines, further straining the capacity and resources of emergency personnel. • First responders are exposed to downed power lines, unstable and unusual debris, hazardous materials, and generally unsafe conditions. • Extended power outages and evacuations may lead to possible looting, destruction of property, and theft, further burdening law enforcement resources.

The total loss estimate due to tornado events is $36,008,700 (in 2024 dollars), having an approximate average annual loss estimate of $600,100. Tornadoes have also caused one fatality and 18 injuries within the City of Round Rock planning area. Based on these significant historic damages and best available data, the impact of a tornado event on the City of Round Rock planning area would be considered “Substantial”, with multiple fatalities possible, complete shutdown of facilities for 30 days or more, and more than 50 percent of property destroyed or with major damage possible.

Table 14-7. Estimated Average Annual Losses

TOTAL PROPERTY & CROP LOSS	AVERAGE ANNUAL LOSS ESTIMATES
$36,008,700	$600,100

ASSESSMENT OF IMPACTS

Tornadoes have the potential to pose a significant risk to the population and can create dangerous situations. Often, providing and preserving public health and safety is difficult. The impact of climate change could produce larger, more severe tornado events, exacerbating the current

tornado impacts. More destructive tornado conditions can be frequently associated with a variety of impacts, including:

- Individuals exposed to the storm can be struck by flying debris, falling limbs, or downed trees causing serious injury or death.
- Structures can be damaged or crushed by falling trees, which can result in physical harm to the occupants.
- Manufactured homes (less than one percent of total housing stock) may suffer substantial damage as they would be more vulnerable than typical site-built structures.
- Portable classrooms may also suffer substantial damage as they would be more vulnerable than other classroom structures.
- Significant debris and downed trees can result in emergency response vehicles being unable to access areas of the community.
- Downed power lines may result in roadways being unsafe for use, which may prevent first responders from answering calls for assistance or rescue.
- Tornadoes often result in widespread power outages increasing the risk to more vulnerable portions of the population who rely on power for health and/or life safety.
- Extended power outages can result in an increase in structure fires and/or carbon monoxide poisoning as individuals attempt to cook or heat their home with alternate, unsafe cooking or heating devices, such as grills.
- Tornadoes can destroy or make residential structures uninhabitable, requiring shelter or relocation of residents in the aftermath of the event.
- First responders must enter the damage area shortly after the tornado passes to begin rescue operations and to organize cleanup and assessments efforts, therefore they are exposed to downed power lines, unstable and unusual debris, hazardous materials, and generally unsafe conditions, elevating the risk of injury to first responders and potentially diminishing emergency response capabilities.
- Emergency operations and services may be significantly impacted due to damaged facilities, loss of communications, and damaged emergency vehicles and equipment.
- Private sector entities such as utility providers, financial institutions, and medical care providers may not be fully operational and may require assistance from neighboring communities until full services can be restored.
- Economic disruption negatively impacts the programs and services provided by the community due to short- and long-term loss in revenue, especially if damage is sustained to major employers within the planning area.
- Damage to infrastructure may slow economic recovery since repairs may be extensive and lengthy.
- When the community is affected by significant property damage it is anticipated that funding would be required for infrastructure repair and restoration, temporary services and facilities, overtime pay for responders, and normal day-to-day operating expenses.
- Displaced residents may not be able to immediately return to work, further slowing economic recovery.
- Residential structures destroyed by a tornado may not be rebuilt for years, reducing the tax base for the community.
- Large or intense tornadoes may result in a dramatic population fluctuation, as people are unable to return to their homes or jobs and must seek shelter and/or work outside of the affected area.

- Businesses that are uninsured or underinsured may have difficulty reopening, which results in a net loss of jobs for the community and a potential increase in the unemployment rate.
- Recreation activities may be unavailable, and tourism can be unappealing for years following a large tornado, devastating directly related local businesses.
- Tornadoes may destroy or degrade endangered species' habitat.
- Historical sites and properties are placed at a higher risk of impact due to materials used and the inability to change properties due to their historic status. The City of Round Rock planning area has five historical places.

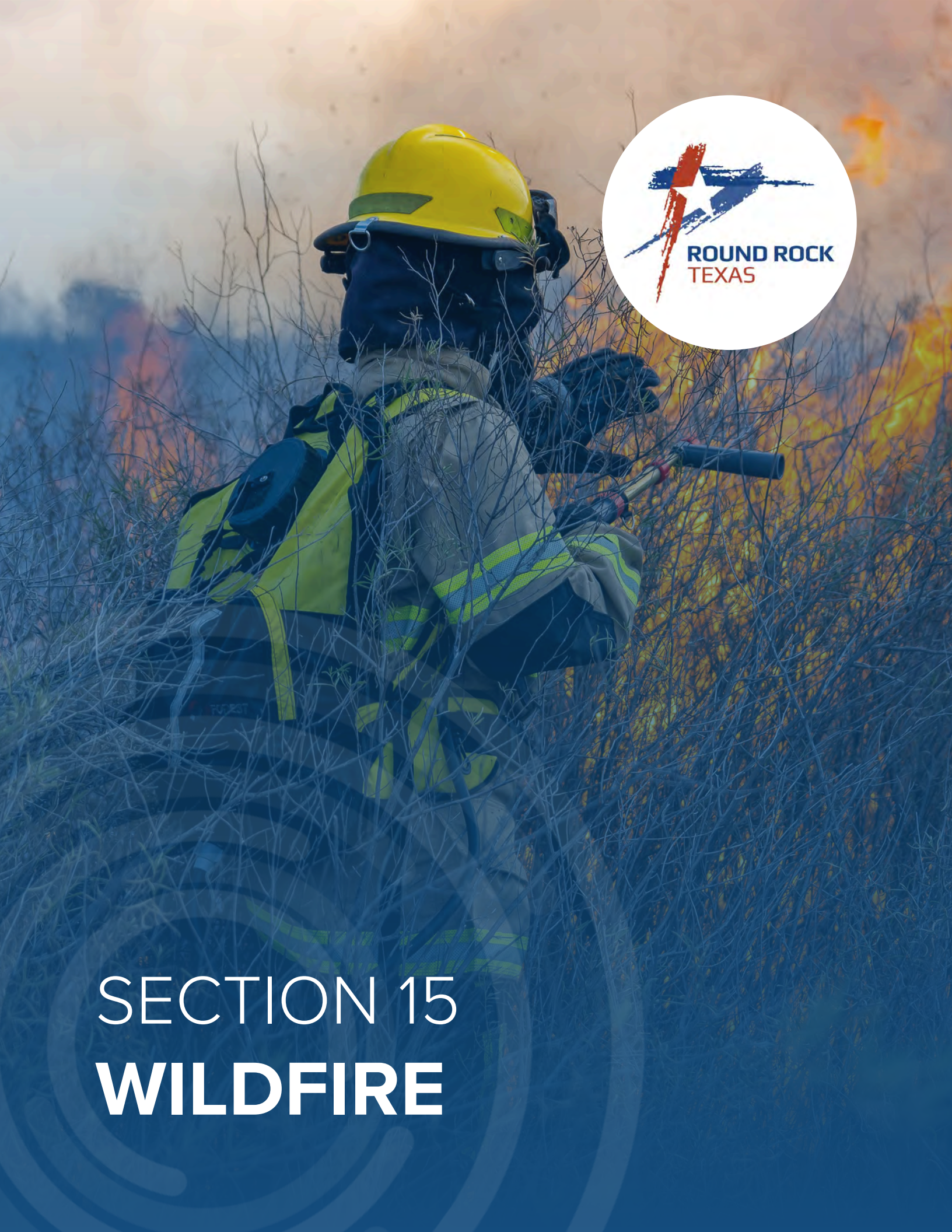
The economic and financial impacts of a tornado event on the community will depend on the scale of the event, what is damaged, costs of repair or replacement, lost business days in impacted areas, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by the community, local businesses, and citizens will contribute to the overall economic and financial conditions in the aftermath of a tornado event.

CLIMATE CHANGE CONSIDERATIONS

The impacts on the frequency and severity of tornado events due to climate change are unclear. According to the Texas A&M 2021 Climate Report Update, the most robust trend in tornado activity in Texas is a likelihood for a greater number of tornadoes in large outbreaks, although the factors contributing to this trend are not expected to continue. Tornadoes spawn from less than 10 percent of thunderstorms, usually supercell thunderstorms that are in a wind shear environment that promotes rotation. [9] Based on climate models that are available, the environmental conditions needed for severe thunderstorm events are estimated to become more likely, resulting in an overall increase in the number of days capable of producing a severe thunderstorm event and potential tornadoes to develop from these storms.[10]

[9] Treisman, Rachel. *The exact link between tornadoes and climate change is hard to draw. Here's why*. NPR. December 13, 2021. https://www.npr.org/2021/12/13/1063676832/the-exact-link-between-tornadoes-and-climate-change-is-hard-to-draw-heres-why

[10] Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900-2036, Texas A&M University Office of the Texas State Climatologist, 2021 update.



SECTION 15
WILDFIRE

HAZARD DESCRIPTION

Wildfire is an unplanned fire burning in natural or wildland areas such as forests, shrub lands, grasslands, or prairies.[1] Texas is one of the fastest growing states in the Nation, with much of this growth occurring adjacent to metropolitan areas. This increase in population across the state will impact counties and communities that are located within the Wildland Urban Interface (WUI). The WUI is described as the area where structures and other human improvements meet and intermingle with undeveloped wildland or vegetative fuels. Population growth within the WUI substantially increases the risk of wildfire. In Texas, nearly 85 percent of wildfires occur within two miles of a community. The City of Round Rock planning area has an estimated 59 percent of the total planning area population that live within the WUI.[2]

Wildfires have the potential to spread quickly given the right environmental conditions, particularly within the wildland urban interface and intermix. Most ignition sources for wildfires are a result of human activities, such as an electrical line sparking dry grasses, an improperly discarded cigarette, burning debris, or arson.

Development has increased drastically in central Texas, resulting in more populated areas within the wildland interface/intermix. Additionally, the area is experiencing hotter, drier climatic conditions. These factors combined make Central Texas at risk from wildfires. While the planning area is continually at some risk for wildfires, that risk is elevated during two periods each year: the winter wildfire season (February through April) and the summer wildfire season (August through October).[3]

The City of Round Rock population is expected to increase over time following population trends over the last few decades. Continued housing development in the WUI will put more people at a greater risk of catastrophic wildfire and put more pressure on land managers and fire department personnel to mitigate fire risk.

[1] FEMA: https://hazards.fema.gov/nri/wildfire
[2] Texas A&M Forest Service, Texas Wildfire Risk Assessment Summary Report, City of Round Rock: https://texaswildfirerisk.com/
[3] Austin American Statesman, “Winter wildfire risk is rising in Central Texas. Here’s what you should know.” January 2023: https://www.statesman.com/story/news/environment/2023/01/30/wildfire-risk-is-rising-in-central-texas-what-you-should-know/69845234007/

Wildfires spread based on the type and quantity of fuel that surrounds it. Fuel can include everything from trees, underbrush and dry grassy fields to homes. The amount of flammable material that surrounds a fire is referred to as the fuel load. Conditions in the weather and environment, such as drought, winds and extreme heat, can cause a fire to spread more quickly.[4] A wildfire event often begins unnoticed and spreads quickly, lighting brush, trees, and homes on fire. For example, a wildfire may be started by a campfire that was not doused properly, a tossed cigarette, burning debris, or arson.

Texas has seen a significant increase in the number of wildfires in the past 30 years, which included wildland, urban interface, or intermix fires. Wildland fires are fueled almost exclusively by natural vegetation, while interface or intermix fires are urban / wildland fires in which vegetation and the built environment provide fuel.

LOCATION

A wildfire incident can create devastating consequences which can be caused or exacerbated by human activities, drought conditions, lightning, or wind events, if the conditions allow. Wildfires can vary greatly in terms of size, location, intensity, and duration. While wildfires are not confined to any specific geographic location, they are most likely to occur in open grasslands.

The Texas A&M Forest Service Wildfire Risk Assessment Portal (TxWRAP) provides historical wildfire data for Texas counties along with mapping resources that includes data layers on the WUI, ignition density, and fire intensity scales throughout the City of Round Rock, along with multiple tips, recommendations, and mitigation solutions for communities and residents. The TxWRAP portal was utilized to produce the maps found in this profile.

The threat to people and property from a wildfire event is greater in the fringe areas where developed areas meet open grass lands, such as the Wildland Urban Interface (WUI) (Figure 15-1). It is estimated that 59 percent of the total population in the City of Round Rock live within the WUI. However, the entire city is at some risk for wildfires.

[4] NOAA Weather Forecasting: https://scijinks.gov/wildfires/

Figure 15-1. Wildland Urban Interface Map – City of Round Rock

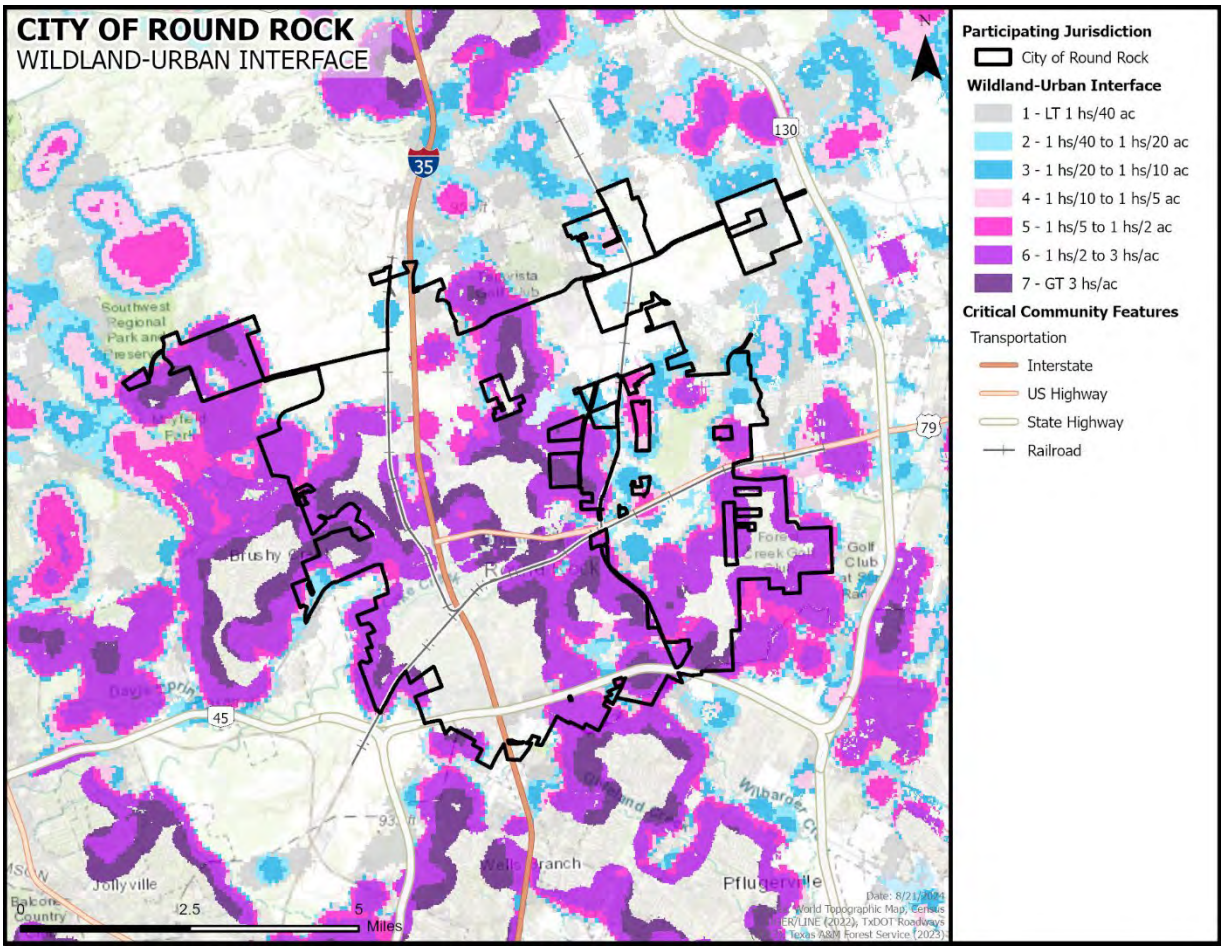
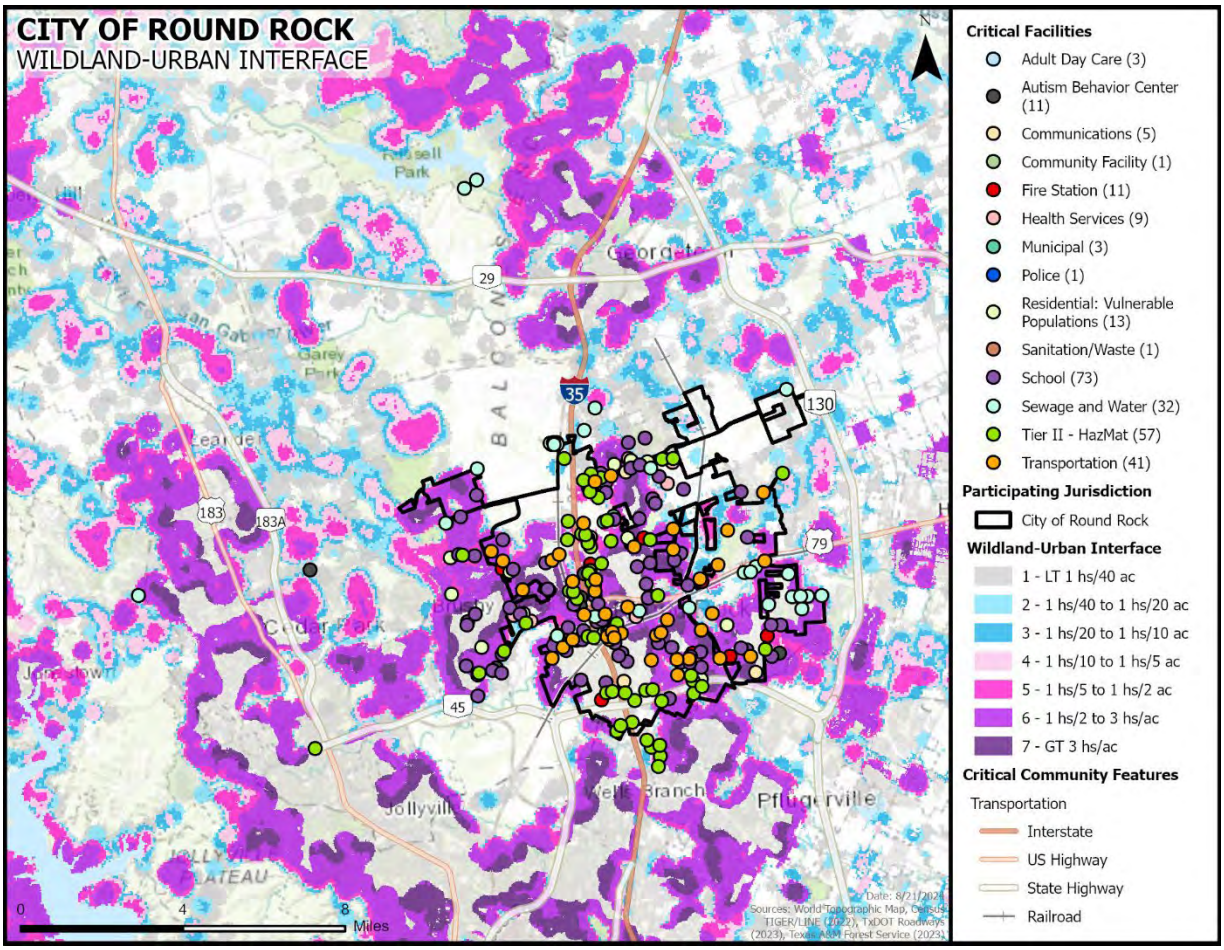


Figure 15-2. Wildland Urban Interface Map with Critical Facilities – City of Round Rock

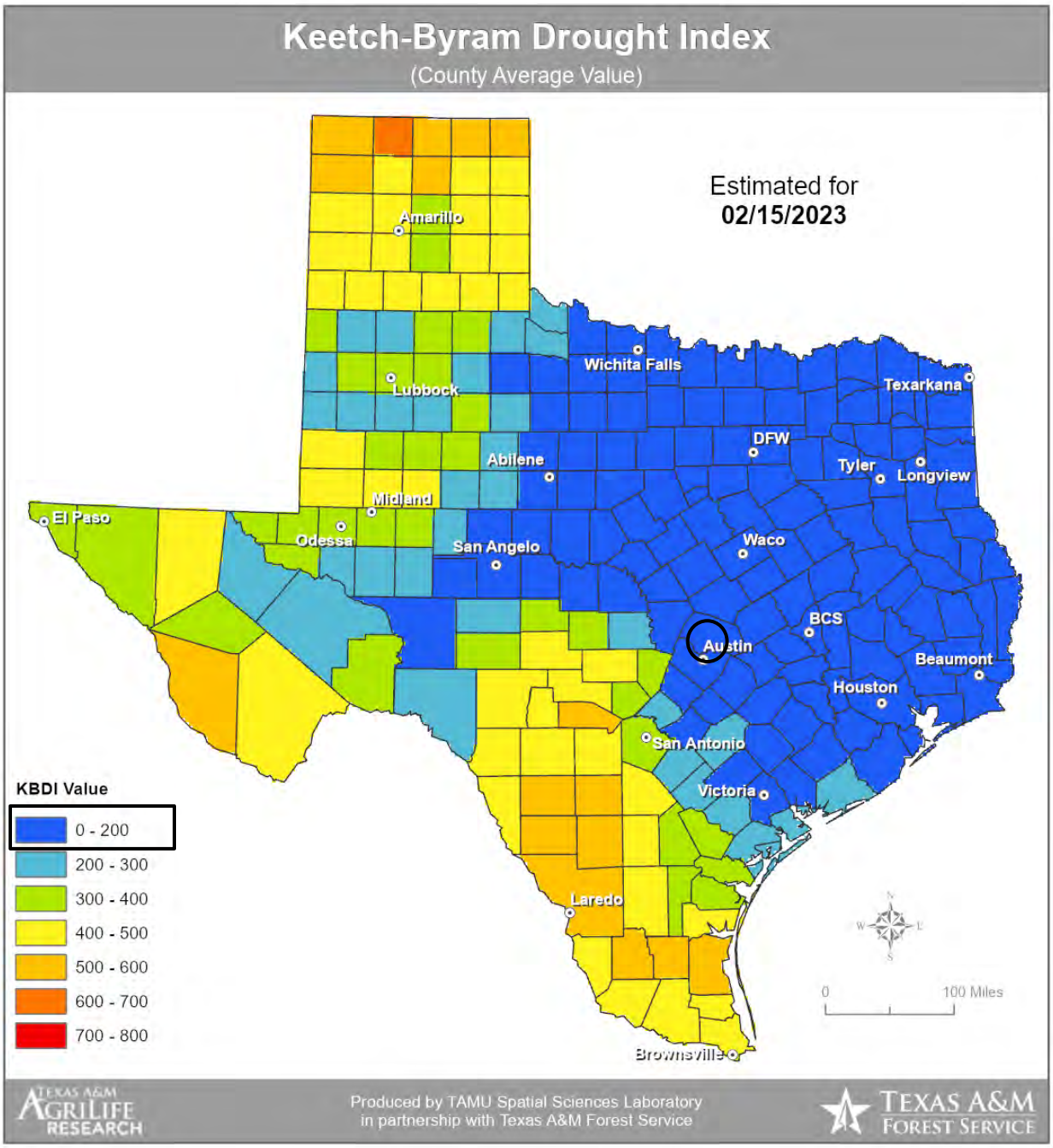


EXTENT

Risk for a wildfire event is measured in terms of magnitude and intensity using the Keetch Byram Drought Index (KBDI), a mathematical system for relating current and recent weather conditions to potential or expected fire behavior. The KBDI determines forest fire potential based on a daily water balance, derived by balancing a drought factor with precipitation and soil moisture (assumed to have a maximum storage capacity of eight inches), and is expressed in hundredths of an inch of soil moisture depletion.

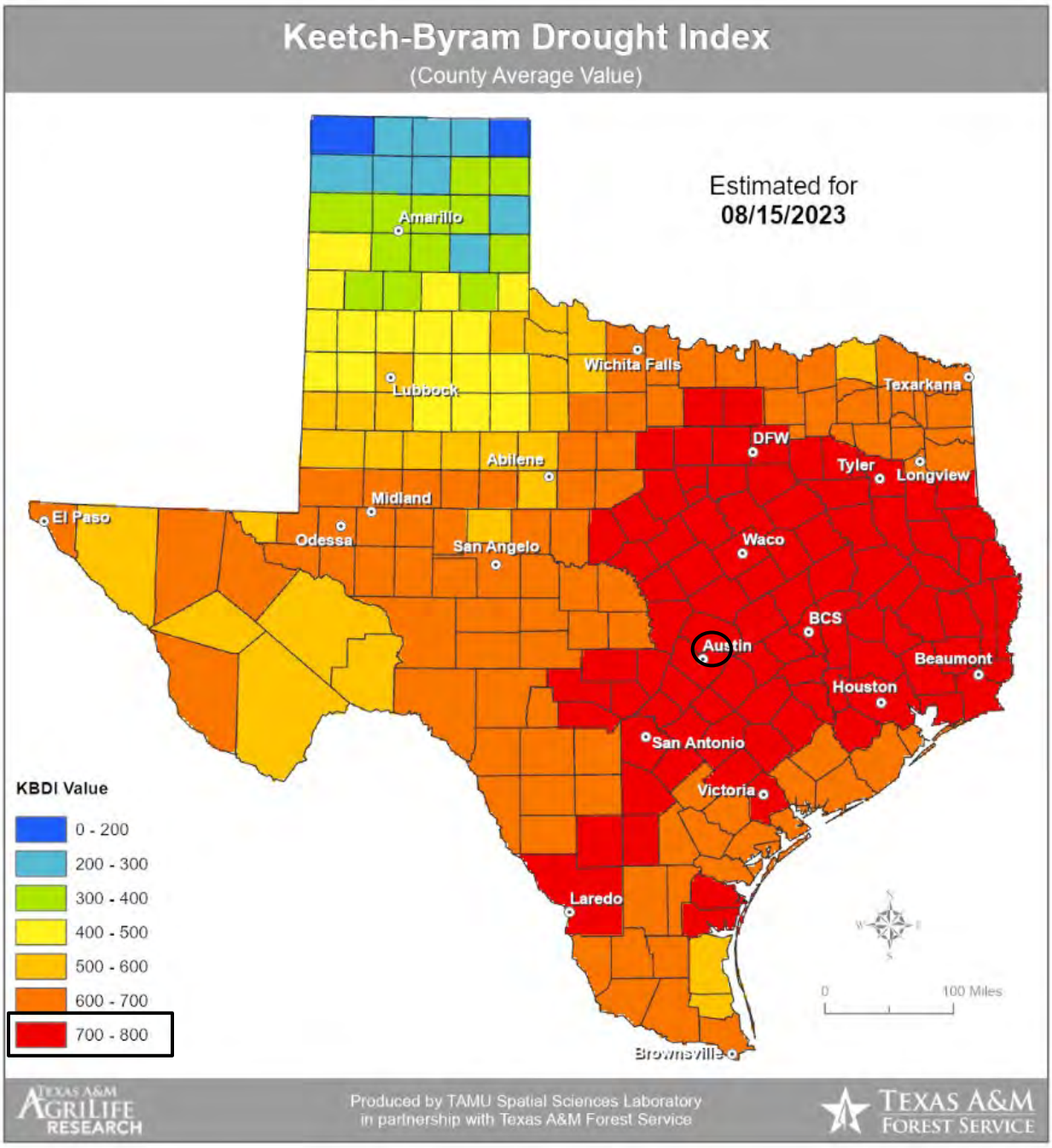
Each color in Figure 15-3 and 15-4 represents the drought index at that location, by date. The drought index ranges from 0 to 800. A drought index of 0 represents no moisture depletion, and a drought index of 800 represents absolutely dry conditions.

Figure 15-3. Keetch-Byram Drought Index (KBDI) for the State of Texas, 2/15/2023[5]



[5] City of Round Rock planning area is located within the black circle.

Figure 15-4. Keetch-Byram Drought Index (KBDI) for the State of Texas, 2023[6]



Fire behavior can be categorized at four distinct levels on the KBDI:

- **0 -200:** Soil and fuel moisture are high. Most fuels will not readily ignite or burn. However, with sufficient sunlight and wind, cured grasses and some light surface fuels will burn in spots and patches.

[6] City of Round Rock planning area is located within the black circle.

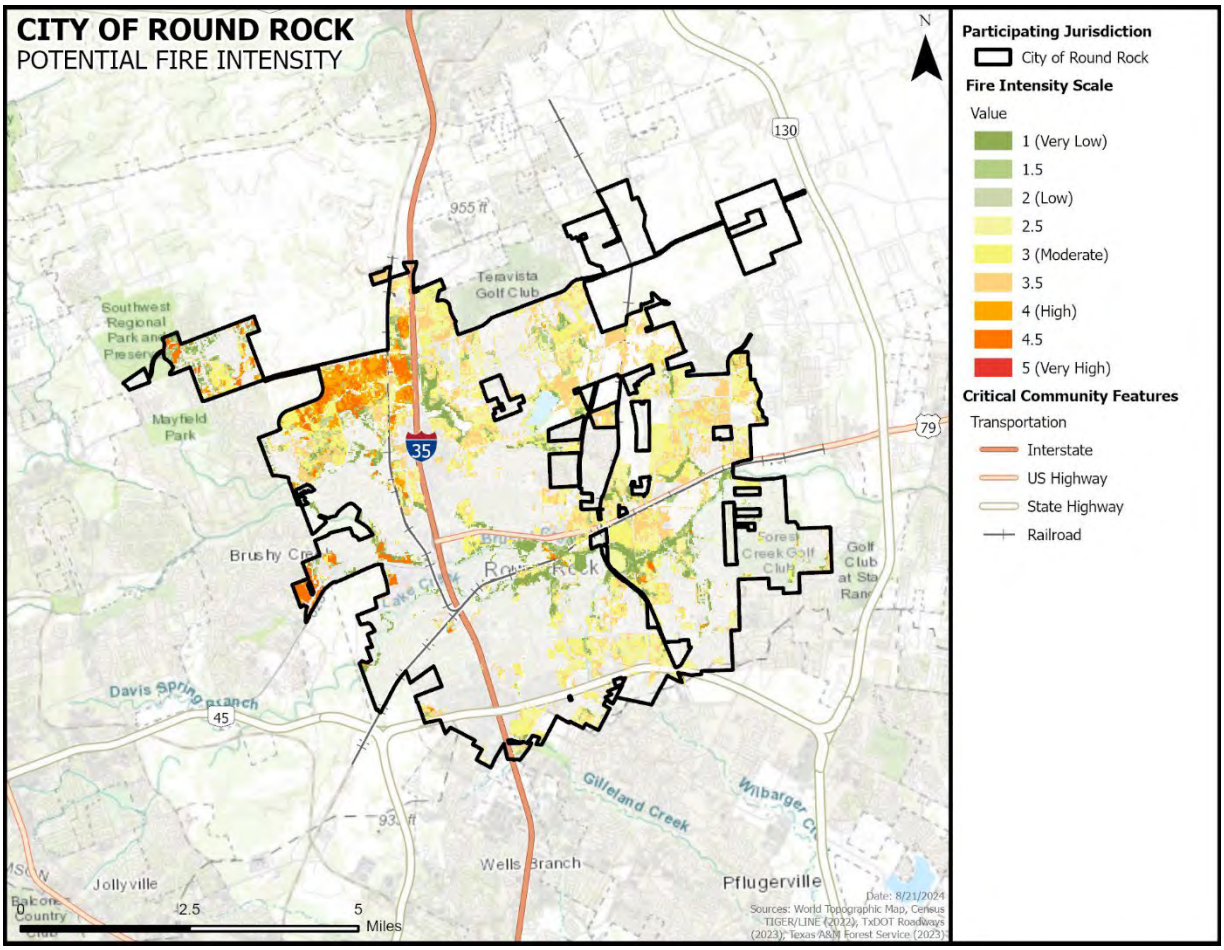
- **200 -400:** Fires more readily burn and will carry across an area with no gaps. Heavier fuels will not readily ignite and burn. Expect smoldering and the resulting smoke to carry into and possibly through the night.
- **400 -600:** Fires intensity begins to significantly increase. Fires will readily burn in all directions exposing mineral soils in some locations. Larger fuels may burn or smolder for several days creating possible smoke and control problems.
- **600 -800:** Fires will burn to mineral soil. Stumps will burn to the end of underground roots and spotting will be a major problem. Fires will burn through the night and heavier fuels will actively burn and contribute to fire intensity.

The KBDI is a good measure of the readiness of fuels for a wildfire event. It should be referenced as the area experiences changes in precipitation and soil moisture, while caution should be exercised in dryer, hotter conditions.

The range of intensity for the City of Round Rock planning area, in a wildfire event, is within 700 to 800. The average extent to be mitigated for the planning area is a KBDI of 630. Based on historical occurrences and readily available fuel, the planning area can anticipate a KBDI range from 0 to 800. At the high end of this range fires will burn to mineral soil. Stumps will burn to the end of underground roots and spotting will be a major problem. Fires will burn through the night and heavier fuels will actively burn and contribute to fire intensity.

The Texas Forest Service's Fire Intensity Scale identifies areas where significant fuel hazards and associated dangerous fire behavior potential exist based on weighted average of four percentile weather categories. The City of Round Rock has a potential for a full range of wildfire intensities. Figure 15-5 identifies the wildfire intensity for the City of Round Rock.

Figure 15-5. Fire Intensity Scale Map – City of Round Rock



HISTORICAL OCCURRENCES

The Texas Forest Service reported 105 wildfire events for the City of Round Rock between 2005 and 2021. There are no reported events in the NCEI Storm Events Database for the City of Round Rock. The Texas A&M Forest Service (TFS) started collecting wildfire reports by volunteer fire departments in 2005. Due to a lack of recorded data for wildfire events prior to 2005 and after 2021, frequency calculations are based on a 17-year reporting period, using only data from recorded years. The map below shows approximate locations of wildfires, which can be grass or brushfires of any size (Figure 15-6). Tables 15-1 through 15-3 identify the number of wildfires and total acreage burned each year within the city boundaries.

Figure 15-6. Location and Historic Wildfire Events in City of Round Rock

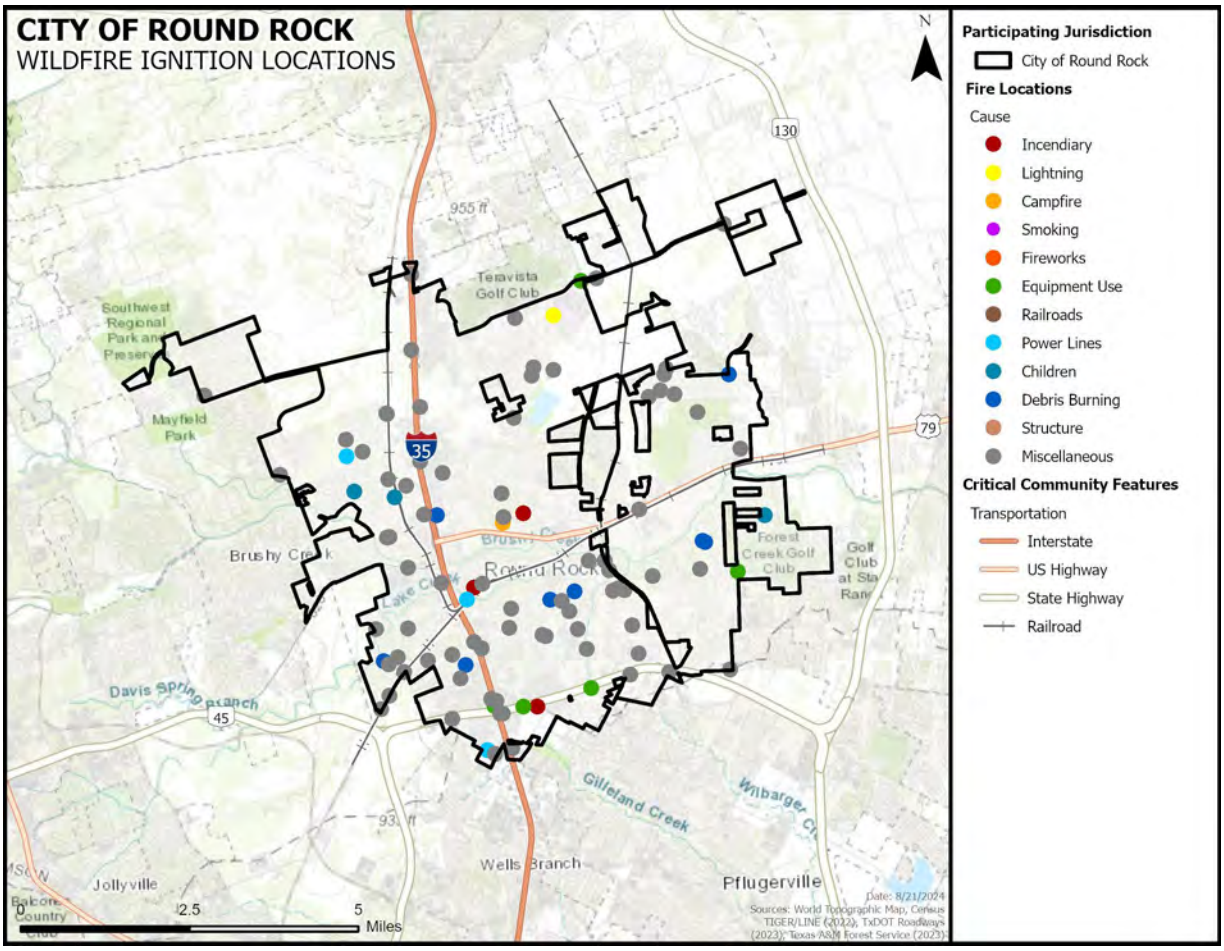


Table 15-1. Historical Wildfire Events Summary, 2005 - 2021[7]

NUMBER OF EVENTS	ACRES BURNED
105	78

[7] Source: Texas A&M Forest Service

Table 15-2. Historical Wildfire Events by Year

YEAR	CITY OF ROUND ROCK
2005	5
2006	19
2007	0
2008	1
2009	36
2010	4
2011	22
2012	9
2013	2
2014	5
2015	2
2016	0
2017	0
2018	0
2019	0
2020	0
2021	0
Total	**105**

Based on the list of historical wildfire events from the Texas A&M Forest Service for the City of Round Rock (listed above), no reported events have occurred since the 2018 plan.

Table 15-3. Acreage of Suppressed Wildfire by Year

YEAR	CITY OF ROUND ROCK
2005	8
2006	13
2007	0
2008	0

YEAR	CITY OF ROUND ROCK
2009	9
2010	3
2011	20
2012	18
2013	2
2014	2
2015	3
2016	0
2017	0
2018	0
2019	0
2020	0
2021	0
Total	**78**

SIGNIFICANT EVENTS

There have been nine declared disasters related to wildfire between 1953 and 2023 in Williamson County, which includes the City of Round Rock planning area (Table 15-4).

Table 15-4. Disaster Declarations for Wildfire, 1953-2023

YEAR	DECLARATION TITLE	DECLARATION TYPE	DISASTER NO.
1993	Texas Extreme Fire Hazard	EM	EM-3113
1999	Texas Extreme Fire Hazards	EM	EM-3142-TX
2006	Extreme Wildfire Threat in Texas	DR	DR-1624-TX
2008	Wildfires in Texas	EM	EM-3284-TX
2008	Texas Florence Fire	FM	FM-2785-TX
2011	Texas Grand Mesa Fire	FM	FM-2922-TX
2011	Texas Horseshoe Fire	FM	FM-2949-TX
2011	Texas Moonglow Fire	FM	FM-2963-TX
2011	Wildfires in Texas	DR	DR-4029-TX

PROBABILITY OF FUTURE EVENTS

Wildfires can occur at any time of the year. As the City of Round Rock moves into wildland, the potential area of occurrence of wildfire increases. With 105 events in a 17-year period, an event within the City of Round Rock planning area is “Highly Likely”, meaning an event is probable within the next year. According to NOAA, research shows that changes in climate create warmer, drier conditions, leading to longer and more active fire seasons, indicating an increase in the frequency and severity of events in the planning area going forward.

VULNERABILITY AND IMPACT

Periods of drought, dry conditions, high temperatures, and low humidity are factors that contribute to the occurrence of a wildfire event. Less developed areas, such as along interstates or in more remote areas where fuels are more prevalent have an increased risk of being affected by wildfire.

The more heavily populated areas of the planning area are not highly likely to experience large, sweeping fires. Unoccupied buildings and open spaces that have not been maintained have the greatest vulnerability to wildfire. The greatest level of concern for wildfires is located across the city where wildland and urban areas interface. Figure 15-6[8] illustrates the areas that are the most vulnerable to wildfire throughout the City of Round Rock.

The City of Round Rock Planning Team identified the following critical facilities (Table 15-5) as assets that are considered the most important to the planning area and are susceptible to a range of impacts caused by wildfire events. For a comprehensive list of critical facilities, please see Appendix C.

Table 15-5. Critical Facilities / Critical Services Vulnerable to Wildfire Events

CRITICAL FACILITIES	CRITICAL FACILITIES AT RISK	POTENTIAL IMPACTS
Emergency Response Services (EOC, Fire, Police, EMS), Hospitals and Medical Centers	7 Fire Stations, 7 Health Services, 1 Police	• Emergency services may be disrupted during a wildfire if facilities are impacted, roadways are inaccessible, or personnel are unable to report for duty. • First responders are at greater risk of injury when in close proximity to the hazard while extinguishing flames, protecting property, or evacuating residents in the area. • Critical city departments may not be able to function and provide necessary services depending on the location of the fire and the structures or personnel impacted. • Roadways in or near the WUI could be damaged or closed due to smoke and limited visibility, slowing or preventing access for emergency response vehicles. • Fire suppression costs can be substantial, exhausting the financial resources of the community.

[8] Source: TxWRAP portal at the following site: https://texaswildfirerisk.com/

CRITICAL FACILITIES	CRITICAL FACILITIES AT RISK	POTENTIAL IMPACTS
		• First responders can experience heart disease, respiratory problems, and other long-term related illnesses from prolonged exposure to smoke, chemicals, and heat. • Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications. • Power outages could disrupt communications, delaying emergency response times. • Structures can be damaged or destroyed in the path of the wildfire. • Power outages could disrupt critical care. • Backup power sources could be damaged or destroyed. • Critical staff may be injured or otherwise unable to report for duty, limiting response capabilities.
Airport, Academic Institutions, Animal Shelter, Evacuation Centers & Shelters, Governmental Facilities, Residential/ Assisted Living Facilities	9 Community Facilities for Vulnerable Populations, 3 Municipal, 13 Residential Facilities for Vulnerable Populations, 51 Schools, 33 Transportation	• Facilities or infrastructure may be damaged, destroyed or otherwise inaccessible. • Essential supplies like medicines, water, food, and equipment deliveries may be significantly delayed. • Additional emergency responders and critical aid workers may not be able to reach the area for days. • Power outages and infrastructure damage may prevent larger airports from acting as temporary command centers for logistics, communications, and emergency operations.
Commercial Supplier (food, fuel, etc.)	N/A	• Facilities, infrastructure, or critical equipment including communications may be damaged, destroyed or otherwise inoperable. • Essential supplies like medicines, water, food, and equipment deliveries may be delayed. • Economic disruption due to power outages and fires negatively impact services as well as area businesses reliant on commercial suppliers.
Utility Services and Infrastructure (electric, water, wastewater, communications), Hazardous Materials	3 Communications, 1 Sanitation/Waste, 18 Sewage and Water, 38 Hazardous Materials	• Wastewater and drinking water facilities and infrastructure may be damaged or destroyed resulting in service disruption or outage for multiple days or weeks. • Disruptions and outages impact public welfare as safe drinking water is critical. • A break in essential and effective wastewater collection and treatment is a health concern, potentially spreading disease. • Exposure to hazardous materials and untreated wastewater is harmful to people and the environment.

CRITICAL FACILITIES	CRITICAL FACILITIES AT RISK	POTENTIAL IMPACTS
		• Any service disruptions can negatively impact or delay emergency management operations. • Power losses

Within the City of Round Rock, a total of 105 fire events were reported from 2005 through 2021 by Texas A&M Forest Service. All events were suspected wildfires. Historic loss and annualized estimates of acres burned due to wildfires are presented in Table 15-6 below. The average frequency is approximately 6 events every year.

