



# Kendall County

## Hazard Mitigation Plan



*Maintaining a Safe, Secure, and Sustainable Community*

For more information, visit our website at:

[www.co.kendall.tx.us](http://www.co.kendall.tx.us)

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## Background

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Kendall County is located approximately 30 miles northwest of San Antonio on IH-10 in the beautiful Texas Hill Country. It is bordered by Gillespie, Blanco, Comal, Bexar, Bandera, and Kerr Counties. Boerne, the county seat, is at the intersection of US Highway 87 and Farm Road 474. Kendall County comprises of rolling to hilly terrain in the Edwards Plateau region, with elevations ranging from 1,000 to 2,000 feet above sea level.

Texas is prone to extremely heavy rains and flooding with half of the world record rainfall rates (48 hours or less).<sup>1</sup> Central Texas, known as Flash Flood Alley, is particularly vulnerable because storms tend to stall out along the Balcones escarpment. While flooding is a well-known risk, Kendall County is susceptible to a wide range of natural hazards, including but not limited to hail, tornadoes, drought, and wildfire. 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 a hazard event from occurring, the impact of hazards can be lessened in terms of their effect on people and property through effective hazard mitigation planning and implementation.

The Federal Emergency Management Agency (FEMA) defines mitigation as, “any action taken to reduce or eliminate the long term risk to human life and property from natural hazards.”<sup>2</sup> Mitigation differs from emergency preparedness and protective measures, which focus on activities designed to make communities more prepared to take appropriate action in a disaster with emergency response and equipment. Mitigation activities involve alteration of physical environments to reduce risks and vulnerabilities to hazards and make it more cost-effective to respond to, and recover from, disasters.

Communities participate in hazard mitigation by developing hazard mitigation plans. The Texas Division of Emergency Management (TDEM) and FEMA have the authority to review and approve hazard mitigation plans through the Disaster Mitigation Act of 2000.

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 local government level, where decisions on the regulation and control of development are ultimately made. A hazard mitigation plan addresses hazard vulnerabilities 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.

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<sup>1</sup> [http://floodsafety.com/texas/regional\\_info/regional\\_info/sanantonio\\_zone.htm](http://floodsafety.com/texas/regional_info/regional_info/sanantonio_zone.htm)

<sup>2</sup> [www.fema.gov](http://www.fema.gov)

### Scope and Participation

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Kendall County's Hazard Mitigation Action Plan, or *the Plan*, is a multi-jurisdictional Plan. The participating jurisdictions include Kendall County and the City of Boerne. Numerous entities and businesses participated as stakeholders in the Plan, including the Lower Colorado River Authority, Pedernales Electric Cooperative, Bandera Electric Cooperative, Boerne Chamber of Commerce, Boerne Kendall County Economic Development Corporation, Comfort Floodplain Coalition, and Methodist Healthcare System. These groups, and others, provided valuable input into the planning process.

For the purposes of this plan, the planning area consists of the unincorporated area of Kendall County and the City of Boerne. Throughout the plan "Kendall County planning area" refers to the entire planning area. Similarly, the term "countywide" refers to the entire planning area as well.

The focus of the Plan is to mitigate those hazards selected from the State Hazard Mitigation Plan which are deemed to pose a risk to the planning area. For each of the hazards selected, a detailed risk assessment was conducted as part of the hazard mitigation planning process. The risk assessment enables the County and City to prioritize mitigation actions based on hazards that pose the greatest risk to lives and property.

### Purpose

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The Plan was prepared by Kendall County, the City of Boerne, and H2O Partners, Inc. The purpose of the Plan is to protect people and structures and to minimize the costs of disaster response and recovery. The goal of the Plan is to minimize or eliminate long-term risks to human life and property from known hazards by identifying and implementing cost-effective hazard mitigation actions. The planning process is an opportunity for Kendall County, the City of Boerne, 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 Kendall County.