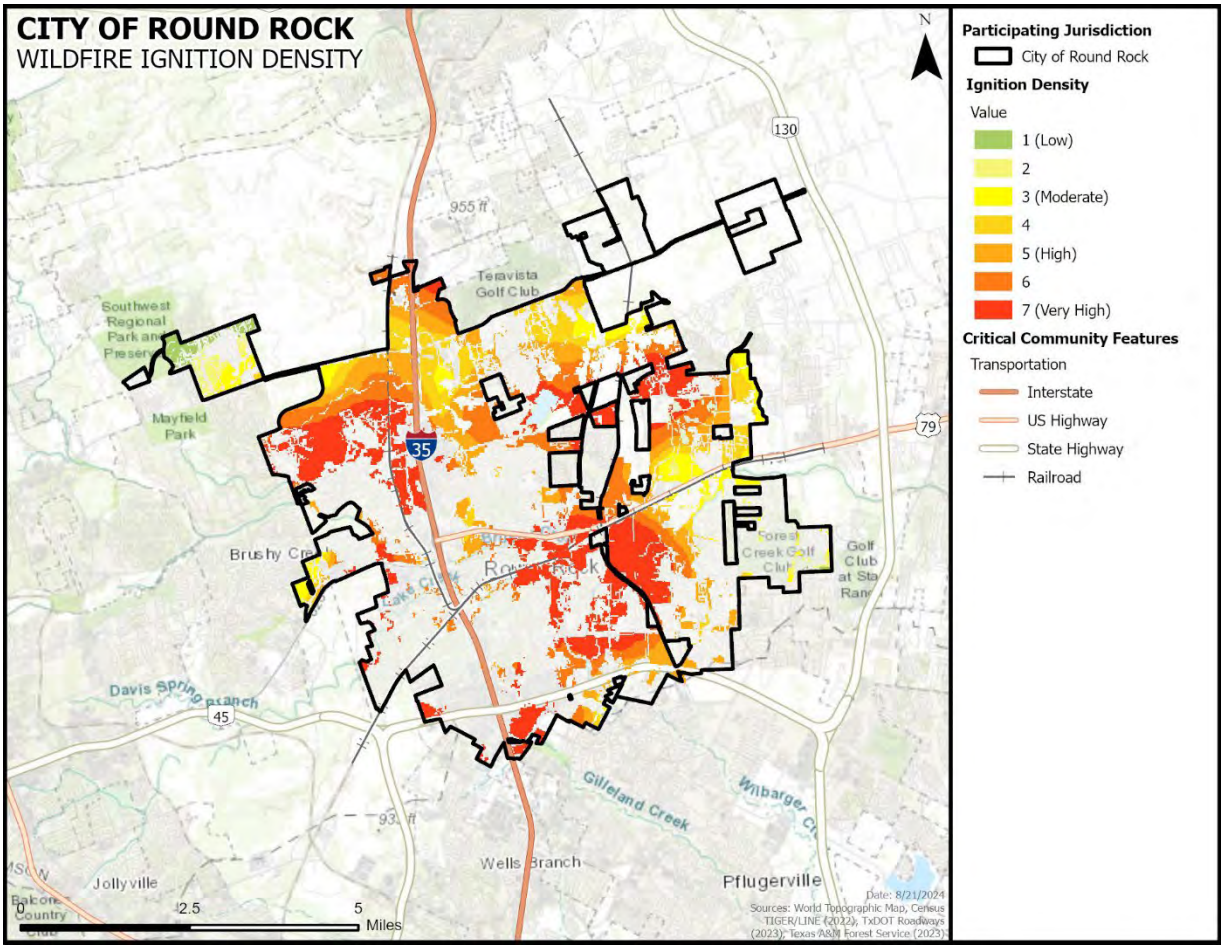
Table 15-6. Average Annualized Acreage Losses[9]

TOTAL ACRES BURNED	AVERAGE ANNUAL ACRE LOSSES
78	5

Wildfire Ignition Density shows the likelihood of a wildfire starting based on historical ignition patterns. Occurrence is derived by modeling historic wildfire ignition locations to create an average ignition rate map. The ignition rate is measured in the number of fires per year per 1,000 acres. Wildfire Ignition Density is a key input into the calculation of the Wildfire Threat output. With most Texas fires being human caused, there is a repeatable spatial pattern of fire ignitions over time. This pattern identifies areas where wildfires are most likely to ignite, and prevention efforts can be planned accordingly.[10] Figure 15-7 show the threat of wildfire to the City of Round Rock.

[9] Events divided by 17 years of data.
[10] Source: TxWRAP portal at the following site: https://texaswildfirerisk.com/

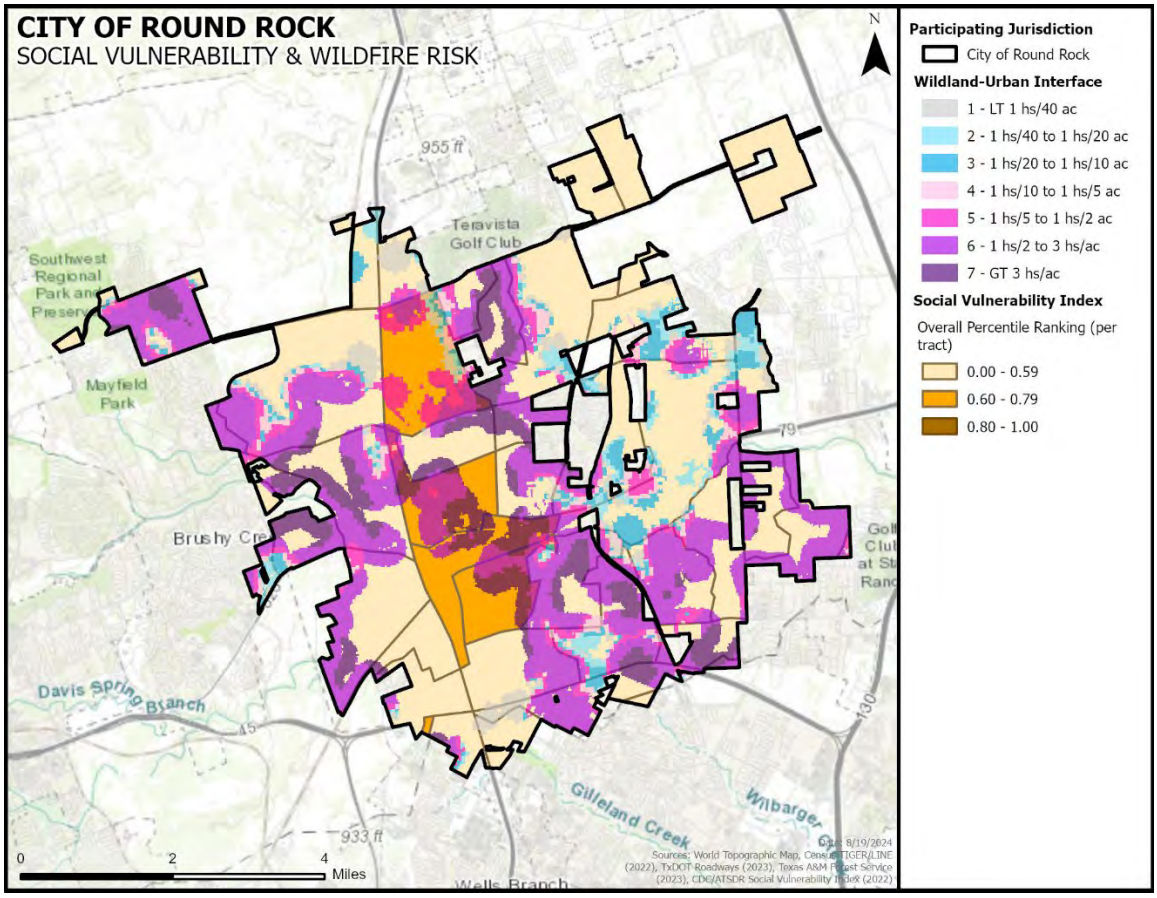
Figure 15-7. Wildfire Ignition Density – City of Round Rock



Diminished air quality is an environmental impact that can result from a wildfire event and pose a potential health risk. The smoke plumes from wildfires can contain potentially inhalable carcinogenic matter. Fine particles of invisible soot and ash that are too small for the respiratory system to filter can cause immediate and possibly long-term health effects. The elderly or those individuals with compromised respiratory systems may be more vulnerable to the effects of diminished air quality after a wildfire event.

The Center for Disease Control (CDC) created a Social Vulnerability Index (SVI) which includes a database and mapping application that identifies and quantifies communities experiencing social vulnerability. The current CDC SVI uses 16 U.S. census variables from the 5-year American Community Survey (ACS) to identify communities that may need support before, during, or after disasters. All 16 variables fall under four broad categories including socioeconomic status (population in poverty, unemployment, etc.), household characteristics (age, disability status, etc.), racial and ethnic minority status, and housing type and transportation (mobile homes, no vehicles, etc.). Populations experiencing social vulnerability may be adversely impacted by natural hazards, disasters, and other community-level stressors. Figure 15-8 identifies areas of social vulnerability using the CDC's SVI and where these areas overlap the City of Round Rock's WUI areas, where wildfire risk is considered the highest.

Figure 15-8. The City of Round Rock's Social Vulnerability and WUI



Climatic conditions such as severe freezes and drought can significantly increase the intensity of wildfires since these conditions kill vegetation, creating a prime fuel source for wildfires. The intensity and rate at which wildfires spread are directly related to wind speed, temperature, and relative humidity.

The severity of impact from major wildfire events can be substantial. Such events can cause multiple deaths, shut down facilities for 30 days or more, and cause more than 50 percent of affected properties to be destroyed or suffer major damage. Severity of impact is gauged by acreage burned, homes and structures lost, and the number of resulting injuries and fatalities.

Based off of historical data for the City of Round Rock, the impact from a wildfire event can be considered "Minor," meaning injuries and/or illnesses do not result in permanent disability, complete shutdown of facilities and services for more than one week and more than 10 percent of property is destroyed or with major damage. Severity of impact is gauged by acreage burned, homes and structures lost, injuries and fatalities.

Table 15-7. Impact for City of Round Rock

IMPACT	DESCRIPTION
Minor	City of Round Rock has an estimated 57,610 people or 59% of the total population that live within the Wildland Urban Interface (WUI). The housing density is most commonly 3 houses per 1 acre. City residents may suffer injuries that do not result in permanent disability. Critical facilities could be shut down for more than one week, and more than 10 percent of total property could be damaged.

ASSESSMENT OF IMPACTS

A Wildfire event poses a potentially significant risk to public health and safety, particularly if the wildfire is initially unnoticed and spreads quickly. The impacts associated with a wildfire are not limited to direct damage. Significant wildfire events can be frequently associated with a variety of impacts, including:

- The City of Round Rock planning area contains several open space areas. Wildfire may adversely affect or destroy endangered species habitat, reduce air quality, increase erosion and risk of flash flooding, contribute to increased local temperatures, and disrupt other ecological functions.
- Recreation activities throughout city parks may be unavailable and tourism can be unappealing for years following a large wildfire event, devastating directly related local businesses and negatively impacting economic recovery.
- Persons, pets, and wildlife in the area at the time of the fire are at risk for injury or death from burns and/or smoke inhalation. First responders are at greater risk of physical injury when in close proximity to the hazard while extinguishing flames, protecting property, or evacuating residents in the area.
- First responders can experience heart disease, respiratory problems, and other long-term related illnesses from prolonged exposure to smoke, chemicals, and heat.
- Emergency services may be disrupted during a wildfire if facilities are impacted, roadways are inaccessible, or personnel are unable to report for duty.
- Critical city departments may not be able to function and provide necessary services depending on the location of the fire and the structures or personnel impacted.
- Non-critical businesses may be directly damaged, suffer loss of utility services, or be otherwise inaccessible, delaying normal operations and slowing the recovery process.
- Displaced residents may not be able to immediately return to work, slowing economic recovery.
- Roadways in or near the WUI could be damaged or closed due to smoke and limited visibility.
- Older homes are generally exempt from modern building code requirements, which may require fire suppression equipment in the structure. 12 percent (approximately 5,539 structures) of homes in the planning area were built before 1980. Similarly, historic buildings may lack fire mitigation materials or measures due to their historic status. There

are five historical places listed on the National Register of Historic Places for the City of Round Rock.
- Some high-density neighborhoods feature small lots with structures close together, increasing the potential for fire to spread rapidly.
- Air pollution from smoke may exacerbate respiratory problems of vulnerable residents.
- Charred ground after a wildfire cannot easily absorb rainwater, increasing the risk of flooding and potential mudflows.
- Wildlife may be displaced or destroyed.
- Historical or cultural resources may be damaged or destroyed.
- Tourism can be significantly disrupted, further delaying economic recovery for the area.
- Economic disruption negatively impacts the programs and services provided by the community due to short- and long-term loss in revenue.
- Fire suppression costs can be substantial, exhausting the financial resources of the community.
- Residential structures lost in a wildfire may not be rebuilt for years, reducing the tax base for the community.
- Direct impacts to municipal water supply may occur through contamination of ash and debris during the fire, destruction of aboveground delivery lines, and soil erosion or debris deposits into waterways after the fire.

The economic and financial impacts of a wildfire event on local government will depend on the scale of the event, what is damaged, costs of repair or replacement, lost business days in impacted areas, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by the community, local businesses, and citizens will contribute to the overall economic and financial conditions in the aftermath of a wildfire event.

CLIMATE CHANGE CONSIDERATIONS

Wildfires require the alignment of a number of factors, including temperature, humidity, and the lack of moisture in fuels, such as trees, shrubs, grasses, and forest debris. All these factors have strong direct or indirect ties to climate variability and climate change. Research shows that changes in climate create warmer, drier conditions, leading to longer and more active fire seasons. Increases in temperatures and the thirst of the atmosphere due to human--caused climate change have increased aridity of forest fuels during the fire season.[11]

Vapor pressure deficit, an indicator of the ability of moisture to evaporate, is projected to increase as temperatures rise and carbon dioxide fertilization reduces transpiration, leading to both lower humidity and increased surface dryness. Overall, increased dryness should extend the wildfire season in places where the fire season is presently constrained by low levels of aridity, such as eastern Texas.[12]

Additionally, it is projected that future changes to the City of Round Rock will include increased temperatures, which according to the U.S. Climate Explorer, the planning area may experience a 6°F increase in the average extreme heat temperatures. Historically, extreme temperatures

[11] NOAA Wildfire Climate Connection, August 2022: wildfire-climate-connection.
[12] Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900-2036, Texas A&M University Office of the Texas State Climatologist, 2021 update.

averaged 100°F in the City of Round Rock, but between 2035 and 2064 the average will be 106°F, increasing the severity and frequency of drought events. The increase in temperature could be higher but will depend on overall future emissions. Changes in precipitation will also impact drought occurrences. The U.S. Climate Explorer also shows that a decrease in overall precipitation is likely overtime, between a 1% and 6% decrease in annual count of intense rainstorms, which are those that drop two or more inches of rain in one day.

Extreme heat and extended periods of drought contribute to wildfire risk in the planning area. Extreme temperatures and periods of drought destroy vegetation in the area, contributing to available fuels that spread wildfires. Additional climate change impacts from drought and extreme heat are discussed in Sections 6 and 8 of this Plan. The projected increases in favorable wildfire conditions, including drought and extreme heat, indicate an increase in favorable wildfire conditions. Additional information and studies are needed to determine the degree and rate of any increased wildfire risk.

SECTION 16
WINTER STORM

SECTION 16: WINTER STORM

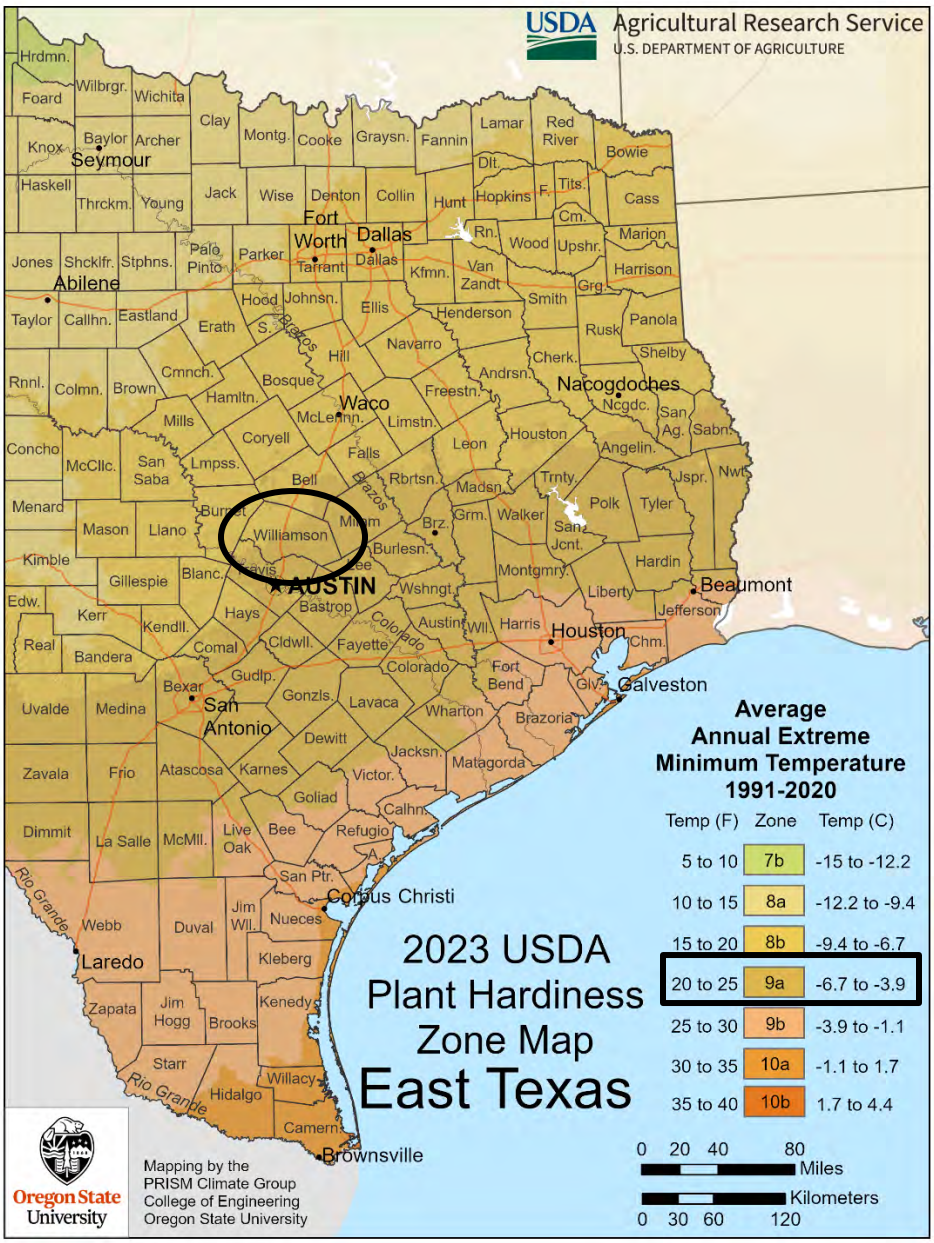
HAZARD DESCRIPTION

A severe winter storm event is identified as a storm with snow, ice, or freezing rain. This type of storm can cause significant problems for area residents. Winter storms are associated with freezing or frozen precipitation such as freezing rain, sleet, snow, and the combined effects of winter precipitation and strong winds. Wind chill is a function of temperature and wind. Low wind chill is a product of high winds and freezing temperatures.

Winter storms that threaten the City of Round Rock planning area usually begin as powerful cold fronts that push south from central Canada. Although the city is at risk of ice hazards, extremely cold temperatures, and snow, the effects and frequencies of winter storm events are generally mild and short-lived.

As indicated in Figure 16-1, the City of Round Rock planning area is located in USDA Hardiness Zone 9a, with annual minimum temperatures between 20°F and 25°F. During times of ice and snow accumulation, response times will increase until public works road crews are able to make major roads passable. Table 16-1 describes the types of winter weather possible to occur in the City of Round Rock planning area.

Figure 16-1. Annual Minimum Temperature[1]



[1] USDA

Table 16-1. Types of Winter Weather

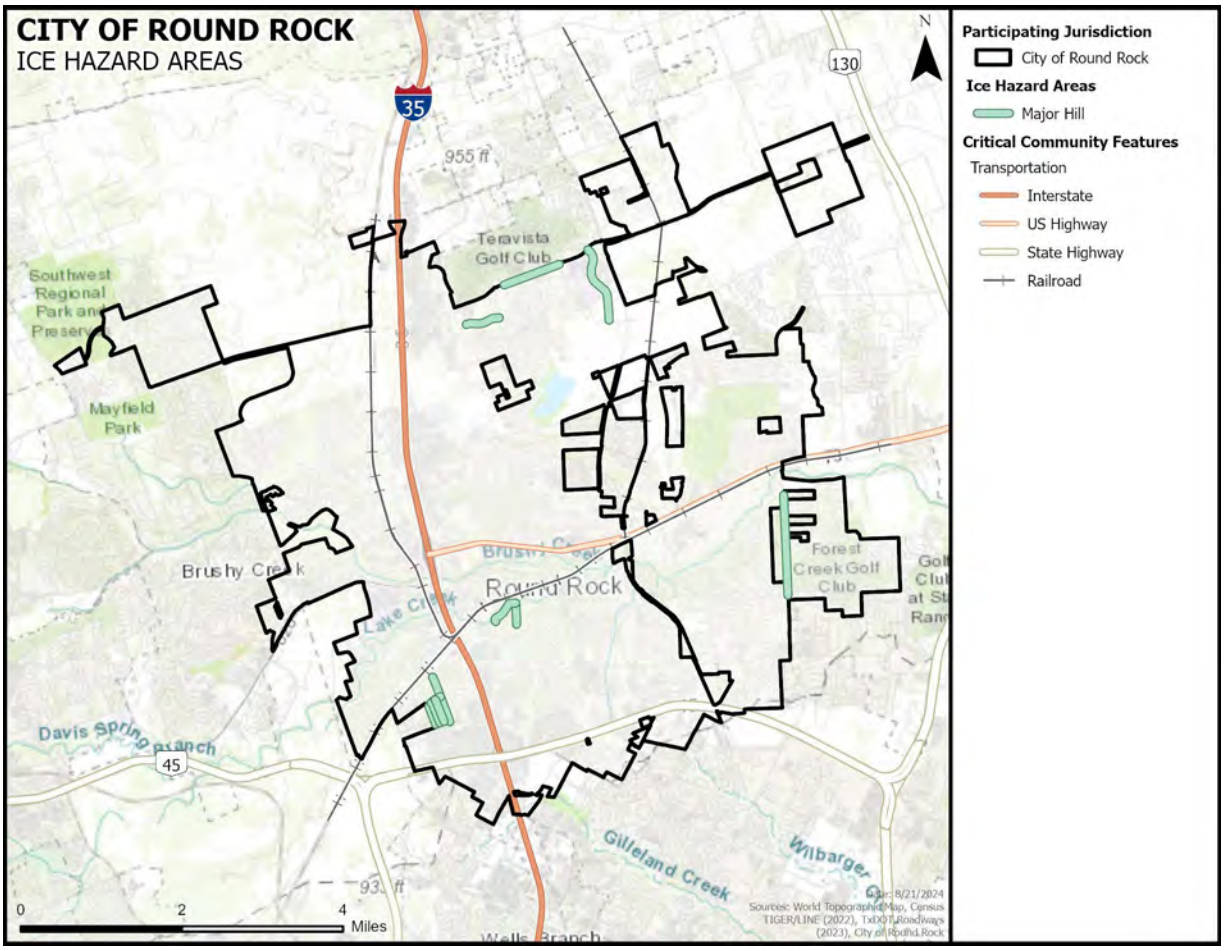
TYPE OF WINTER WEATHER	DESCRIPTION
Freezing Rain or Freezing Drizzle	Rain or drizzle is likely to freeze upon impact, resulting in a coating of ice glaze on roads and all other exposed objects.
Sleet	Small particles of ice usually mixed with rain. If enough sleet accumulates on the ground, it makes travel hazardous.
Blizzard	Sustained wind speeds of at least 35 mph are accompanied by considerable falling or blowing snow. This alert is the most perilous winter storm with visibility dangerously restricted.
Frost/Freeze	Below freezing temperatures are expected and may cause significant damage to plants, crops, and fruit trees.
Wind Chill	A strong wind combined with a temperature slightly below freezing can have the same chilling effect as a temperature nearly 50 degrees lower in a calm atmosphere. The combined cooling power of the wind and temperature on exposed flesh is called the wind-chill factor.

LOCATION

Winter storm events are not confined to specific geographic boundaries. Therefore, all existing and future buildings, facilities, and populations in the City of Round Rock planning area are vulnerable to a winter storm hazard and could potentially be impacted.

All of the planning area is equally vulnerable to an occurrence of a winter storm event. However, certain areas pose increased risk to automobile transportation and may require special attention and resources from the City. Ten stretches of road within the City of Round Rock planning area were identified by the Planning Team as major hills which may require de-icing treatment during winter storms. Figure 16-2 indicates these identified major hills within the planning area that may impact or prevent safe travel during a winter storm.

Figure 16-2. Major Hills in the City of Round Rock



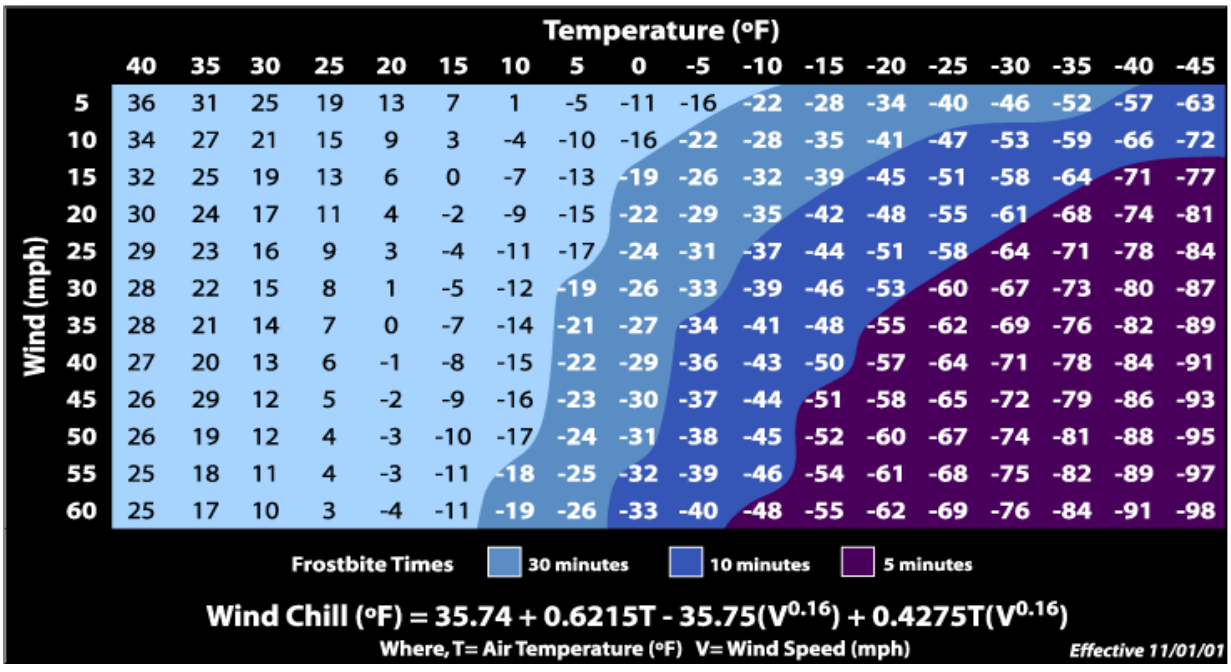
EXTENT

The extent or magnitude of a severe winter storm is measured in intensity based on the temperature and level of accumulations as shown in Table 16-2. This table should be read in conjunction with the wind-chill factor described in Figure 16-3 to determine the intensity of a winter storm. The chart is not applicable when temperatures are over 50°F or winds are calm. This index was developed by the National Weather Service.

Table 16-2. Magnitude of Severe Winter Storms

INTENSITY	TEMPERATURE RANGE (Fahrenheit)	EXTENT DESCRIPTION
Mild	40° – 50°	Winds less than 10 mph and freezing rain or light snow falling for short durations with little or no accumulations
Moderate	30° – 40°	Winds 10 – 15 mph and sleet and/or snow up to 4 inches
Significant	25° – 30°	Intense snow showers accompanied with strong gusty winds between 15 and 20 mph with significant accumulation
Extreme	20° – 25°	Wind driven snow that reduces visibility, heavy winds (between 20 to 30 mph), and sleet or ice up to 5 millimeters in diameter
Severe	Below 20°	Winds of 35 mph or more and snow and sleet greater than 4 inches

Figure 16-3. Wind Chill Chart



Wind chill temperature is a measure of how cold the wind makes real air temperature feel to the human body. Since wind can dramatically accelerate heat loss from the body, a blustery 30°F day would feel just as cold as a calm day with 0°F temperatures. The City of Round Rock planning area has 40 previous occurrences recorded from 1996 through 2023 in the National Centers for Environmental Information (NCEI) Storm Events Database. The planning area has never experienced a blizzard, but it has been subject to winter weather and winter storms.

The average number of cold days is similar for the entire planning area. Therefore, the intensity or extent of a winter storm event to be mitigated for the area ranges from mild to moderate according to the definitions at Table 16-2. The City of Round Rock planning area can expect anywhere between 0.1 to 4.0 inches of ice and snow during a winter storm event, and temperatures between 20°F and 25°F with winds ranging from 0 to over 35 mph.

The National Weather Service issues a winter storm watch, advisory or warning in advance of an event in order to give people enough time to prepare for an event. The City of Round Rock could be under any of these warning types in advance of a winter storm event. Table 16-3 describes when each warning type would be issued.

Table 16-3. Winter Storm Watch, Advisory, Warning Descriptions

TYPE OF WINTER WEATHER	DESCRIPTION
Winter Weather Advisory	This alert may be issued for a variety of severe conditions. Weather advisories may be announced for snow, blowing or drifting snow, freezing drizzle, freezing rain, or a combination of weather events.
Winter Storm Watch	Severe winter weather conditions may affect your area (freezing rain, sleet, or heavy snow may occur separately or in combination).
Winter Storm Warning	Severe winter weather conditions are imminent.
Freezing Rain or Freezing Drizzle	Rain or drizzle is likely to freeze upon impact, resulting in a coating of ice glaze on roads and all other exposed objects.
Sleet	Small particles of ice usually mixed with rain. If enough sleet accumulates on the ground, it makes travel hazardous.
Blizzard	Sustained wind speeds of at least 35 mph are accompanied by considerable falling or blowing snow. This alert is the most perilous winter storm with visibility dangerously restricted.
Frost/Freeze	Below freezing temperatures are expected and may cause significant damage to plants, crops, and fruit trees.
Wind Chill	A strong wind combined with a temperature slightly below freezing can have the same chilling effect as a temperature nearly 50 degrees lower in a calm atmosphere. The combined cooling power of the wind and temperature on exposed flesh is called the wind-chill factor.

HISTORICAL OCCURRENCES

According to historical records and the best available data there have been 40 recorded winter storm events in Williamson County, which includes the City of Round Rock. Historical winter storm information, as provided by the NCEI, identifies winter storm activity across a multi-county

forecast area for each event and does not provide data for single jurisdictions since these events are widespread. The appropriate percentage of the total property and crop damage reported for the entire forecast area has been allocated to each county impacted by the event, when appropriate. Historical winter storm data for the planning area is provided on a County-wide basis per the NCEI database. Table 16-4 shows historical incident information for the planning area.

Table 16-4. Historical Winter Storm Events, 1996-2023[2]

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
City of Round Rock	2/1/1996	0	0	$0	$0
City of Round Rock	12/23/1998	0	0	$0	$0
City of Round Rock	12/12/2000	0	0	$0	$0
City of Round Rock	11/28/2001	0	0	$0	$0
City of Round Rock	2/24/2003	0	0	$0	$0
City of Round Rock	12/7/2005	0	0	$0	$0
City of Round Rock	1/15/2007	0	0	$0	$0
City of Round Rock	1/27/2009	0	0	$0	$0
City of Round Rock	2/23/2010	0	0	$0	$0
City of Round Rock	2/3/2011	0	0	$0	$0
City of Round Rock	2/9/2011	0	0	$0	$0
City of Round Rock	11/24/2013	0	0	$0	$0
City of Round Rock	11/25/2013	0	0	$0	$0
City of Round Rock	12/5/2013	0	0	$0	$0
City of Round Rock	12/7/2013	0	0	$0	$0
City of Round Rock	3/4/2014	0	0	$0	$0
City of Round Rock	1/23/2014	0	0	$0	$0
City of Round Rock	1/27/2014	0	0	$0	$0
City of Round Rock	2/7/2014	0	0	$0	$0
City of Round Rock	1/10/2015	0	0	$0	$0
City of Round Rock	2/16/2015	0	0	$0	$0
City of Round Rock	2/23/2015	0	0	$0	$0

[2] Values are in 2024 dollars.

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
City of Round Rock	2/27/2015	0	0	$0	$0
City of Round Rock	3/4/2015	0	0	$0	$0
City of Round Rock	12/28/2015	0	0	$0	$0
City of Round Rock	12/31/2017	0	0	$0	$0
City of Round Rock	12/7/2017	0	0	$0	$0
City of Round Rock	1/16/2018	0	0	$0	$0
City of Round Rock	11/11/2019	0	0	$0	$0
City of Round Rock	2/5/2020	0	0	$0	$0
City of Round Rock	2/13/2021	0	0	$0	$0
City of Round Rock	2/16/2021	0	0	$0	$0
City of Round Rock	2/11/2021	0	0	$295,000	$0
City of Round Rock	1/10/2021	0	0	$0	$0
City of Round Rock	1/11/2022	0	0	$0	$0
City of Round Rock	1/20/2022	0	0	$0	$0
City of Round Rock	2/3/2022	0	0	$0	$0
City of Round Rock	2/24/2022	0	0	$0	$0
City of Round Rock	1/30/2023	0	0	$0	$0
City of Round Rock	2/1/2023	0	0	$23,312,700	$0
TOTALS		**0**	**0**	**$23,607,700**	

Based on the list of historical winter storm events for the City of Round Rock planning area, 12 of the events have occurred since the 2018 Plan.

SIGNIFICANT EVENTS

February 11, 2021 – Winter Storm Uri (DR-4586)

Winter Storm Uri was one of the most impactful winter events in the state's history. The winter storm event lasted a week and brought snow, sleet, and freezing rain to the Southeast region. The presence of the storm began on February 10, 2021, when a cold front brought a surge of cold air to the Area. From February 11th to the 18th, the winter storm hit the region, including the City of Round Rock, and many areas were placed under a Winter Storm Warning.

Fatalities across the state were attributed to hypothermia, vehicle accidents, carbon monoxide poisoning, and chronic medical conditions complicated by a lack of electricity over several days. Statewide, more than 69 percent of households lost power at some point during the event, with

average disruptions lasting 42 hours, 21 of which were consecutive. Water service was also disrupted, with 49 percent of households losing running water with an average disruption of 52 hours.[3]

In the City of Round Rock planning area, it was reported that many residents suffered during the power grid failure and experienced rolling power outages. Many roads across the planning area were snow packed, leading to significant transportation disruptions. Additionally, many trees and limbs were downed due to the accumulation of ice from freezing rain. Property damages from Winter Storm Uri in Williamson County, including the City of Round Rock planning area, are estimated at $295,000 (2024 dollars).

February 1, 2023

A combination of a shallow layer of cold air, brought in by a cold front, combined with warm, moist southeasterly flow above produced freezing rain and freezing drizzle for several days. These rains began around 11:00 AM on January 30th and continued off and on through February 2nd. Freezing rains led to ice accumulation across the region, with about 0.5 inches of ice accumulating in the City of Round Rock. Across Williamson County, multiple automobile accidents were reported, and many trees and tree branches were downed due to the weight of the ice. Many of the fallen trees caused downed power lines, leading to widespread power outages across the county, including the City of Round Rock. In total, the estimated damages for Williamson County, including the City of Round Rock planning area, was $23,312,700 (2024 dollars).

PROBABILITY OF FUTURE EVENTS

According to historical records, the City of Round Rock planning area is expected to experience approximately one to two winter storm events each year. The probability of a future winter storm event affecting the City of Round Rock planning area is considered “Highly Likely”, with a winter storm likely to occur within the next year.

VULNERABILITY AND IMPACT

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 under the weight or causing tree limbs to fall on the lines. These events can disrupt electric service for long periods.

An economic impact may occur due to increased consumption of heating fuel, which can lead to energy shortages and higher prices. House fires and resulting deaths tend to occur more frequently from 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.

The City of Round Rock Planning Team identified the following critical facilities (Table 16-5) as assets that are considered the most important to the planning area and are susceptible to a range of impacts caused by winter storm events. For a comprehensive list of critical facilities, please see Appendix C.

[3] Donald, Jess. “Winter Storm Uri. The Economic Impact of the Storm”. October 2021. Fiscal Notes. Texas Comptroller of Public Accounts. https://comptroller.texas.gov/economy/fiscal-notes/2021/oct/winter-storm-impact.php

Table 16-5. Critical Facilities Vulnerable to Winter Storm Events

CRITICAL FACILITIES	POTENTIAL IMPACTS
Emergency Response Services (EOC, Fire, Police, EMS), Hospitals and Medical Centers	• Emergency operations, services and response times may be significantly impacted due to power outages, and/or loss of communications. • Exposure to extreme cold can cause illnesses in first responders if exposed for a period of time. • Roads may become impassable due to snow and/or ice impacting response times by emergency services. • Extended power outages due to increased usage may lead to possible looting, destruction of property, and theft, further burdening law enforcement resources.
Airport, Academic Institutions, Animal Shelter, Evacuation Centers & Shelters, Governmental Facilities, Residential/ Assisted Living Facilities	• Power outages due to increased usage could disrupt critical care. • Backup power sources could be damaged. • Increased number of patients due to exposure to cold temperatures could lead to a strain on staff. • Water pipes can freeze and burst leading to flooding within facilities. • Facilities, infrastructure, or critical equipment including communications may be damaged, destroyed or otherwise inoperable. • Essential supplies like medicines, water, food, and equipment deliveries may be delayed. • Economic disruption due to power outages negatively impact airport services as well as area businesses reliant on airport operations. • Exposure risks to outdoor workers.
Commercial Supplier (food, fuel, etc.)	• Facilities, infrastructure, or critical equipment including communications may be damaged, destroyed or otherwise inoperable. • Essential supplies like medicines, water, food, and equipment deliveries may be delayed.
Utility Services and Infrastructure (electric, water, wastewater, communications)	• Emergency operations, services and response times may be significantly impacted due to power outages, and/or loss of communications. • Roads may become impassable due to snow and/or ice impacting response times by emergency services. • Power outages due to increased usage could disrupt critical care. • Backup power sources could be damaged. • Water pipes can freeze and burst leading to flooding within facilities.

People and animals are subject to health risks from extended exposure to cold air (Table 16-6). Elderly people are at greater risk of death from hypothermia during these events, especially in the neighborhoods with older housing stock. According to the U.S. Center for Disease Control, every year hypothermia kills about 600 Americans, half of whom are 65 years of age or older.

Due to factors like limited mobility, communication difficulties, medical needs, sensitivity to cold temperatures, reliance on support services, transportation challenges, housing accessibility issues, and possible shortages in emergency shelter accommodations, people with disabilities are particularly vulnerable to winter storms. Inclusive measures are crucial to address these vulnerabilities and ensure their safety during severe weather events.

Populations living below the poverty level may not be able to afford to run heat on a regular basis or an extended period of time. In addition, people who speak a language other than English may face increased vulnerability due to language barriers that limit their access to important information such as weather-related warnings and instructions regarding safety measures.

The population over 65 in the City of Round Rock planning area is estimated at 10 percent of the total population and children under the age of 5 are estimated at 6 percent. The population with a disability is estimated at 11 percent of the total population. An estimated 8 percent of the planning area population live below the poverty level and 25 percent of the populations speaks a language other than English.[4]

Older homes tend to be more vulnerable to the impacts of winter storm events. Approximately, 12 percent (an estimated 5,539 structures) of the housing units in the planning area were built before 1980 (Table 16-7).

Table 16-6. Populations at Greater Risk of Winter Storm Events

ELDERLY (over 65)	YOUTH (under 5)	WITH A DISABILITY	BELOW POVERTY LEVEL	NON-ENGLISH SPEAKING
12,356	7,219	12,927	9,276	30,183

Table 16-7. Structures at Greater Risk of Winter Storm Events

SFR STRUCTURES BUILT BEFORE 1980
5,539

Winter Storms have been known to cause injury to humans and occasionally have been fatal. Overall, the average loss estimate of property and crops in the planning area is considered $23,607,700 (2024 dollars) with an average annualized loss of $843,100. No injuries or fatalities have been caused by winter storms in the planning area based on best available data. However, based on historic loss and damages, the impact of winter storm damages on the City of Round Rock planning area can be considered “Minor,” meaning injuries and illnesses do not result in permanent disability, complete shutdown of critical facilities for more than one week, and more than 10 percent of property destroyed or with major damage.

[4] US Census Bureau, American Community Survey Five-Year Estimates

Table 16-8. Winter Storm Event Damage Totals, 1996- 2023

PROPERTY & CROP LOSS	AVERAGE ANNUAL LOSS ESTIMATES
$23,607,700	$843,100

ASSESSMENT OF IMPACTS

The greatest risk from a winter storm hazard is to public health and safety. The impact of climate change could produce longer, more intense winter storm events, exacerbating the current winter storm impacts. Worsening winter storm conditions can be frequently associated with a variety of impacts, including:

- Vulnerable populations, particularly the elderly (10 percent of total population), children under 5 (6 percent of total population), and those with a disability (11 percent of total population), can face serious or life-threatening health problems from exposure to extreme cold including hypothermia and frostbite.
- Loss of electric power or other heat source can result in increased potential for fire injuries or hazardous gas inhalation because residents burn candles for light or use fires or generators to stay warm.
- Response personnel, including utility workers, public works personnel, debris removal staff, tow truck operators, and other first responders, are subject to injury or illness resulting from exposure to extreme cold temperatures.
- Response personnel would be required to travel in potentially hazardous conditions, elevating the life safety risk due to accidents and potential contact with downed power lines.
- Operations or service delivery may experience impacts from electricity blackouts due to winter storms.
- Power outages are possible throughout the planning area due to downed trees and power lines and/or rolling blackouts.
- Critical facilities without emergency backup power may not be operational during power outages.
- Emergency response and service operations may be impacted by limitations on access and mobility if roadways are closed, unsafe, or obstructed.
- Hazardous road conditions will likely lead to increases in automobile accidents, further straining emergency response capabilities.
- Depending on the severity and scale of damage caused by ice and snow events, damage to power transmission and distribution infrastructure can require days or weeks to repair.
- Winter storms can reduce the efficacy of shaded fuel breaks for wildfire mitigation as treated areas were more likely to have downed trees and limbs than untreated areas.
- Winter storms can result in damage to endangered species habitat and increased fuel loads within forested habitats.
- Older structures built to less stringent building codes may suffer greater damage as they are typically more vulnerable to impacts of winter storm events. Approximately 12 percent of homes in the City were built before 1980. Similarly, historic buildings and sites are placed at a higher risk of impact due to materials used and the inability to change

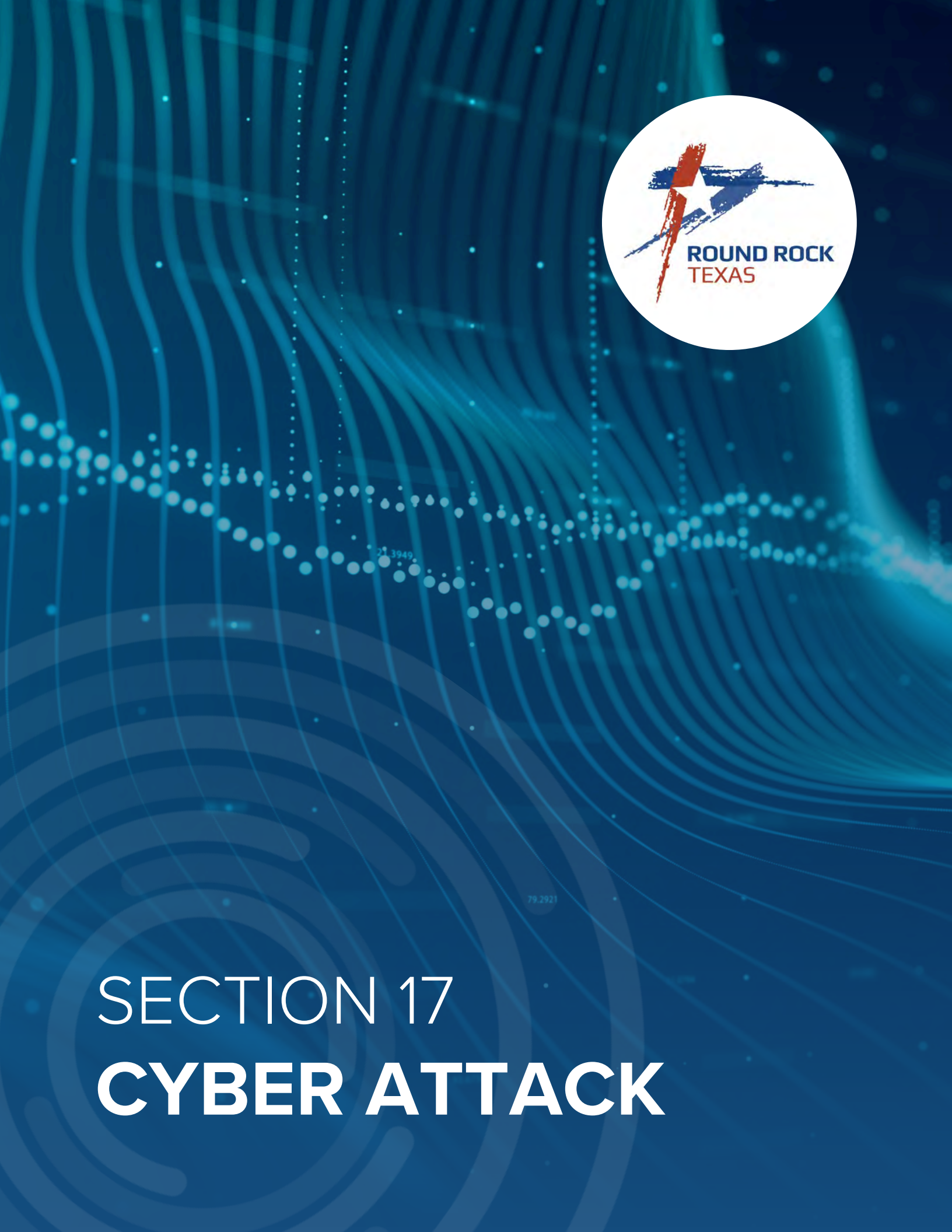
properties due to their historic status. There are five historical places listed on the National Register of Historic Places for the City of Round Rock.
- Schools may be forced to shut early due to treacherous driving conditions.
- Exposed water pipes may be damaged by severe or late season winter storms at both residential and commercial structures, causing significant damages.

The economic and financial impacts of winter weather on the community will depend on the scale of the event, what is damaged, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by the community, local businesses and citizens will also contribute to the overall economic and financial conditions in the aftermath of a winter storm event.

CLIMATE CHANGE CONSIDERATIONS

Climate change is expected to reduce the number of extreme cold events statewide but increase in the variability of events.[5] Extreme cold events will continue to be possible but overall winters are becoming milder, and the frequency of extreme winter weather events are decreasing due to the warming of the Arctic and less extreme cold air coming from that region.[6] A trend that is expected to continue with winter extremes estimated to be milder by 2036 compared to extremes in the historic record.[7]

[5] Fourth National Climate Assessment. Chapter 23 Southern Great Plans. U.S. Global Change Program. 2018.
[6] Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900-2036, Texas A&M University Office of the Texas State Climatologist, 2021 update.
[7] Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900-2036, Texas A&M University Office of the Texas State Climatologist, 2021 update.



SECTION 17
CYBER ATTACK

HAZARD DESCRIPTION

A cyber-attack is any type of offensive maneuver employed by individuals or organizations that targets computer information systems, infrastructures, computer networks, and personal computer devices by various means of malicious acts. The malicious act usually originates from an anonymous source that either steals, alters, or destroys a specified target by hacking into a susceptible system.

Cyberspace and its underlying infrastructure are vulnerable to a wide range of risks including both physical and cyber threats and hazards. Sophisticated cyber actors and nation-states exploit vulnerabilities to steal information and money and can develop capabilities to disrupt, destroy, or threaten the delivery of essential services. Various crimes are perpetrated through cyberspace including the production and distribution of child pornography and child exploitation conspiracies, banking and financial fraud, intellectual property violations, and other crimes, all of which have substantial human and economic consequences.

Cyberspace is particularly difficult to secure from cyber-attack events, due to a number of factors including the ability of malicious actors to operate from anywhere in the world, the links between cyberspace and physical systems, and the difficulty of reducing vulnerabilities and consequences in complex cyber networks. Of growing concern is the cyber threat to critical infrastructure, which is increasingly subject to sophisticated cyber intrusions that pose new risks. As information

technology becomes increasingly integrated with physical infrastructure operations, there is increased risk for wide scale or high-consequence events that could cause harm or disrupt services upon which our economy and the daily lives of millions of Americans depend. In light of the risk and potential consequences of cyber events, strengthening the security and resilience of cyberspace has become an important homeland security mission.[1]

The City of Round Rock has experienced growth over the past decade, which means a larger amount of data and more residents who may be impacted in the event of a cyber-attack within the planning area. The City takes steps to safeguard the integrity of its data and to prevent unauthorized access to information that is maintained in their computer systems. These measures are designed and intended to prevent corruption of data, block unauthorized access, and to ensure the integrity of information. Among these measures are frequently implementing methods to enhance redundancy across the City's network, including necessary security measures such as keeping robust backups. Additionally, the City partners with the US Cybersecurity and Infrastructure Security Agency (CISA) to further increase security of critical facilities. Other ongoing measures the City of Round Rock is taking include adding additional aerial fiber routes to prevent widespread outages in the event of a broken fiber or temporary equipment issues. This section reviews the hazards to the cybersecurity assets for the City of Round Rock planning area.

HAZARDS

DENIAL OF SERVICE ATTACKS

A denial of service attack (DoS) is the attempt to make a computer or network resource unavailable to its intended users. A DoS attack may come from one or several computers, while a distributed denial of service attack (DDoS) will be launched from many, often thousands of computers. While DoS attacks may occur frequently and typically can be handled by the City's equipment, a DDoS attack can overload the City of Round Rock's network or computer resources resulting in extended downtime. Often these attacks rely on lower-level network vulnerabilities.

DATA LOSS / LEAKAGE

Data loss can result from a variety of reasons, both intentional and unintentional. Data loss may result from a failure to properly backup or have disaster recovery equipment and processes, employees improperly handling sensitive data, and criminal activities such as espionage, theft, sabotage, and other malicious acts.

INFRASTRUCTURE LOSS / FAILURE

Loss of computer and network resources may result from a variety of natural and human-caused disasters including tornadoes, hurricanes, and explosions due to accidents, power loss, terrorism, and fire.

INSIDER THREATS

Insider threats are malicious threats to the planning area that come from City of Round Rock employees, contractors, and volunteers who have access to the City's computers, networks, and data. An insider can initiate a DoS attack, leak or steal data, and sabotage the infrastructure and data.

[1] Source: Department of Homeland Security

ORGANIZED CYBERCRIME, STATE-SPONSORED HACKERS ESPIONAGE

Organized cybercrime, which may include state-sponsored cybercrime, are attacks on the City of Round Rock's computers, network, and data by criminal organizations. These criminals may be motivated by money or political reasons. Often these attacks are well planned out, difficult to identify due to their more limited scope, and can result in extensive damage.

THIRD PARTY MISMANAGEMENT

Reliance on third parties for cyber services implies acceptance of the risk that the third party will properly protect the cyber resources from loss or unavailability. Hazards from the use of third parties include DoS, DDoS, data loss and leakage, infrastructure loss and failure, insider threats, and organized cybercrime.

ADVANCE PERSISTENT THREATS

An advanced persistent threat (APT) is a stealthy and continuous attack on City of Round Rock over a long period of time. The "advanced" process signifies sophisticated techniques using malware to exploit vulnerabilities in systems. The "persistent" process suggests that an external command and control system is continuously monitoring and extracting data from a specific target. The "threat" process indicates human involvement in orchestrating the attack.

CIVIL DISORDER

Civil disorder may impact the cybersecurity of the planning area by directly or indirectly impacting City of Round Rock's ability to support its computers, networks, and data. Civil disorder can result in the planning area not having resources due to direct impact to the computers and networks, and indirectly by limiting the resources necessary to run the computers and networks.

LOCATION

Cyberwar is deceptive, invisible to most, and fought out of sight. It takes place in cyberspace, a location that cannot be seen, touched, or felt. Physical instruments, such as computers, routers, and cables can be seen; however, these instruments interact in cyberspace, a virtual and unseen realm. Thus, the source of the hazard can extend from one part of the world to attacks on public or private sector entities in another part of the world, and the perpetrator can remain unknown in a legally provable sense. The entire City of Round Rock planning area can be affected by a cyber-attack.

EXTENT

Currently an official index for measuring the extent of a cyber-attack does not exist. The extent, nature, and timing of cyber-attack events are impossible to predict. There may or may not be any warning. Some cyber-attack events take a long time (weeks, months, or years) to be discovered and identified.[2] Therefore, the City of Round Rock planning area is vulnerable to all types of cyber-attack, and can occur anywhere, and at any time.

The extent of damages is based on historical incidents in the City of Round Rock planning area are classified as low, medium, and high; third party information regarding the impact; and if the planning area has experienced an occurrence of the incident.

[2] Source: http://www.ready.gov/cyber-attack

Denial of service attacks: Low
A DoS and DDoS attack could result in an extended cyber-outage in the planning area. The outage, although impacting the daily business of the planning area, would not have a substantial economic impact on the City.

Data loss / leakage: High
Data loss and leakage experienced by the planning area could result in costly remediation efforts to ensue. For example, if personally identifiable information (PII) is leaked, the City may be required to pay for credit protection services. Since the City of Round Rock manages a large quantity of sensitive information, the possibility of costly remediation efforts is high.

Infrastructure loss / failure: High
Loss of a cyber-processing facility could result in very high expenses to remediate, repair, and recover from the loss.

Insider threats: Medium
Insider threats can result in substantial impacts to the organization, depending on what data the insider has accessed. The City of Round Rock has remediated insider threats by using the industry standard separation of duties, and performing background checks of its employees, contractors, and volunteers.

Organized cybercrime, state-sponsored hackers' espionage: High
The planning area is a moderate target for organized criminals and state-sponsored hackers due to its political environment and the size of the organization. Due to the potential extent of attacks by organized criminals, the possibility and severity of resulting damages are great.

Third party mismanagement: Low
Since each vendor is isolated from the service it performs, the damages from one third party's mismanagement are fairly low.

Advanced persistent threats: High
The impact of an APT to the planning area can be severe because a large number of systems can be affected and the remediation of such an attack could be expensive to recover from.

Civil disorder: High
The impacts of civil disorder on cybersecurity could be extensive due to the typical physical nature of the attacks.

HISTORICAL OCCURRENCES

It's been reported that the electric grid is attacked every four days either physically or through cyber threats.[3] The numbers of attacks are accelerating and becoming more sophisticated. The Texas Governor announced that websites belonging to state agencies have seen an increase in attempted cyber-attacks coming out of Iran (about 10,000 per minute) in the time since Iranian general Qassem Soleimani was killed in a U.S. drone strike.[4] While the majority of attacks to gather data are not successful, the City of Round Rock's technology security team remains on

[3] Source: USA Today, March 2015, website: https://www.usatoday.com/story/news/2015/03/24/power-grid-physical-and-cyber-attacks-concern-security-experts/24892471/
[4] Statesman News Network, January 2020, Website: https://www.statesman.com/news/20200110/austin-on-guard-after-texas-hit-with-increased-cyberattacks-from-iran

high alert. The Electric Reliability Council of Texas (ERCOT) reportedly has a team of professionals and a series of procedures they utilized to protect the planning area systems from cyber-attacks.

Based on available data, no known cyber-attack incidents have impacted the City of Round Rock. Even though cyber-attack events are virtually impossible to predict, the City of Round Rock planning area has the potential of an occurrence happening at any time.

PROBABILITY OF FUTURE EVENTS

The probability of occurrence based on historical incidents in the planning area are classified as low, medium, and high; as well as third party information regarding the likelihood of incidents if the City has not had an occurrence of the incident.

Denial of service attacks: Low

The planning area has frequent DOS attack attempts which are not severe enough to impact the City of Round Rock's service levels. The City has had no DDoS attacks over the last year which successfully impacted services. Although there have been attempts for service disruptions through phishing emails, a fraudulent attempt to obtain sensitive information has not been successful. The City employs vendor software, such as network monitoring software, which supports critical infrastructure. The City uses defense-in-depth to prevent, detect, and mitigate viruses, malware, or potentially unwanted programs (PuP) at multiple levels from City edge devices and web browsers, down to all endpoints.

Data loss / leakage: Low

The planning area is subject to several compliance requirements which specifically address data loss and leakage. These compliance standards include but are not limited to:

- Payment Card Industry Security Standard (PCI DSS)
- Health Insurance Portability and Accountability Act of 1996 (HIPAA)
- Criminal Justice Information Services Division (CJIS)

The City of Round Rock had no instances of data loss over the last year which resulted in the City having to remediate the situation.

Infrastructure loss / failure: Low

The planning area has multiple data centers which are hardened in various ways to minimize the possibility of outage. Resilience and redundancy are continuously being reviewed and addressed to reduce the risk of loss or failure; the City is currently undergoing efforts to further increase redundancy in the City's aerial fiber network. Historically, the infrastructure has had few outages that were extended. A prime example of potentially affected infrastructure would be health care systems within the planning area.

Insider threats: Low

The City of Round Rock requires anyone who has access to government network and resources to have gone through a background check, which is regularly reviewed. All IT staff are background checked and fingerprinted in compliance with Th Criminal Justice Information System's (CJIS) requirements. There has never been evidence of insider attacks in the City of Round Rock.

Organized cybercrime, state-sponsored hackers' espionage: Medium
Over the last five years, many organized cyberattack attempts may have been made on the City of Round Rock, as DDoS and malware attacks have become more and more frequent across the globe. However, based on best available data, no known cyberattack attempts have been successful on bypassing the City's security measures or impacting the City's network, equipment, or the community.

Third party mismanagement: Low
The City of Round Rock planning area utilizes third parties for implementing certain cybersecurity measures, such as network monitoring, endpoint protection, and advanced threat protection. CISA is also leveraged for several City activities. The primary third-party vendor used by the City does not have direct access to user emails by default, and can only access messages the City submits to them for analysis purposes. Stored copies of messages can be removed at any time at the City's request. There have not been any recorded instances of third-party mismanagement in the City of Round Rock to date.

Advanced persistent threats (APT): Low
APTs are defined as a highly sophisticated threat actor with the resources and knowledge needed to stage a long-term attack campaign and remain undetected for extended periods of time. APTs may use a wide variety of techniques to attack their targets, including malware and ransomware strains. The City of Round Rock maintain systems which monitor symptoms of APT. These include defense-in-depth systems with multiple layers reporting to a Security information and event management (SIEM) system which analyzes disparate data seams and potential Indicators of Compromise (IOC). Additionally, the City utilizes network monitoring tools to detect changes in device state and configuration. No successful APT cyber-attacks are known to have impacted the planning area.

Civil disorder: Low
Nationally, civil disorder events have been correlated or followed up by a cyber-attack to critical infrastructure, and national trends indicate a general rise in such events. However, the City of Round Rock has relatively low civil disorder events historically, and there have been no cyber-attacks tied into civil disturbance events within the last five years. Local, state, and federal officials monitor such events and establish lines of communication in the event that a cyber incident may unfold. The probability of following this national trend is low for the planning area.

Overall, cyber-attacks of all kinds are impossible to predict, but attack attempts have continuously risen across the country in recent years. Based on these global trends and historical evidence, the City of Round Rock planning area is vulnerable to a range of cyber threats. The probability of future cyber-attack attempts is nearly certain and considered Highly Likely, meaning an attempt is probable in the next year. However, based on historical data and the security systems which the City of Round Rock employs, the probability of a major, successful cyber-attack event impacting the City of Round Rock is considered "Unlikely," meaning an event of this magnitude is probable within the next ten years.

VULNERABILITY AND IMPACT

With the internet being largely open and unregulated, it leaves the planning area vulnerable to cyber-attacks and threats. The attack can be on information systems resulting in a data breach,

or the spread of a virus. With the growing dependence on digital interconnectivity even a small incident may have widespread and damaging consequences.

Transportation, public safety, and utility services are all critical, and highly dependent on information technology. The motive behind such disruptions can be driven by religious, political, and other objectives.

A cyber-attack can last a few minutes to a couple of days, although large-scale events and their impacts can last much longer. Cyber-attacks differ by motive, type, vector, and perpetrator profile.

Cybersecurity involves protecting infrastructure by preventing, detecting, and responding to cyber-attack incidents. Unlike physical threats that prompt immediate action, such as "stop, drop, and roll," in the event of a fire; cyber threats are often difficult to identify and comprehend. Among these dangers are viruses erasing entire systems, intruders breaking into systems and altering files, intruders using a computer or device to attack others, and intruders stealing confidential information. The spectrum of cyber-attack risks is limitless. Threats of cyber-attack can have wide-ranging effects on the individual, community, organizational, and national level. Risks from cyber-attack include:

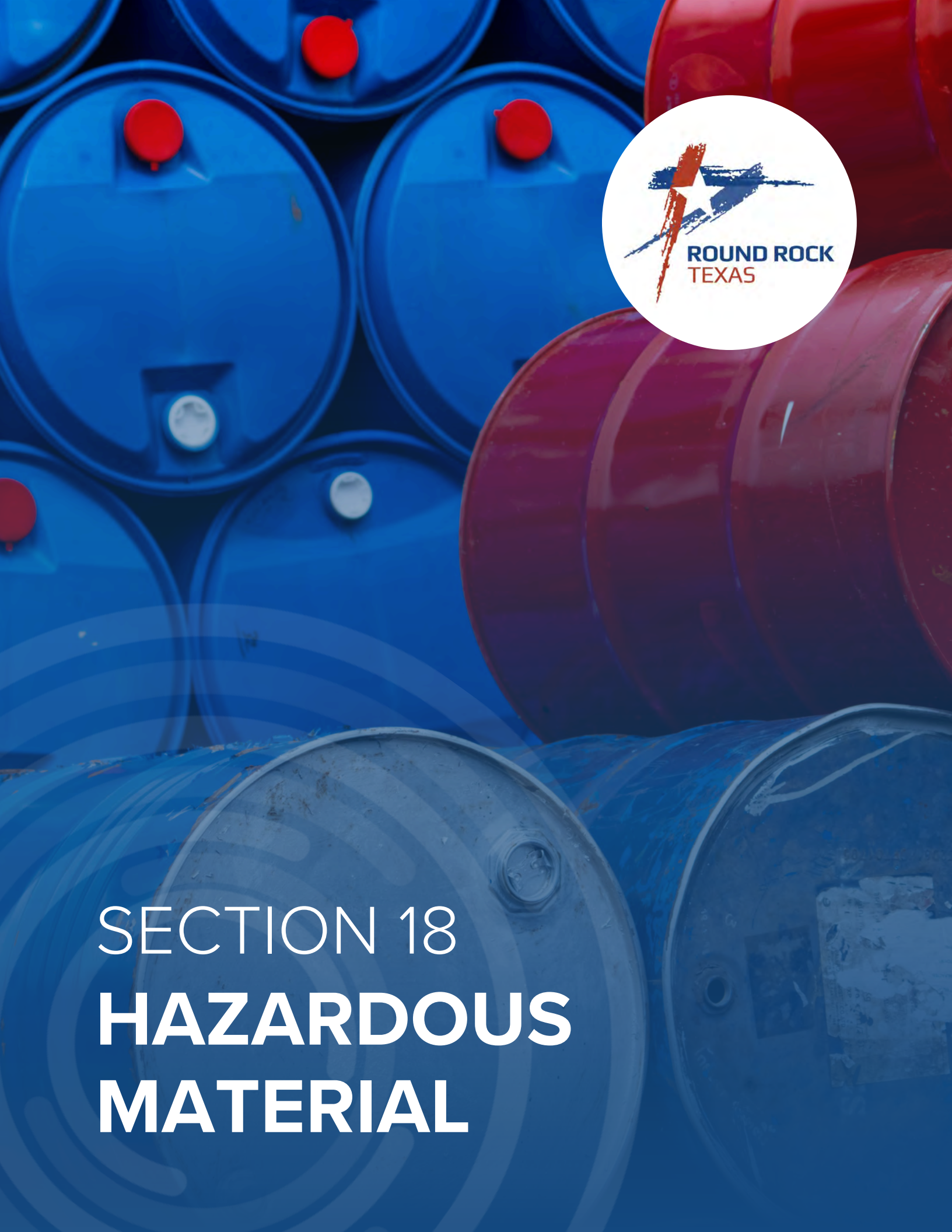
- Organized cybercrime, state-sponsored hackers, and cyber espionage, which can pose national security risks to our country.
- Transportation, power, and other services may be disrupted by large scale cyber incidents, and the extent of the disruption is highly uncertain as it will be determined by many unknown factors including the target and size of the incident.
- Vulnerability to data breach and loss increases if an organization's network is compromised, and therefore information about a company, its employees, and its customers can be at risk.
- Individually-owned devices such as computers, tablets, mobile phones, and gaming systems that connect to the Internet are vulnerable to intrusion, and therefore personal information may be at risk without proper security.[5]

Based on historical events, the potential impact of cyber-attacks for the entire City of Round Rock planning area can be considered "Major" due to the critical facilities that can be indirectly impacted by an attack. While deaths, injuries or damages to the built environment are not directly caused by a cyber-attack, the secondary or cascading effects of an attack could be devastating.

CLIMATE CHANGE CONSIDERATIONS

As a non-natural hazard, climate change has no direct impact on the future occurrences of cyber-attack incidents. However, climate change is associated with an increase in severe weather. If severe weather events occur concurrently with a cyber-attack, the stress on emergency services, critical infrastructure, and the community may be compounded. Research and data regarding the impact of climate change on non-natural events is minimal and limited.

[5] Source: http://www.ready.gov/cyber-attack



SECTION 18

HAZARDOUS MATERIAL

SECTION 18: HAZARDOUS MATERIALS

HAZARD DESCRIPTION

Hazardous materials come in the form of explosives, flammable and combustible substances, poisons, and radioactive materials. A hazardous material (HAZMAT) incident involves a substance outside normal safe containment in sufficient concentration to pose a threat to life, property, or the environment.

Chemicals are found everywhere. They purify drinking water, increase crop production, and simplify household chores. But chemicals also can be hazardous to humans or the environment if used or released improperly. Hazards can occur during production, storage, transportation, use, or disposal. Communities can be put at risk if a chemical is used unsafely or released in harmful amounts into the environment in which residents live, work, or play.

In a hazardous materials incident, solid, liquid, and/or gaseous contaminants may be released from fixed or mobile containers. This profile focuses on fixed sites. Weather conditions will directly affect how the hazard develops.

The Toxics Release Inventory (TRI) is a publicly available database from the federal Environmental Protection Agency (EPA) which contains information on toxic chemical releases and other waste management activities that are reported annually by certain covered industry groups federal facilities. This inventory was established under the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) and expanded by the Pollution Prevention Act of 1990. Each year, facilities that meet certain activity thresholds must report their releases and other waste management activities for listed toxic chemicals to the EPA and their state or tribal entity. A facility must report if it meets the following three criteria:

- The facility falls within one of the following industrial categories: manufacturing; metal mining; coal mining; electric generating facilities that combust coal and/or oil; chemical wholesale distributors; petroleum terminals and bulk storage facilities; Resource Conservation and Recovery Act (RCRA) Subtitle C Treatment, Storage and Disposal (TSD) facilities; and solvent recovery services.
- Have ten or more full-time employee equivalents.
- Manufactures or processes more than 25,000 pounds or otherwise uses more than 10,000 pounds of any listed chemical during the calendar year. Persistent, Bio-accumulative and

Toxic (PBT) chemicals are subject to different thresholds of ten pounds, 100 pounds or 0.1 grams depending on the chemical.

Submission of a Tier II form is required under Section 312 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA). Under EPCRA, all facilities which store significant quantities of hazardous chemicals must share this information with state and local emergency responders and planners. Facilities in Texas share this information by filing annual hazardous chemical inventories with the Texas Department of State Health Services (DSHS), Local Emergency Planning Committees (LEPCs), and local fire departments. The Texas Tier II Report contains facility identification information and detailed chemical data about hazardous chemicals stored at the facility.

A facility must report if it meets the following criteria:

- Any company using chemicals that could present a physical or health hazard must report them if the quantities of those chemicals exceed Tier II threshold limits.
- If an industry has an Occupational Safety and Health Administration (OSHA) deemed hazardous chemical that exceeds the appropriate threshold at a certain point in time, then the chemical must be reported. These chemicals may be on the list of 355 Extremely Hazardous Substances (EHS) or could be one of the 650,000 reportable hazardous substances (not on the EHS list). This reporting format is for a "snapshot in time." EHS chemicals must be reported if the quantity is greater than 500 pounds or the Threshold Planning Quantity (TPQ) amount, if the TPQ is less than 500 pounds. Chemicals not considered to be EHS must be reported if their quantity is 10,000 pounds or greater.

LOCATION

A hazardous material spill occurring along railroad tracks and major highways near populated areas in the City of Round Rock is of concern to the planning team. Trains and trucks can carry a variety of materials that would, in large quantity, threaten the health and safety of people and the natural environment in the vicinity of a spill.

All major highways, railroads, and the surrounding areas are at risk of a HAZMAT incident. There are several high capacity roadways in the City of Round Rock, including Interstate 35, SH-45, SH-130, and US 79. The city is centrally located between some of the state's largest cities, including Houston, San Antonio, and Dallas, which are all less than 200 miles away. As a transportation hub and densely populated area, the City of Round Rock is vulnerable to hazardous materials incidents.

The National Hazardous Materials Route Registry (NHMRR) lists, as reported by States and Tribal governments, all designated and restricted roads and preferred highway routes for transportation of highway route-controlled quantities of Class 7 radioactive materials and non-radioactive hazardous materials. According to NHMRR data, no routes for the transportation of these hazardous materials are located in or near the City of Round Rock planning area.[1]

Under the Community Right-to-Know program laws upheld at the state and federal level, all facilities which store significant quantities of hazardous chemicals must share this information

[1] Source: https://www.fmcsa.dot.gov/regulations/hazardous-materials/national-hazardous-materials-route-registry-state

with state and local emergency responders and planners. Facilities in Texas share this information by filing annual hazardous chemical inventories with the state, with Local Emergency Planning Committees (LEPCs), and with local fire departments.

Figure 18-1 shows the locations of available georeferenced TRI toxic sites in and around the City of Round Rock. Only toxic sites that have georeferenced data available were analyzed; 500-meter and 2500-meter circle buffers are also drawn around each hazardous material site.

There are 15 TRI sites total in the City of Round Rock, per EPA's database, with 13 of those sites reporting previous toxic releases into the planning area between 1987 and 2023. Of those, six sites have reporting available for chemicals released into the planning area in 2022. Five sites reported toxic releases in 2022, with Exfluor Research accounting for the most chemicals (623 lbs.) released into the planning area in that year, according to TRI data. Table 18-1 lists the names, locations, and hazardous chemicals associated of TRI toxic sites in and around the City of Round Rock planning area which reported toxic releases for 2022.

Figure 18-1. EPA Toxic Release Inventory (TRI) Facility Locations

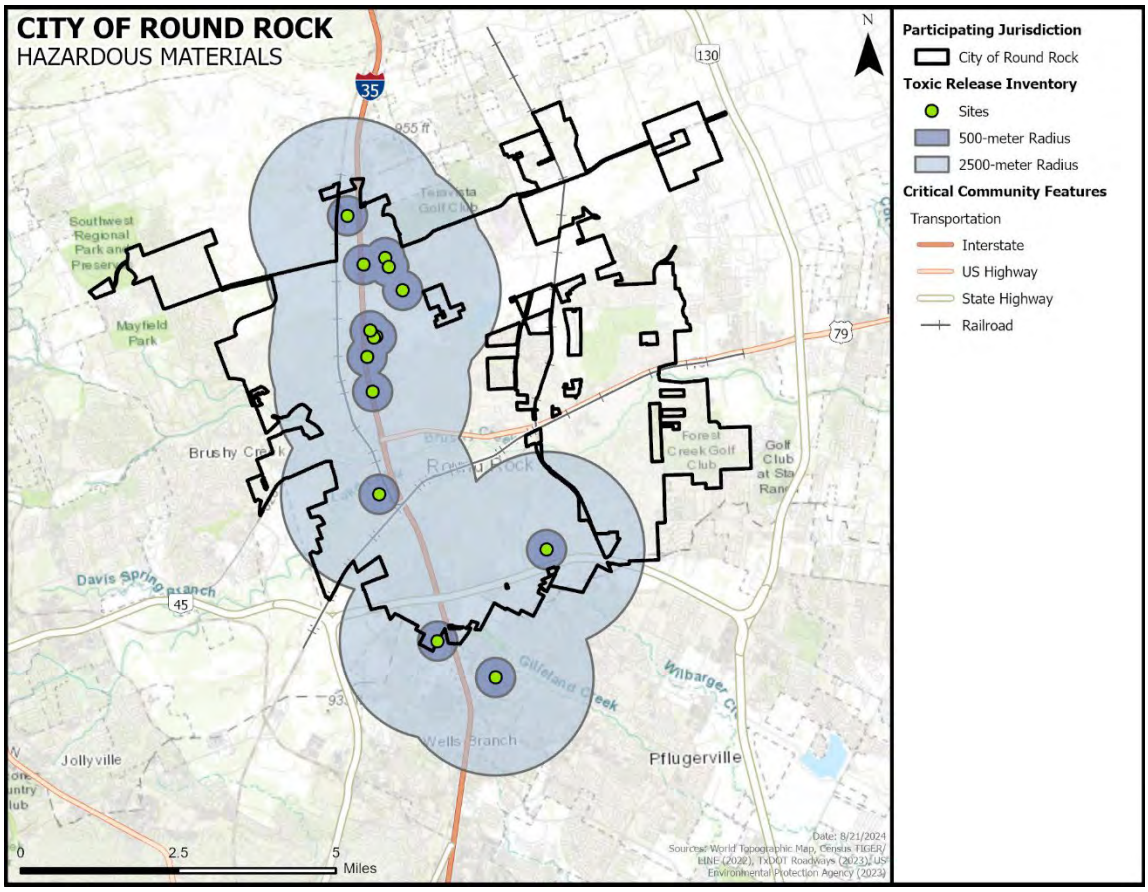


Table 18-1. EPA 2022 Toxic Release Inventory (TRI) for the City of Round Rock[2]

TRI FACILITY NAME	LOCATION	ASSOCIATED CHEMICALS
Exfluor Research	City of Round Rock	Hydrogen Fluoride, Fluorine, Octanoyl Fluoride, 1-Decanol, Methyl perfluorooctanoate, Perfluorononanoic acid
Cargill Meat Solutions Corp.	City of Round Rock	Ammonia
ICU Medical Inc.	City of Round Rock	Di(2-ethylhexyl) phthalate
Teco-Westinghouse Motor Co.	City of Round Rock	Copper and copper compounds
TXI-Round Rock Ready Mix	City of Round Rock	Lead and lead compounds, Nitrate compounds

EXTENT

The extent of a hazardous material release will depend on whether it is from a mobile or fixed site and the size of impact. The range of intensity will vary greatly depending on the circumstances. These factors and conditions include the material, toxicity, duration of the release, and environmental conditions such as the wind and precipitation.

Hazardous materials or toxic releases can have substantial impact on communities. Such events can cause multiple deaths, completely shut down facilities for 30 days or more, and cause more than 50 percent of affected properties to be destroyed or suffer major damage. In a hazardous materials incident, solid, liquid and/or gaseous contaminants may be released from fixed or mobile containers. Weather conditions would directly affect how the hazard develops. The micro-meteorological effects on buildings and terrain can alter travel patterns and duration of agents. Shielding in the form of permanent shelter can protect people from harmful effects. Non-compliance with fire and building codes, as well as failure to maintain existing fire and containment features can substantially increase damage from a hazardous materials release. The duration of a hazardous materials incident can range from hours to days. Warning time is minimal to none.

HISTORICAL OCCURRENCES

Hazardous materials are substances that if released or misused can cause death, serious injury, long-lasting health effects, and damage to infrastructure and the environment. Many products containing hazardous chemicals are used and stored in homes routinely. These products are also shipped daily on the nation's highways, railroads, waterways, and pipelines.

The City of Round Rock has identified 12 significant hazardous materials incidents between 2021 and 2024. This includes fuel, oil, ammonia, and pesticide leaks with most related to transportation incidents. There is one known and reported injury due to an unintentional release of Perfluoroadipoyl Fluoride inside an Exfluor Research facility in 2023.

A total of 59 spill incidents have been reported in the City of Round Rock between 2002 and 2024 according to the Texas Commission on Environmental Quality (TCEQ) Emergency Response

[2] Only TRI sites with reported chemical releases for 2022 are listed. Source: https://www.epa.gov/toxics-release-inventory-tri-program

Spills database.[3] This includes chemical spills reported to and investigated by TCEQ. Damages, injuries, and fatalities are not reported in this database, and a spill's inclusion in this dataset does not necessarily indicate significant damage to public health, property, or the natural environment occurred. However, the frequency of these events does indicate a significant level of risk for the planning area.

PROBABILITY OF FUTURE EVENTS

Hazardous material spills are usually the result of human error and/or accidents, which cannot be predicted. However, given the amount of traffic through the planning area and its large network of transportation, it is probable that an incident will occur in any given year. Most spills will not lead to negative health or safety impacts and will not cause substantial negative impacts on the air, soil, or groundwater. The probability of a spill threatening the health of thousands and of having long-term negative environmental consequences is, based on previous experience, low.

Based on the historic incident records and team input, the frequency of occurrence for typical hazardous material incidents would be considered highly likely. However, many of the previous spill incidents were minor and related to vehicle accidents resulting in fuel and oil spills. Based on the best available data the frequency of occurrence for more significant hazardous material incidents is considered "Occasional", meaning an event is probable in the next five years for the City of Round Rock.

VULNERABILITY AND IMPACT

The City of Round Rock is vulnerable to hazardous materials incidents, due to its dense population, proximity to major roadways and rail lines, and 15 TRI facilities (including 5 facilities which reported toxic releases in 2022) being located within its boundary.

Public health and environmental impacts are the most common effects of a hazardous materials incident. The release of toxic chemicals can pose immediate health effects including respiratory problems, chemical burns, poisoning, and long-term illnesses such as cancer. Vulnerable populations including children and the elderly may be more susceptible to health impacts. The population over 65 in the City of Round Rock is estimated at 10 percent of the total population and children under the age of 5 are estimated at 6 percent.

In extreme cases, an evacuation may be ordered to remove people from the hazardous area. Evacuating areas affected by HAZMAT incidents can be difficult, especially for people with disabilities or those who live below the poverty level and lack transportation and financial resources. In addition, people who speak a language other than English may face increased vulnerability due to language barriers that limit their access to important information such as weather-related warnings and instructions regarding safety measures. Populations with a disability are estimated at 11 percent. An estimated 8 percent of the planning area population lives below the poverty level, and 25 percent of the populations speaks a language other than English**.**

[3] Source: https://data.texas.gov/dataset/Texas-Commission-on-Environmental-Quality-Emergenc/xagr-a3x2/about_data

Table 18-2. Populations at Greater Risk of HAZMAT Incidents[4]

ELDERLY (over 65)	YOUTH (under 5)	WITH A DISABILITY	BELOW POVERTY LEVEL	NON-ENGLISH SPEAKING
12,356	7,219	12,927	9,276	30,183

Hazardous materials can have significant and long-term environmental impacts due to the release of toxic chemicals into the environment. Spills or leaks of chemicals may contaminate the soil, making it unsuitable for agriculture. Hazardous material incidents can also cause water pollution. The toxic substances can be carried by rainwater or runoff into nearby water bodies, which can harm aquatic life, disrupt ecosystems, and pose a public health risk if contamination occurs to drinking water sources. Gaseous releases can lead to air pollution, which can become widespread. HAZMAT incidents can also disrupt the local ecosystem, harming animals, and insects, leading to the displacement of native species.

While the best available data does not provide historical dollar loss amounts, hazardous material incidents can also be costly and impact the local economy. Emergency containment, clean up, and disposal may strain local resources and budgets. HAZMAT incidents can also lead to property damage, most commonly to industrial facilities and transportation networks. Based on best available data, the impact of hazardous materials incidents for the City of Round Rock is considered “Limited” meaning injuries and/or illnesses are treatable with first aid, shutdown of facilities and services for 24 hours or less, and less than 10 percent of property being destroyed or with major damage.

Critical facilities in the planning area are vulnerable to a range of direct and indirect impacts caused by HAZMAT incidents. Many of the impacts to critical facilities identified by the City of Round Rock Planning Team are similar to the impacts listed in Sections 5 through 16. Table 18-3 identifies assets that are considered the most important to the planning area and are susceptible to a range of impacts caused by hazardous materials events. For a comprehensive list of critical facilities, please see Appendix C.

Table 18-3. Critical Facilities Vulnerable to Hazardous Materials Events

CRITICAL FACILITIES	POTENTIAL IMPACTS
Emergency Response Services (EOC, Fire, Police, EMS), Hospitals and Medical Centers	• Emergency operations and services may be significantly impacted due to responding to the impacts of a hazardous materials event. • Emergency vehicles, including critical equipment, can be damaged during response efforts. • Based on the size of the event healthcare facilities may experience impact to the capacity and resources of providing emergency medical assistance and services.

[4] U.S. Census Bureau, American Community Survey, 2022

CRITICAL FACILITIES	POTENTIAL IMPACTS
Airport, Academic Institutions, Animal Shelter, Evacuation Centers & Shelters, Governmental Facilities, Residential/ Assisted Living Facilities	• Evacuations may be necessary due to the extent and size of a hazardous material event.
Commercial Supplier (food, fuel, etc.)	• Facilities, infrastructure, or critical equipment near the hazardous material event may be damaged, destroyed or otherwise inoperable. • Essential supplies like medicines, water, food, and equipment deliveries may be delayed. • Economic disruption due to necessary response and recovery efforts may negatively impact commercial operations.
Utility Services and Infrastructure (electric, water, wastewater, communications)	• Emergency operations and critical services may be significantly impacted due to injuries or damages sustained during response and recovery to a hazardous material event. • Emergency vehicles, including critical equipment, can be damaged during response efforts. • Further damage based on site contamination can further strain the capacity and resources of emergency personnel and critical services.

ASSESSMENT OF IMPACTS

HAZMAT incidents have the potential to pose a significant risk to people and can create dangerous and difficult situations for public health and safety officials. HAZMAT incidents can be frequently associated with a variety of impacts, including:

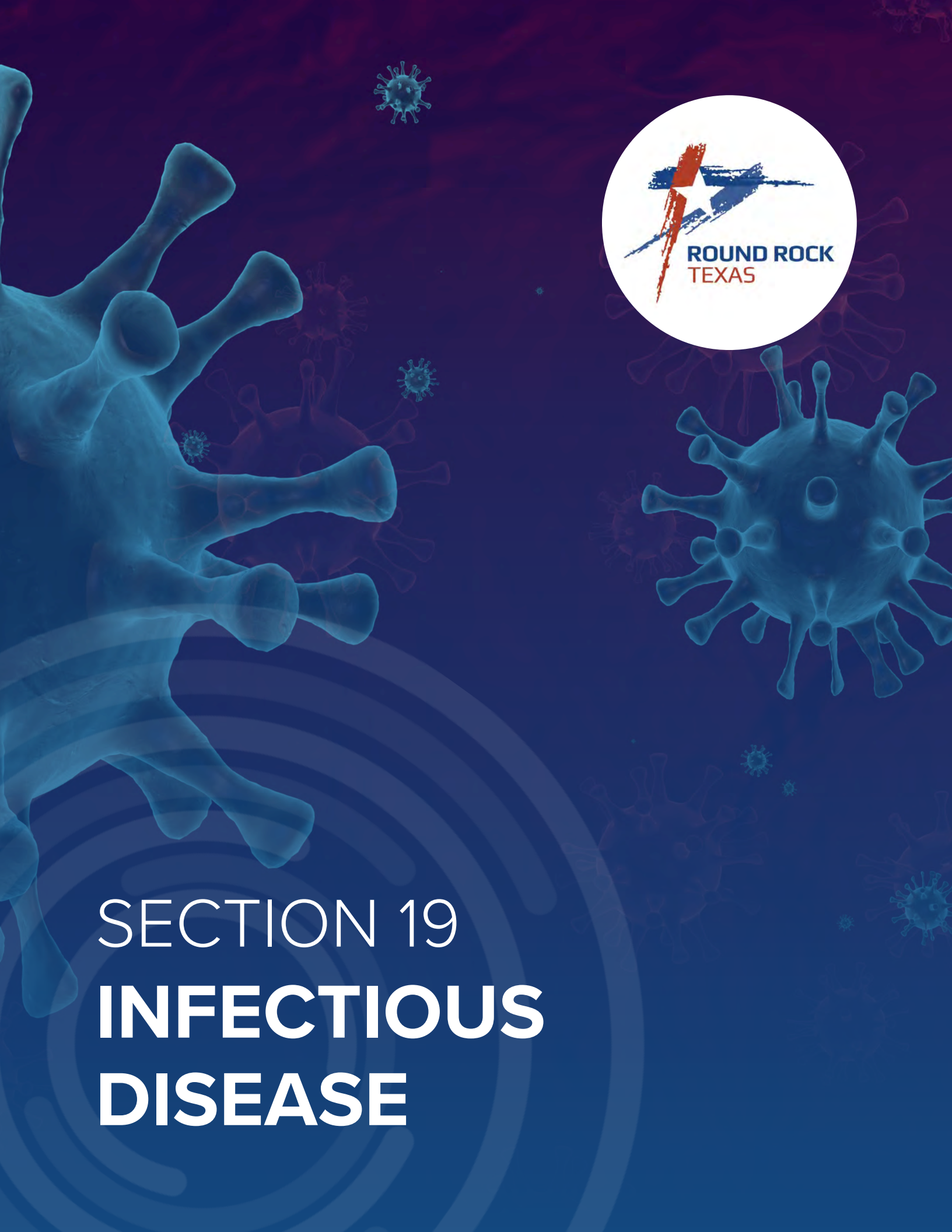
- Vulnerable populations, particularly the elderly (10 percent of total population) and children under 5 (6 percent of total population), can face serious or life-threatening health problems from exposure to toxic chemicals.
- Transportation disruptions and road closures can result in emergency response vehicles being unable to access areas of the community.
- First responders are exposed to toxic chemicals, hazardous materials, and generally unsafe conditions, which could result in sickness and long-term health impacts.
- Economic disruption negatively impacts the programs and services provided by the community due to short- and long-term loss in revenue.
- Evacuations, shelter in place orders, or the closure of transportation routes can lead to the disruption of critical facilities, businesses, and schools.
- The environment may experience significant damage leading to air and water contamination, loss of wildfire, agriculture, and tourism.

The economic and financial impacts of hazardous material incidents on the area will depend entirely on the scale of the event, where the event occurs, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event

planning done by the community, local businesses, and citizens will also contribute to the overall economic and financial conditions in the aftermath of any HAZMAT incident.

CLIMATE CHANGE CONSIDERATIONS

As a non-natural hazard, climate change has no direct impact on the future occurrences of hazardous material incidents. However, climate change is associated with an increase in severe weather. Severe weather events may cause damage to the storage of hazardous materials and can lead to an increase in chemical spills, leaks, or fires. Research and data regarding the impact of climate change on non-natural events is minimal and limited.

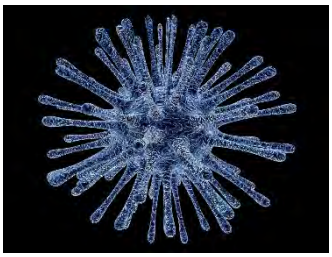


SECTION 19

INFECTIOUS DISEASE

SECTION 19: INFECTIOUS DISEASE

HAZARD DESCRIPTION



An infectious disease is a clinically evident disease resulting from germs, such as bacteria, viruses, and fungi, that enter the body, multiply, and cause infection. Some infectious diseases are contagious, or communicable, meaning they can spread from one person to another. Other infectious diseases can be spread by germs carried in air, water, food, or soil. They can also be spread by vectors, like biting insects, or by animals to humans.[1]

There are three classifications commonly used to identify disease impacts: endemic, epidemic, and pandemic. An endemic is the baseline level of disease, or the normal amount of a particular disease expected in the community. An epidemic is the sudden rise or increase in the number of reported diseases, usually above what is normally expected within a specific population or area. A pandemic is an epidemic that has spread over several countries or continents, affecting a large number of people.[2]

According to FEMA, infectious diseases are a major threat around the world, killing millions globally each year. Concerns of pandemics have risen because the globalized economy and growing population foster large scale international travel and trade. Growing populations increase the vulnerability of all areas to disease because a denser population increases the risk of exposure to an infectious disease and advances the spread of infection.