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

Kendall County, the City of Boerne, and planning participants identified ten natural hazards and three human-caused hazards to be addressed by the Plan. The specific goals of the Plan are to:

- Minimize disruption to Kendall County and the City of Boerne 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;
- Assess any previous mitigation projects and develop unique mitigation strategies to meet future development and risks;
- Develop and implement comprehensive mitigation planning activities for Kendall County and the City of Boerne, and integrate these activities into existing planning mechanisms;
- Serve as a basis for future funding that may become available through grant and technical assistance programs offered by the State or Federal government. The Plan will enable Kendall County and the City of Boerne to take advantage of rapidly developing mitigation grant opportunities as they arise; and
- Ensure that Kendall County and the City of Boerne maintain eligibility for the full range of future Federal disaster relief.



### Authority

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The Plan will be tailored specifically for Kendall County, the City of Boerne, and plan participants including Planning Team members, stakeholders, and the general public who participated in the Plan 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 (44CFR, Part 201), which specifies the criteria for approval of mitigation plans required in Section 322 of the DMA 2000, and standards found in FEMA's "Local Mitigation Plan Review Guide" (October 2011), and the "Local Mitigation Planning Handbook" (March 2013). Additionally, the Plan is developed in accordance with FEMA's Community Rating System (CRS) Floodplain Management Plan standards and policies.

### Summary of Sections

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Sections 1 and 2 of the Plan outline the purpose and the process of development. Section 3 profiles Kendall County in terms of population and economy.

Sections 4 through 18 present a hazard overview and information on individual hazards. For each hazard, the Plan presents a description of the hazard, a list of historical hazard events, and the results of the vulnerability and risk assessment process.

Section 19 presents mitigation goals and objectives. Mitigation actions for the County and the City are presented in Section 20, while Section 21 identifies plan maintenance mechanisms.

The list of planning team members and stakeholders is located in Appendix A. Public survey results are analyzed in Appendix B. Appendix C contains a detailed list of critical facilities for the area, and Appendix D lists dam locations. Appendix E contains information regarding workshops and meeting documentation. Capability Assessment results for the County and the City are located in Appendix F.

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## Plan Preparation and Development

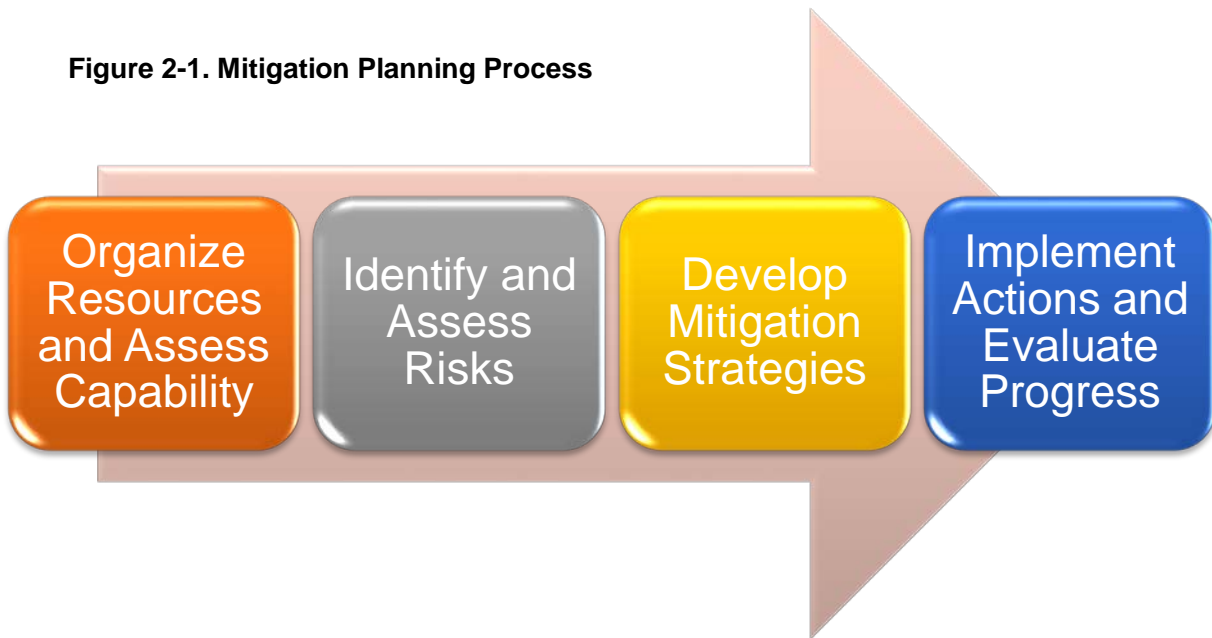
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Hazard mitigation planning involves coordination with various constituents and stakeholders to develop a more disaster-resistant community. Section 2 provides an overview of the planning process including the identification of key steps and a detailed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

### Overview of the Plan

Kendall County hired H2O Partners, Inc. (Consultant Team) to provide technical support and oversee the development of the Plan. The Consultant Team used the FEMA “Local Mitigation Plan Review Guide” (October 1, 2011), and the “Local Mitigation Planning Handbook” (March 2013) to develop the plan. The overall planning process is shown in Figure 2-1 below.

**Figure 2-1. Mitigation Planning Process**



Kendall County, the City of Boerne and the Consultant Team met in February 2016 to begin organizing resources by identifying Planning Team members and conducting a Capability Assessment.

### Planning Team

The Planning Team was established using a direct representation model. Key members of H2O Partners, Inc. developed the Plan in conjunction with the Advisory Committee and the Planning Team. The Advisory Committee was comprised of the Kendall County Emergency Management Coordinator and the City of Boerne's Emergency Management Coordinator. The Planning Team consisted of key staff from the participating jurisdictions. A Stakeholder Working Group was invited to participate via email, attend meetings, and was integral to providing comments and data for the Plan. Appendix A provides a complete listing of all participating Planning Team members and stakeholders by organization and title.

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

- The nature/magnitude of risks currently affecting the community;
- Mitigation goals to address current and expected conditions;
- Whether current resources will be appropriate for implementing the Plan;
- Implementation problems, such as technical, political, legal, or coordination issues that may hinder development;
- Anticipated outcomes; and
- How Kendall County, agencies, and partners will participate in the implementation process.

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**Table 2-1. Advisory Planning Team**

ORGANIZATION	TITLE
Kendall County Office of Emergency Management	Emergency Management Coordinator
Kendall County	County Judge
City of Boerne Fire Marshal's Office	Emergency Management Coordinator

**Table 2-2. Planning Team Members**

ORGANIZATION	TITLE
Kendall County Office of Emergency Management	Assistant Emergency Management Coordinator/Assistant to the Fire Marshal
Waring Fire Department	Fire Chief
Boerne Independent School District	Director of Facilities and Construction
Comfort Independent School District	Superintendent
City of Boerne	Chief of Police
City of Boerne Public Works	Director
City of Boerne Fire Department	Fire Chief
City of Boerne Fire Department	Assistant Fire Chief
Kendall County Sherriff's Office	Sheriff
Kendall County Sherriff's Office	Chief Deputy
Sisterdale Volunteer Fire Department	Volunteer
Kendall County Road & Bridge	Staff
Kendall County Road & Bridge	Crew Leader
Kendall County Human Resources	Director
Kendall County	Auditor
Kendall County Development and Floodplain Management	Director
Kendall County Geographical Information System	Administrator
Comfort Floodplain Coalition	Committee Member

Based on results of completed Capability Assessments, Kendall County also described methods for achieving mitigation in the future by expanding on their existing capabilities. Sample mitigation actions developed with similar hazard risk by planning team members were shared at the meetings. These

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important discussions resulted in development of multiple mitigation actions that are included in the Plan to further mitigate risk from natural hazards in the future. Other options for improving capabilities include the following:

- Establishing Planning Team members with the authority to monitor the Plan and identify grant funding opportunities for expanding staff.
- Identifying 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) by monitoring classes and availability through [preparetexas.org](http://preparetexas.org).
- Reviewing current floodplain ordinances for opportunities to increase resiliency such as modifying permitting or building codes.
- Developing ordinances that will require all new developments to conform to the highest mitigation standards.