The United States Centers for Disease Control and Prevention (CDC) monitors and reports infectious disease outbreaks across the region. These outbreaks are published on the CDC website (https://www.cdc.gov/outbreaks/index.html). The CDC also manages the Nationally Notifiable Disease List. A notifiable disease is one that, when diagnosed, requires health providers by law to report to state or local public health officials. Notifiable diseases must be reported due to their contagiousness, severity, or frequency. The list is compiled through collaborative efforts among state health departments and the CDC, therefore, diseases that are considered notifiable vary from state to state. Internationally notifiable diseases (i.e., cholera, plague, and yellow fever) are also reportable in compliance with the World Health Organization's International Health

[1] Source: Centers for Disease Control and Prevention (CDC), https://www.cdc.gov/ncezid/who-we-are/index.html#:~:text=Infectious%20diseases%20are%20illnesses%20caused,from%20one%20person%20to%20another.
[2] Source: Centers for Disease Control and Prevention (CDC), https://www.cdc.gov/scienceambassador/nerdacademy/glossary.html

Regulations. The Texas Department of State and Health Services (DSHS) manages the state's list of notifiable conditions, which includes but is not limited to, the following:

- Coronavirus
- Diphtheria
- Hepatitis A and B
- Human Immunodeficiency Virus (HIV)
- Influenza
- Measles
- Plague
- Human Rabies
- Smallpox
- Cholera
- Viral Hemorrhagic Fever (including Ebola)
- Yellow Fever

LOCATION

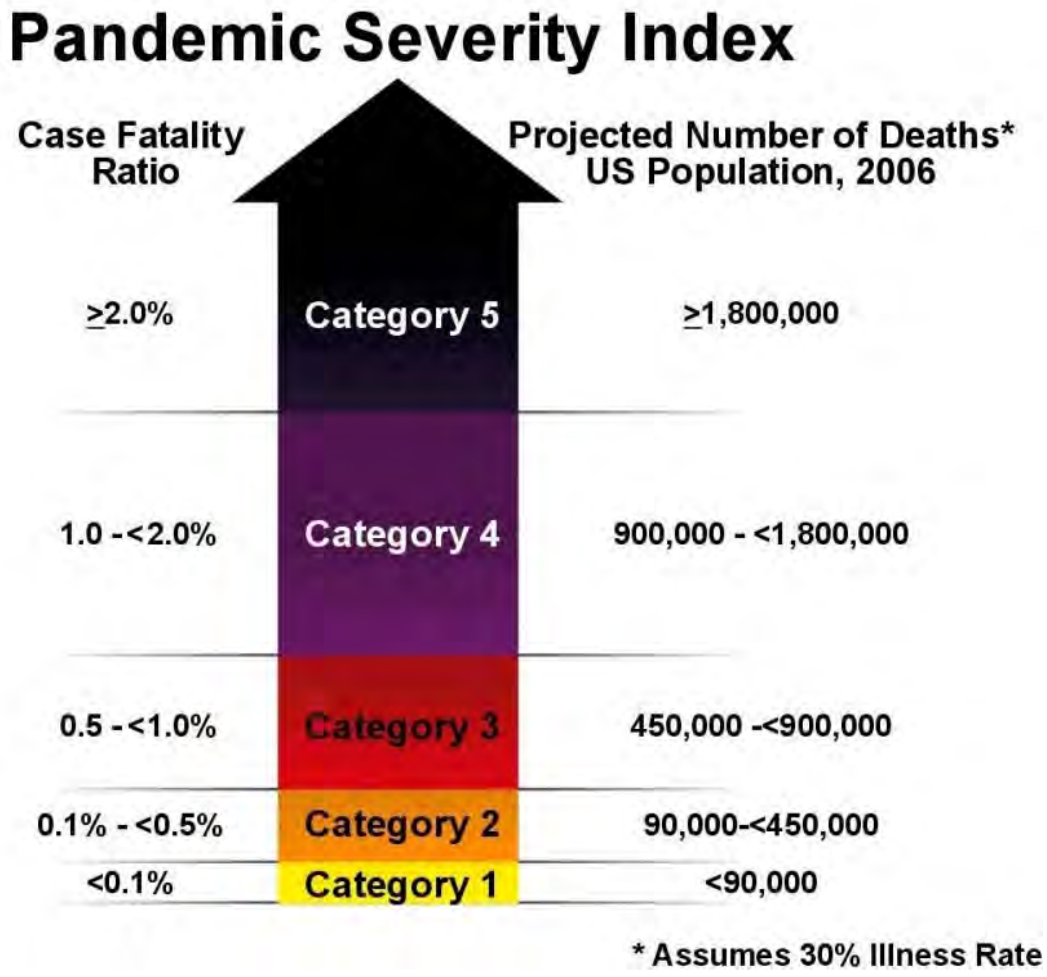
Pandemics cannot be predicted and only a few happen every century. The impacts from an infectious disease event can affect all areas of the world, therefore all areas are vulnerable, as evidenced by the COVID-19 pandemic. Since air travel and worldwide shipping have increased, it has become increasingly difficult to contain localized outbreaks as infected or exposed people travel across the globe in a matter of hours. Third world countries have fewer resources to fight disease and may be more vulnerable than more industrialized nations. In the United States, the U.S. public health system works at the federal, state, and local level to monitor diseases, plan, and prepare for outbreaks, and prevent epidemics where possible.

There is no distinct geographic boundary to infectious disease, therefore, it can occur throughout the entire City of Round Rock planning area.

EXTENT

In terms of extent, an outbreak can range from a local endemic to a worldwide pandemic. The severity of a pandemic virus can be evaluated by using the Case Fatality Ratio (CFR) method. The CFR is the proportion of the number of deaths divided by the number of confirmed patients of a disease, which is then used to assess and compare the severity of the endemic, epidemic, or pandemic. It also can be used to evaluate the effect of new treatments, with measures decreasing as treatments improve. As depicted in Figure 19-1 through 19-3, the higher the CFR, the more severe the infectious disease outbreak, and the greater the extent. The City of Round Rock planning area is subject to the full range of extent in an infectious disease event.

Figure 19-1. Case-Fatality Rate for Severity[3]



[3] Source: Centers for Disease Control and Prevention (CDC): https://www.cdc.gov/media/pdf/mitigationslides.pdf

Figure 19-2. Pandemic Severity Index Interventions

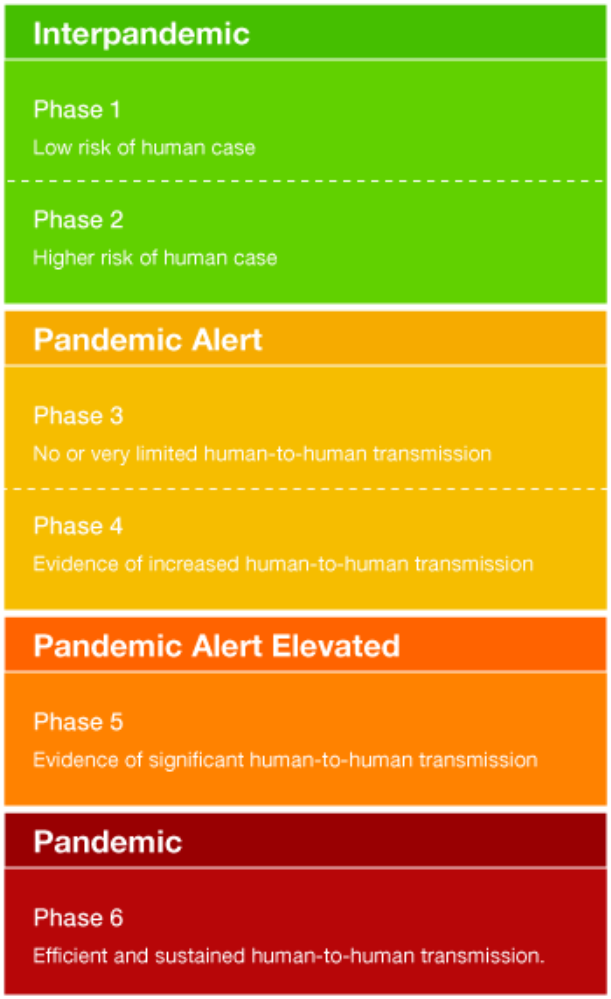
	Pandemic Severity Index		
Interventions by Setting	**1**	**2 and 3**	**4 and 5**
Home			
Voluntary isolation of ill at home (adults and children); combine with use of antiviral treatment as available and indicated	Recommend	Recommend	Recommend
Voluntary quarantine of household members in homes with ill persons (adults and children); consider combining with antiviral prophylaxis if effective, feasible, and quantities sufficient	Generally not recommended	Consider	Recommend
School			
Child social distancing –dismissal of students from schools and school-based activities, and closure of child care programs	Generally not recommended	Consider: ≤ 4 weeks	Recommend: ≤ 12 weeks
–reduce out-of-school contacts and community mixing	Generally not recommended	Consider: ≤ 4 weeks	Recommend: ≤ 12 weeks

Figure 19-3. Pandemic Severity Index Interventions

	Pandemic Severity Index		
Interventions by Setting	**1**	**2 and 3**	**4 and 5**
Workplace/Community Adult social distancing			
–decrease number of social contacts (e.g., encourage teleconferences, alternatives to face-to-face meetings)	Generally not recommended	Consider	Recommend
–increase distance between persons (e.g., reduce density in public transit, workplace)	Generally not recommended	Consider	Recommend
–modify, postpone, or cancel selected public gatherings to promote social distance (e.g., stadium events, theater performances)	Generally not recommended	Consider	Recommend
–modify workplace schedules and practices (e.g., telework, staggered shifts)	Generally not recommended	Consider	Recommend

In addition, the World Health Organization (WHO) established various warning levels for pandemic events, as depicted in Figure 19-4. During the COVID-19 pandemic, the planning area was in Phase 6.

Figure 19-4. Risk levels for Pandemic (World Health Organization)



HISTORICAL OCCURRENCES

Occurrences of infectious disease events are fairly common and have the ability to affect entire regions at one time. Texas has experienced various outbreaks beginning in the early 1800s to now. The City of Round Rock planning area has also been impacted by other nation-wide and global outbreaks including the epidemics and pandemics provided in the table below.

Table 19-1. Historical Infectious Disease Outbreaks in Texas

YEAR	INFECTIOUS DISEASE OUTBREAK
1833	Cholera appeared in Texas causing many deaths. It appeared again in 1849.[4]
1918	An influenza (flu) pandemic occurred and caused 20 million deaths worldwide.

[4] Source: Texas State Historical Association, https://www.tshaonline.org/handbook/entries/epidemic-diseases

YEAR	INFECTIOUS DISEASE OUTBREAK
2009	A novel strain of H1N1, or "Swine Flu" was detected in Mexico and the United States which caused approximately 60.8 million cases, 274,304 hospitalizations and more than 12,000 deaths.[5]
2012	While the Zika virus was around much sooner, Texas suffered a severe outbreak in 2012, with 1,868 reported cases.
2020	Texas identified its first case of COVID-19 in 2020, which quickly became a pandemic, impacting millions of people worldwide. As of 2024, more than 9,000,000 cases of COVID-19 have been reported in Texas, alone.[6] As of May 2023, Williamson County, which includes the City of Round Rock planning area, reported more than 172,238 confirmed or probable cases of the virus, as well as 952 deaths.

Some infectious diseases, such as the influenza, occur annually, like during "flu season." Other viruses such as the human immunodeficiency virus (HIV), which has impacted millions of people worldwide, are an ongoing issue. Other infectious diseases are very dangerous, and outbreaks may be localized. For example, in 2014, the first case of Ebola was diagnosed in the United States in a person who had traveled to Dallas, Texas from Liberia. Later, a nurse previously involved in direct care of the first patient was confirmed to have Ebola, and another case was reported in Ohio at the same time. The "Dallas Ebola cluster" highlighted the importance of locally planning for infectious disease outbreaks.[7]

PROBABILITY OF FUTURE EVENTS

Epidemics and pandemics have occurred in human and animal populations for thousands of years. As humans began to gather and congregate in urban areas, the potential for pandemics and epidemics increased. As trade routes became established and contact with other cities became more frequent, the potential for transmission of illnesses increased. In modern society, the ease of global travel has created a situation where viruses and bacteria can spread quickly from one continent to another.

Historical evidence shows that the population of the City of Round Rock planning area is vulnerable to disease outbreak, and the probability of future infectious disease or pandemic events is possible, however, it is considered "Unlikely" due to the frequency of such outbreaks. Federal, state, and local public health officials maintain surveillance in hopes of identifying disease prominence and containing potential threats before they become epidemics.

VULNERABILITY AND IMPACT

Estimated potential losses to the built environment are difficult to calculate because infectious disease causes little damage to the built environment and generally losses are experienced through public health response and medical costs, and lost wages of patients. Therefore, it is

[5] Carrat, F. et al. Timelines of Infection and Disease in Human Influenza: A Review of Volunteer Challenge Studies. American Journal of Epidemiology, 2008, 167: 775–785.
[6] Source: Texas Health and Human Services: https://www.dshs.texas.gov/covid-19-coronavirus-disease/texas-covid-19-surveillance
[7] Source: CDC, https://www.cdc.gov/mmwr/preview/mmwrhtml/mm63e1114a5.htm

assumed that all buildings and facilities are exposed to disease but would experience negligible damage in the occurrence of an outbreak event. For example, upkeep and maintenance of buildings and facilities would fall behind due to the high absenteeism of employees or the closing of facilities.

Critical infrastructure services, such as emergency services, utility services, water services and telecommunications can be limited by an infectious disease event. As seen during the COVID-19 pandemic, many jurisdictions executed a mandatory shutdown of non-essential businesses. The gradual re-opening of businesses and restaurants was completed in incremental stages to try and limit the spread of the infection and protect consumers while restarting the economy. Larger gatherings of people were limited to 50 and below and at times to 10 and below. Area school districts closed all campuses and implemented remote learning. Similar impacts are expected during future infectious disease outbreaks.

People and populations most vulnerable to infectious disease outbreaks include the elderly, children, people with disabilities, and those with pre-existing medical conditions. In addition, people living in poverty may not have the means to purchase personal protection equipment (PPE), medicine, and may have limited access to healthcare resources. Those who speak a language other than English may also become isolated and not have the same access to medical resources during an endemic, epidemic, or pandemic.

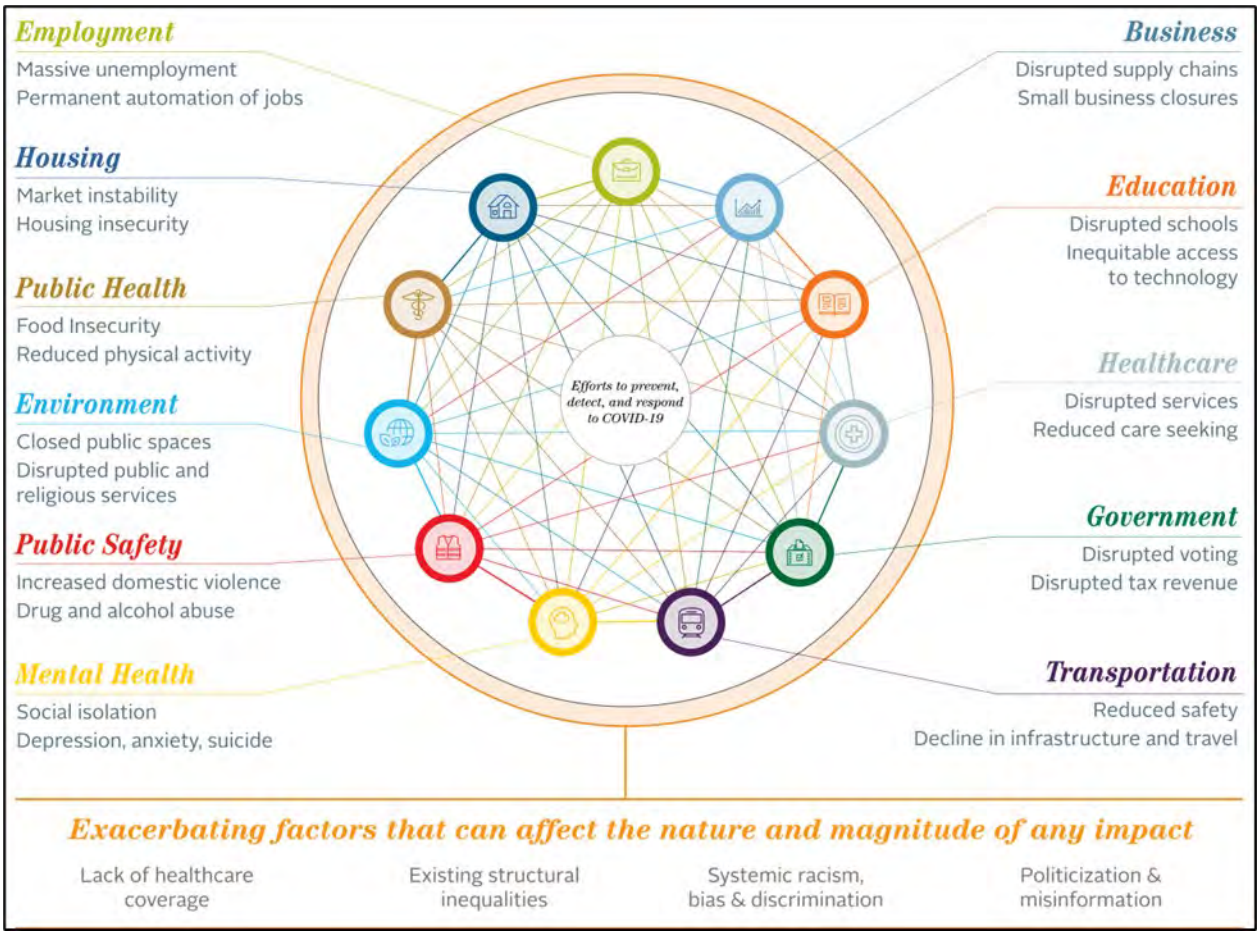
The population over 65 in the City of Round Rock planning area is estimated at 10 percent of the total population and children under the age of 5 are estimated at 6 percent. Populations with a disability are estimated at 11 percent. An estimated 8 percent of the planning area population live below the poverty level and 25 percent of the populations speaks a language other than English.

Table 19-2. Populations at Greater Risk of Infectious Disease Outbreaks

ELDERLY (over 65)	**YOUTH** (under 5)	**WITH A DISABILITY**	**BELOW POVERTY LEVEL**	**NON-ENGLISH SPEAKING**
12,356	7,219	12,927	9,276	30,183

The recent COVID-19 pandemic demonstrated that the response costs to the public health sector for an outbreak, the economic impact, and the impact to health for the City of Round Rock planning area, is “Substantial.” Multiple deaths can be expected, and the City of Round Rock planning area facilities could be shut down for 30 days or more. Other, unexpected, secondary impacts may also occur, as learned during the COVID-19 pandemic. Figure 19-5 provides an overview of secondary impacts of COVID-19 in the United States, which can be expected in the future.

Figure 19-5. Secondary Impacts of the COVID-19 Pandemic in the United States[8]



ASSESSMENT OF IMPACTS

Disease impacts are larger than normal segments of the population, and few sectors of the population are left untouched by infectious disease. The impact of an infectious disease event will be measured by the number of fatalities, how the community is affected, and to what extent. The physical problems associated with infectious diseases may be short term or may lead to long-term physical maladies and can be frequently associated with a variety of impacts, including:

- Absenteeism in the workplace can have negative impacts on the overall functioning of society, particularly if it is prolonged.
- The risks to public health and safety include first responders and others with increased exposure to the disease. Response personnel likely to experience the greatest impact would be those with medical responsibilities, such as fire fighters, ambulance workers, and clinic and hospital personnel.

[8] Degrees, Model shows intersecting secondary impacts of COVID-19 in the US, August 6, 2020, website: https://degrees.fhi360.org/2020/08/model-shows-intersecting-secondary-impacts-of-covid-19-in-the-united-states/

- If City staff stay home due to illness, someone in their home is ill, or because they fear becoming ill, the ability of local government to maintain operations and deliver services could be seriously limited or compromised.
- A pandemic event may result in heightened stress for responders, health care providers, public health workers, individuals, and communities.
- The public will require information on how to recognize and cope with the short- and long-term risks of sustained stress during mass vaccinations, for those debilitated by an illness, and their caregivers.
- There is the possibility of indirect damage to structures resulting from staff absenteeism and lack of routine operations and maintenance.
- Human infectious diseases do not normally pose a risk to the natural environment. Infectious diseases tend to be specific to humans, and therefore pose little threat to the natural environment or non-mammalian species. However, certain exceptions exist including the avian flu, which can affect both birds and humans.
- Infectious disease outbreaks can be costly. Seasonal flu occurs annually and is estimated to cost the U.S. economy between $71 million and $167 million per year.[9] Severe pandemics have been predicted to cause more than $700 billion in economic losses, and to result in a 5.5% decrease in U.S. Gross Domestic Product (GDP).[10]
- If the normal movement of the epidemic within society needs to be curtailed, a process known as “social distancing,” then a greater impact to the local economy could occur.
- Depending on the situation, examples of cancellations and building closures might include cancellation of public events, such as concerts, sports events, movies, plays; and closure of recreational facilities, such as community swimming pools, youth clubs, gymnasiums.
- When clear communication to the public fails, it can result in a loss of credibility, and can result in a loss of public confidence in leadership.
- Public dissatisfaction with government response will typically increase as the number of cases rises and public fear increases.
- Perceptions of inequality in medical care, particularly if those inequalities are based on socioeconomic status, ethnicity, age, gender, or seniority, can lead to increased dissatisfaction with government and leadership, and may result in a weakening of social order or hostility towards those in leadership or medical roles.
- Required rationing of supplies or vaccinations may be necessary.
- There could be significant public resistance to a decision to quarantine those who are ill or exposed, to restrict travel, or to implement social distancing.

The economic and financial impacts of infectious diseases on the community will depend on the severity of the disease, how many people are impacted, and how quickly the disease can be contained. The level of preparedness and pre-event planning done by the community, local businesses and citizens will also contribute to the overall economic and financial conditions in the aftermath of an infectious disease event.

[9] Source: World Health Organization
[10] Source: Federal Reserve Bank of St. Louis

CLIMATE CHANGE CONSIDERATIONS

According to the CDC and other climate change specialists, climate change does increase the risk of health threats. Mild winters, early springs, and warmer temperatures are giving mosquitoes and ticks more time to reproduce, spread diseases, and expand their habitats throughout the United States. Between 2004 and 2018, the number of reported illnesses from mosquito, tick, and flea bites more than doubled, with more than 760,000 cases reported in the United States. Nine new germs spread by mosquitoes and ticks were discovered or introduced into the United States during this period. A major concern with this shift is the potential spread of Lyme disease, the West Nile virus, and the Zika virus.

Climate change has forced some animal species into new habitats as their natural habitats disappear, and it has expanded the habitats of other animals. This movement of animals into new areas increases opportunities for contact between humans and animals and the potential spread of zoonotic diseases, for example, wildlife carrying the rabies virus are expanding to new geographic areas of the country. In addition, as global temperatures rise, deadly diseases that are a threat in other countries, like Ebola, Lassa, Rift Valley fever, and monkeypox, will increase along with the risk of them being imported into the United States.[11]

[11] Source: CDC, https://www.cdc.gov/ncezid/what-we-do/climate-change-and-infectious-diseases/index.html

SECTION 20
PIPELINE FAILURE

SECTION 20: PIPELINE FAILURE

HAZARD DESCRIPTION

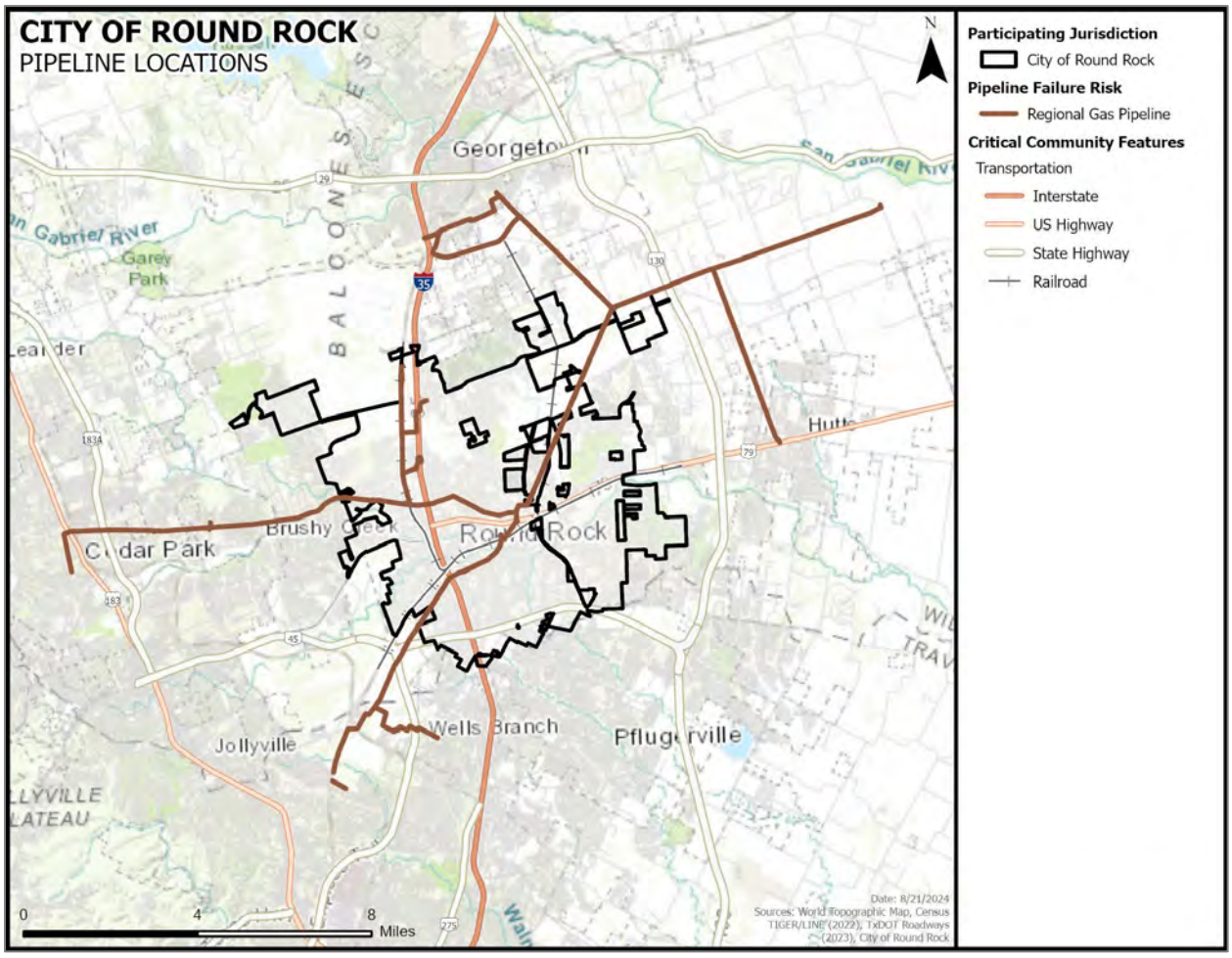
Energy pipeline breach or pipeline failure of an oil or natural gas pipeline is a serious hazard event. An estimated 2.4 million miles of pipelines in the United States carry hazardous materials. Natural gas pipelines transport natural gas and oil. Liquid petroleum pipelines transport crude oil and refined products from crude oils, such as gasoline, home heating oil, jet fuel, kerosene, liquefied propane, ethylene, butane and petrochemical products. Oil pipelines can also transport liquefied gases, such as carbon dioxide.

Pipeline failure is a rare occurrence and has the potential to cause extensive property damage and loss of life. Pipelines have caused fires and explosions that killed more than 200 people and injured more than 1,000 people nationwide with 50 of the injuries in Texas in the last decade.

LOCATION

Figure 20-1 shows the location of gas and oil energy pipelines in the City of Round Rock according to the U.S. Department of Transportation's National Pipeline Mapping System (NPMS). Areas nearest to existing gas or hazardous material pipelines within the City of Round Rock planning area would be the most vulnerable in the event of a pipeline failure.

Figure 20-1. City of Round Rock Planning Area Pipeline Locations



EXTENT

Pipeline failure incidents can range from minor to catastrophic, depending on the cause and location of the incident. Minor leaks may be localized and cause limited environmental and structural damage, requiring simple repairs. Major incidents can be widespread and lead to environmental contamination, injuries, and potential fatalities. The extent of damages will depend on the type of material released, location of the incident, and overall response and containment efforts.

The U.S. Department of Transportation's (DOT) Pipeline and Hazardous Material Safety Administration (PHMSA), acting through the Office of Pipeline Safety (OPS), administers the Department's national regulatory program to assure the safe transportation of natural gas, petroleum, and other hazardous materials by pipeline. The OPS develops regulations and other approaches to risk management to assure safety in design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. Since 1986, the pipeline safety program has been funded by a user-fee assessed on a per-mile basis for all pipeline operators that OPS regulates.

SECTION 20: PIPELINE FAILURE

HISTORICAL OCCURRENCES

Pipeline failure events can be caused by corrosion, equipment failure, damage from excavations, incorrect operation, and natural forces. Incidents are generally categorized by severity and type of affected pipeline system component.

The PHMSA defines significant events as those incidents reported by pipeline operators when any of the following occur:

- Fatality or injury requiring in-patient hospitalization;
- $50,000 or more in total costs, measured in 1984 dollars;
- Highly volatile liquid releases of 5 barrels or more or other liquid releases of 50 barrels or more; and
- Liquid releases resulting in an unintentional fire or explosion.

The PHMSA defines a serious pipeline incident as an event involving a fatality or injury requiring in-patient hospitalization. Across Texas between 2004 and 2023, PHMSA reports 39 fatalities, 138 injuries, and over $1 billion in damages as a result of over 3,500 pipeline incidents. However, based on best available data, none of these events are known to have occurred in or impacted the City of Round Rock planning area. [1]

PROBABILITY OF FUTURE EVENTS

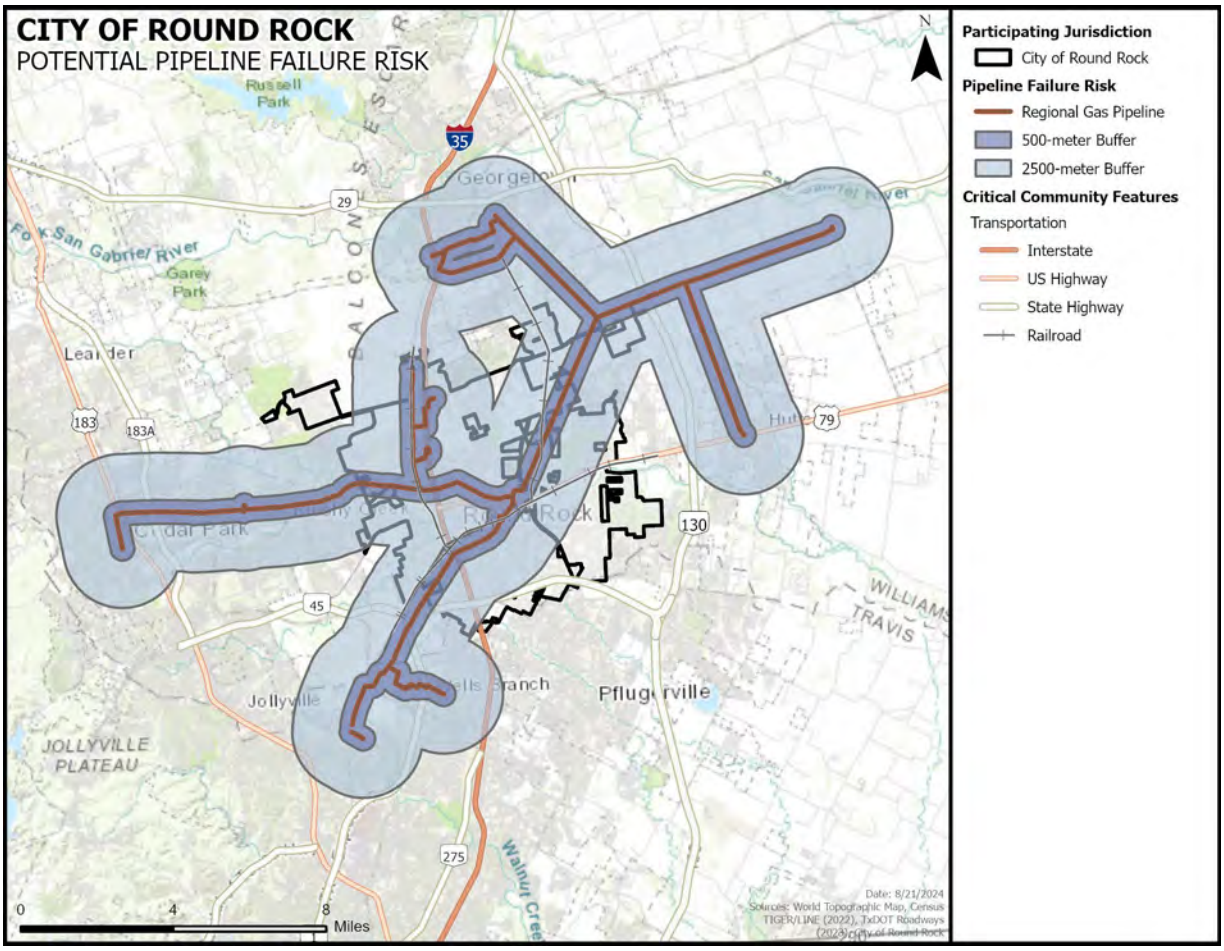
According to the historical incident data, a pipeline incident for the City of Round Rock planning area is considered “Unlikely,” with an event probable in the next ten years.

VULNERABILITY AND IMPACT

The analysis for gas pipelines is for natural gas and the analysis for oil pipelines is for natural gas liquids. The immediate and primary area of impact for both types of pipeline events is a 500-meter buffer. The secondary area of impact for both types of pipeline events is a 2,500-meter buffer. Figure 20-2 shows the pipeline buffer areas. Both types of impact can inflict substantial damage on the surrounding areas. Pipeline breaches have the potential to cause multiple deaths and complete shutdown of facilities for 30 days or more.

[1] Source: Pipeline and Hazardous Materials Safety Administration and Railroad Commission of Texas

Figure 20-2. Pipeline Location with 500- and 2,500-meter buffer



Based on historical data, pipeline failure can have a “Minor” severity of impact on the City of Round Rock planning area, meaning pipeline failure events can cause injuries and illnesses that do not result in permanent disability, shutdown critical facilities for up to one week, and damage or destroy more than 10 percent of property.

The following facilities in Table 20-1 are located within the 2,500-meter buffer zone for the pipelines located in the planning area and are considered vulnerable in the event of a pipeline failure. Of the 269 total critical facilities identified by the City of Round Rock Planning Team, 208 fall within the 2,500-meter buffer zone of a pipeline. For a comprehensive list of critical facilities, please see Appendix C.

Table 20-1. Critical Facilities at Greater Risk to Pipeline Failure

FACILITY TYPE	FACILITIES WITHIN 2,500-METER BUFFER ZONE
Adult Day Care	3
Autism Behavior Center	9
Communications	3

FACILITY TYPE	FACILITIES WITHIN 2,500-METER BUFFER ZONE
Community Facility	1
Fire Station	9
Health Services	9
Municipal	3
Police	1
Residential: Vulnerable Populations	10
Sanitation/Waste	1
School	56
Lift Station	3
Pump Station	2
Water Tank/Tower	1
Wastewater Treatment Plant	3
Water Treatment Plant	8
Tier II - HazMat	42
Transportation	38
TOTAL	**208**

ASSESSMENT OF IMPACTS

The risk to public health and safety during a pipeline failure event depends on a number of factors, including the type and amount of chemical(s) involved, location, weather conditions, time of day, and presence of an ignition source. The location of pipelines determines the potential number of people in proximity to the hazard and is a significant factor when determining the risk to public health and safety. It is possible that the release of materials from a pipeline failure could involve a number of fatalities. It is likely that inhaled hazardous gases may result in respiratory problems, including burning sensations in the lungs, nose, and throat. The release of solids or liquids can be absorbed through the skin and may cause burns on contact. In some instances, the threat to health and safety may not be evident for an extended period of time.

Depending on the nature and extent of a pipeline failure, the public could be required to either evacuate the area or shelter in place, which would interrupt normal routines. Response personnel are also at risk from more concentrated or prolonged exposure to the agent involved in the event. Through response efforts, response personnel may respond and come in contact with hazardous substances before the nature of the hazard is determined. Response personnel also have a greater likelihood of impacts from secondary explosions or leaks.

SECTION 20: PIPELINE FAILURE

Generally, pipeline failure events will interrupt operations and services within a limited area. The nature of the interruption will depend on the facilities in the impacted area. For example, if the event results in the temporary closure or evacuation of a hospital, this will also impact all hospitals in the area because area hospitals may be expected to assume the patient load for the now-inaccessible facility. However, if the event is near non-essential businesses, the operational or service interruption might not be as far-reaching. While the closure of businesses would result in negative impacts for those businesses, this scenario would not have the same community impacts as the first example.

Damage to roadways, railways, and physical infrastructure resulting from a pipeline failure event can impair normal operations and delivery of services.

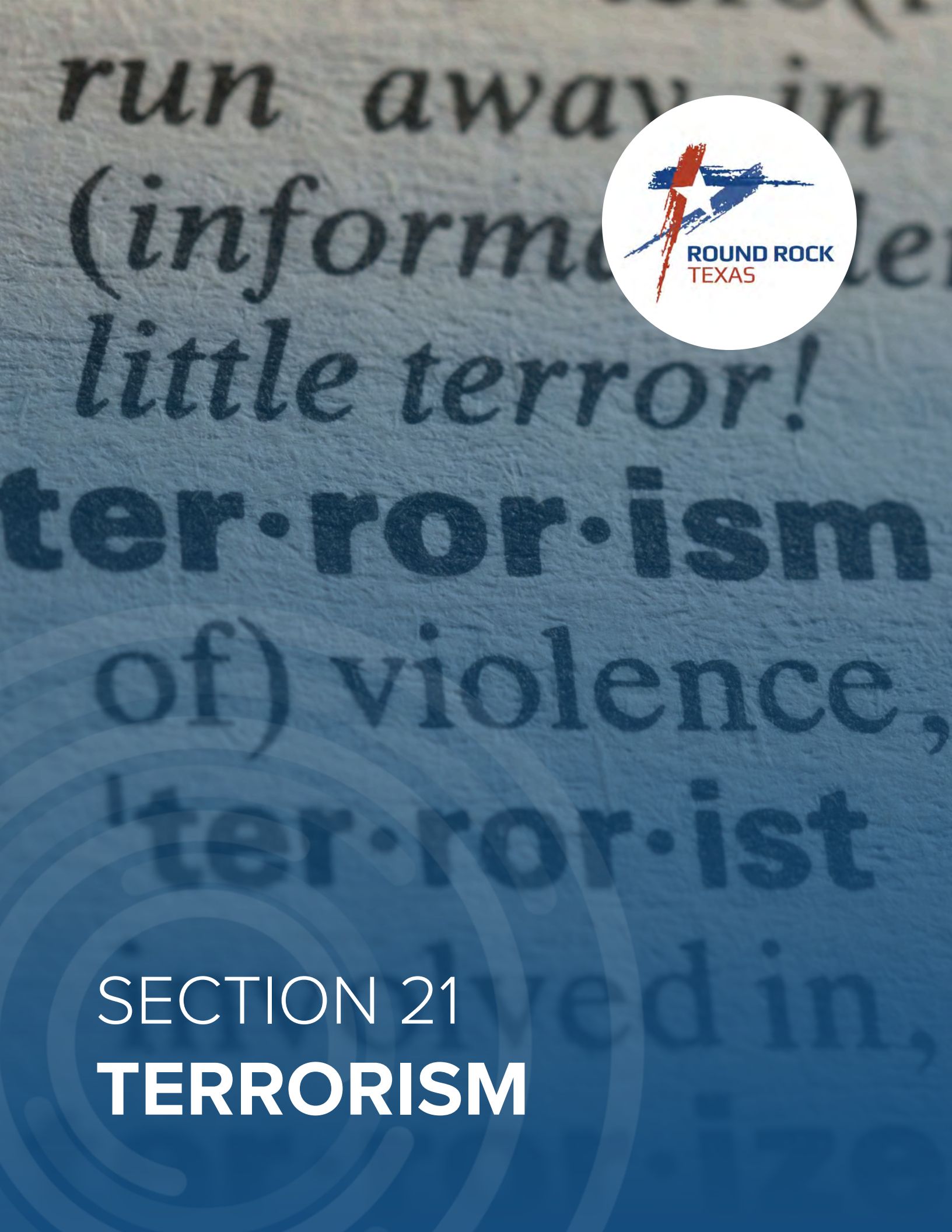
During a pipeline failure event, the pressure in a pipeline can disrupt the soil above a break. Any facility or piece of infrastructure over or adjacent to a rupture could be damaged or destroyed. If gas ignites, it will set flammable objects near it on fire. Depending on environmental factors such as wind, proximity of vegetation or other fuels, and dryness of the environment, the fire could spread to other nearby structures damaging or destroying them.

Any infrastructure in the area of the incident could be impacted by a pipeline failure event. Gas lines, water lines, sewer lines, and communication lines can be interrupted or destroyed, depending on the nature of the event. If the event is significant enough, utilities in the area may need to be temporarily suspended or disconnected, which would impact multiple facilities and properties.

Environmental risks from pipeline failure events can range from nonexistent to catastrophic, depending on the nature and extent of the release.

CLIMATE CHANGE CONSIDERATIONS

As a non-natural hazard, climate change has no direct impact on the future occurrences of pipeline failure incidents. However, climate change is associated with an increase in severe weather, flooding, extreme heat, drought, and wildfires. An increase in these events can lead to pipeline damage through scouring, erosion, debris impact, and intense heat. Research and data regarding the impact of climate change on non-natural events is minimal and limited.



ROUND ROCK
TEXAS

SECTION 21
TERRORISM

SECTION 21: TERRORISM

HAZARD DESCRIPTION

The Federal Bureau of Investigation (FBI) categorizes terrorism in the United States as one of two types—domestic terrorism or international terrorism. Domestic terrorism involves groups or individuals whose terrorist activities are directed at elements of our government or population without foreign direction. International terrorism involves groups or individuals whose terrorist activities are foreign-based and/or directed by countries or groups outside of the United States, or whose activities transcend their national boundaries.

A terrorist attack can take several forms, depending on the technological means available to the terrorist, the nature of issue motivating the attack, and the points of weakness of the terrorist's target. Bombings are the most frequently used terrorist method in the United States. A terrorist using a chemical or biological weapon is of particular concern to officials. Special training and equipment are needed in order to safely manage a Weapons of Mass Destruction incident.

Biological agents are infectious microbes or toxins used to produce illness or death in people, animals or plants. Biological agents can be dispersed as aerosols or airborne particles. Terrorists may use biological agents to contaminate food or water, as they are extremely difficult to detect.

Chemical agents kill or incapacitate people, destroy livestock, or ravage crops. Some chemical agents are odorless and tasteless and are therefore difficult to detect. These chemical agents can have an immediate effect (a few seconds to a few minutes) or a delayed effect (several hours to several days).

The Department of Defense estimates that as many as 26 nations may possess chemical agents and/or weapons, and an additional 12 may be seeking to develop them. The Central Intelligence Agency reports that at least 10 countries are believed to possess or are currently conducting research on biological agents for weaponization.

Terrorist incidents – as with other natural and technological disasters – involve the application of one or more modes of harmful force to the built environment. These modes include contamination (as in the case of chemical, biological radiological or nuclear hazards), energy (explosives, arson, and even electromagnetic waves), or denial of service (sabotage, infrastructure breakdown, and transportation service disruption).