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

The Planning Team developed hazard mitigation actions for mitigating risk from potential flooding and wildfire, including promoting the FireWise program, practicing hazard mitigation techniques, and placing hazard warning signs at low-water crossings. In order to reduce damages and loss of life resulting from flooding that occurs during heavy rain periods, the Plan also includes a county-wide action to create a GIS map showing all low-water crossings within the County, and then develop a website, make public and educate the public on how to access and use this map to avoid those areas.

### Planning Process

The process to prepare this Plan included following the four major steps included in 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 Kendall County and the City of Boerne's identified vulnerabilities, specific mitigation strategies were discussed and created at the Mitigation Workshop. Finally, Plan maintenance and implementation procedures were developed and are included in Section 21. 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 describe herein, the following factors were taken into consideration:

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

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### Kickoff Workshop

The Kickoff Workshop was held at the Kendall County Courthouse in the Commissioners Court Room on February 8, 2016. This initial meeting was an opportunity to inform County officials and key department personnel about how the planning process pertained to their distinct roles and responsibilities, and also methods to involve stakeholder groups such as the Boerne Chamber of Commerce, the Boerne Kendall County Economic Development Corporation, the Comfort Floodplain Coalition, and area businesses. 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 Meeting, and through a series of email and phone correspondences, the Planning Team conducted preliminary hazard identification. The Planning Team in coordination with the Consultant Team reviewed and considered a full range of natural and human-caused hazards. Once identified, the teams narrowed the list to significant hazards by reviewing hazards affecting the area as a whole, the 2013 State of Texas Hazard Mitigation Plan Update, and initial study results from reputable sources such as federal and state agencies. Based on this initial analysis, the team identified a total of eleven natural hazards and three human-caused hazards that pose a significant risk to the planning area.

### Risk Assessment

An initial risk assessment for Kendall County and the City of Boerne was completed in February 2016 and the results were presented to Planning Team members at the Risk Assessment Workshop held on May 5, 2016. 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 citizens.

Potential dollar losses from each hazard were estimated using the Federal Emergency Management Agency's Hazards U.S. Multi-Hazards (MH) Model (HAZUS-MH) and other HAZUS-like modeling techniques. The assessments examined the impact of various hazards on the built environment, including general building stock (e.g., residential, commercial, industrial), 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. Each participant at the Risk Assessment Workshop was provided a risk ranking sheet that asked participants to rank hazards in terms of the probability or frequency of occurrence, extent of spatial impact, and the magnitude of impact. The results of the ranking sheets identified unique perspectives on varied risks throughout the planning area.

The assessments were also used to set priorities for mitigation strategy based on potential dollar losses and loss of lives. A hazard profile and vulnerability analysis for each of the hazards can be found in Sections 4 through 18 in this Plan.



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### Mitigation Review and Development

Developing the Mitigation Strategy for the Plan involved identifying mitigation goals and new mitigation actions. A Mitigation Workshop was held at Kendall County Commissioners Court Chambers on July 26, 2016. In addition to the Planning Team, stakeholder groups were invited to attend the workshop. Regarding hazard mitigation actions, Workshop participants emphasized the desire for flood and wildfire projects. Additionally, the County and the City were proactive in identifying mitigation actions to lessen the risk of all the identified hazards included in the Plan.

An inclusive and structured process was used to develop and prioritize new hazard mitigation actions for the Plan. 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 20.