LOCATION

There is no distinct geographic boundary to the threat of terrorism. An event is possible throughout the City of Round Rock. However, it is important to note that high-risk targets for acts of terrorism

include military and civilian government facilities, international airports, large cities, and high-profile landmarks. Terrorists might also target large public gatherings, water and food supplies, utilities, and corporate centers. Further, terrorists can spread fear by sending explosives or chemical and biological agents through the mail.

EXTENT

The Homeland Security Advisory System, issued by the U. S. Department of Homeland Security, previously used a color-coded terrorism warning system that identified five threat levels. In 2011, the Department of Homeland Security (DHS) replaced the color-coded alerts of the Homeland Security Advisory System (HSAS) with the National Terrorism Advisory System (NTAS), designed to more effectively communicate information about terrorist threats by providing timely, detailed information to the American public.

NTAS now consists of two types of advisories: Bulletins and Alerts. DHS has added Bulletins to the advisory system to be able to communicate current developments or general trends regarding threats of terrorism. As of July 2024, there has not been an active Bulletin since November 24, 2023. However, a Bulletin was active continuously from January 27, 2021, through November 24, 2023. NTAS Bulletins permit the Secretary to communicate critical terrorism information that, while not necessarily indicative of a specific threat against the United States, can reach homeland security partners or the public quickly, thereby allowing recipients to implement necessary protective measures. Because DHS may issue NTAS Bulletins in circumstances not warranting a more specific warning, NTAS Bulletins provide the Secretary with greater flexibility to provide timely information to stakeholders and members of the public.

When there is specific, credible information about a terrorist threat against the United States, DHS will share an NTAS Alert with the American public when circumstances warrant doing so. The Alert may include specific information, if available, about the nature of the threat, including the geographic region, mode of transportation, or critical infrastructure potentially affected by the threat, as well as steps that individuals and communities can take to protect themselves and help prevent, mitigate, or respond to the threat. The Alert may take one of two forms: Elevated, if there is credible threat information, but only general information about timing and target such that it is reasonable to recommend implementation of protective measures to thwart or mitigate against an attack; or Imminent, if the threat is believed credible, specific, and impending in the very near term. Terrorism Advisory System Alerts are described in Figure 21-1.[1]

[1] Source: Department of Homeland Security, https://www.dhs.gov/national-terrorism-advisory-system

Figure 21-1. National Terrorism Advisory

Red Cross also issues Advisory System Recommendations for individuals, families, neighborhoods, schools and businesses for each alert level. These may be found at: *www.redcross.org.*

Heightened periods for terrorism risk are based on intelligence and other information. A potential terrorist event could devastate the community physically, economically and psychologically for many years to come. Warning time for terrorism may be minimal to none.

HISTORICAL OCCURRENCES

The history of terrorism on United States soil includes the attacks of September 11, 2001, on the World Trade Center in New York and the Pentagon in Washington, D.C. and the ensuing anthrax attacks; the 1995 bombing of the Murrah Federal Building in Oklahoma City; the bombing of the World Trade Center in 1993; and the Boston Marathon Bombings in 2013.

However, the State of Texas has experienced a significant number of domestic terrorism events as shown in Figure 21-2. The United States Department of Homeland Security reported 231

domestic terrorism incidents between 2010 and 2021. These incidents occurred across the United States, but the greatest number of events occurred in states with major metropolitan areas such as California, New York, and Washington D.C.

Figure 21-2. National Terrorism Advisory

Source: GAO analysis of Department of Homeland Security Counterterrorism Mission Center data. | GAO-23-104720

None of these incidents occurred within the planning area, but surrounding communities have been impacted, and some of the nation's worst attacks have occurred within the state. While complete prevention of an attack may not be attainable, the city can lessen the likelihood and/or the potential effects of an incident. The City of Round Rock continues to improve its readiness to respond to a terrorist incident through participation in state and federal programs that provide training and equipment for agencies that would respond to a local terrorist incident, and in exercises that help to improve agency coordination and test local response plans.

PROBABILITY OF FUTURE EVENTS

The types, frequencies, and locations of many natural hazards are identifiable and, even in some cases, predictable, as the laws of physics and nature govern them. Malevolence, however, cannot be forecast with any accuracy. There is, therefore, some potential for most, if not all, types of intentional terrorist acts to occur anywhere and at any time. Reports also show that domestic terrorist incidents are on the rise in the United States, which indicates the slight possibility of an increased risk in the future. Based on best available data, it is "Unlikely" for a terrorist event to occur in the planning area in the next ten years.

VULNERABILITY AND IMPACT

There is no defined geographic boundary for a terrorist event. All of the population, buildings, critical facilities, infrastructure and lifelines, and hazardous materials facilities within the City of Round Rock planning area are considered exposed to the hazards of terrorism and could potentially be affected.

There are no past local events. Therefore, all assets and facilities are potentially at risk of damage that may, for the most part, be secondary.

Terrorist events can have a “Substantial” severity of impact, meaning multiple deaths, complete shutdown of facilities for 30 days or more, and more than 50 percent of affected properties destroyed or with major damage.

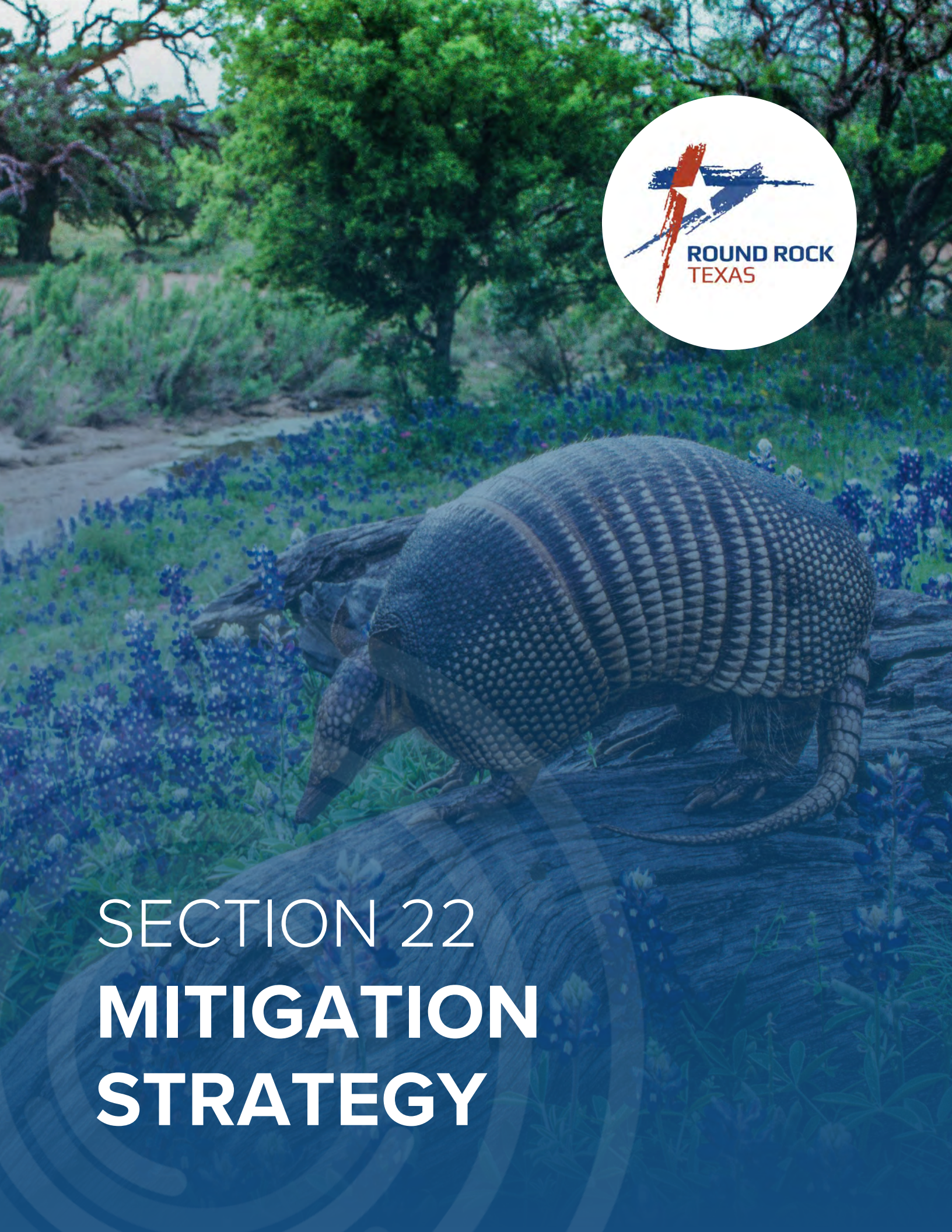
ASSESSMENT OF IMPACTS

Terrorist events have the potential to pose a significant risk to people, critical infrastructure and facilities, the economy, and built and natural environments. Due to the unforeseeable nature of terrorist attacks, as well as the broad variety of methods terrorist actors may utilize, the impacts of an event vary widely and are impossible to predict. Some of the potential impacts of a terrorist event include:

- Direct economic injury or destruction in the planning area can occur from terrorist attacks which target plants, machines, transportation systems, workers, or other smaller economic resources such as local businesses or restaurants.
- A terrorist attack can lead to community-wide mental health issues and trauma such as PTSD, depression, anxiety, a sense of helplessness, and substance abuse.
- Evacuations, shelter in place orders, or the closure of transportation routes can lead to the disruption of critical facilities, businesses, and schools.
- In the event of chemical or biological weapons being used, the environment may experience significant damage leading to air and water contamination, loss of wildfire, agriculture, and tourism.
- First responders are exposed to toxic chemicals, hazardous materials, and generally unsafe conditions, which could result in sickness and long-term health impacts.
- Vulnerable populations, particularly the elderly (10 percent of total population) and children under 5 (6 percent of total population), can face serious or life-threatening health problems from exposure to toxic chemicals.
- The population who speaks languages other than English (25 percent of total population) may have difficulty receiving urgent updates and safety guidance in the event of a terrorist attack.
- Terrorist attacks targeting critical facilities may result in the shutdown of essential services for extended periods of time. (See Appendix C for a comprehensive list of critical facilities in the City of Round Rock.)

CLIMATE CHANGE CONSIDERATIONS

As a non-natural hazard, climate change has no direct impact on the future occurrences of terrorism incidents. However, climate change is associated with an increase in severe weather. If severe weather events occur concurrently with a terrorist attack, the stress on emergency services, critical infrastructure, and the community may be compounded. Research and data regarding the impact of climate change on non-natural events is minimal and limited.



SECTION 22

MITIGATION STRATEGY

MITIGATION GOALS

Based on the results of the risk and capability assessments, the Planning Team developed and prioritized the mitigation strategy. This involved utilizing the results of both assessments and reviewing the goals and objectives that were included in the previous 2018 Plan. At the Mitigation Workshop in June 2024, Planning Team members reviewed the mitigation strategy from the previous Plan. The consensus among all members present was that the strategy developed for the 2018 Plan required some changes including expanding on existing goals and the addition of a goal around equity and vulnerable populations.

GOAL 1

Protect public health and safety.

OBJECTIVE 1.1

Advise the public about health and safety precautions to guard against injury and loss of life from hazards.

OBJECTIVE 1.2

Maximize utilization of the latest technology to provide adequate warning, communication, and mitigation of hazard events.

OBJECTIVE 1.3

Reduce the danger to, and enhance protection of, high risk areas during hazard events.

OBJECTIVE 1.4

Protect critical facilities and services.

GOAL 2

Build and support local capacity and commitment to continuously become less vulnerable to hazards.

OBJECTIVE 2.1

Build and support local partnerships to continuously become less vulnerable to hazards.

OBJECTIVE 2.2

Build a cadre of committed volunteers to safeguard the community before, during, and after a disaster.

OBJECTIVE 2.3

Build hazard mitigation concerns into city planning and budgeting processes.

GOAL 3
Increase public understanding, support, and demand for hazard mitigation.

OBJECTIVE 3.1
Heighten public awareness regarding the full range of natural and human-caused hazards the public may face.

OBJECTIVE 3.2
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.

OBJECTIVE 3.3
Publicize and encourage the adoption of appropriate hazard mitigation measures.

GOAL 4
Protect new and existing properties.

OBJECTIVE 4.1
Reduce repetitive losses to the National Flood Insurance Program (NFIP).

OBJECTIVE 4.2
Use the most cost-effective approach to protect existing buildings and public infrastructure from hazards.

OBJECTIVE 4.3
Enact and enforce regulatory measures to ensure that future development will not put people in harm's way or increase threats to existing properties.

GOAL 5
Maximize the resources for investment in hazard mitigation.

OBJECTIVE 5.1
Maximize the use of outside sources of funding.

OBJECTIVE 5.2
Maximize participation of property owners in protecting their properties.

OBJECTIVE 5.3
Maximize insurance coverage to provide financial protection against hazard events.

OBJECTIVE 5.4
Prioritize mitigation projects, based on cost-effectiveness and sites facing the greatest threat to life, health, and property.

GOAL 6
Promote growth in a sustainable manner.

OBJECTIVE 6.1
Incorporate hazard mitigation activities into long-range planning and development activities.

OBJECTIVE 6.2
Promote beneficial uses of hazardous areas while expanding open space and recreational opportunities.

OBJECTIVE 6.3

Utilize regulatory approaches to prevent creation of future hazards to life and property.

GOAL 7

Promote equity and protect vulnerable populations and underserved communities through hazard mitigation activities.

OBJECTIVE 7.1

Allocate resources and funding to implement hazard mitigation activities that directly benefit vulnerable and underserved communities.

OBJECTIVE 7.2

Build and support local partnerships to leverage resources and expertise in addressing hazard related equity concerns.

OBJECTIVE 7.3

Establish internal decision-making processes that integrate equity into project selection.

OBJECTIVE 7.4

Monitor and evaluate the effectiveness of mitigation activities to ensure equitable outcomes and protection of vulnerable populations.

SECTION 23

PREVIOUS ACTIONS

SECTION 23: PREVIOUS ACTIONS

SUMMARY

This section includes analysis from the 2018 City of Round Rock Hazard Mitigation Plan. Planning Team members were given copies of the previous mitigation actions submitted in the 2018 City of Round Rock Hazard Mitigation Plan at the mitigation workshop. Each participating entity reviewed the previous actions and provided an analysis as to whether the action had been completed, should be deferred as an ongoing activity, or be deleted from the Plan Update. The actions from the 2018 plan are included in this section as they were written in 2018, except for the “2024 Analysis” section.

CITY OF ROUND ROCK

	City of Round Rock Previous Action – Action #1
Proposed Action:	Educate Residents and RRISD on how to mitigate their homes and facilities from these Hazards via website, public forums, blogs, etc.
BACKGROUND INFORMATION	
Site and Location:	City-wide
Objective Addressed:	3.1, 3.2, 4.2, 5.1, 5.2, 5.3
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam/Levee Failure, Drought, Extreme Heat, Flood, Hail, Hurricane/Tropical Strom, Lightning, Tornado, Wildfire, Wind, Winter Weather
Priority (High, Moderate, Low):	Medium – Ranking 3
Estimated Cost:	Less than $10,000
Potential Funding Sources:	Budget
Lead Agency/Department Responsible:	Emergency Management and RRISD
Implementation Schedule:	48 months

2024 ANALYSIS:
Delete action. The City has proposed other improved education and awareness type actions.

SECTION 23: PREVIOUS ACTIONS

	City of Round Rock Previous Action – Action #2
Proposed Action:	Purchase NOAA All Hazards radios and disperse to residents and RRISD and target businesses for use for hazard events.
BACKGROUND INFORMATION	
Site and Location:	City-wide
Objective Addressed:	1.2, 3.1, 3.2, 5.1, 5.2, 5.3
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam/Levee Failure, Drought, Extreme Heat, Flood, Hail, Hurricane/Tropical Strom, Lightning, Tornado, Wildfire, Wind, Winter Weather
Priority (High, Moderate, Low):	Medium – Ranking 8
Estimated Cost:	Less than $10,000
Potential Funding Sources:	Budget, Donations, Sponsors
Lead Agency/Department Responsible:	Emergency Management and Round Rock ISD
Implementation Schedule:	36 months

2024 ANALYSIS:
Delete Action. City has identified alternative action in Plan Update.

	City of Round Rock Previous Action – Action #3
Proposed Action:	Implement new or enlarge existing detention structures to reduce flooding.
BACKGROUND INFORMATION	
Site and Location:	City-wide
Objective Addressed:	1.3, 2.1, 2.2, 3.1, 3.3, 4.1, 4.4
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam/Levee Failure, Flood, Hurricane/Tropical Storm
Priority (High, Moderate, Low):	High – Ranking 1
Estimated Cost:	Greater than $100,000
Potential Funding Sources:	Budget, HMA, Partners
Lead Agency/Department Responsible:	Stormwater Engineering
Implementation Schedule:	60 months

2024 ANALYSIS:
Completed. WCID raised and increased detention of city dams.

	City of Round Rock Previous Action – Action #4
Proposed Action:	Enlarge channels and/or culverts.
BACKGROUND INFORMATION	
Site and Location:	City-wide
Objective Addressed:	1.1, 1.3, 1.4, 2.1, 2.2, 4.4
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam/Levee Failure, Flood, Hurricane/Tropical Storm
Priority (High, Moderate, Low):	Medium – Ranking 2
Estimated Cost:	Granter than $100,000
Potential Funding Sources:	Budget, HMA
Lead Agency/Department Responsible:	Stormwater Engineering
Implementation Schedule:	60 months

2024 ANALYSIS:
Completed. The City of Round Rock completed this using Stormwater Utility funds. The Stormwater Capital Improvement Plan is implemented. Channel improvements and additional channel improvements, inlets, and pipes have been completed. In addition, creek cleanups were conducted.

SECTION 23: PREVIOUS ACTIONS

	City of Round Rock Previous Action – Action #5	
	Proposed Action:	Armor channel banks, flood-proof structures and/or remove infrastructure or structures to reduce flooding impacts.
	BACKGROUND INFORMATION	
	Site and Location:	City-wide
	Objective Addressed:	1.1, 1.3, 1.4, 2.1, 2.2, 3.3, 4.1, 4.3, 4.4
	Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Natural Systems Protection Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam/Levee Failure, Flood, Hurricane/Tropical Storm
Priority (High, Moderate, Low):	High – Ranking 4
Estimated Cost:	Grant than $100,000
Potential Funding Sources:	Budget, HMA
Lead Agency/Department Responsible:	Stormwater Engineering
Implementation Schedule:	60 months

2024 ANALYSIS:
Completed. The City of Round Rock completed this project using the Stormwater Utility Fund. There were gabion baskets used to eliminate erosion. There were also channel improvements, including the use of trickle channels.

SECTION 23: PREVIOUS ACTIONS

	City of Round Rock Previous Action – Action #6	
	Proposed Action:	New and updated models and a network of gauges and/or cameras will be used for real-time and predictive Mappings
	BACKGROUND INFORMATION	
	Site and Location:	City-wide
	Objective Addressed:	1.2, 1.3, 4.2, 4.1, 4.4, 5.1, 5.2, 5.3
	Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam/Levee Failure, Flood, Hurricane/Tropical Storm
Priority (High, Moderate, Low):	High – Ranking 5
Estimated Cost:	Greater than $100,000
Potential Funding Sources:	Budget, HMA, Partners
Lead Agency/Department Responsible:	Stormwater Engineering
Implementation Schedule:	48 months

2024 ANALYSIS:
Completed. The City of Round Rock has completed this project using the Stormwater Utility Fund. There is a Stormwater Master Plan that also mentions the use of a model, which helps in the decision-making process for future stormwater projects.

SECTION 23: PREVIOUS ACTIONS

	City of Round Rock Previous Action – Action #7
Proposed Action:	A variety of large equipment can help minimize flooding by keeping drainage ways and culverts free of debris and limbs.
BACKGROUND INFORMATION	
Site and Location:	City-wide
Objective Addressed:	1.1, 1.3, 1.4, 2.1, 2.2, 4.4
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Preparedness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam/Levee Failure, Flood, Hurricane/Tropical Storm
Priority (High, Moderate, Low):	Medium – Ranking 9
Estimated Cost:	Greater than $100,00
Potential Funding Sources:	Budget, HMA
Lead Agency/Department Responsible:	Stormwater Operations
Implementation Schedule:	24 months

2024 ANALYSIS:
Completed.

SECTION 23: PREVIOUS ACTIONS

	City of Round Rock Previous Action – Action #8
Proposed Action:	Evaluate and implement expansion of the City reuse water system and alternative water sources to ease drought impacts.
BACKGROUND INFORMATION	
Site and Location:	City Water systems
Objective Addressed:	1.2, 4.1, 4.2, 4.4, 5.1, 5.2, 5.3
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Natural Systems Protection Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Drought, Wildfire
Priority (High, Moderate, Low):	Medium
Estimated Cost:	Greater than $100,000
Potential Funding Sources:	Budget, HMA, TWDB
Lead Agency/Department Responsible:	Utilities & Environmental Services
Implementation Schedule:	60 months

2024 ANALYSIS:
Completed. The City of Round Rock completed this mitigation action using the Water Utility Fund. The water reuse system is always expanding.

SECTION 23: PREVIOUS ACTIONS

	City of Round Rock Previous Action – Action #9
Proposed Action:	Adjust wiring to equipment as needed to allow for newly purchased generators as temporary or permanent installations.
BACKGROUND INFORMATION	
Site and Location:	City Buildings
Objective Addressed:	1.1, 1.3, 1.4
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and infrastructure

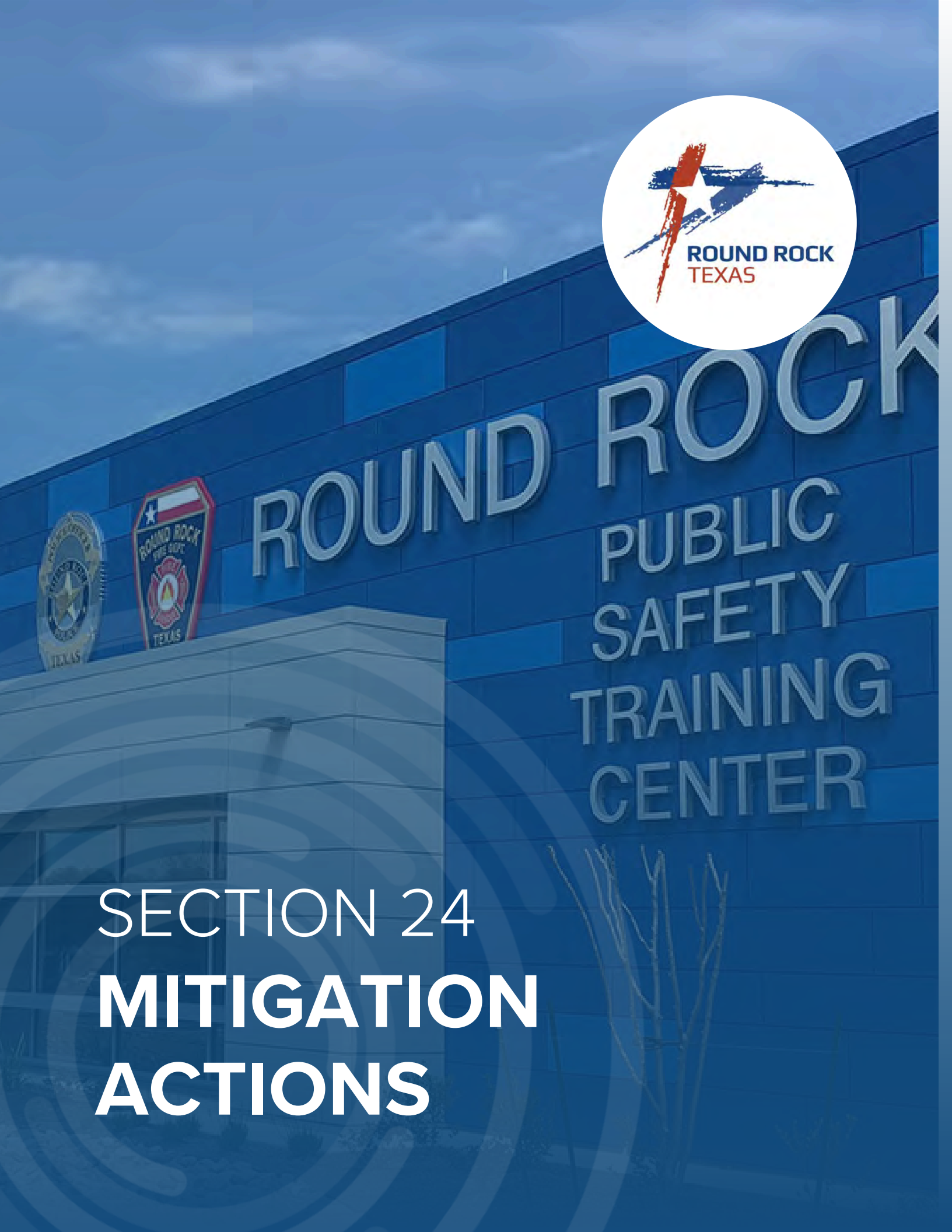
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam/Levee Failure, Flood, Hail, Hurricane/ Tropical Strom, Lightning, Tornado, Wildfire, Wind, Winter Weather
Priority (High, Moderate, Low):	High
Estimated Cost:	Less than $100,000
Potential Funding Sources:	Budget, HMA
Lead Agency/Department Responsible:	General Services, Parks & RRISD facilities
Implementation Schedule:	60 months

2024 ANALYSIS:
Delete Action. City has identify alternative action in Plan Update.

City of Round Rock Previous Action – Action #10	
Proposed Action:	Add hail guards to existing A/C to minimize damage and downtime due to storms.
BACKGROUND INFORMATION	
Site and Location:	City Buildings with A/C units
Objective Addressed:	1.1, 1.3, 1.4
Type of Action: *(Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Hail
Priority (High, Moderate, Low):	Medium
Estimated Cost:	Greater than $100,000
Potential Funding Sources:	Budget, HMA
Lead Agency/Department Responsible:	Facilities
Implementation Schedule:	60 months

2024 ANALYSIS:
Completed. It has become a standard practice to add hail guards to facilities to minimize storm damage impacts.



ROUND ROCK
TEXAS

SECTION 24
MITIGATION ACTIONS

SECTION 24: MITIGATION ACTIONS

SUMMARY

As discussed in Section 2, at the mitigation workshop the planning team and stakeholders met to develop mitigation actions for each of the natural hazards included in the Plan Update. Each of the actions in this section were prioritized based on FEMA's Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLEE) criteria necessary for the implementation of each action.

As part of the economic evaluation of the STAPLEE analysis, jurisdictions analyzed each action in terms of the overall costs, measuring whether the potential benefit to be gained from the action outweighed costs associated with it. As a result of this exercise, priority was assigned to each mitigation action by marking them as High (H), Moderate (M), or Low (L). An action that is ranked as "High" indicates that the action will be implemented as soon as funding is received. A "Moderate" action is one that may not be implemented right away depending on the cost and number of citizens served by the action. Actions ranked as "Low" indicate that they will not be implemented without first seeking grant funding and after "High" and "Moderate" actions have been completed.

Within each mitigation action worksheet, the Planning Team considered all potential funding sources that could be utilized to implement the proposed project. To ensure all potential funding resources are considered and are not limited to those sources identified within the action worksheet, please see Appendix G for a list of all available State and Federal grant programs as of 2024. The Planning Team will continue to seek out other available funding sources during the 5-year cycle as notices of funding opportunity (NOFO) are released.

All mitigation actions created by Planning Team members are presented in this section. More than one hazard is sometimes listed for an action, if appropriate. Actions presented in this section represent a comprehensive range of mitigation actions per current State and FEMA Guidelines, including one action, per hazard, and at least two different types.

Table 24-1. City of Round Rock Mitigation Action Matrix

TYPE OF ACTION	
Action #1 – Plans/Regulations (Blue)	Action #4 – Structural (Orange)
Action #2 – Education/Awareness (Red)	Action #5 – Preparedness/Response (Black)
Action #3 – Natural Systems Protections (Green)	

Jurisdiction	Dam Failure	Drought	Earthquake	Extreme Heat	Flood	Hail	Land Subsidence	Lightning	Thunderstorm Wind	Tornado	Wildfire	Winter Storm	Cyber Attack	Hazardous Materials	Infectious Disease	Pipeline Failure	Terrorism
City of Round Rock	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●

CITY OF ROUND ROCK

CITY OF ROUND ROCK MITIGATION ACTIONS														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
1	Implement education and awareness programs to educate citizens of hazards that can threaten the area and mitigation measures to reduce injuries, fatalities, and property damages. Continue updating Ready the Round Rock educational campaign and HSEM website.	City-wide	Promote hazard awareness and protect citizens from potential injuries and damages.	Education and Awareness	Dam Failure, Drought, Earthquake, Extreme Heat, Flood, Hail, Land Subsidence, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Cyber Attack, Hazardous Materials, Infectious Disease, Pipeline Failure, Terrorism	Safety/Security Communications	Y	H	$10,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	HSEM, Communications and Marketing, Neighborhood Services, Fire Dept., Parks and Recreation, Public Works, Police Dept.	12 Months	N/A	Promotes public safety.

CITY OF ROUND ROCK MITIGATION ACTIONS														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
2	Enhance resource management capabilities by collaborating with internal and external stakeholders to recognize the resources that may be available prior to, during, and after an incident.	City-wide	Increases efficiency of resource management during all disaster phases.	Preparedness /Response	Dam Failure, Drought, Earthquake, Extreme Heat, Flood, Hail, Land Subsidence, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Cyber Attack, Hazardous Materials, Infectious Disease, Pipeline Failure, Terrorism	Communication, Safety/Security	N/A	H	$10,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	HSEM, Community and Neighborhood Services	36 Months	N/A	Promotes public safety.
3	Identify all dams within the City of Round Rock and the extra territorial jurisdiction (ETJ). Collaborate with WCID Capital Improvements to identify maintenance and concerns with local dams and implement recommended improvements to reduce risk from failure.	City-wide	Reduce risk of damages to structures; Ensure continuity of critical services; Reduce risk of injuries and fatalities.	Structure and Infrastructure Local Plans and Regulations	Dam Failure	Safety/Security	Y	H	$3,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Public Works, Fire Department	60 Months	CIP	N/A

SECTION 24: MITIGATION ACTIONS

CITY OF ROUND ROCK MITIGATION ACTIONS														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
4	Identify low-lying areas that are at high risk for flooding. Adopt and implement routine inspections to ensure that culverts and drainage systems are clear of debris. Remove debris from drainage systems on a regular basis.	City-wide flood prone areas	Reduce damages to infrastructure; Ensure continuity of services during and after event; Reduce damages associated with power outages; Reduce risk of injuries or fatalities to vulnerable populations.	Structure and Infrastructure	Flood	Safety/Security, Transportation, Water Systems	Y	M	$100,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Utilities/ Transportation, Fire Department	36 Months	Drainage Plan	Protects infrastructure, reduces cost of reparation, and prevents injury to residents.

CITY OF ROUND ROCK MITIGATION ACTIONS														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
5	Harden/retrofit critical facilities to hazard-resistant levels, including but not limited to, installing hail guards on HVAC systems.	City-wide critical facilities	Reduce damages at critical facilities; Ensure continuity of critical services during and after event; Reduce risk of injury to emergency and critical personnel.	Structure and Infrastructure	Dam Failure, Drought, Earthquake, Extreme Heat, Flood, Hail, Land Subsidence, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Cyber Attack, Hazardous Materials, Infectious Disease, Pipeline Failure, Terrorism	Safety/Security	Y	L	$100,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	General Services	12 Months	CIP	Protects infrastructure, reduces cost of reparation, and prevents injury to residents.
6	Reduce water usage by monitoring local water sources and their capacity, implement water restrictions early in drought emergencies and collaborate with fire department to reduce water usage at the training facility.	City-wide	Ensure continuity of critical services; Promote water conservation measures; Maintain drinking water capacity during emergencies.	Local Plans and Regulations	Drought, Extreme Heat	Safety/Security, Food/Hydration/ Shelter	N/A	M	$50,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Utilities, Public Works, Fire Department	12 Months	N/A	N/A

CITY OF ROUND ROCK MITIGATION ACTIONS														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
7	Adopt regulations that all new construction will be built with lifelong foundations to mitigate future land subsidence risk.	City-wide	Reduce damages to structures and infrastructure.	Local Plans and Regulations	Land Subsidence	Safety/Security	Y	M	$5,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	General Services	12 Months	CIP	N/A
8	Monitor old facilities for movement using advanced monitoring systems and conduct regular inspections to detect subsidence early. Stabilize detected movement promptly using techniques such as grouting, underpinning, or reinforcement to ensure the structural integrity of the facilities.	City-wide	Reduce damages to structures and infrastructure.	Structure and Infrastructure	Land Subsidence	Safety/Security	Y	M	$1,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	General Services	60 Months	CIP	N/A

SECTION 24: MITIGATION ACTIONS

CITY OF ROUND ROCK MITIGATION ACTIONS														
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Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
9	Implement procedures to assist the fire department with wildfire events by ensuring that vehicles and equipment are operational. Ensure that a team of mechanics are on trained on procedures and on standby for support.	City-wide	Reduce damages to infrastructure; Ensure continuity of services during and after event; Reduce risk of injuries or fatalities to vulnerable populations.	Local Plans and Regulations Preparedness /Response	Wildfire	Safety/Security	N/A	M	$50,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	General Services	12 Months	N/A	N/A

SECTION 24: MITIGATION ACTIONS

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Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
10	Mitigate winter storm impacts by improving early warning systems, ensuring all transportation, public safety, and utility systems are winter ready, providing education on snow chain installation, retrofitting and hardening facilities for severe winter weather, and ensure generators are in working condition prior to winter season.	City-wide	Reduce damages to infrastructure; Ensure continuity of services during and after event; Reduce damages associated with power outages; Reduce risk of injuries or fatalities to vulnerable populations.	Structure and Infrastructure Education and Awareness	Winter Storm	Safety/Security	Y	M	$1,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	General Services, Fire Department	12 Months	N/A	N/A
11	Collect and maintain updated emergency action plans for all high-hazard dams within city limits and ETJ. Continue to participate in the WCID Technical Advisory Committee (TAC).	City-Wide (Behrens Ranch Parkland Mayfield Parkland Meadow Lake Park Old Settlers Park)	Reduce risk of damages through improved planning practices; Provide regional flood awareness to the public.	Local Plans and Regulations	Dam Failure	Communication, Safety/Security	N/A	M	$10,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Public Works, Parks and Recreation	12 Months	N/A	N/A

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Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
12	Develop a Community Wildfire Protection Plan (CWPP) to identify community areas with highest wildfire risk, identify risk reduction projects, and provide public education.	City-wide	Reduce risk of damages through improved planning practices.	Local Plans and Regulations	Wildfire	Safety/Security	N/A	L	$50,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Fire Department	24 Months	N/A	N/A
13	Provide public education on tornado shelters and sheltering procedures. Identify and collaborate with volunteer organizations to assist with shelter operations.	City-wide	Reduce risk to residents through improved awareness efforts.	Education and Awareness Preparedness /Response	Thunderstorm Wind, Tornado	Safety/Security	N/A	L	$50,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Fire Department, Public Works	12 Months	N/A	N/A

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**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
14	Educate citizens on lightning safety to potentially mitigate impacts of home fires. Including but not limited to information about: checking attic space after lightning strikes, calling 911 for smoke or fires, shutting attic doors to reduce air intake to potential fire, and knowing where utility cutoffs are in safety campaigns.	City-wide	Promote hazard awareness and protect citizens from potential injuries and damages.	Education and Awareness	Lightning	Safety/Security	N/A	L	$50,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Fire Department	12 Months	N/A	N/A
15	Create and implement training programs to mitigate a multitude of hazardous materials release. Conduct Tier II walkthroughs of critical facilities on a regular basis.	City-wide, ETJ	Reduce damages at critical facilities; Ensure continuity of critical services during and after event; Reduce risk of injury to emergency and critical personnel.	Local Plans and Regulations	Hazardous Materials	Hazardous Materials	N/A	M	$100,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Fire Department	12 Months	N/A	N/A

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Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
16	Implement pre-positioned debris management contract to avoid delay in debris cleanup after hazard events.	City-wide	Ensure continuity of critical services.	Preparedness /Response	Winter Storm, Tornado, Thunderstorm Wind	Safety/Security	N/A	H	$50,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Parks and Recreation Department, Transportation	12 Months	N/A	N/A
17	Identify and maintain air gap (isolating computers and/or networks) for crucial processes in the water and wastewater treatment and transportation to mitigate loss of data during a disaster.	City-wide	Ensure continuity of critical services; Prevent incursions, data loss, system downtime and customer information security.	Education and Awareness	Cyber Security	Safety/Security	N/A	M	$20,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Public Works, IT	12 Months	N/A	N/A

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Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
18	Establish cooling centers and hydration stations for city employees and local residents during extreme heat events.	City-wide	Reduce the risk of injuries or fatalities to vulnerable populations and critical service employees	Education and Awareness	Extreme Heat	Safety/Security	N/A	M	$100,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Public Works, Parks and Recreation, HSEM, CRR, CRU	12 Months	N/A	N/A
19	Implement recommended structural projects to mitigate flooding at WCID Priority Areas 8 and 9 (area of high risk to life and property per the regional Flood Protection Plan).	City-wide, Brushy Creek flood prone areas	Protect critical infrastructure, reduce loss to property and life, and reduce damage.	Structure and Infrastructure	Flood	Safety/Security	Y	H	$10 Million	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Public Works	60 Months	Flood Protection Plan, Capital Improvement Plan	Protects infrastructure, reduces cost of reparation and prevents injury to residents.

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Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
20	Develop and implement a Regional Flood Plan.	City of Round Rock Upper Brushy Creek Basin, Williamson County	Reduce risk in high hazard areas by promoting and incentivizing development in low-risk areas; Reduce risk of damages through improved planning practices.	Local Plans and Regulation	Flood	Safety/Security	Y	H	$100,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Public Works	48 Months	N/A	Protects communities and reduces risk of flooding.
21	Develop and implement public works and transportation plans that address hazardous materials concerns and enhance coordination with Fire and Police Departments for training and planning practices.	City-wide	Reduce risk of damages through improved planning practices.	Local Plans and Regulations	Hazardous Materials	Hazardous Materials	N/A	M	$50,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Public Works, Fire Department	12 Months	N/A	N/A

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Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
22	Install lightning protection equipment on all critical infrastructure, public works facilities, and all new CORR facilities. In addition, implement employee training regarding lightning safety and asset protection.	City-wide Critical Facilities	Reduce risk and avoid loss to community and critical infrastructure by promoting early detection and prevention. Protect citizens and city personnel.	Structure and Infrastructure Education and Awareness	Lightning	Safety/Security	Y	L	$100,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Public Works, Fire Department, General Services	12 Months	N/A	N/A
23	Identify critical pipeline transmission infrastructure and identify alternatives for rerouting. Create and implement training protocols for personnel.	City-wide	Ensure continuity of critical services.	Structure and Infrastructure Education and Awareness	Pipeline Failure	Safety/Security, Energy (Power/Fuel)	Y	H	$100,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Public Works, Fire Department	12 Months	N/A	N/A

SECTION 24: MITIGATION ACTIONS

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Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
24	Coordinate with the Fire Department to maintain adequate water for emergency use during wildfire events and to provide safe transportation corridors for wildfire related evacuations.	City-wide	Reduce risk of wildfires and the spread of wildfire by increasing water access and firefighting capabilities; Reduce risk of injuries and fatalities.	Local Plans and Regulations	Wildfire	Safety/Security	N/A	L	$10,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Public Works	12 Months	N/A	N/A
25	Implement an education and awareness program addressing winter weather and informing residents of transportation impacts.	City-wide	Promote hazard awareness and protect citizens from potential injuries and damages.	Education and Awareness	Winter Storm	Communication	N/A	M	$5,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Transportation Department	36 Months	N/A	N/A

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Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
26	Enhance relationships with neighborhood leaders and HOAs to improve communication, outreach, education and awareness. Develop a strategic approach to enhance resources and community engagement to better serve the community, including the underserved and vulnerable populations.	City-wide	Promote hazard awareness and protect citizens from potential injuries and damages; Reduce risk of injuries or fatalities to vulnerable populations.	Education and Awareness	Dam Failure, Drought, Earthquake, Extreme Heat, Flood, Hail, Land Subsidence, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Cyber Attack, Hazardous Materials, Infectious Disease, Pipeline Failure, Terrorism	Communication	N/A	H	$10,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Community & Neighborhood Services	24 Months	N/A	Promotes public safety.

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Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
27	Enhance current continuity plans by conducting business process analyses and business impact analyses to ensure critical services are operable during all natural and non-natural hazards.	City-wide	Ensure continuity of public services.	Local Plans and Regulations	Dam Failure, Drought, Earthquake, Extreme Heat, Flood, Hail, Land Subsidence, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm, Cyber Attack, Hazardous Materials, Infectious Disease, Pipeline Failure, Terrorism	Safety/Security	N/A	L	$10,000	Local Department Budget, Staff time, Bonds, Tax Revenue	IT Department	36 Months	N/A	Promotes public safety.

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Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
28	Retrofit the city's wastewater infrastructure to mitigate the impact of flooding by upgrading drainage systems, elevating critical equipment, installing flood barriers, enhancing stormwater management, and integrating advanced monitoring and early warning systems. (The wastewater treatment plant on the east side of the city has a flood risk. There is a chance that should the 1% Annual Chance Storm Event using Atlas 14 rainfall data occur, a portion of the plant's capacity could be impacted if floodwaters were to rise to associated estimated elevations.)	City-wide	Reduce risk of flood water contamination; Reduce risk of surface water infiltration and sewage backup; Ensure continuity of critical services.	Structure and Infrastructure	Dam Failure, Flood	Safety/Security	Y	M	$1,000,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Floodplain Management Department	48 Months	CIP	Protects infrastructure, reduces cost of reparation, and prevents injury to residents.

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Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
29	Mitigate low water crossings by, including but not limited to, elevating roadways, installing larger culverts and/or drainage systems, improving roadway materials, and installing flood warning signs.	City-wide	Reduce risk of injuries, fatalities and damages through structural projects and education and awareness	Structure and Infrastructure Education and Awareness	Flood	Safety/Security, Communication	N/A	H	$500,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Floodplain Management Department	48 Months	CIP	Protects infrastructure, reduces cost of reparation, and prevents injury to residents.

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Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
30	Provide/construct additional means of access into single-entry neighborhoods and parts of the City; Update subdivision codes for a higher level of ingress and egress. [There are areas within the city that are within a floodplain and only have one way in and one way out of some of its communities and some facilities (e.g. west wastewater treatment plant), which could complicate the ability to get in or out of a community or facility without the use of specialized equipment and personnel.]	City-wide, near the West Waste water Treatment Plant	Reduce risk to residents through improved evacuation alternatives; improve firefighting capabilities through improved access alternatives	Local Plans and Regulations Structure and Infrastructure	Dam Failure, Flood, Wildfire	Safety/Security	N/A	M	$100,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Floodplain Management Department	48 Months	Local Building Codes/ Ordinances; CIP	Promotes public safety.