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 point of contact.
- Planning Team members considered benefits that would result from the hazard mitigation actions compared the cost of those projects. Although detailed cost-benefit analyses were beyond the scope of this Plan, 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 was made available to the general public for review and comment on Kendall County's website.

## Review of Existing Plans, Plan Integration, and Updates

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### 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

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Management (TDEM), and local hazard assessments and plans. Section 4 and the hazard-specific sections of the Plan (Sections 5-18) 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 Climatic Data Center (NCDC). Results of past hazard events were found through searching the NCDC. The USACE studies were reviewed for their assessment of risk and potential projects in the region. State Data Center documents were used to obtain population projects. The State Demographer webpages were reviewed for population and other projects and are included in Section 3 of the Plan. Information 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 development requirements.

### Incorporation of Existing Plans into the HMAP Process

A Capability Assessment was completed by key Kendall County and City of Boerne departments which provided information pertaining to existing plans, policies, ordinances and regulations to be integrated into the goals and objectives of the Plan. The relevant information was included in a master Capability Assessment in 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, Kendall County has completed a Trails and Greenway Plan to assist in preserving floodplains and riparian areas and facilitate stormwater management and erosion control through complementary goals. Kendall County's Comprehensive Plan is incorporated into the Plan as it pertains to mitigating risk from natural disasters and the resulting effects on transportation, and development in floodplain areas; and educating residents on how to protect themselves and their property. Additionally, mitigation actions from other plans were reviewed, such as Floodplain Management Plans and Stormwater Management plans. Finally, the 2013 State of Texas Mitigation Plan Update, 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 2013 State Plan Update was also used as a guidance document, along with FEMA materials, in the development of the Kendall County Hazard Mitigation Plan.

### Incorporation of the HMAP into Other Planning Mechanisms

Planning Team members will integrate implementation of the Plan with other planning mechanisms for Kendall County, such as the Emergency Management Plan (Disaster Plan). Existing plans for the Kendall County and the City of Boerne will be reviewed in light of the Plan, and incorporated into the hazard mitigation plan, as appropriate. This section discusses how the Plan will be implemented by the County and the City. 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 budget process allocates resources and prioritizes the needs of a local jurisdiction, school districts, or other organization, and is a major element to incorporating existing studies and other planning mechanisms into the Plan. For a government entity, the budget often represents the legal authority to spend money, and is an opportunity to optimize resources found in existing planning mechanisms with hazard mitigation objectives and goals. The annual budget review is an important tool to execute mitigation goals and objectives, and provide funding for identified hazard mitigation actions. The identified contact persons for Kendall County and the City of Boerne will participate in the budgetary process to track identified hazard mitigation actions, recommend prioritization for grant

## Section 2: Planning Process

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funding, and update and maintain the mitigation strategy developed for Kendall County and the City of Boerne.

Kendall County and the City of Boerne will each be responsible for implementing its own mitigation actions contained in Section 20. Each action has been assigned to a specific County and City department that is responsible for tracking and implementing the action.

A funding source has been listed for each identified action. This source may be used when the jurisdiction begins to seek funds to implement the action. An implementation time period has also been assigned to each action as an incentive for seeing the action through to completion and to gauge whether actions are implemented on a timely basis.

Kendall County and the City of Boerne will integrate hazard mitigation actions contained in the Plan with existing planning mechanisms such as the Land Use and Open Space Plans, Stormwater Management Plan, Watershed Protection Plan, Capital Improvement Plans (under development), Hydrologic/Hydraulic Studies, and other local and area planning efforts. Kendall County will work closely with other area organizations to coordinate implementation of hazard mitigation actions that benefit the planning area in terms of financial and economic impact.

Upon formal adoption of the Plan, Planning Team members from Kendall County and the City of Boerne will review existing plans, along with building codes to guide and control development and ensure that hazard mitigation actions are implemented. Both Kendall County and the City of Boerne will be responsible for coordinating periodic review of the Plan 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 its various existing planning mechanisms and analyze the need for any amendments or updates in light of the approved Plan. Kendall County and the City of Boerne will ensure that future long-term planning objectives will contribute to the goals of this hazard mitigation 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 hazard mitigation plan, existing planning mechanisms will be reviewed and analyzed as they pertain to the hazard mitigation plan.