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Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
31	Create, implement, and enforce strong cybersecurity policies. Conduct regular audits and assessments to identify and address vulnerabilities.	City-wide facilities and IT infrastructure	Enhance resilience against cyber-attacks through education and awareness; Ensure continuity of critical services; Reduce damages to critical infrastructure.	Local Plans and Regulations	Cyber Attack	Safety/Security	N/A	M	$5,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	It Department, Police Department	24 Months	N/A	N/A
32	Strengthen IT infrastructure by installing and regularly updating firewalls, intrusion detection, and prevention systems. Ensure all networks are secure, including public Wi-Fi networks. Use encryption for sensitive data both in transit and at rest.	City-wide facilities and IT software	Enhance resilience against cyber-attacks through education and awareness; Ensure continuity of critical services; Reduce damages to critical infrastructure.	Structure and Infrastructure Local Plans and Regulations	Cyber Attack	Communications	N/A	H	$100,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	IT Department, CORR Employees, Police Department	24 Months	N/A	N/A

CITY OF ROUND ROCK MITIGATION ACTIONS														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
33	Regularly educate and train employees on cybersecurity best practices, including recognizing phishing attempts and proper password management; Run awareness campaigns to keep cybersecurity top of mind for all city employees; Provide easy ways for residents to report suspicious activity.	City-wide	Enhance resilience against cyber-attacks through education and awareness; Ensure continuity of critical services; Reduce damages to critical infrastructure.	Education and Awareness	Cyber Attack	Communications	N/A	M	$5,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	It Department, Police Department	24 Months	N/A	N/A
34	Employ or consult with cybersecurity experts to mitigate emerging threats. Collaborate with private sector companies and other municipalities to share knowledge and resources.	City-wide	Enhance resilience against cyber-attacks through education and awareness; Ensure continuity of critical services; Reduce damages to critical infrastructure.	Local Plans and Regulations	Cyber Attack	Communications	N/A	H	$100,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	IT Department, CORR Employees, Police Department	24 Months	N/A	N/A

CITY OF ROUND ROCK MITIGATION ACTIONS														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
35	Ensure all software and systems are regularly updated and patched to protect against known vulnerabilities. Where possible, enable automated updates to reduce the risk of delays in applying critical patches.	City-wide Networks	Enhance resilience against cyber-attacks through education and awareness; Ensure continuity of critical services; Reduce damages to critical infrastructure.	Local Plans and Regulations	Cyber Attack	Communications	N/A	H	$5,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	IT Department, CORR Employees, Police Department	12 Months	N/A	N/A
36	Regularly back up all critical data and systems. Develop and test disaster recovery plans to ensure quick restoration of services after an attack.	City-wide Networks	Enhance resilience against cyber-attacks through education and awareness; Ensure continuity of critical services; Reduce damages to critical infrastructure.	Local Plans and Regulations	Cyber Attack	Communications	N/A	H	$5,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	IT Department, CORR Employees	12 Months	N/A	N/A

CITY OF ROUND ROCK MITIGATION ACTIONS														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
37	Implement continuous monitoring of networks and systems to detect suspicious activity. Use threat intelligence to stay informed about the latest cyber threats and trends.	City-wide Networks	Enhance resilience against cyber-attacks through education and awareness; Ensure continuity of critical services; Reduce damages to critical infrastructure.	Local Plans and Regulations	Cyber Attack	Communications	N/A	H	$5,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	IT Department, CORR Employees, Police Department	12 Months	N/A	N/A
38	Ensure compliance with all relevant laws, regulations, and standards related to cybersecurity. Work with legal experts to develop frameworks for prosecuting cybercriminals.	City-wide	Enhance resilience against cyber-attacks through education and awareness; Ensure continuity of critical services; Reduce damages to critical infrastructure.	Local Plans and Regulations	Cyber Attack	Communications	N/A	H	$5,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	IT Department, CORR Employees, Police Department	12 Months	N/A	N/A

CITY OF ROUND ROCK MITIGATION ACTIONS														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
39	Collaborate with federal, state, and local law enforcement agencies to share intelligence and information about potential threats; Collaborate with fusion centers that facilitate the sharing of intelligence across jurisdictions.	City, State, and Federal facilities Austin Regional Intelligence Center	Ensure continuity of critical services; Reduce risk of injuries to critical service employees; Enhance resilience against terrorism.	Local Plans and Regulations	Terrorism	Safety/Security	N/A	M	$10,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Round Rock Police Department	24 Months	N/A	N/A

CITY OF ROUND ROCK MITIGATION ACTIONS														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
40	Install surveillance cameras in high-risk areas and ensure they are monitored regularly. Implement access control measures at critical infrastructure sites, such as government buildings, transportation hubs, and public utilities. All facilities listed (Police Department, Fire Stations, Water Treatment Plant, City Hall, Water Towers, Lift Stations, Major Intersections, Cap-Metro downtown station, and Bob Bennett Building) are controlled access with security fencing for lift stations and water towers, and keycard access for city buildings. Major buildings have surveillance cameras and the fire stations have procedures to secure buildings when personnel are away for a call for service.	City-wide Critical facilities	Ensure continuity of critical services; Reduce risk of injuries to critical service employees; Enhance resilience against terrorism.	Structure and Infrastructure Local Plans and Regulations	Terrorism	Safety/Security	N/A	M	$10,000	Local Budget; State Grants (GLO, TAMFS, TDA, TDEM, TWDB, TXDOT); Federal Grants: (FEMA HMA Grants, CDBG, CDC, DOH, EDA, EPA, HUD, NFIP, NFWF, NOAA, NRCS, SBA, USACE, USDA, USFS, USFWS)	Round Rock Police Department	36 Months	N/A	N/A

SECTION 24: MITIGATION ACTIONS

CITY OF ROUND ROCK MITIGATION ACTIONS														
**Reduces risk to new and/or existing buildings and infrastructure*														
Action #	Proposed Action	Site	Benefit	Action Type	Hazards	Community Lifeline	Infra.*	Priority (High, Mod., Low)	Cost	Potential Funding Sources	Lead Agency	Timeline	Existing Plans	NFIP
41	Implement a program to educate the public on recognizing and reporting potential threats and on what to do in the event of a terrorist attack. Provide resources and enhance relationships between law enforcement and the community to build trust and encourage the reporting of suspicious activities.	City-wide	Ensure continuity of critical services; Reduce risk of injuries to residents; Enhance resilience against terrorism.	Education and Awareness	Terrorism	Safety/Security	N/A	M	$10,000	Local Department Budget, Staff time, Bonds, Tax Revenue	Round Rock Police Department	12 Months	N/A	N/A
42	Develop comprehensive emergency action plans that include procedures for managing terrorist incidents, such as bombings, shootings, or cyber-attacks. Ensure that these plans are regularly updated and tested.	City-wide	Ensure continuity of critical services; Reduce risk of injuries to critical service employees; Enhance resilience against terrorism.	Local Plans and Regulations	Terrorism	Safety/Security	N/A	M	$10,000	Local Department Budget, Staff time, Bonds, Tax Revenue	Police Department, Fire Department, Public Works, Parks and Recreation	12 Months	N/A	N/A

ROUND ROCK
TEXAS

SECTION 25

PLAN MAINTENANCE

SECTION 25: PLAN MAINTENANCE

PLAN MAINTENANCE PROCEDURES

The following is an explanation of how the City of Round Rock and the general public will be involved in implementing, evaluating, and enhancing the Plan over time. When the plan is discussed in all maintenance procedures it includes mitigation actions and hazard assessments. The sustained hazard mitigation planning process consists of four main parts:

- Incorporation
- Monitoring and Evaluation
- Updating
- Continued Public Involvement

INCORPORATION

The City of Round Rock will be responsible for further development and implementation of mitigation actions. Each action has been assigned to a specific department within the city. The following describes the process by which the city will incorporate elements of the mitigation plan into other planning mechanisms.

PROCESS OF INCORPORATION

Once the Plan Update is adopted, the City of Round Rock will implement actions based on priority and the availability of funding. The city currently implements policies and programs to reduce loss to life and property from hazards. The mitigation actions developed for this Plan Update enhance this ongoing effort and will be implemented through other program mechanisms where possible.

The potential funding sources listed for each identified action may be used when the City seeks funds to implement actions. An implementation time period or a specific implementation date has been assigned to each action as an incentive for completing each task and gauging whether actions are implemented in a timely manner.

The City of Round Rock will integrate implementation of their mitigation actions with other plans and policies such as construction standards and emergency management plans, and ensure that these actions, or proposed projects, are reflected in other planning efforts. Coordinating and integrating components of other plans and policies into goals and objectives of the Plan Update

will further maximize funding and provide possible cost-sharing of key projects, thereby reducing loss of lives and property and mitigating hazards affecting the area.

Upon formal adoption of the Plan Update, planning team members will work to integrate the hazard mitigation strategies into other plans and codes as they are developed. Participating team members will conduct periodic reviews of plans and policies, once per year at a minimum, and analyze the need for revisions in light of the approved Plan. The planning team will review all comprehensive land use plans, capital improvement plans, annual budget reviews, emergency operations or management plans, and transportation plans to guide and control development. The City will ensure that capital improvement planning in the future will also contribute to the goals of this Hazard Mitigation Plan Update to reduce the long-term risk to life and property from all hazards. Within one year of formal adoption of the Hazard Mitigation Plan Update, existing planning mechanisms will be reviewed by each jurisdiction.

The City of Round Rock is committed to implementing their mitigation actions. Planning team members will review and revise, as necessary, the long-range goals and objectives in strategic plan and budgets to ensure that they are consistent with this mitigation action plan. Additionally, the team will work to advance the goals of this hazard mitigation plan through its routine, ongoing, long-range planning, budgeting, and work processes.

Table 25-1 identifies types of planning mechanisms and examples of methods for incorporating the Plan Update into other planning efforts. The team members, listed in Table 25-2 below, will be responsible for the review of these planning mechanisms and their incorporation of the plan, with the exception of the Floodplain Management Plans; the Floodplain Administrator on staff will be responsible for incorporating the plan when floodplain management plans are updated, or new plans are developed.

Table 25-1. Methods of Incorporation of the Plan

PLANNING MECHANISM	DEPARTMENT / TITLE RESPONSIBLE	INCORPORATION OF PLAN
Annual Budget Review	Finance Director	Various departments and key personnel that participated in the planning process will review this Plan Update and mitigation actions therein when conducting their annual budget review. Allowances will be made in accordance with grant applications sought, and mitigation actions that will be undertaken, according to the implementation schedule of the specific action.
Capital Improvement Plans	Finance Director	Prior to any revisions to the Capital Improvement Plan (CIP), City departments will review the risk assessment and mitigation strategy sections of this HMAP, as limiting public spending in hazardous zones is one of the most effective long-term mitigation actions available to local governments.

PLANNING MECHANISM	DEPARTMENT / TITLE RESPONSIBLE	INCORPORATION OF PLAN
Comprehensive Plans	Planning and Development and Director	The City of Round Rock has a Comprehensive Plan in place. Since comprehensive plans involve developing a unified vision for a community, the mitigation vision and goals of the HMAP will be reviewed in the development or revision of a Comprehensive Plan.
Floodplain Management Plans	Floodplain Administrator	Floodplain management plans include preventative and corrective actions to address the flood hazard. Therefore, the actions for flooding and information found in Section 9 of this Plan Update discussing the people and property at risk to flood, will be reviewed and revised when updating the flood management plans or developing new plans.
Grant Applications	Emergency Management Coordinator	This Plan Update will be evaluated when grant funding is sought for mitigation projects. If a project is not in the Plan Update, a Plan Revision may be necessary to include the action in the Plan.
Regulatory Plans	Planning and Development Services Director	Currently, the City of Round Rock has regulatory plans in place, such as an Emergency Management Action Plan, Land Use Plan, and Evacuation Plan. The HMAP will be consulted when departments review or revise their current regulatory planning mechanisms, or in the development of regulatory plans that are not currently in place.

MONITORING AND EVALUATION

Periodic revisions of the Plan are required to ensure that goals, objectives, and mitigation actions are kept current. When the plan is discussed in these sections, it includes the risk assessment and mitigation actions as a part of the monitoring, evaluating, updating and review process. Revisions may be required to ensure the Plan is in compliance with federal and state statutes and regulations. This section outlines the procedures for completing Plan revisions, updates, and review. Table 25-2 indicates the department and title of the party responsible for Plan monitoring, evaluating, updating, and review of the Plan.

Table 25-2. Team Members Responsible for Plan Monitoring, Evaluating, Updating, and Review of the Plan

DEPARTMENT	TITLE
City of Round Rock – Administration	City Manager
City of Round Rock – Community and Neighborhood Services	Director
City of Round Rock – Fire	Fire Chief
City of Round Rock – General Services	Director
City of Round Rock – Homeland Security and Emergency Management	Emergency Management Coordinator
City of Round Rock – Parks and Recreation	Director
City of Round Rock – Planning and Services	Director
City of Round Rock – Police	Chief of Police
City of Round Rock – Transportation	Director
City of Round Rock – Utilities and Environmental Services	Executive Director – Public Works

MONITORING

Designated Planning Team members are responsible for monitoring, evaluating, updating, and reviewing the Plan, as shown in Table 25-2. Individuals holding the title listed in Table 25-2 will be responsible for monitoring the Plan on an annual basis. Plan monitoring includes reviewing and incorporating into the Plan other existing planning mechanisms that relate or support goals and objectives of the Plan; monitoring the incorporation of the Plan into future updates of other existing planning mechanisms as appropriate; reviewing mitigation actions submitted and coordinating with various departments to determine if mitigation actions need to be re-evaluated and updated; evaluating and updating the Plan as necessary; and monitoring plan maintenance to ensure that the process described is being followed, on an annual basis, throughout the planning process. The Planning Team will develop a brief report that identifies policies and actions in the plan that have been successfully implemented and any changes in the implementation process needed for continued success. A summary of meeting notes will report the particulars involved in developing an action into a project. In addition to the annual monitoring, the Plan will be similarly reviewed immediately after extreme weather events include but not limited to state and federally declared disasters.

EVALUATION

As part of the evaluation process, the Planning Team will assess changes in risk; determine whether the implementation of mitigation actions is on schedule; determine whether there are any

implementation problems, such as technical, political, legal, or coordination issues; and identify changes in land development or programs that affect mitigation priorities for each respective department or organization.

The Planning Team will meet on an annual basis to evaluate the Plan and identify any needed changes and assess the effectiveness of the plan achieving its stated purpose and goals. The team will evaluate the number of mitigation actions implemented along with the loss-reduction associated with each action. Actions that have not been implemented will be evaluated to determine if any social, political, or financial barriers are impeding implementation and if any changes are necessary to improve the viability of an action. The team will evaluate changes in land development and/or programs that affect mitigation priorities. The annual evaluation process will help to determine if any changes are necessary. In addition, the Plan will be similarly evaluated immediately after extreme weather events including but not limited to state and federally declared disasters.

UPDATING

PLAN REVISIONS

At any time, minor technical changes may be made to update the City of Round Rock Hazard Mitigation Action Plan Update 2025. Material changes to mitigation actions or major changes in the overall direction of the Plan or the policies contained within it, must be subject to formal adoption by the city.

The City of Round Rock will review proposed revisions and vote to accept, reject, or amend the proposed change. Upon ratification, the Revision will be transmitted to TDEM.

In determining whether to recommend approval or denial of a Plan Revision request, the City will consider the following factors:

- Errors or omissions made in the identification of issues or needs during the preparation of the Plan Update;
- New issues or needs that were not adequately addressed in the Plan Update; and
- Changes in information, data, or assumptions from those on which the Plan Update was based.

FIVE (5) YEAR REVIEW

The Plan will be thoroughly reviewed by the Planning Team at the end of three years from the approval date, to determine whether there have been significant changes in the planning area that necessitate changes in the types of mitigation actions proposed. Factors that may affect the content of the Plan include new development in identified hazard areas, increased exposure to hazards, disaster declarations, increase or decrease in capability to address hazards, and changes to federal or state legislation.

The Plan review process provides the City of Round Rock an opportunity to evaluate mitigation actions that have been successful, identify losses avoided due to the implementation of specific mitigation measures, and address mitigation actions that may not have been successfully implemented as assigned.

It is recommended that the full Executive and Advisory Planning Team (Section 2, Tables 2-1 and 2-2) meet to review the Plan at the end of three years because grant funds may be necessary for

the development of a five-year update. Reviewing planning grant options in advance of the five-year Plan update deadline is recommended considering the timelines for grant and planning cycles can be in excess of a year.

Following the Plan review, any revisions deemed necessary will be summarized and implemented according to the reporting procedures and Plan Revision process outlined herein. Upon completion of the review, update, and revision process the revised Plan will be submitted to TDEM for final review and approval in coordination with FEMA.

CONTINUED PUBLIC INVOLVEMENT

Public input was an integral part of the preparation of this Plan and will continue to be essential for Plan updates. The Public will be directly involved in the annual evaluation, monitoring, reviews and cyclical updates. Changes or suggestions to improve or update the Plan will provide opportunities for additional public input.

The public can review the Plan on the City of Round Rock's website, where officials and the public are invited to provide ongoing feedback, via email.

The Planning Team may also designate voluntary citizens from the planning area or willing stakeholder members from the private sector businesses that were involved in the Plan's development to provide feedback on an annual basis. It is important that stakeholders and the immediate community maintain a vested interest in preserving the functionality of the planning area as it pertains to the overall goals of the mitigation plan. The Planning Team is responsible for notifying stakeholders and community members on an annual basis and maintaining the Plan.

The City of Round Rock's Communication and Marketing Department will notify the public, as necessary, of any maintenance or periodic review activities during the implementation, monitoring, and evaluation phases. Additionally, the Communication and Marketing Department will strategically develop an outreach plan to inform the public of information regarding Plan updates . The Communications and Marketing Department will keep the public and stakeholders apprised of potential opportunities to fund and implement mitigation projects identified in the Plan.

APPENDIX A
PLANNING TEAM

APPENDIX A: PLANNING TEAM

PLANNING TEAM MEMBERS

The City of Round Rock Hazard Mitigation Action Plan Update 2025 was organized using a direct representative model. An Executive Planning Team from the city, shown in Table A-1, was formed to coordinate planning efforts and request input and participation in the planning process. Table A-2 reflects the Advisory Planning Team, consisting of additional city departments that participated throughout the planning process. Table A-3 is comprised of stakeholders who were invited to provide Plan input. Public outreach efforts and meeting documentation is provided in Appendix E.

Table A-1. Executive Planning Team

ORGANIZATION / DEPARTMENT	TITLE
City of Round Rock - Fire	Assistant Fire Chief - Fire
City of Round Rock - Fire	Assistant Fire Chief - Fire[1]
City of Round Rock - Fire	Fire Chief
City of Round Rock – Homeland Security and Emergency Management	Emergency Management Coordinator

Table A-2. Advisory Planning Team

ORGANIZATION / DEPARTMENT	TITLE
City of Round Rock - Administration	Assistant City Manager
City of Round Rock - Administration	Assistant City Manager[2]
City of Round Rock - Administration	City Manager
City of Round Rock - Administration	Deputy City Clerk
City of Round Rock – City Council	Mayor
City of Round Rock – Communications and Marketing	Director - Communications
City of Round Rock - Community and Neighborhood Services	Director
City of Round Rock - Finance	Deputy Chief Financial Officer
City of Round Rock – Fire	Captain - Community Risk Reduction
City of Round Rock – Fire	Program Manager – Crisis Response

[1] Please note these city representatives have the same title and are not duplicated entries.
[2] Please note these city representatives have the same title and are not duplicated entries.

APPENDIX A: PLANNING TEAM

ORGANIZATION / DEPARTMENT	TITLE
City of Round Rock - General Services	Assistant Director
City of Round Rock - General Services	Director
City of Round Rock - Information Technology	GIS Technician
City of Round Rock - Information Technology	Systems Analyst
City of Round Rock - Parks and Recreation	Assistant Director
City of Round Rock - Parks and Recreation	Director
City of Round Rock - Parks and Recreation	Manager - Forestry
City of Round Rock - Parks and Recreation	Manager – Parks and Recreation Development
City of Round Rock - Parks and Recreation	Manager – Parks Development
City of Round Rock - Planning and Development Services	Director
City of Round Rock - Police	Assistant Chief
City of Round Rock - Police	Police Chief
City of Round Rock - Transportation	Assistant Director
City of Round Rock - Transportation	Director
City of Round Rock - Transportation	Superintendent
City of Round Rock - Utilities and Environmental Services	Assistant Director - Utilities
City of Round Rock - Utilities and Environmental Services	Executive Director – Public Works
City of Round Rock - Utilities and Environmental Services	Supervisor - Utilities GIS

STAKEHOLDERS

The following groups listed in Table A-3 represent a list of organizations invited to stakeholder meetings, public meetings, and workshops throughout the planning process and include: members of community groups, non-profit organizations, private businesses, utility providers, neighboring counties, school and universities, and state and federal agencies. The public were also invited to participate via e-mail throughout the planning process. Many of the invited organizations and stakeholders participated and were integral to providing comments and data for the Plan. For a list of attendees at meetings, please see Appendix E[3].

[3] Information contained in Appendix E is exempt from public release under the Freedom of Information Act (FOIA).

Table A-3. Stakeholders

AGENCY	TITLE	STAKEHOLDER TYPE
Agape Ministry	General Representative	Religious Organization
American Red Cross	Chief Executive Officer	Community Organization
American Red Cross	Disaster Program Manager for Central Texas	Community Organization
Atmos	General Representative	Utility Provider
Aventine at Rose	Maintenance Director	Residential Community - Vulnerable Populations
Bastrop County	Emergency Management Coordinator	Neighboring Community
Baylor Scott and White Hospital - Round Rock	Head of Public Safety	Healthcare Agency
Bell County	Emergency Management Coordinator	Neighboring Community
Brazos River Authority	Emergency Management	Community Organization / Utility Provider
Brazos River Authority	Service Manager	Community Organization / Utility Provider
Burnet County	Emergency Management Coordinator	Neighboring Community
Capital Area Council of Governments	Executive Director	Regional Agency
CapMetro	Emergency Preparedness	Utility Provider
Central Texas Together	General Representative	Community Organization
City of Cedar Park	Emergency Management Coordinator	Neighboring Community
City of Georgetown	Emergency Management Coordinator	Neighboring Community
City of Leander	Emergency Management Coordinator	Neighboring Community
City of Round Rock - City Council	Place 1	Local Government
City of Round Rock - City Council	Place 2	Local Government
City of Round Rock - City Council	Place 3 / Mayor Pro Tem	Local Government
City of Round Rock - City Council	Place 4	Local Government
City of Round Rock - City Council	Place 5	Local Government

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AGENCY	TITLE	STAKEHOLDER TYPE
City of Round Rock - City Council	Place 6	Local Government
Community Christian Church	General Representative	Religious Organization
Cornerstone Hospital - Austin - Round Rock	Chief Executive Officer	Healthcare Agency
Cottages Chandler Creek	Executive Director	Residential Community - Vulnerable Populations
Court at Round Rock	Executive Director	Residential Community - Vulnerable Populations
Environmental Protection Agency (EPA) – Region 6	Deputy Regional Administration	Federal Agency
Environmental Protection Agency (EPA) – Region 6	Director of Superfund and Emergency Management Division	Federal Agency
Environmental Protection Agency (EPA) – Region 6	Regional Administration	Federal Agency
Fairway Vista	General Representative	Residential Community - Vulnerable Populations
FBG Church	General Representative	Religious Organization
The Fellowship	General Representative	Religious Organization
The Greater Round Rock Community Foundation	General Representative	Community Organization
Habitat for Humanity	Media Coordinator	Non-Profit Organization
Hearthstone	Administrator	Residential Community - Vulnerable Populations
Hill Country Bible	General Representative	Religious Organization
ICNA Relief Austin	Chapter Coordinator	Community Organization
Lee County	Emergency Management Coordinator / Grants Writer	Neighboring Community
Life Church	General Representative	Religious Organization
Maximizing Hope	General Representative	Community Organization
Meal on Wheels	Director of Community Services	Non-Profit Organization
Milam County	Emergency Management Coordinator	Neighboring Community
Mission Accomplished	General Representative	Community Organization
Missions Church	General Representative	Religious Organization
Mobile Auto Clinic	General Representative	Community Organization

APPENDIX A: PLANNING TEAM

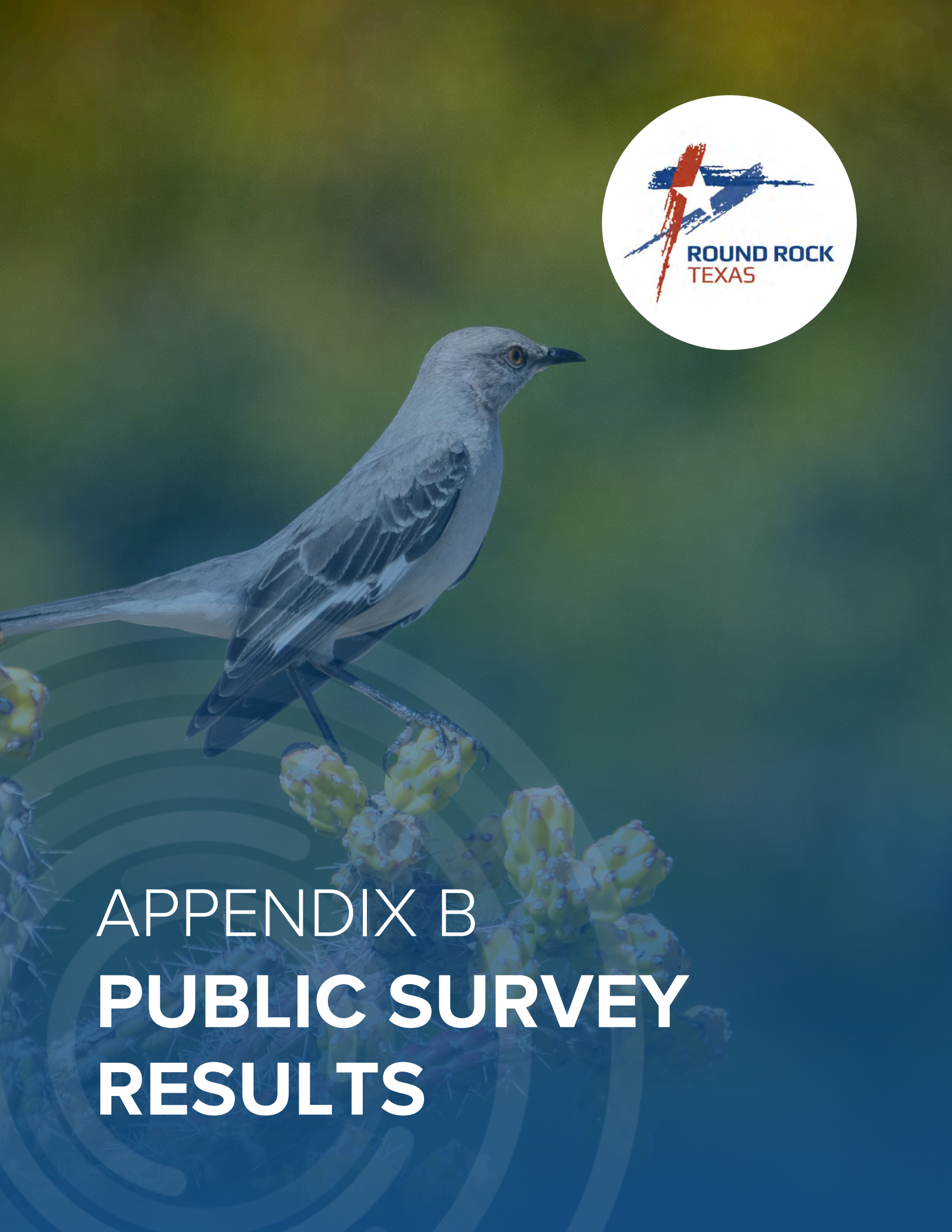
AGENCY	TITLE	STAKEHOLDER TYPE
National Weather Services (NWS)	Austin/San Antonio Regional Contact	Federal Agency
NOAA	Regional Representative	Federal Agency
Park Valley Inn	Administrator	Residential Community - Vulnerable Populations
Pedernales Electric Cooperative	General Representative	Utility Provider
Project Linus - Central Texas	Chapter Coordinator	Community Organization
Restoration Covenant Church	Co-Pastor	Religious Organization
Round Rock Area Serving Center	Executive Director	Community Organization
Round Rock Assisted Living	Administrator	Residential Community - Vulnerable Populations
Round Rock Church of Christ	General Representative	Religious Organization
Round Rock First Baptist	General Representative	Religious Organization
Round Rock KXAN	News Representative	Media
Round Rock Library	Director	Community Organization
Round Rock ISD	Director of Risk Management and Compliance	Academia
Sacred Heart Community Center	Center Representative	Community Organization
San Gabriel	Executive Director	Residential Community - Vulnerable Populations
Serene Setting	General Representative	Residential Community - Vulnerable Populations
St. David's Medical Center and Hospital - Round Rock	Head of Security	Healthcare Agency
State Legislature	House District 20	State Legislature
State Legislature	House District 52	State Legislature
State Legislature	House District 136	State Legislature
State Senate	Senate District 5	State Senate
State Senate	Senate District 24	State Senate
Temple College - East Williamson County Higher Education Center	Chief of Operations	Academia
Texas A&M Agrilife Extension	District 8 Representative	State Agency

APPENDIX A: PLANNING TEAM

AGENCY	TITLE	STAKEHOLDER TYPE
Texas A&M Forest Service	Mitigation and Prevention Program Coordinator for Williamson County	State Agency
Texas A&M Health Science Center - Round Rock	Security Manager	Academia
Texas Baptist Children's Home	General Representative	Community Organization
Texas Commission on Environmental Quality (TCEQ) - Region 11	Executive Assistant	State Agency
Texas Commission on Environmental Quality (TCEQ) - Region 11	Regional Director	State Agency
Texas Department of Health and Human Services, Region 7	Deputy Regional Director	State Agency
Texas Department of Health and Human Services, Region 7	Program Manager	State Agency
Texas Department of Health and Human Services, Region 7	Regional Director	State Agency
Texas Department of Housing and Community Affair	Director of Single-Family and Homeless Program	State Agency
Texas Department of Housing and Community Affair	Manager of Single-Family Program	State Agency
Texas Department of Transportation (TXDOT)	District Engineer	State Agency
Texas Division of Emergency Management (TDEM)	County Liaison Officer	State Agency
Texas Floodplain Management Association, Region 5	Director	State Agency
Texas Parks and Wildlife	District Leader	State Agency
Texas State Technical College (TSTC)	Deputy Safety Officer	Academia
Texas State University – Round Rock Campus	Interim Vice President	Academia
Texas State University – Round Rock Campus	University Police Sergeant	Academia
Texas Water Development Board (TWDB)	Deputy Executive Administrative of the Planning Division	State Agency

APPENDIX A: PLANNING TEAM

AGENCY	TITLE	STAKEHOLDER TYPE
Texas Windstorm Insurance Association	Chief Deputy Commissioner	State Agency
Touch of Home	Administrator	Residential Community - Vulnerable Populations
Travis County	Deputy Emergency Management Coordinator	Neighboring Community
Trinity Care	Administrator	Residential Community - Vulnerable Populations
Union Pacific	General Representative	Utility Provider
United Way – Williamson County	Executive Director	Community Organization
University Village	General Representative	Residential Community - Vulnerable Populations
U.S. Army Corps of Engineers / Texas Silver Jackets	Regional Representative for Fort Worth/Galveston Office	Federal Agency
U.S. Fish & Wildlife	Southwest Regional Representative	Federal Agency
Williamson County	Deputy Director of OEM	Neighboring Community
Williamson County Cities Health District	Emergency Preparedness Director	Community Organization
Williamson County Cities Health District	Executive Director	Community Organization
Williamson County Conservation Foundation	WCCF Board President	Community Organization
Williamson County Landfill	General Representative	Community Organization / Utility Provider
Williamson County Regional Animal Shelter	Animal Services Director	Community Organization
Williamson County Regional Animal Shelter	Community Programs Coordinator	Community Organization
Williamson County Veterans Services	County VSO	Community Organization



ROUND ROCK
TEXAS

APPENDIX B
PUBLIC SURVEY RESULTS

APPENDIX B: PUBLIC SURVEY RESULTS

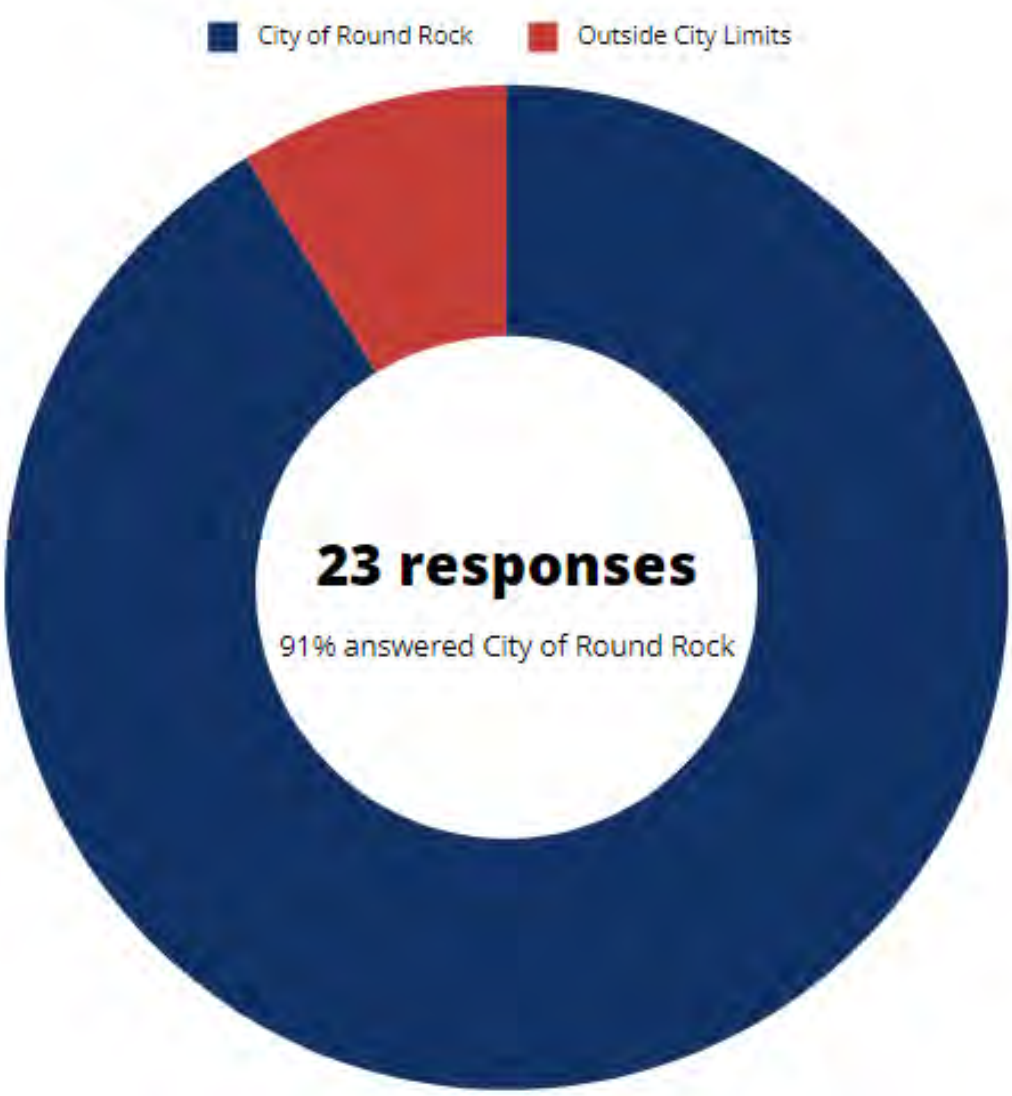
OVERVIEW

The City of Round Rock prepared a public survey that requested public opinion on a wide range of questions relating to natural hazards. The survey was made available through the city's website. This survey link was also distributed at public meetings and stakeholder events throughout the planning process.

The results of the survey are analyzed in Appendix B. The purpose of the survey was twofold: 1) to solicit public input during the planning process, and 2) to help the jurisdictions identify any potential mitigation actions or problem areas.

All public survey results were discussed and shared with the Planning Team during the Mitigation Strategy Workshop. These results are also provided below. The survey results provide information regarding the public's experience with natural hazards, their perceived hazards of concern, recommended mitigation actions, and additional valuable insights. Overall, this survey enhances the mitigation planning process by ensuring the plan properly represents the community, is informed through local knowledge, and by promoting equity.

PUBLIC SURVEY RESULTS



Have you ever experienced or been impacted by a disaster?

83% Responded 'Yes'

Personal experiences shared in survey responses included:

"Winter Storm Uri in February 2021. Power outage at my home for 4 days. Water pipe broke. Ice Storm in February 2023. Damage to trees and property. Power outage for 3 days. F2 tornado some wind damage."

"I was in the areas of the Hail storm that occurred last year, the blizzard that strolled through about 4 years ago, luckily I was out of the range of the tornado. Not much damage was done to my areas except for a lot of tree fall(and subsequent cleanup)"

"Excessive HAIL storm, Sunday, Sept. 24, 2023. All roofs in our small subdivision were damaged & probably 98%+ had to be replaced. Residents' vehicles badly damaged, leading to extensive vehicle repairs &/or total replacements."

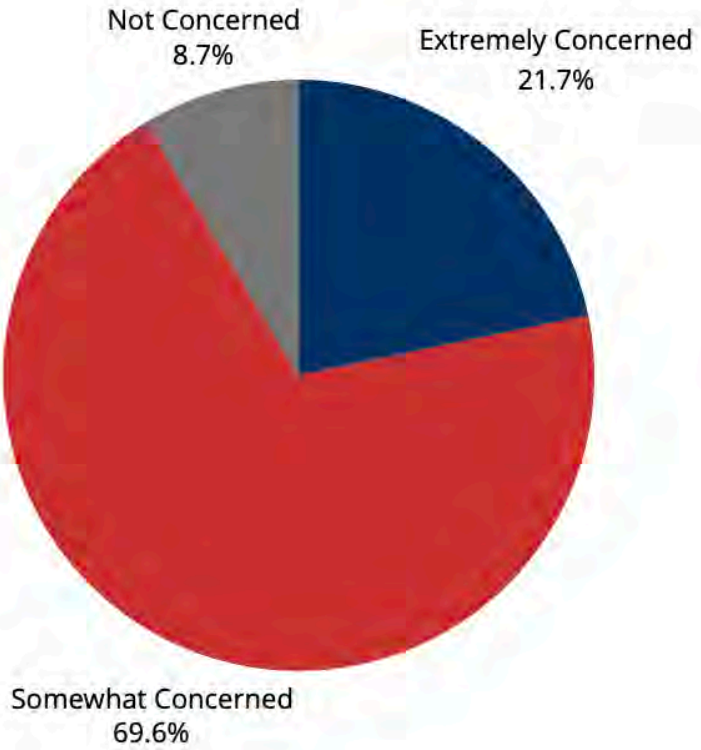
"Home and yard damaged by Tornado, hail and trees from ice storms."

"Tornado 2020 (@ work), hail storms damaged cars and house, freezes and ice storms loss of power and tree and house damage. Also lent assistance to friends, neighbors, etc. "

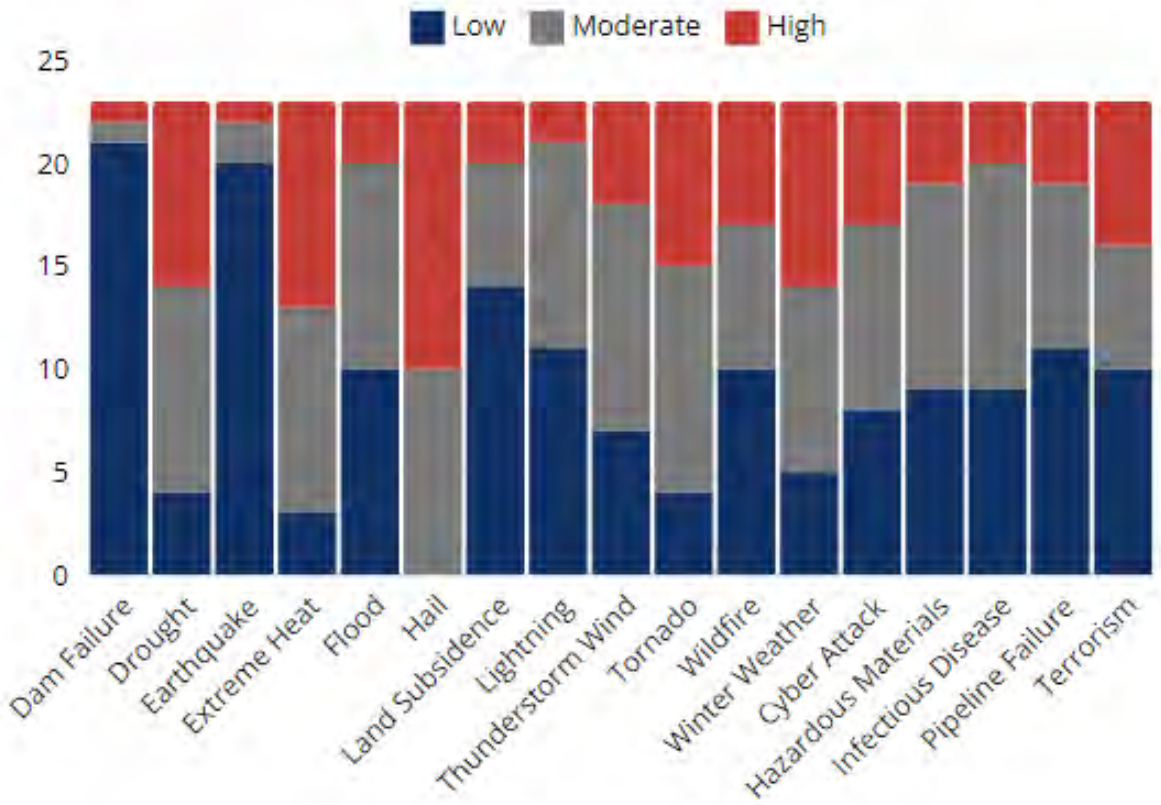
"House was flooded in 2013 and 2015 from an inadequate drainage system near Brushy Creek."

30% of those who have been impacted by a disaster mentioned tornado in their explanations.

Concern level for the possibility of their community being impacted by a disaster.



With the consideration of frequency of occurrence and potential impact severity, please indicate your concern level for each of the following hazards:



Other hazards mentioned:

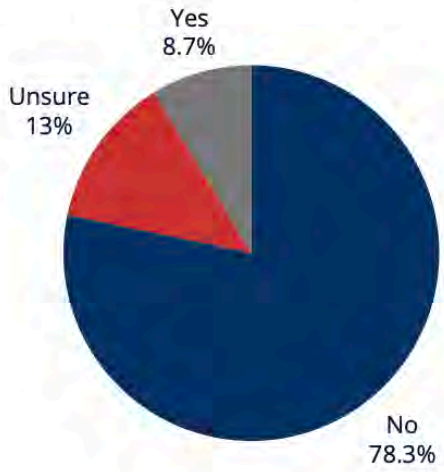
"Water or power outage"

"Power grid."

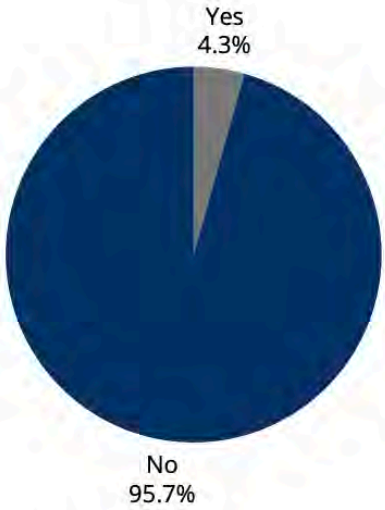
"Crime and public disorder"

"Train derailment since so close to RR tracks."

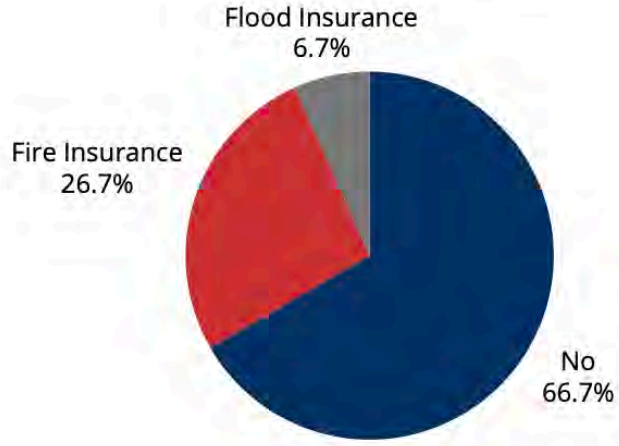
To your knowledge, is your home located in any high hazard risk zones?



Have you had any issues getting homeowners or renters insurance due to risks of hazardous events?



Do you have any hazard specific insurance? Why or why not?



Have you taken any actions to make your home or neighborhood more resistant to hazards?

52% Responded 'Yes'

75% of those who have taken action through tree removal/fuel reduction

52% of survey responders are interested in making their homes or neighborhoods more resistant to hazards.

Actions taken included:

Keep trees trimmed. Regular house maintenance, backup power sources.