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.

Further, Kendall County will work with neighboring jurisdictions to advance the goals of the Plan 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	METHOD OF INCORPORATION
Grant Applications	Kendall County and the City of Boerne will consult the Plan whenever there are yearly grant funding cycles available through FEMA, including the Pre-Disaster Mitigation (PDM) cycle, and when there is a Disaster Declaration for Texas triggering Hazard Mitigation Grant Program (HMGP) funds. Mitigation actions for each jurisdiction will be reviewed by the planning team members and information will be updated for

## Section 2: Planning Process

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PLANNING MECHANISM	METHOD OF INCORPORATION
	completing applications, such as maps and risk assessment data. If a project is not in the Plan, an amendment may be developed.
Annual Budget Review	Kendall County and the City of Boerne will review the Plan and mitigation actions therein when conducting its annual budget review. When allocating funds for upcoming operating and construction budgets, high priority mitigation actions will be reviewed during Commissioner Court meetings and City Council meetings. Each identified staff member/planning Team member will be responsible for bringing mitigation actions to the meeting to discuss feasibility of the potential project in terms of the availability of funds, grant assistance, and preliminary cost benefit review.
Emergency Planning	The Plan will be consulted during updates to the local emergency and/or disaster recovery plan. Risk assessment and vulnerability data will be pulled from the plan and analyzed in conjunction with the review, renewal, or re-writing of an Emergency Operations or Management Plan. This data will either be included within the new emergency planning mechanism or included as an appendix. Mitigation projects that relate to prevention and protection will also be reviewed for relevance to determine if they should be included.
Comprehensive/Capital Improvements	Before any updates to the Comprehensive/Capital Improvement Plans (CIP) are conducted, Kendall County and the City of Boerne will review the risk assessment and mitigation strategy sections of the Plan, as limiting public spending in hazardous zones is one of the most effective long-term mitigation actions available to local governments. Profile information and data regarding NFIP compliance and maintenance will be reviewed in conjunction with any CIP that is developed. If new census or land use data is available, this information should be added to the Plan Update.
Floodplain Management Plan and Fire Protection	The Plan will be utilized in updating and maintaining floodplain management and fire protection plans, as the goals of both planning mechanisms are similar. In updating or maintaining these plans, the Plan will be consulted for NFIP compliance, flood risk, wildfire risk, and extent. Information from these sections will be reviewed for inclusion. In addition, mitigation actions that address wildfire and flood will be reviewed for inclusion.

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Appendix F provides an overview of Planning Team members' existing planning and regulatory capabilities to support implementation of mitigation strategy objectives. Appendix F also provides further analysis of how each intends to incorporate hazard mitigation actions into existing plans, policies, and the annual budget review as it pertains to prioritizing grant applications for funding and implementation of identified hazard mitigation projects.

### Plan Review and Plan Update

As with the development of the Plan, Kendall County will oversee the review and update process for relevance and to make adjustments, as necessary. At the beginning of each fiscal year, Team Members will meet to evaluate the Plan and review other planning mechanisms to ensure consistency with long-range planning efforts. In addition, participants will also meet twice a year, by conference call or presentation, to re-evaluate prioritization of the mitigation actions.

## Timeline for Implementing Mitigation Actions

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Planning Team members (Table A-1 and A-2, Appendix A) will engage in discussions regarding a timeframe for how and when to implement each 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 Mitigation Action worksheets included in the Plan for Kendall County and the City of Boerne.

The Planning Team will evaluate and prioritize the most suitable mitigation actions for the community to implement. The timeline for implementation of actions will partially be directed by Kendall County's comprehensive planning process, capital improvements plan, budgetary constraints, and community needs. Kendall County and the City of Boerne are committed to addressing and implementing hazard mitigation actions that may be aligned with and integrated into the Plan.