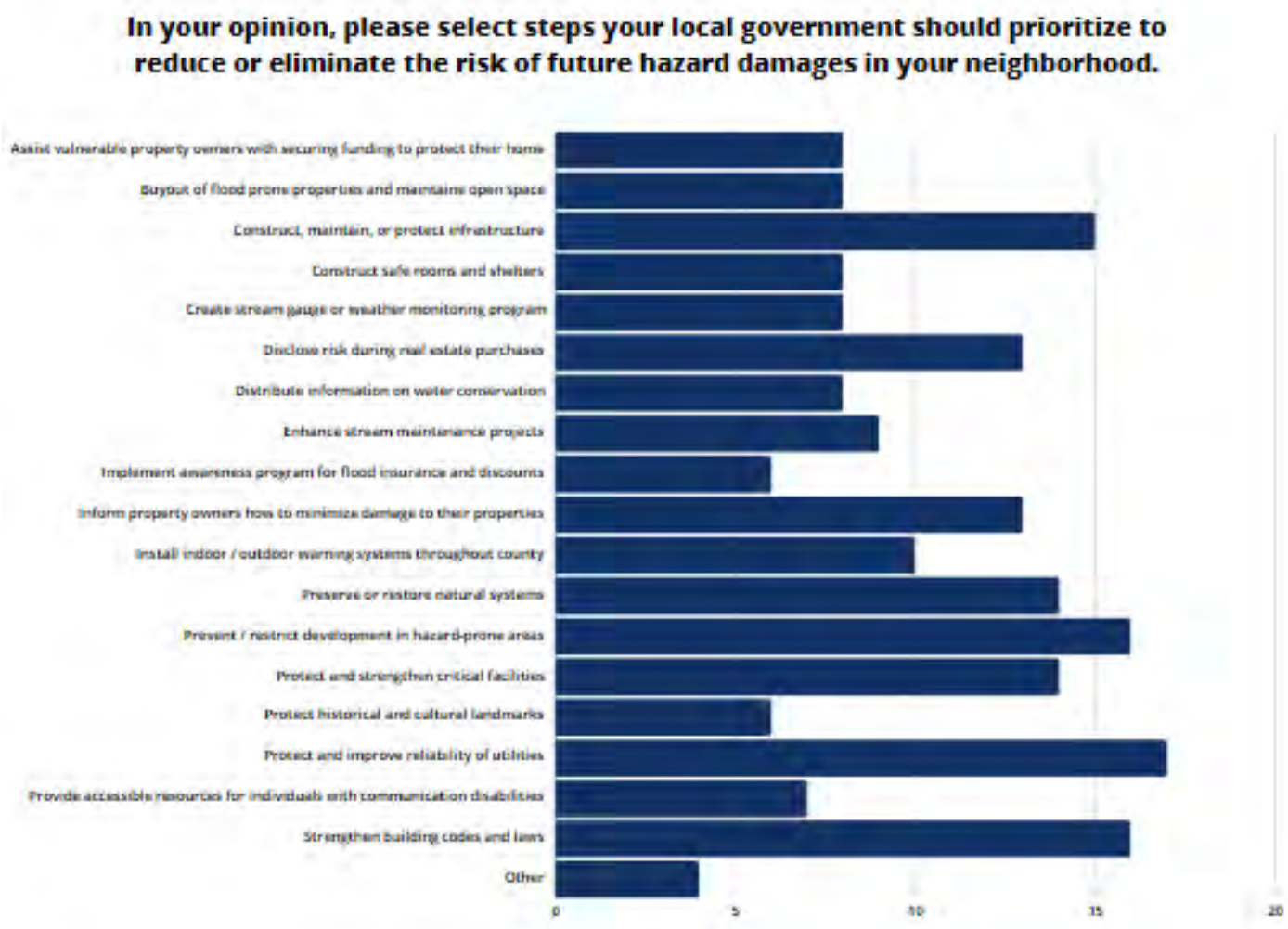
Removed trees and vegetation that grow into power lines.

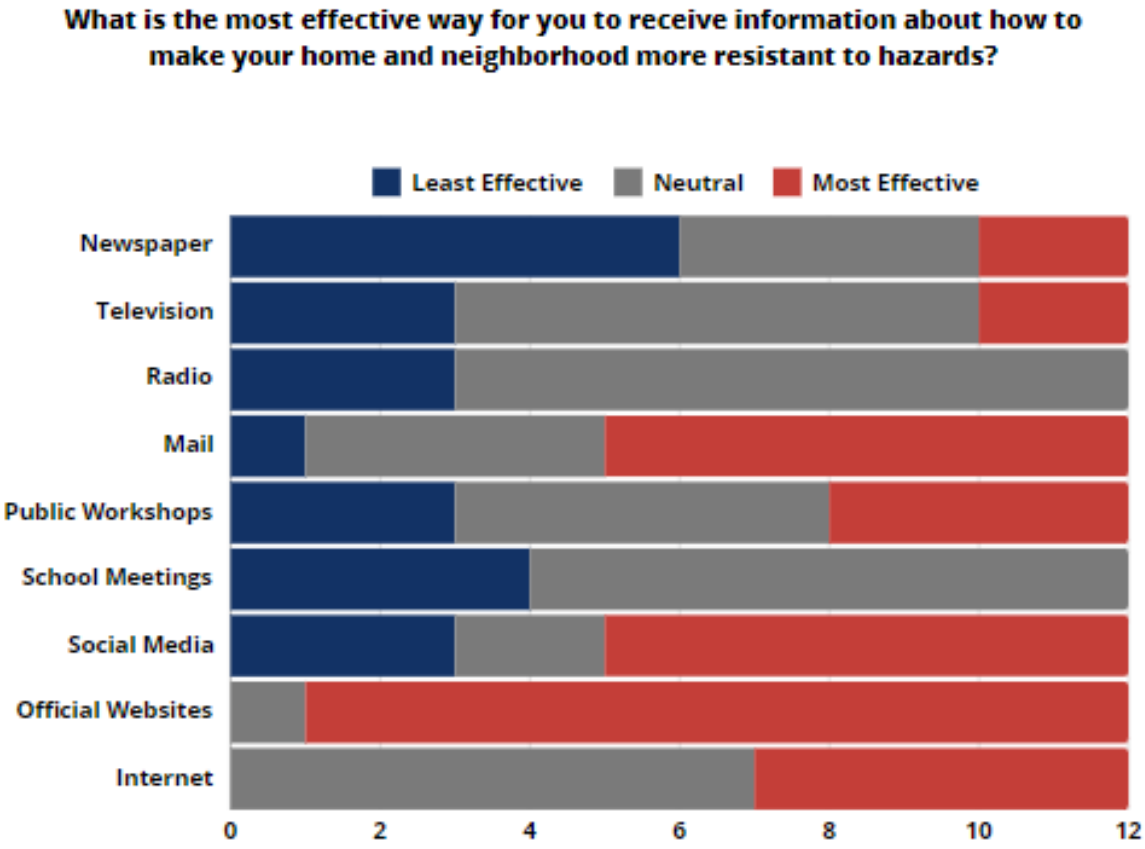
We installed drains in our yards that flow directly to the storm drain and we built raised garden beds around our entire back yard.

Cutting down dead trees, have little foliage around exterior of my house. Never leave filled gas tank in the hot sun (as I observe at many houses); Let gas mower cool off (several hours) before I store in garage.

The City constructed a large drainage way/easement near my subdivision. We installed drains in our yards that flow directly to the storm drain and we built raised garden beds around our entire back yard.

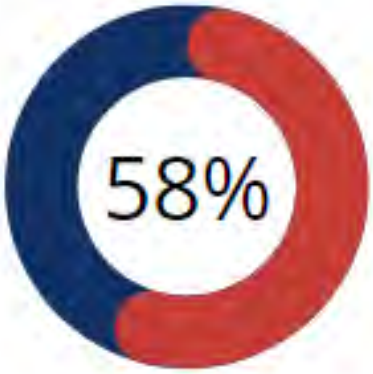
Class 4 roof shingles.


In your opinion, please select steps your local government should prioritize to reduce or eliminate the risk of future hazard damages in your neighborhood.
Assist vulnerable property owners with securing funding to protect their home
Buyout of flood prone properties and maintains open space
Construct, maintain, or protect infrastructure
Construct safe rooms and shelters
Create stream gauge or weather monitoring program
Disclose risk during real estate purchases
Distribute information on water conservation
Enhance stream maintenance projects
Implement awareness program for flood insurance and discounts
Inform property owners how to minimize damage to their properties
Install indoor / outdoor warning systems throughout county
Preserve or restore natural systems
Prevent / restrict development in hazard-prone areas
Protect and strengthen critical facilities
Protect historical and cultural landmarks
Protect and improve reliability of utilities
Provide accessible resources for individuals with communication disabilities
Strengthen building codes and laws
Other
0
5
10
15
20


What is the most effective way for you to receive information about how to make your home and neighborhood more resistant to hazards?
Least Effective
Neutral
Most Effective
Newspaper
Television
Radio
Mail
Public Workshops
School Meetings
Social Media
Official Websites
Internet
0
2
4
6
8
10
12

Effectiveness of communication methods for receiving information about how to make your home and neighborhood more resistant to hazards

Official Website

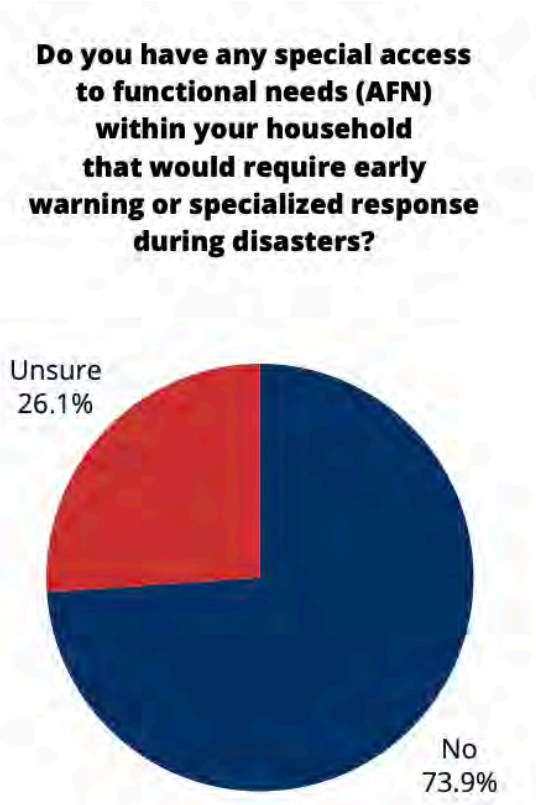


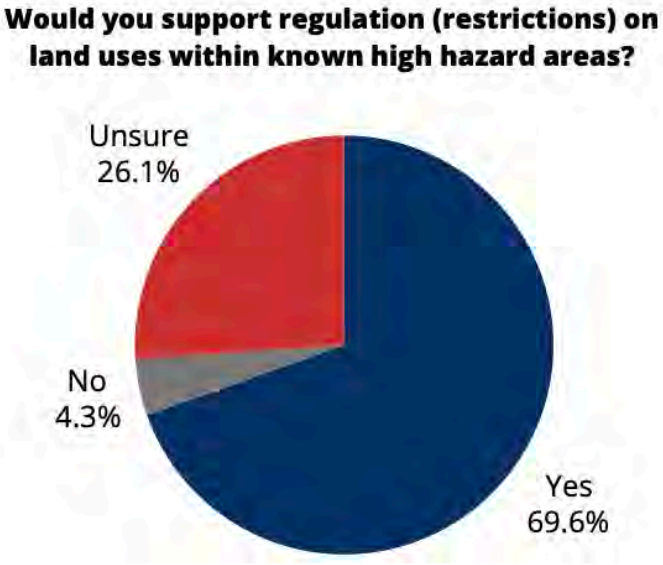
Social Media & Mail

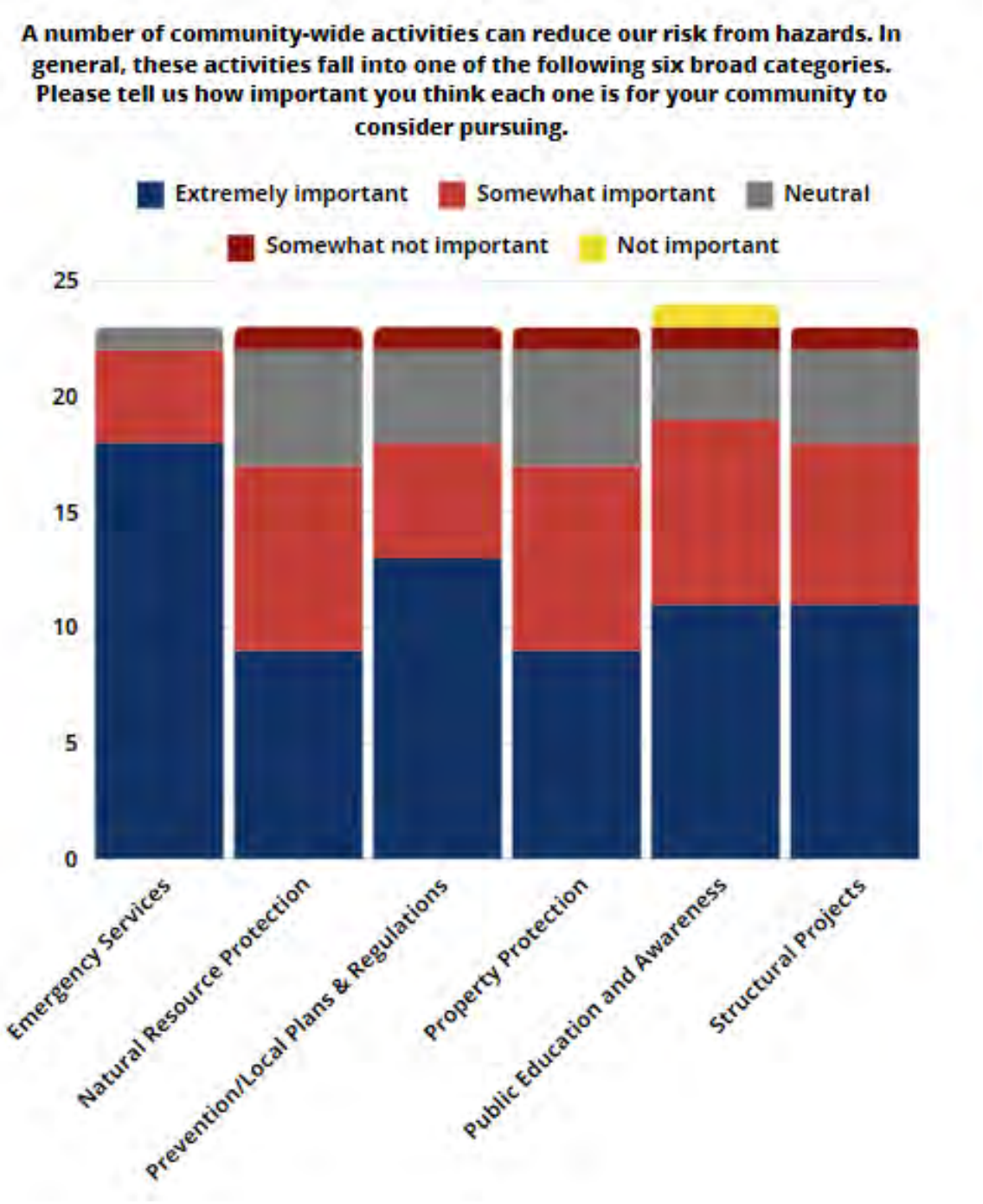
Additional communication methods recommended:

Alerts

Texts


Do you have any special access to functional needs (AFN) within your household that would require early warning or specialized response during disasters?
Unsure 26.1%
No 73.9%


Would you support regulation (restrictions) on land uses within known high hazard areas?
Unsure 26.1%
No 4.3%
Yes 69.6%



Emergency Services - Actions that protect people and property during and immediately after a hazard event. Examples include warning systems, evacuation planning, emergency response training, and protection of critical facilities or systems.

Natural Resource Protection - Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems. Examples include floodplain protection, habitat preservation, slope stabilization, riparian buffers, and forest management.

Prevention / Local Plans & Regulations - Administrative or regulatory actions that influence the way land is developed and buildings are built. Examples include planning and zoning, building codes, open space preservation, and floodplain regulations.

Property Protection - Actions that involve the modification of existing buildings to protect them from a hazard or removal from the hazard area. Examples include acquisition, relocation, elevation, structural retrofits, and storm shutters.

Public Education and Awareness - Actions to inform citizens about hazards and techniques they can use to protect themselves and their property. Examples include outreach projects, school education programs, library materials, and demonstration events.

Structural Projects - Actions intended to lessen the impact of a hazard by modifying the natural progression of the hazard. Examples include dams, levees, seawalls detention / retention basins, channel modification, retaining walls, and storm sewers.

APPENDIX C
CRITICAL FACILITIES

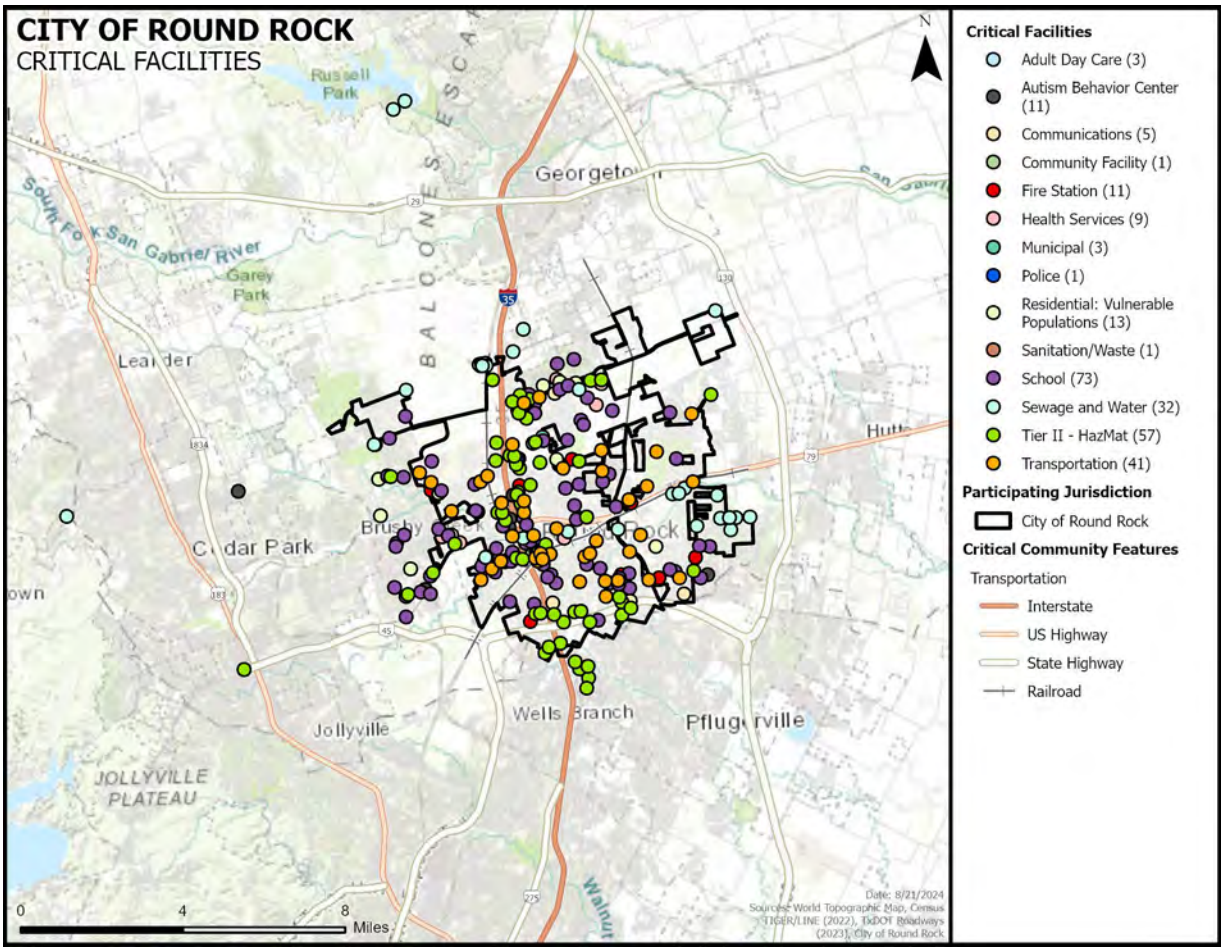
APPENDIX C: CRITICAL FACILITIES

OVERVIEW

Appendix C is **For Official Use Only (FOUO)** and may be exempt from public release under FOIA. Figure C-1 locates all critical facilities that were included in the risk assessment. Mapped facilities were provided by Planning Team members. Table C-1 notes the critical facilities by type.

CRITICAL FACILITIES

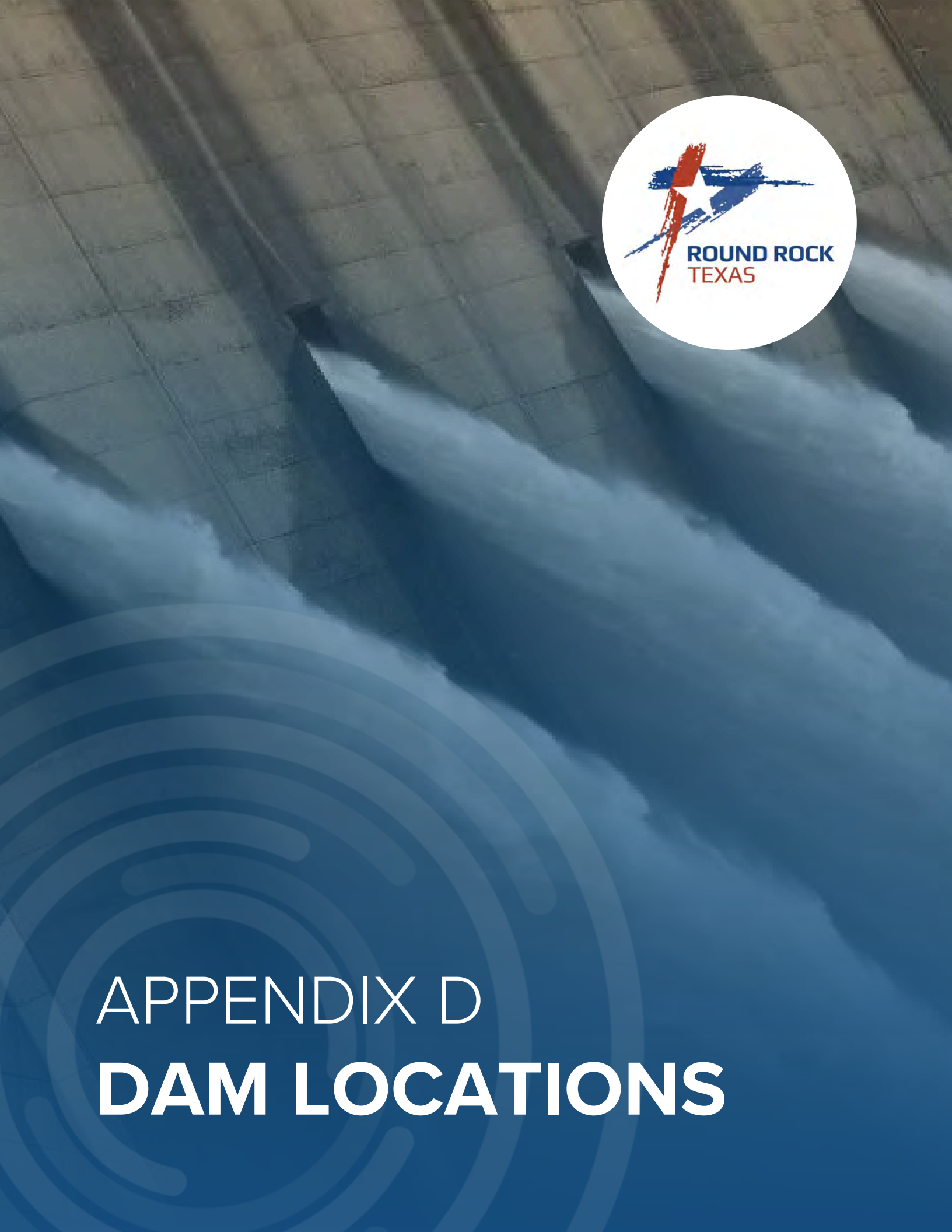
Figure C-1. Critical Facilities in City of Round Rock



APPENDIX C: CRITICAL FACILITIES

Table C-1. Critical Facilities by Type in City of Round Rock

TYPE	NUMBER
Adult Day Care	3
Autism Behavior Center	11
Communications – Radio Tower	5
Community Facility – Senior Center	1
Fire Station	10
Fire Station – Critical Response Unit	1
Health Services – Dialysis	1
Health Services – Health Center	2
Health Services – Hospital	3
Health Services – Rehabilitation	3
Municipal	3
Police	1
Residential: Vulnerable Populations – Assisted Living	13
Sanitation/Waste - Recycling	1
School	73
Sewage and Water – Lift Station	12
Sewage and Water – Pump Station	4
Sewage and Water – Wastewater Treatment Plant	3
Sewage and Water – Storage Tank	4
Sewage and Water – Water Treatment Plant	9
Tier II – HazMat	57
Transportation - Bridge	41



APPENDIX D
DAM LOCATIONS

APPENDIX D: DAM LOCATIONS

OVERVIEW

Appendix D is **For Official Use Only (FOUO)** and may be exempt from public release under the Freedom of Information Act (FOIA).

DAM LOCATIONS

Table D-1 below reflects all dams that are located in the participating jurisdictions within the City of Round Rock County Hazard Mitigation Action Plan Update 2025. This list includes High, Significant, and Low Hazards Dams. Section 5 of the plan doesn't profile dams that were deemed to pose no past, current, or future risk to the planning area as no loss of life or impact to critical facilities or infrastructure is expected in the event of a breach. The asterisk denotes those that were profiled in the hazards assessment. Some dams are located in Williamson County but have been profiled in the plan as a city asset or due to their proximity and/or potential impact to the planning area.

Table D-1. List of Dam Locations and Storage Capacities

JURISDICTION	LATITUDE	LONGITUDE	HEIGHT (feet)	STORAGE (acre feet)
City of Round Rock	30.484172	-97.713573	36	3,202
City of Round Rock*	30.541358	-97.678738	41	5,844
City of Round Rock	30.536535	-97.710947	32	2,984
City of Round Rock*	30.541862	-97.662362	24.8	2,549
City of Round Rock*	30.520457	-97.599098	41	970
City of Round Rock	30.540025	-97.750604	32	2,839
City of Round Rock	30.486466	-97.681984	30	75.45
City of Round Rock	30.577267	-97.780334	39	779
City of Round Rock*	30.534679	-97.791313	56.5	3,226
City of Round Rock*	30.487442	-97.809842	49	3,488
City of Round Rock*	30.507858	-97.766405	54	5,587
City of Round Rock	30.470298	-97.745865	42	6,935
City of Round Rock	30.522309	-97.748596	11	64
City of Round Rock/ Williamson County*	30.53666	-97.625222	34	739
City of Round Rock/ Williamson County	30.56717	-97.629383	48	4,868

ROUND ROCK
TEXAS

APPENDIX E
MEETING DOCUMENTATION

WORKSHOP DOCUMENTATION

Appendix E is **For Official Use Only (FOUO)** and may be exempt from public release under the Freedom of Information Act (FOIA).

The City of Round Rock held a series of Planning Team workshops: a Kickoff Workshop on April 15, 2024, a Risk Assessment Workshop on May 22, 2024, and Mitigation Strategy Workshop on June 18, 2024. At each of these workshops members of the Planning Team were informed of the planning process, expressed opinions, and volunteered information. The City of Round Rock hosted public meetings. The sign-in sheets for each workshop and public meeting are included below. For more details on the workshops and planning process, see Section 2.

Figure E-1. City of Round Rock Kickoff Workshop, April 15, 2024

ROUND ROCK TEXAS

CITY OF ROUND ROCK HAZARD MITIGATION PLAN
Virtual Kick-Off Workshop
Microsoft Teams
April 15, 2024 @ 2:00 PM

H2O PARTNERS

Name	Jurisdiction	Title	Email	Phone
Matt Fitzgerald	CO Round Rock	Superintendent of Transportation	mattfitzgerald@roundrocktexas.gov	512-341-3186
Paul Hernandez	CO Round Rock	Superintendent Wastewater Collections	paulhernandez@roundrocktexas.gov	512-845-9315
Justin Carmichael	CO Round Rock	Assistant Chief of Police	jcarmichael@roundrocktexas.gov	512-671-2855
Brian Kuhn	CO Round Rock	Assistant Director - Transportation	bkuhn@roundrocktexas.gov	512-218-6694
Sara Bustilloz	CO Round Rock	Marketing and Communications Director	sbustilloz@roundrocktexas.gov	512-218-5447
Brad Wiseman	CO Round Rock	Assistant City Manager	bwiseman@roundrocktexas.gov	512-341-3321
Gary Hudder	CO Round Rock	Director - Transportation	ghudder@roundrocktexas.gov	512-218-5560
Annie Burwell	CO Round Rock	Program Manager - Crisis Response	lburwell@roundrocktexas.gov	512-218-5491
Allen Banks	CO Round Rock	Chief of Police	abanks@roundrocktexas.gov	512-218-5521
Bradley Dushkin	CO Round Rock	Director of Planning & Development Services	bdushkin@roundrocktexas.gov	512-671-2728

CITY OF ROUND ROCK HAZARD MITIGATION PLAN
Virtual Kick-Off Workshop
Microsoft Teams
April 15, 2024 @ 2:00 PM

Name	Jurisdiction	Title	Email	Phone
Rick Atkins	CO Round Rock	Parks and Recreation Director	ricka@roundrocktexas.gov	512-341-3344
Ricci Strayhorn	CO Round Rock	Forestry Manager	rstrayhorn@roundrocktexas.gov	512-341-3151
Katie Baker	CO Round Rock	Park Development Manager	kbaker@roundrocktexas.gov	512-341-3355
Mike Hemker	CO Round Rock	Parks Operations Manager	mhemker@roundrocktexas.gov	512-218-5541
David Buzzell	CO Round Rock	Assistant Director of Parks and Recreation	dbuzzell@roundrocktexas.gov	512-341-3345
Chad Kinder	CO Round Rock	Superintendent of Water Treatment Plant	wkinder@roundrocktexas.gov	512-341-3134
Joe Brehm	CO Round Rock	Director of Community & Neighborhood Services Department	Jbrehm@roundrocktexas.gov	512-341-3148
Melana Taylor	CO Round Rock	Deputy Chief Financial Officer	mtaylor@roundrocktexas.gov	512-218-3295
Shane Glaiser	CO Round Rock	Fire Chief	sglaiser@roundrocktexas.gov	512-671-2783

CITY OF ROUND ROCK HAZARD MITIGATION PLAN
Virtual Kick-Off Workshop
Microsoft Teams
April 15, 2024 @ 2:00 PM

Name	Jurisdiction	Title	Email	Phone
Wylie Brownell	CO Round Rock	Assistant Fire Chief	wbrownell@roundrocktexas.gov	512-671-2748
Charles Dittman	CO Round Rock	Assistant Fire Chief	cdittman@roundrocktexas.gov	512-671-2276
Captain Darwin Shell	CO Round Rock	Captain	dshell@roundrocktexas.gov	512-671-2876
Cheree Smith	CO Round Rock	EMC	cheree.smith@roundrocktexas.gov	512-341-3106
Krystian Murray	H2O Partners	Mitigation Specialist	kmurray@h2opartnersusa.com	512.827.1795
Will Parker	H2O Partners	Mitigation Outreach Specialist	wparker@h2opartnersusa.com	512.539.7016
Stevie-Ann O'Donnell	H2O Partners	Mitigation Outreach Coordinator	sodonnell@h2opartnersusa.com	631-921-2460

Figure E-2. City of Round Rock Risk Assessment Workshop, May 22, 2024

CITY OF ROUND ROCK HAZARD MITIGATION PLAN
Virtual Risk Assessment Workshop
Microsoft Teams
May 22, 2024 @ 2:00 PM

Name	Jurisdiction	Title	Email	Phone
Annie Burwell	Round Rock	Crisis Response Program Manager	lburwell@roundrocktexas.gov	512-218-5491
Brad Wiseman	Round Rock	Assist. City Manager	bwiseman@roundrocktexas.gov	512-341-3321
Bradley Dushkin	Round Rock	Director of Planning & Development	bdushkin@roundrocktexas.gov	512-671-2728
Brian Kuhn	Round Rock	Assist. Director of Transportation	bkuhn@roundrocktexas.gov	512-218-6694
Brooks Bennett	Round Rock	Assist. City Manager	bbennett@roundrocktexas.gov	512-218-7070
Chad McDowell	Round Rock	General Services Director	cmcdowell@roundrocktexas.gov	512-341-3191
Charles Dittman	Round Rock	Assist. Fire Chief	cdittman@roundrocktexas.gov	512-671-2776
Cheree Smith	Round Rock	EMC	cheree.smith@roundrocktexas.gov	512-341-3106
Corey Amidon	Round Rock	Assist. Director of General Services	camidon@roundrocktexas.gov	512-341-3144
Gary Hudder	Round Rock	Director of Transportation	ghudder@roundrocktexas.gov	512-218-5560

CITY OF ROUND ROCK HAZARD MITIGATION PLAN
Virtual Risk Assessment Workshop
Microsoft Teams
May 22, 2024 @ 2:00 PM

Name	Jurisdiction	Title	Email	Phone
Joe Brehm	Round Rock	Director of Community & Neighborhood Services Department	jbrehm@roundrocktexas.gov	512-671-2734
Justin Carmichael	Round Rock	Assist. Chief of Police	jcarmichael@roundrocktexas.gov	512-671-2855
Matt Fitzgerald	Round Rock	Superintendent of Transportation	mattfitzgerald@roundrocktexas.gov	512-341-3186
Mike Hemker	Round Rock	Parks Operations Manager	mhemker@roundrocktexas.gov	512-218-5541
Ricci Strayhorn	Round Rock	Forestry Manager	rstrayhorn@roundrocktexas.gov	512-341-3151
Rich Reedy	Round Rock	Supervisor – Utilities GIS	rreedy@roundrocktexas.gov	512-218-6606
Sara Bustilloz	Round Rock	Marketing & Communications Director	sbustilloz@roundrocktexas.gov	512-218-5447
Shan Glaiser	Round Rock	Fire Chief	sglaiser@roundrocktexas.gov	512- 671-2783
Wylie Brownell	Round Rock	Assist. Fire Chief	wbrownell@roundrocktexas.gov	512-761-5748

CITY OF ROUND ROCK HAZARD MITIGATION PLAN
Virtual Risk Assessment Workshop
Microsoft Teams
May 22, 2024 @ 2:00 PM

Name	Jurisdiction	Title	Email	Phone
Francisco Vincent	Round Rock	UES Assist. Director	fvicent@roundrocktexas.gov	n/a
Will Parker	H2O Partners Inc	Mitigation Specialist	Wparker@h2opartnersusa.com	512-539-7016
Rhonda Murphy	H2O Partners Inc	Deputy Program Manager	Rmurphy@h2opartnersusa.com	512-571-2088
Heather Ferrara	H2O Partners Inc	Program Manager	Heather@h2opartnersusa.com	205-586-6616
Stevie-Ann O'Donnell	H2O Partners Inc	Mitigation Outreach Coordinator	Sodonnell@h2opartnersusa.com	631-921-2460

Figure E-3. City of Round Rock Mitigation Strategy Workshop, June 18, 2024

CITY OF ROUND ROCK HAZARD MITIGATION PLAN
Virtual Mitigation Strategy Workshop
Microsoft Teams
June 18, 2024 @ 2:00 PM

Name	Jurisdiction	Title	Email	Phone
Annie Burwell	Round Rock	Crisis Response Program Manager	lburwell@roundrocktexas.gov	512-218-5491
Ariana Bernal	Round Rock	GIS technician	abernal@roundrocktexas.gov	n/a
Bradley Dushkin	Round Rock	Director of Planning & Development	bdushkin@roundrocktexas.gov	512-671-2728
Brian Kuhn	Round Rock	Assist. Director of Transportation	bkuhn@roundrocktexas.gov	512-218-6694
Charles Dittman	Round Rock	Assist. Fire Chief	cdittman@roundrocktexas.gov	512-671-2776
Cheree Smith	Round Rock	EMC	cheree.smith@roundrocktexas.gov	512-341-3106
Corey Amidon	Round Rock	Assist. Director of General Services	camidon@roundrocktexas.gov	512-341-3144
Joe Brehm	Round Rock	Director of Community & Neighborhood Services Department	jbrehm@roundrocktexas.gov	512-671-2734
Justin Carmichael	Round Rock	Assist. Chief of Police	jcarmichael@roundrocktexas.gov	512-671-2855
Ricci Strayhorn	Round Rock	Forestry Manager	rstrayhorn@roundrocktexas.gov	512-341-3151

APPENDIX E: MEETING DOCUMENTATION

ROUND ROCK TEXAS

CITY OF ROUND ROCK HAZARD MITIGATION PLAN
Virtual Mitigation Strategy Workshop
Microsoft Teams
June 18, 2024 @ 2:00 PM

H2O PARTNERS

Name	Jurisdiction	Title	Email	Phone
Sara Bustilloz	Round Rock	Marketing & Communications Director	sbustilloz@roundrocktexas.gov	512-218-5447
Shane Glaiser	Round Rock	Fire Chief	sglaiser@roundrocktexas.gov	512-671-2783
Sophia Schreffler-Zegarra	Round Rock	Systems Analyst – Geospatial Services/IT	gschrefflerzegarra@roundrocktexas.gov	512-993-0632
Wylie Brownell	Round Rock	Assist. Fire Chief	wbrownell@roundrocktexas.gov	512-761-5748
Will Parker	H2O Partners Inc	Mitigation Specialist	Wparker@h2opartnersusa.com	512-539-7016
Payton Morris	H2O Partners Inc	Mitigation Specialist	Pmorris@h2opartnersusa.com	737-376-4992
Shawna Payan	H2O Partners Inc	Mitigation Specialist	Spayan@h2opartnersusa.com	737-376-4983
Krystian Murray	H2O Partners Inc	Mitigation Specialist	Kmurray@h2opartnersusa.com	512-827-1795

PUBLIC MEETING DOCUMENTATION

As discussed in Section 2, public meetings were held in the City of Round Rock. Documentation in the form of sign-in sheets for each of the meetings follows.

Figure E-4. Public Meeting, April 15, 2024

ROUND ROCK TEXAS

CITY OF ROUND ROCK HAZARD MITIGATION PLAN
Public Meeting #1
Public Safety Training Center, Room 1203
2801 N. Mays St., Round Rock, TX 78665
April 15, 2024 @ 5:30 PM

H2O PARTNERS

Name	Jurisdiction	Title	Email	Phone
Will Parker	H2O Partners	Mitigation Specialist	wparker@h2opartnersusa.com	[illegible]
[illegible]	[illegible]	Clinical Director	[illegible]@gmail.com	[illegible]
Aaron Dickerson	Atmos Energy	Project Manager	[illegible]@atmosenergy.com	[illegible]
Michael [illegible]	Resident		[illegible]	954-247-5151
Kayla Burnett	H2O partners	Mitigation Specialist	kburnett@h2opartnersusa.com	[illegible]
Cheree Smith	CORR	EMC	Cheree.smith@roundrocktexas.gov	[illegible]

Figure E-5. Public Meeting, May 22, 2024

CITY OF ROUND ROCK HAZARD MITIGATION PLAN
Public Meeting #2
Round Rock Public Library, Meeting Rooms A&B Combo
200 E. Liberty Ave., Round Rock, TX 78664
May 22, 2024 @ 5:30 PM

Name	Jurisdiction	Title	Email	Phone
Will Parker	H2O Partners	Mitigation Specialist	wparker@H2Opartnersusa.com	817-470-1474
Cherise Smith	COLL	EMC	Cherise.smith@roundrocktexas.gov	512-328-1320
Heather Ferraro	H2O Partners	Program Mgr	heatherf@h2opartnersusa.com	205-516-6616

Figure E-6. Public Meeting, June 18, 2024

CITY OF ROUND ROCK HAZARD MITIGATION PLAN
Public Meeting #3
Public Safety Training Center, Room 1203
2801 N. Mays St., Round Rock, TX 78665
June 18, 2024 @ 5:30 PM

Name	Jurisdiction	Title	Email	Phone
Will Parker	H2O Partners	Mitigation Specialist	wparker@H2Opartnersusa.com	817-470-1474
Cherise Smith	COLL	EMC	Cherise.smith@roundrocktexas.gov	512-328-1320

PUBLIC NOTICES

Public notices to announce the City of Round Rock's participation in the Plan Update development process were posted on their website, through the local media, and/or posting the information on bulletin boards in public facilities.

Figure E-7. City of Round Rock Public Notice, City Hall Bulletin

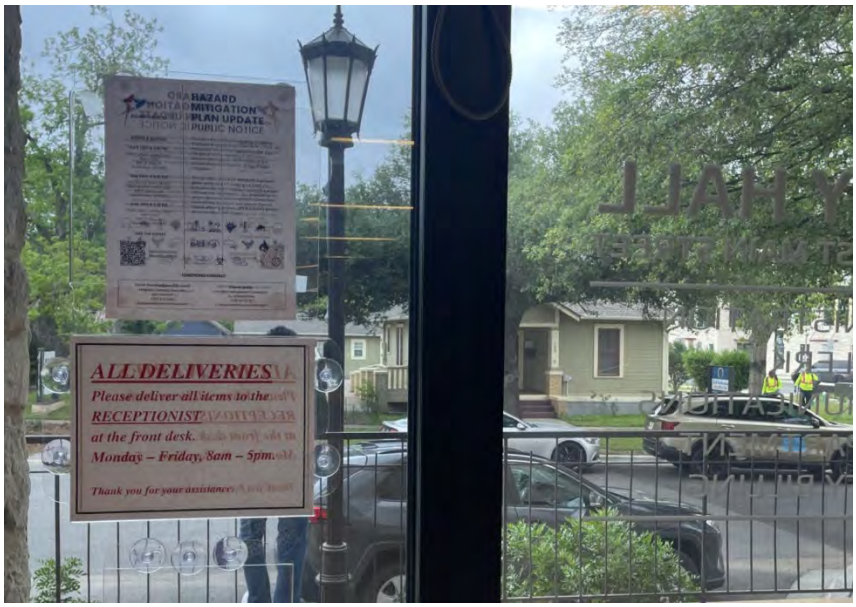


Figure E-8. City of Round Rock Public Notice, City Website

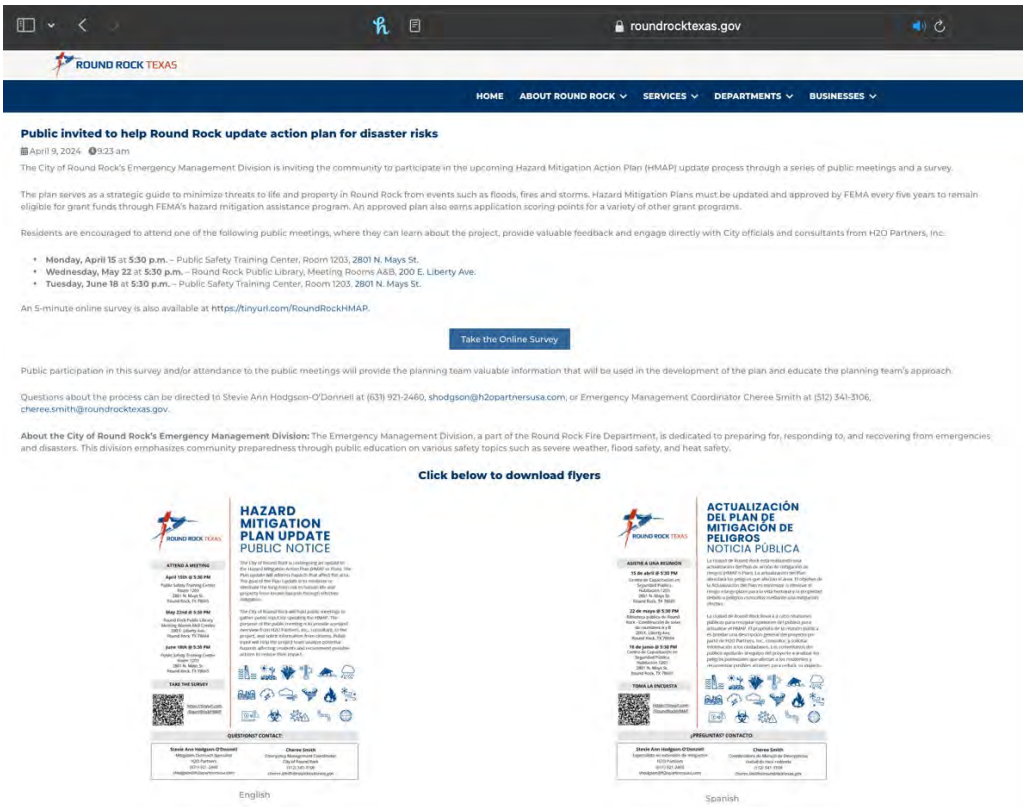
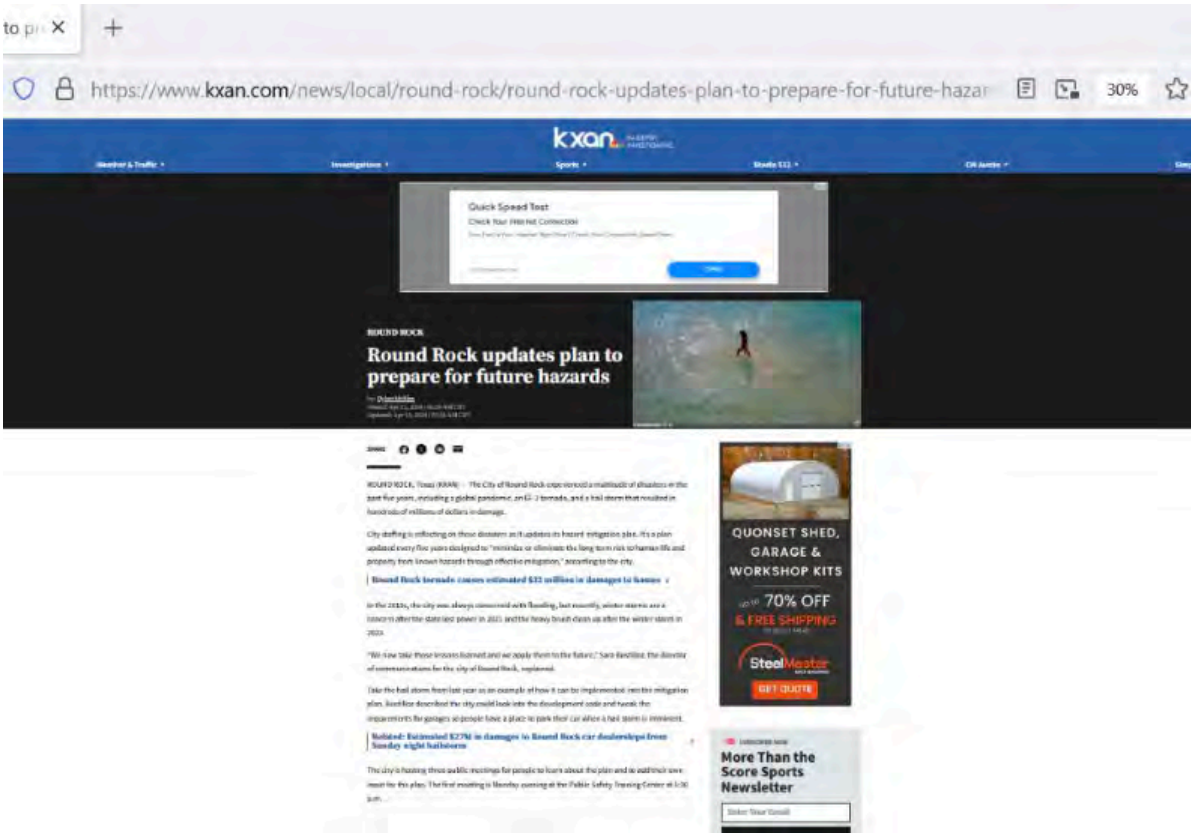


Figure E-9. City of Round Rock Public Notice, KXAN News Report



APPENDIX F

CAPABILITY ASSESSMENT

APPENDIX F: CAPABILITY ASSESSMENT

OVERVIEW

A Community Capability Assessment is an integral component of the Hazard Mitigation Planning Process. It is an invaluable tool in assessing a community's existing planning and regulatory capabilities to support implementation of mitigation strategy objectives.

Beginning on Page 2, a completed Capability Assessment Checklist provides information on existing policies, plans, and regulations in place for Planning Team members at the local level or that may be provided by the County on an as-needed basis. ***Participation is denoted with an "x" on the Checklist.***

COMMUNITY CAPABILITY ASSESSMENTS

COMMUNITY CAPABILITY CHECKLIST	*City of Round Rock*
PLANS	
Capital Improvements Plan	X
Climate Change Adaptation Plan	
Community Wildfire Protection Plan	
Comprehensive / Master Plan / Land Use Plan	X
Continuity of Operations Plan	X
Drought Contingency Plan/Protocol on Water Restrictions	X
Economic Development Plan	X
Emergency Management Action Plan	X
Emergency Operations Plan	X
Evacuation Plan	X
Extreme Heat Protocol	X
Hazard Mitigation Plan	X
Stormwater Management Plan / Ordinance	X
Transportation Plan	X
POLICIES / ORDINANCES	
Building Codes	X
Fire Code	
Floodplain Ordinance	X
Manufactured Home Restrictions	X
Stormwater Ordinance	X

APPENDIX F: CAPABILITY ASSESSMENT

COMMUNITY CAPABILITY CHECKLIST	*City of Round Rock*
Subdivision Regulations	X
Wildfire Ordinance	
Zoning Ordinance/Land Use Restrictions	X
PROGRAMS	
Firewise Communities	X
Floodplain Maps/Flood Insurance Studies	X
Hydrologic/Hydraulic Studies	X
Mutual Aid Agreement	X
National Flood Insurance Program Participant	X
NFIP Community Rating System Participant	
Property Acquisition Program	
Public Education/Awareness Programs	X
Storm Drainage Systems Maintenance Program	X
Stream Maintenance Program	
StormReady Communities	X
Warning Systems/Services (reverse 911, outdoor warning sirens)	X
STAFF / DEPARTMENTS	
Building Code Official	X
Emergency Manager	X
Engineers	X
Environmental Conservation Specialist	X
Floodplain Administrator	X

APPENDIX F: CAPABILITY ASSESSMENT

COMMUNITY CAPABILITY CHECKLIST	*City of Round Rock*
Geographic Information System (GIS) Coordinator	X
Personnel with Hazard Knowledge	X
Planners	X
Public Information Official	X
Resource Development/Grant Writer	X

APPENDIX G

STATE AND FEDERAL FUNDING OPPORTUNITIES

APPENDIX G: STATE AND FEDERAL FUNDING OPPORTUNITIES

OVERVIEW

Texas utilizes state funds to improve statewide hazard mitigation capabilities and advance their hazard mitigation goals to help identify, understand, and manage various risks associated with natural hazards. State funds also provide funding for state facility and infrastructure upgrades, hazard mapping, mitigation planning, and other mitigation programmatic activities. Table G-1 describes a variety of loan and grant programs offered by state agencies for which mitigation activities may be eligible.

Table G-1. Summary of State Funded Mitigation Programs

AGENCY	FUNDING PROGRAM
Texas A&M Forest Service (TAMFS)	• Community Fire Protection Program • Community Wildfire Defense Grant • Fire-Adapted Communities Program (FAC) • Firewise USA Program • Forest Land Enhancement Program • Forest Legacy Program • Mitigation Project Support Fund Prescribed Fire Grants • Resilient Landscapes Program • Rural Fire Assistance Grant • State Fire Assistance for Mitigation (SFAM) - Mechanical Fuels Grants • State Fire Assistance for Mitigation (SFAM) - Vegetative Fuel Break Grant • Texas Longleaf Conservation Assistance Program • Urban Tree Canopy Project (UTC)
Texas Commission on Environmental Quality (TCEQ)	• Clean Water Act Section 319 Grants • High Hazard Potential Dam Program (HHPD) • Nonpoint Source Grant Program • U.S.-Mexico Border Water Infrastructure Program
Texas Department of Agriculture (TDA)	• Agricultural Management Assistance (AMA) • Agricultural Water Enhancement Program (AWEP) • Community Development Block Grant • Community Development Block Grant for Rural Texas • Conservation Innovation Grants (CIG) • Environmental Quality Incentives Program (EQUIP)
Texas Department of Housing and Community Affairs (TDHCA)	• Texas HOME Disaster Relief
Texas Department of State Health Services (TXDSHS)	• Hospital Preparedness Program (HPP) Cooperative Agreement • Public Health Emergency Preparedness (PHEP) Cooperative Agreement

APPENDIX G: STATE AND FEDERAL FUNDING OPPORTUNITIES

AGENCY	FUNDING PROGRAM
Texas Department of Transportation (TXDOT)	• Bridge Preventative Maintenance Program • Emergency Relief (ER) Program • Highway Bridge Replacement and Rehabilitation Program • Safe Rest Stops Program • Transportation Enhancement Program
Texas Division of Emergency Management (TDEM)	• Building Resilient Infrastructure & Communities (BRIC) • Emergency Management Performance Grant (EMPG) • Fire Management Assistance Grants (FMAG) • Hazard Mitigation Planning Grants Program (HMGP) • Homeland Security Grant Program (HSGP) • Individual Assistance (IA) • National Earthquake Hazard Reduction Program (NEHRP) • Public Assistance (PA) Section 406 Funds
Texas Economic Development & Tourism (EDT)	• Economic Development Administration Grants and Investments
Texas General Land Office (TXGLO)	• Beach Grants • Beach Maintenance Reimbursement Fund • Coastal and Estuarine Land Conservation Program (CELCP) • Coastal Erosion Planning and Response Act (CEPRA) • Coastal Management Program (CMP) • Community Development Block Grant – Disaster Recovery (CDBG-DR) • Community Development Block Grant – Mitigation (CDBG-MIT) • Gulf of Mexico Energy Security Act (GOMESA) • Hazard Mitigation Grant Program Supplemental -LHMPP
Texas Parks and Wildlife Department (TPWD)	• Nation Resources Damage Assessment (NRDA) • National Wildlife Wetland Refuge System • North American Wetland Conservation Fund • Partners for Fish and Wildlife • Texas Farm and Ranch Lands Conservation Program (TFRLCP) • Wildlife Habitat Incentive Program (WHIP)
Texas State Soil and Water Conservation Board (TSSWCB)	• Clean Water Act Section 319 Grants • Nonpoint Source Grant Program
Texas Water Development Board (TWDB)	• Agricultural Water Conservation Grants • Agricultural Water Conservation Loans • Clean Water State Revolving Fund (SWSRF) • Community Assistance Program (CAP) • Drinking Water State Revolving Fund (DWSRF) • Economically Distressed Areas Program • Emergency Community Water Assistance Grants • Flood Infrastructure Fund (FIF) • Flood Mitigation Assistance (FMA) Program

AGENCY	FUNDING PROGRAM
Texas Water Development Board (TWDB) (continued)	• Flood Mitigation Assistance (FMA) Swift Program • Flood Protection Planning Program • Groundwater Conservation District Loan Program • Planning Assistance to States • Regional Facility Planning Grant Program • Regional Water Planning Group Grants • Research and Planning Fund and Fund Development Program • Risk MAP Program • Rural Development Grants • Rural Water Assistance Fund • Silver Jackets • Small Flood Control Projects (USACE Section 205) • State Participation Program – Regional Water and Wastewater Facilities • State Water Implementation Fund for Texas (SWIFT) • State Water Resources Research Act Program • Texas Infrastructure Resiliency Fund (TIRF) • Water Research Grant Program • Water SMART - Drought Response Program • Texas Water Development Fund (DFund)

In addition to State funded programs, many local jurisdictions benefit from federal mitigation funding opportunities. FEMA'S Hazard Mitigation Assistance is a primary source for the implementation of mitigation projects throughout the Nation. Table G-2 described additional Federal, State, Local, and Non-Profit mitigation funding sources specifically within the State of Texas.

Table G-2. Federal, State, Local and Non-Profit Mitigation Funding Sources in Texas

NAME	LEVEL	SOURCE AGENCY	MANAGING STATE AGENCY	PURPOSE OF FUNDING
Agricultural Management Assistance (AMA)	Federal	USDA, NRCS	TDA	Provides financial and technical assistance to agricultural producers to voluntarily address issues such as water management, water quality, and erosion control by incorporating conservation methods into their farming operations.
Agricultural Water Enhancement Program (AWEP)	Federal	USDA, NRCS	TDA	Voluntary conservation initiative that provides financial and technical assistance to agricultural producers to implement water enhancement activities on agricultural land to conserve surface and ground water and improve water quality.

APPENDIX G: STATE AND FEDERAL FUNDING OPPORTUNITIES

NAME	LEVEL	SOURCE AGENCY	MANAGING STATE AGENCY	PURPOSE OF FUNDING
Agricultural Water Conservation Grants	State	TWDB	TWDB	Provided to state agencies and political subdivisions for projects that support the implementation of conservation of water management strategies identified in state and regional water plans. Yearly applications. Up to $1.2 million available annually. Grant categories vary from year to year.
Agricultural Water Conservation Loans	State	TWDB	TWDB	Agricultural water conservation loans to use either for improvements on facilities or as loan to individuals. Low-interest, fixed rates. Up to 10-year repayment terms. U.S. Iron and Steel requirements apply to certain projects. Eligible Loan applicants include political subdivisions.
AmeriCorps - Corporation for National & Community Service (CNCS)	Federal	AmeriCorps	N/A	Provides funding for volunteers to serve communities, including disaster prevention. AmeriCorps/Vista has assisted local communities with wildfire mitigation projects.
American Recovery and Reinvestment Act (ARRA)	Federal	DOT Federal Transit Administration	TDA	Nicknamed the Recovery Act was a stimulus package enacted by the 111th U.S. Congress and signed into law by President Barack Obama in February 2009. Developed in response to the Great Recession, the primary objective of this federal statute was to save existing jobs and create new ones as soon as possible. Other objectives were to provide temporary relief programs for those most affected by the recession and invest in infrastructure, education, health, and renewable energy.
Assistance to Firefighters program - Fire Prevention & Safety (FP&S) **Grants**	Federal	FEMA, AFG		Fire Prevention & Safety (FP&S) Grants support projects that enhance the safety of the public and firefighters from fire and related hazards.
Beach Grants	Federal	EPA	TXGLO	EPA awards grants under authority of the BEACH Act to eligible states, territories, and tribes with beaches on ocean and Great Lakes coasts to develop and implement programs to monitor their beaches and notify the public when it is not safe to swim.

APPENDIX G: STATE AND FEDERAL FUNDING OPPORTUNITIES

NAME	LEVEL	SOURCE AGENCY	MANAGING STATE AGENCY	PURPOSE OF FUNDING
Beach Maintenance Reimbursement Fund	State	GLO	TXGLO	Allocates approximately $750,000 per year to help communities keep their beaches maintained. Applications are distributed to eligible participants in early fall and are due within a specified amount of time, no less than 30 days. Contracts are renewable annually.
Bridge Preventative Maintenance Program	State	TXDOT	TXDOT	A planned, cost-effective treatment that preserves, improves, or delays future deterioration of the condition of a bridge. To be eligible for the BMIP a bridge must have a condition rating of 5 or 6 for at least one of the following: deck, superstructure, substructure, culvert, or channel. Safety and improvement to the physical conditions of the State's on-system bridges are TxDOT's main goals in the prioritization of the bridges using BMIP funds. The Bridge Division develops an initial list each FY of eligible bridges in each district and distribute to the districts for the annual program call.
Building Resilient Infrastructure & Communities (BRIC)	Federal	FEMA	TDEM	Pre-disaster/annual cycle addressing all natural hazards, emphasis on infrastructure & lifelines.
Clean Water Act Section 319 Grants	Federal	EPA	TCEQ and TSSWCB	Provides grants for a wide variety of activities related to non-point source pollution runoff mitigation.
Clean Water State Revolving Fund (CWSRF)	Federal	EPA	TWDB	Providing low-cost financing for a wide range of wastewater, stormwater, reuse, and other pollution control projects.
Coastal and Estuarine Land Conservation Program (CELCP)	Federal	NOAA	TXGLO	When NOAA provides funding for CELCP, the GLO provides coastal communities an opportunity to apply for up to three projects per year, with federal grants for any single project not to exceed $3 million.
Coastal Erosion Planning and Response Act (CEPRA)	State	GLO	TXGLO	Since 2000, the Texas General Land Office's Coastal Erosion Planning and Response Program has received more than $62 million in state funding and more than $62 million in matching funds, completing more than 200 coastal erosion projects and studies. The application process for non-emergency project funding requests opens every even year in February and closes in early June of that same year.

APPENDIX G: STATE AND FEDERAL FUNDING OPPORTUNITIES

NAME	LEVEL	SOURCE AGENCY	MANAGING STATE AGENCY	PURPOSE OF FUNDING
Coastal Management Program (CMP)	Federal	NOAA	TXGLO	Texas receives approximately $2 million annually in grants from National Oceanic and Atmospheric Administration (NOAA) and 90% of the funds are passed through to local governments and entities to address environmental needs and promote sustainable economic development along the coast. Projects must improve the management of the state's coastal resources and ensure long-term ecological and economic productivity. Section 306 administrative funds can be used for non-construction, coastal planning and education, and research. Section 306A improvement funds can be utilized for construction and land acquisition projects and preservation and restoration. CMP funding categories include Coastal Natural Hazards Response, Critical Areas Enhancement, Public Access, Water/Sediment Quantity and Quality Improvements, Waterfront Revitalization and Ecotourism Development, Permit Streamlining/ Assistance, Governmental Coordination and Local Government Planning Assistance.
Community Assistance Program (CAP)	Federal	FEMA, NFIP	TWDB	Product-oriented financial assistance program directly related to the flood loss reduction objectives of the NFIP.
Community Development Block Grant	Federal	HUD	TDA	The primary objective is to develop viable communities by providing decent housing and suitable living environments and expanding economic opportunities principally for persons of low- to moderate- income. Eligible applicants are non-entitlement cities under 50,000 in population and non-entitlement counties that have a non-metropolitan population under 200,000 and are not eligible for direct CDBG funding from HUD may apply for funding through any of the Texas CDBG programs.
Community Development Block Grant – Disaster Recovery (CDBG-DR)	Federal	HUD	TXGLO	Often following a disaster, the state may receive a CDBG-DR Supplement intended for mitigation and disaster recovery projects in the affected areas. Funding can be used to acquire properties in hazard prone areas. Since CDBG funds lose their federal identify they can also be used to supplement state or local match requirements on other funds such as FEMA HMA grants. Funding also supports public facilities including water and wastewater.

APPENDIX G: STATE AND FEDERAL FUNDING OPPORTUNITIES

NAME	LEVEL	SOURCE AGENCY	MANAGING STATE AGENCY	PURPOSE OF FUNDING
Community Development Block Grant for Rural Texas	State	TDA	TDA	TDA administers the Community Development Block Grant for Rural Texas. The primary objective of the CDBG is to develop viable communities by providing decent housing and suitable living environments and expanding economic opportunities principally for persons of low- to moderate-income. Eligible applicants are non-entitlement cities under 50,000 in population and non-entitlement counties that have a non-metropolitan population under 200,000 and are not eligible for direct CDBG funding from HUD may apply for funding through any of the Texas CDBG programs.
Community Development Block Grant – Mitigation (CDBG-MIT)	Federal	HUD	TXGLO	Eligible grantees to use this assistance in areas impacted by recent disasters to carry out strategic and high-impact activities to mitigate disaster risks and reduce future losses. In February of 2018, Congress appropriated $12 billion dollars in Community Development Block Grant (CDBG) funds specifically for mitigation activities for qualifying disasters in 2015, 2016, and 2017. HUD was able to allocate an additional $3.9 billion, bringing the amount available for mitigation to nearly $16 billion.
Community Fire Protection Program	Federal	USDA	TAMFS	Mitigation delivered via USDA Forest Service and Private Forestry Coop Fire Program.
Community Wildfire Defense Grant	Federal	USFS	TAMFS	Offers financial assistance to at-risk local communities with planning for and mitigating against the risk of catastrophic wildfire. This program is authorized in Public Law 117-58, the Infrastructure Investment and Jobs Act. Two primary objectives: The development and revision of Community Wildfire Protection Plans (CWPP), and the implementation of projects described in a CWPP that is less than ten years old. Prioritizes at-risk communities that are in an area identified as having high or very high wildfire hazard potential, are low-income, and/or have been impacted by a severe disaster. No minimum federal funding limit for projects.

APPENDIX G: STATE AND FEDERAL FUNDING OPPORTUNITIES

NAME	LEVEL	SOURCE AGENCY	MANAGING STATE AGENCY	PURPOSE OF FUNDING
Conservation Innovation Grants (CIG)	Federal	USDA, NRCS	TDA	Voluntary program intended to stimulate the development and adoption of innovative conservation approaches and technologies while leveraging federal investment in environmental enhancement and protection, in conjunction with agricultural production.
Drinking Water State Revolving Fund (DWSRF)	Federal	EPA	TWDB	Makes funds available to drinking water systems to finance infrastructure improvements. The program also emphasizes providing funds to small and disadvantaged communities and to programs that encourage pollution prevention as a tool for ensuring safe drinking water.
Economic Development Administration Grants and Investments	Federal	U.S. DOC, EDA	EDT	Invests and provides grants for community construction projects, including mitigation activities.
Economically Distressed Areas Program	State	TWDB	TWDB	Provides financial assistance for projects serving economically distressed areas where water or sewer services do not exist, or systems do not meet minimum state standards. Eligible EDAP applicants include cities, counties, water districts, nonprofit water supply corporations, and all other political subdivisions. The city or county where the project is located must adopt and enforce Model Subdivision Rules for the regulation of subdivisions prior to application for financial assistance. Projects must also be in an economically distressed area where the median household income is not greater than 75 percent of the median state household income.
Emergency Community Water Assistance Grants	Federal	USDA	TWDB	$150,000 to $500,000 available to rural communities with populations over 10,000 people with a median household income less than $65,900. Aids communities who have experienced a decline in quantity or quality of drinking water as a result of an emergency including drought.
Emergency Management Performance Grant (EMPG)	Federal	FEMA	TDEM	The EMPG program provides a yearly allocation of funding to support state and local emergency management programs. This has included providing some funding for local mitigation plans, mitigation-oriented studies, and related activities.

APPENDIX G: STATE AND FEDERAL FUNDING OPPORTUNITIES

NAME	LEVEL	SOURCE AGENCY	MANAGING STATE AGENCY	PURPOSE OF FUNDING
Emergency Relief (ER) **Program**	Federal	US DOT - FHWA	TXDOT	Provides funds for roads and bridges on Federal-aid highways that are damaged as a direct result of a natural disaster or catastrophic failure from an external cause.
Emergency Watershed Protection (EWP)	Federal	USDA, NRCS	TWDB	Provides funding and technical assistance for emergency measures such as floodplain easements in impaired watersheds. Funding available through the Simplified Acquisition Procedures (SAP) ranges from $25K to $100K. Funded through contracts between project sponsors and the NRCS. There are no grants. The NRCS pays 75% of the costs.
Environmental Quality Incentives Program (EQUIP)	Federal	USDA, NRCS	TDA	Provides funding and technical assistance to farmers and ranchers to promote agricultural production and environmental quality as compatible goals.
Fire-Adapted Communities Program (FAC)	Federal	FEMA, USFA	TAMFS	Collaborates to identify its wildfire risk and works collectively on actionable steps to reduce its risk of loss. This work protects property and increases the safety of firefighters and residents.
Fire Management Assistance Grants (FMAG)	Federal	FEMA	TDEM	Provides fire suppression support to states when loss of life and property are imminent. Wildfire mitigation is also eligible under emergency protection if life is in imminent danger.
Firewise USA Program	Federal	USDA, DOI, NASFF, NFPA	TAMFS	The national Firewise USA® recognition program provides a collaborative framework to help neighbors in a geographic area get organized, find direction, and take action to increase the ignition resistance of their homes and community and to reduce wildfire risks at the local level.
Flood Infrastructure Fund (FIF)	State	TWDB	TWDB	Enacted through Senate Bill 7 to address needs identified following the flood disasters of 2015, 2016, and 2017. Senate Bill 500 appropriated $793 million. The purpose is to provide loans and grants for flood activities and projects. Once the State Flood Plan is adopted, the account may only be used for projects included in the plan. The SWIFT Advisory Committee is the oversight entity.
Flood Mitigation Assistance Program (FMA)	Federal	FEMA	TWDB	Repetitive flood loss property reduction and projects that mitigate losses to NFIP insured properties.

NAME	LEVEL	SOURCE AGENCY	MANAGING STATE AGENCY	PURPOSE OF FUNDING
Flood Protection Planning Program	State	TWDB	TWDB	Developed to evaluate solutions to flooding problems in the state of Texas. Planning activities eligible for this program may include:
Forest Land Enhancement Program	Federal	USDA, NRCS	TAMFS	Provides educational, technical, and financial assistance to help landowners implement sustainable forestry management objectives.
Forest Legacy Program	Federal	USFS	TAMFS	Program providing funding to protect private forest lands that are environmentally, economically, and socially critical. This program reduces development in the wildland-urban interface.
Hazard Mitigation Grant Program (HMGP)	Federal	FEMA	TDEM	Post-disaster multi-hazard mitigation funding for federally declared disasters. HMGP Post Fire funds are available for FMAG declarations.
Hazard Mitigation Grant Program Supplemental – Local Hazard Mitigation Plan Program (LHMPP) **Hazard Mitigation Grant Program Supplemental – Local Hazard Mitigation Plan Program** (LHMPP) (continued)	Federal	FEMA	TXGLO	Local Hazard Mitigation Plan Program (LHMPP) assists eligible entities by providing grants to develop or update local hazard mitigation plans, or to provide cost share for hazard mitigation planning activities funded through other federal sources. Community Development Block Grant Mitigation (CDBG-MIT) funds allocated by the United States Department of Housing and Urban Development (HUD) and administered by the Texas General Land Office (GLO) fund these planning activities, and the Hazard Mitigation Plan development and approval oversight is administered by the Federal Emergency Management Agency (FEMA) and administered by the Texas Division of Emergency Management (TDEM Grant awards will range from $20,000 – $100,000.
High Hazard Potential Dam Program (HHPD)	Federal	FEMA	TCEQ	Pre-disaster/annual cycle, for non-federal high hazard dams rated Unsatisfactory. Local match is 35% for each of the four grant periods.
Highway Bridge Replacement and Rehabilitation Program	Federal	FHWA	TXDOT	Provides funding to enable states to improve the condition of highway bridges through replacement, rehabilitation, and systematic preventive maintenance. Also includes the National Historic Covered Bridge Preservation Program.

APPENDIX G: STATE AND FEDERAL FUNDING OPPORTUNITIES

NAME	LEVEL	SOURCE AGENCY	MANAGING STATE AGENCY	PURPOSE OF FUNDING
Homeland Security Grant Program (HSGP)	Federal	DHS	TDEM	Homeland security activities identified in the state and local strategic plans. Funding supports threat & hazard and risk identification for natural, technological, and human-caused hazards. Some prevention activities may be considered mitigation.
Hospital Preparedness Program (HPP) **Cooperative Agreement**	Federal	HHS	TXDSHS	HPP is the primary source of federal funding for health care system preparedness and response and, in collaboration with public health, prepares health care delivery systems to save lives through the development of health care coalitions (HCCs). Under the direction of the HPP providers, the HCCs develop plans and provide training, and coordinate regional exercises.
Hydrologic Research Grants	Federal	NOAA		Up to $125,000 to conduct joint research and development on pressing surface water hydrology issues common to national, regional, local operational offices. Eligible applicants are federally recognized agencies of state or local governments, quasi-public institutions such as water supply or power companies, hydrologic consultants and companies involved in using and developing hydrologic forecasts.
Groundwater Conservation District Loan Program	State	TWDB	TWDB	Provides short-term loans to finance the start-up costs of Groundwater Conservation Districts. Funding is available for any Groundwater District or Authority with the authority to regulate the spacing of water wells, the production from water wells, or both. The program is authorized under Texas Water Code Chap. 36, Subchapter. L, and governed by TWDB rules in 31 Tex. Admin. Code Chap. 363, Subchapter. H.
Gulf of Mexico Energy Security Act (GOMESA)	Federal	DOI	TXGLO	GOMESA significantly enhances oil and gas leasing activities and creates revenue sharing provisions for the oil- and gas-producing states of Alabama, Louisiana, Mississippi, and Texas, and their coastal political subdivisions (CPSs). GOMESA funds are used for coastal conservation, restoration, and hurricane protection. The second phase of GOMESA revenue sharing began in Fiscal Year 2017 and expands the definition of qualified Outer Continental Shelf revenues to include receipts from Gulf of Mexico leases subject to withdrawal or moratoria restrictions. A revenue-sharing cap of $500 million per year for the four Gulf producing states, their CPSs and the Land and Water Conservation Fund applies from fiscal years 2016 through 2055.

APPENDIX G: STATE AND FEDERAL FUNDING OPPORTUNITIES

NAME	LEVEL	SOURCE AGENCY	MANAGING STATE AGENCY	PURPOSE OF FUNDING
Individual Assistance (IA)	Federal	FEMA	TDEM	Following a disaster, funds can be used to mitigate hazards when repairing individual and family homes.
In-Lieu Fee Program Mitigation Projects	Federal	USACE	Community Applicants	Restoration, establishment, enhancement, and/or preservation of aquatic resources through funds paid to a governmental or non-profit natural resources management entity to satisfy compensatory mitigation requirements for Department of the Army permits.
Mitigation Banks	Federal	USACE	Community Applicants	Mitigation Banks are sites approved by the Corps to sell compensatory mitigation credits for projects resulting in unavoidable impacts to waters of the U.S. When a permit is issued that requires compensatory mitigation, the permit will specify how many credits are required to be purchased at an approved mitigation bank.
National Earthquake Hazards Reduction Program (NEHRP)	Federal	FEMA	TDEM	Provides money to support enhanced earthquake risk assessments in local hazard mitigation plans and other earthquake hazard mitigation and preparedness activities.
Natural Resources Damage Assessment (NRDA)	Federal	EPA	TPWD	ERAs evaluate the likelihood that adverse ecological effects are occurring or may occur as a result of exposure to physical stressors (e.g., cleanup activities) or chemical stressors (e.g., release of hazardous substances) at a site.
National Weather Service (NWS)	Federal	NOAA - NWS		NWS offers storm spotter training, along with weather and flooding safety guides. They can also sometimes provide funding to support severe weather signage in parks or other public places.
National Wildlife Wetland Refuge System	Federal	USFWS	TPWD	Provides funding for the acquisition of lands into the federal wildlife refuge system.
Nonpoint Source Grant Program	Federal	EPA	TCEQ, TSSWCB	The federal Clean Water Act (CWA) requires States to develop a program to protect the quality of water resources from the adverse effects of nonpoint source (NPS) water pollution. TCEQ and TSSWCB administer federal grants for activities that prevent or reduce nonpoint source pollution (NPS).

NAME	LEVEL	SOURCE AGENCY	MANAGING STATE AGENCY	PURPOSE OF FUNDING
North American Wetland Conservation Fund	Federal	USFWS	TPWD	Provides funding for wetland conservation projects.
NRCS Conservation Programs	Federal	USDA, NRCS	Community Applicants	Provides funding through several programs for the conservation of natural resources.
Partners for Fish and Wildlife	Federal	USFWS	TPWD	Provides financial and technical assistance to landowners for wetland restoration projects in "Focus Areas" of the state.
Planning Assistance to States	Federal	USACE	TWDB	Aids states in planning for the development, utilization, and conservation of water and related land resources.
Pre-Disaster Mitigation Loan Program	Federal	SBA		Provides low-interest loans to small businesses for mitigation projects.
Prescribed Fire Grants	State	TAMFS	TAMFS	TAMFS's Mitigation & Prevention Department annually implements four prescribed fire grants intended to protect local communities and restore ecosystems. (1) SFAM Plains Prescribed Fire Grant – aids communities that have been or may be threatened by wildland fire by funding prescribed burning to reduce hazardous fuels in or around communities. Treatment areas will be located adjacent to priority communities in Texas that are at the highest risk for loss during a Southern Plains Wildfire Outbreak event. (2) The Community Protection Program Grant aids reducing the hazard of high-risk fuels on private lands through the use of prescribed burning. The treatment area will be within 10 miles of a National Forest boundary. The grant's goal is to protect high-risk communities and associated forest resources by reducing the risk of catastrophic wildfire on private and public lands. (3) The State Fire Assistance for Mitigation Central & East Texas Grant provides assistance to communities that have been or may be threatened by wildfire by funding prescribed burning to reduce hazardous fuels in and around communities. Treatment areas

NAME	LEVEL	SOURCE AGENCY	MANAGING STATE AGENCY	PURPOSE OF FUNDING
Prescribed Fire Grants (continued)				will be private property in the 43 Counties in Central and East Texas that have a Community Wildfire Protection Plan within the county. The goal is to protect high-risk communities and aid in ecosystem restoration by utilizing prescribed fire to consume excess vegetation before it contributes to catastrophic wildfire. Priority will be given to treatments sites that are within a CWPP, located near a Firewise community, located near homes based on Texas Wildfire Risk Assessment Portal and contain ecosystems that will benefit from prescribed fire. (4) Neches River and Cypress Basin Watershed Restoration Program - Prescribed Fire Grant provides assistance to landowners in utilizing prescribed fire for ecological improvement to the Neches River and Cypress Basin watersheds. This program will benefit the public and natural resources through improvement of water quality and quantity, control of invasive species and enhancement of wildlife habitat. Treatment areas will be private property in the Neches River and Cypress Basin Watersheds. Priority will be given to prescribed burn treatments that promote native ecosystem restoration, are in priority watershed protection zones and near public land.
Public Assistance (PA) **Section 406 Funds**	Federal	FEMA	TDEM	Following a disaster, funds can be used to mitigate hazards when repairing damages to a public structure or infrastructure. Wildfire mitigation is also eligible under emergency protection if life is in imminent danger.
Public Health Emergency Preparedness (PHEP) **Cooperative Agreement**	Federal	CDC	TXDSHS	Helps health departments build and strengthen their abilities to effectively respond to a range of public health threats, including infectious diseases, natural disasters, and biological, chemical, nuclear, and radiological events. Preparedness activities funded by the PHEP cooperative agreement specifically target the development of emergency-ready public health departments that are flexible and adaptable.

APPENDIX G: STATE AND FEDERAL FUNDING OPPORTUNITIES

NAME	LEVEL	SOURCE AGENCY	MANAGING STATE AGENCY	PURPOSE OF FUNDING
Regional Facility Planning Grant Program	State	TWDB	TWDB	TWDB grants to political subdivisions of the State of Texas for studies and analyses to evaluate and determine the most feasible alternatives to meet regional water supply and wastewater facility needs, estimate the costs associated with implementing feasible regional water supply and wastewater facility alternatives, and identify institutional arrangements to provide regional water supply and wastewater services for areas in Texas.
Regional Water Planning Group Grants	State	TWDB	TWDB	Developed to guide and support planning of the state's water resources by administering and assisting in the development of the regional and state water plans. The department strives to improve the planning process each cycle by developing clear guidance for the program's stakeholders and utilizing best-available data, methodologies, and technical innovations.
Research and Planning Fund and Fund Development Program	State	TWDB	TWDB	Offers grants to eligible applicants for the development or revision of regional water plans. The proposed planning must be a plan, an amendment to an approved regional water plan developed by the regional water planning group for a regional water planning area pursuant to the Texas Water Code, §16.053 and Chapter 357, or other special studies approved by the TWDB which will enhance water planning efforts in the region. Activities eligible for funding are those related to the development, revision, or improvement of regional water plans including public meetings, hearings, and special studies.
Resilient Landscapes Program	Federal	USDA, USFS	TAMFS	The USFS is working with partners to restore healthy, resilient, fire-adapted ecosystems. Restoring ecosystems includes thinning crowded forests and using prescribed fire on two to three million acres each year, which can help prevent the buildup of flammable vegetation that feeds extreme wildfires.
Risk MAP Program	Federal	FEMA, NFIP	TWDB	Establishes or updates floodplain mapping and multi-hazard risk products.
Rural Development Grants	Federal	USDA-Rural Development	TWDB	Provides grants and loans for infrastructure and public safety development and enhancement in rural areas. Provides $100,000 or 75% of the total project, whichever is less.

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NAME	LEVEL	SOURCE AGENCY	MANAGING STATE AGENCY	PURPOSE OF FUNDING
Rural Fire Assistance Grant	Federal	NIFC	TAMFS	Funds fire mitigation activities in rural communities.
Rural Utilities Service (RUS)	Federal	USDA-Rural Development		RUS administers programs that provide much-needed infrastructure or infrastructure improvements to rural communities. These include water and waste treatment, electric power, and telecommunications services.
Rural Water Assistance Fund	State	TWDB	TWDB	Designed to assist small rural utilities to obtain low-cost financing for water and wastewater projects. The RWAF offers tax-exempt equivalent interest rate loans with long-term finance options.
Safe Rest Stops Program	State	TXDOT	TXDOT	Texas has 21 major highways that serve as long distance travel corridors. Along each of these roadways, rest areas are an essential safety feature to reduce accidents caused by driver fatigue. These facilities give travelers a break from driving, and then return them to the road rested, refreshed and alert.
State Fire Assistance for Mitigation (SFAM) **- Mechanical Fuels Grants**	State	TAMFS	TAMFS	Provides financial assistance to reduce the hazard of high-risk fuels on private lands using hazardous fuel reduction. The grant's goal is protected high risk communities within the 32 high risk counties in Central Texas identified by Texas A&M Forest Service Mitigation and Prevention Department. Priority will be given to landowners that live with in the 32 high risk counties, are in a county or city that has an active Community Wildfire Protection plan or live with in a Firewise USA Site.
SFAM Vegetative Fuel Break Grant	State	TAMFS	TAMFS	Provides financial assistance for the creation of vegetative fuel breaks on private lands in Texas. Vegetative fuel breaks are trees and shrubs systematically planted adjacent to fields, homesteads, or feedlots to reduce or redirect the wind. Projects will be in the Texas High Plains. The goal of the grant is to protect high-risk communities by reducing the risk of catastrophic wildfire on private and public lands. Grant recipients will be reimbursed up to $2,500 for actual costs associated with creating a green, vegetative fuel break, consisting of a minimum of 3 rows of trees and 400 feet in length.

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NAME	LEVEL	SOURCE AGENCY	MANAGING STATE AGENCY	PURPOSE OF FUNDING
Silver Jackets	Federal	USACE	TWDB	Can provide funding for flood related studies, public awareness, risk analysis, and flood response plans. Construction of small flood control projects.
Small Flood Control Projects (USACE Section 205)	Federal	USACE	TWDB	Authorizes use of USACE to do feasibility and construction of small flood control projects.
State Participation Program – Regional Water and Wastewater Facilities	State	TWDB	TWDB	The State Participation Program enables the TWDB to provide funding and assume a temporary ownership interest in a regional water, wastewater, or flood control project when the local sponsors are unable to assume debt for an optimally sized facility. The program is intended to encourage the optimum regional development of projects by funding excess capacity for future use where the benefits can be documented, and where such development is unaffordable without state participation. The goal is to allow for the "right sizing" of projects in consideration of future needs.
State Water Implementation Fund for Texas (SWIFT)	State	TWDB	TWDB	Passed by the Legislature and approved by Texas voters through a constitutional amendment, the SWIFT program helps communities develop and optimize water supplies at cost-effective rates. The program provides low-interest loans, extended repayment terms, deferral of loan repayments, and incremental repurchase terms for projects with state ownership aspects.
State Water Resources Research Act Program	Federal	USGS	TWDB	USGS in cooperation with the National Institutes for Water Resources supports an annual call for proposals to focus on water problems and issues that are of a regional or interstate nature or relate to a specific program priority identified by the Secretary of the Interior and the Institutes.
Texas Farm and Ranch Lands Conservation Program (TFRLCP)	State	TPWD	TPWD	Maintains and enhances the ecological and agricultural productivity of these lands through Agricultural Conservation Easements. The TFRLCP supports responsible stewardship and conservation of working lands, water, fish and wildlife, and agricultural production through:

NAME	LEVEL	SOURCE AGENCY	MANAGING STATE AGENCY	PURPOSE OF FUNDING
Texas Farm and Ranch Lands Conservation Program (TFRLCP) (continued)				• Generating interest and awareness in easement programs and other options for conserving working lands. • Leveraging available monies to fund as many high-quality projects as possible. Highlighting the ecological and economic value of working lands and the opportunities to conserve working lands for the future.
Texas HOME Disaster Relief	Federal	TDHCA	TDHCA	The Texas HOME Disaster Relief Program is a long-term housing program designed to help eligible organizations serve income eligible households impacted by disasters. Funds are available to assist with federal or state declared disasters, or other natural or man-made disasters that may occur. The Department's practice is to maintain a HOME Disaster Relief Fund balance of $1 million whenever possible. These funds can be accessed to support impacted households not located in communities that receive HOME funds directly from the U.S. Department of Housing and Urban Development (HUD).
Texas Longleaf Conservation Assistance Program	Federal	National Fish and Wildlife Foundation (NFWF)	TAMFS	Provides eligible landowners with financial and technical assistance for establishing, enhancing, and managing longleaf pine. Landowners with property within ten East Texas counties which include Angelina, Hardin, Jasper, Nacogdoches, Newton, Polk, San Augustine, Sabine, San Jacinto, Trinity, and Tyler are eligible to apply. Approved participants may receive up to 50% payment not to exceed a standard cap rate for implementing approved conservation practices. Approved conservation practices include prescribed burning, reforestation, site preparation, and forest stand improvement.
Texas Infrastructure Resiliency Fund (TIRF)	State	TWDB	TWDB	Enacted through Senate Bill 7 to address needs identified following the flood disasters of 2015, 2016, and 2017. Senate Bill 500 appropriated $685 million. Purpose is to provide loans, grants, and matching funds for flood projects through four separate accounts. Each account has different purposes. The oversight entity is the TIRF Advisory Board (SWIFT Advisory Committee and TDEM Director as non-voting member).

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NAME	LEVEL	SOURCE AGENCY	MANAGING STATE AGENCY	PURPOSE OF FUNDING
Texas Water Development Fund (DFund)	State	TWDB	TWDB	State funded loan program The DFund enables the Board to fund multiple eligible components in one loan to our borrowers, e.g., an application for funding of water and wastewater components can be processed in a single loan. Provide financial assistance for water supply projects, wastewater projects, and flood control projects (including structural and nonstructural flood protection improvements).
Transportation Enhancement Program	Federal	FHWA	TXDOT	Provides opportunities for non-traditional transportation related activities. Projects should go above and beyond standard transportation activities and be integrated into the surrounding environment in a sensitive and creative manner that contributes to the livelihood of the communities, promotes the quality of our environment, and enhances the aesthetics of our roadways. Projects undertaken with enhancement funds are eligible for reimbursement of up to 80 percent of allowable costs.
United States Geological Survey (USGS)	Federal	USGS		USGS issues competitive grants and cooperative agreements to support research in earthquake hazards, the physics of earthquakes, earthquake occurrence, and earthquake safety policy.
Urban Tree Canopy Project (UTC)	Federal	USDA, USFS	TAMFS	Urban tree canopy (UTC) is the layer of leaves, branches, and stems of trees that cover the ground when viewed from above. In urban areas, the UTC provides an important stormwater management function by intercepting rainfall that would otherwise run off of paved surfaces and be transported into local waters though the storm drainage system, picking up various pollutants along the way. UTC also reduces the urban heat island effect, reduces heating/cooling costs, lowers air temperatures, reduces air pollution, increases property values, provides wildlife habitat, and provides aesthetic and community benefits such as improved quality of life.
U.S.-Mexico Border Water Infrastructure Program	Federal	EPA	TCEQ	Provides grant assistance to U.S. and Mexican communities located within 60 miles of the border for the development and construction of high-priority drinking water and wastewater facilities. The program furthers EPA's mission of protecting human health and the environment by providing critical resources for what is often an area's first drinking water and basic sanitation services.

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NAME	LEVEL	SOURCE AGENCY	MANAGING STATE AGENCY	PURPOSE OF FUNDING
Water Research Grant Program	State	TWDB	TWDB	TWDB funds a variety of water planning and water research studies and projects intended to assist and support regional water planning efforts or to answer regional water planning questions.
Water Conservation Field Services Program	Federal	HUD	Texas A&M AgriLife	Provides several grants related to safe housing initiatives.
Water2025 Challenge Grant Program for Western States	Federal	Bureau of Reclamation	TWDB	Up to $25,000 for projects that improve water use efficiency and improve water management practices.
Watershed Processes and Water Resources	Federal	Bureau of Reclamation	TWDB	Up to $250,000 for projects that can be completed within 24 months and that reduce conflicts through water conservation, efficiency, and markets.
Watershed Processes and Water Resources – National Research Initiative Standard Research (Part T)	Federal	USDA	TWDB	$100,000 available. Sponsors research that addresses two areas: (1) understanding fundamental watershed processes; and (2) developing appropriate technology and management practices for improving the effective use of water (consumptive and non-consumptive) and protecting or improving water quality for agriculture and forestry production.
WaterSMART – Drought Response Program	Federal	USDA	TWDB	$500,000 available. Innovative research in understanding fundamental processes that affect the quality and quantity of water resources at diverse spatial and temporal scales, ways on improving water resource management in agriculture, forested, and rangeland watersheds, and developing appropriate technology to reach those goals.
Wildlife Habitat Incentive Program (WHIP)	Federal	USDA, NRCS	TPWD	Voluntary program for conservation-minded landowners who want to develop and improve wildlife habitat on agricultural land, nonindustrial private forest land, and tribal land.

ADOPTION RESOLUTIONS