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

## Stakeholder and Public Involvement

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An important component of 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 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 hazards present in their community and take steps to reduce their impact.

The public was involved in the development of the Kendall County Hazard Mitigation Action Plan 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 available for public review on Kendall County's website.

The draft Plan was made available to the general public for review and comment on Kendall County's website. The public was notified at the public meetings that the draft Plan would be available on the

## Section 2: Planning Process

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County's website. No feedback was received on the draft Plan, although public feedback was given on the public survey, and all relevant information was incorporated into the Plan.

The Plan will be advertised and posted on Kendall County's website upon approval from FEMA.

### Stakeholder Involvement

Stakeholders provide an essential service in 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, and hospitals were invited to participate in the development of the Plan. The Stakeholder Working Group (Table A-3, Appendix A, and Table 2-4, below), included a broad range of representatives from both the public and private sector, and served as a key component in the County's outreach efforts for development of the Plan. Documentation of stakeholders meetings is found in Appendix E. A list of organizations invited to attend via email may be found below.

**Table 2-4. Stakeholder Working Group**

ORGANIZATION	TITLE	PARTICIPATED
Texas State Senate District 25	State Senator for Boerne	
Texas State House District 73	State Representative for Boerne	X
Comfort Chamber of Commerce	President	X
Pedernales Electric Cooperative	Vice President, Power Supply and Energy Services	
Comfort Floodplain Coalition	Engineer	X
Lower Colorado River Authority	Senior Real Estate Representative	
Bandera Electric Cooperative	District 8 Director, District 4 Director	
Boerne Chamber of Commerce	Chairman	X
Boerne Kendall County Economic Development Corporation	CEO/President	
Southwest Texas Regional Advisory Council	Division Director	X
Methodist Health	Emergency Management Specialist	X
Methodist Healthcare System - Emergency Department	Vice President, Emergency Services	X
Cow Creek Groundwater Conservation District	Secretary	X
2-1-1 Texas Health and Human Services Commission	Human Services Coordinator	X



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Stakeholders and participants from neighboring communities that attended the Planning Team and public meetings played a key role in the planning process. For example, it was stressed the need for tree trimming around power lines in the planning area. Downed trees account for a significant portion of power outages. Tree trimming practices and policies will reduce the number and size of power outages in the area.

### Public Meetings

A series of open public meetings were held at various locations, to collect public and stakeholder input. Topics of discussion for the meetings included the purpose of hazard mitigation, discussion of the planning process, and types of natural and human-caused hazards. Representatives from area neighborhood associations, and area residents were invited to participate. Additionally, the County utilized social media such as Facebook, Twitter, and the local media to increase public participation in the Plan development process. Documentation on the public meetings are found in Appendix E.

Public meetings were held on the following dates and locations:

- February 8, 2016, Kendall County Commissioners Court Room
- May 5, 2016, Bourne Fire Station Training Room
- July 26, 2016, Kendall County Commissioners Court Room

### Public Participation Survey

In addition to the open public meetings, The Planning and Consulting Team developed a public survey designed to solicit public input during the planning process from citizens and stakeholders, and 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 Kendall County's website. A total of 166 surveys were completed online, the results of which are analyzed in Appendix B. Kendall County reviewed the input from the surveys and decided which information to incorporate into the Plan as hazard mitigation actions. For example, many citizens mention public education and awareness through outreaches and risk communication; therefore, several mitigation actions were added on conducting public education and awareness through a variety of mechanisms for different hazards.

# Section 3: County Profile

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## Overview

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Most of the Kendall County area was part of the Bexar County established by the Republic of Texas in 1836; it later became part of Kerr County, which separated from Bexar in 1856. Comfort served as the county seat of Kerr County for two years before Kendall County was formed. In 1859, residents of Boerne and Sisterdale petitioned the legislature for a new county; the legislature granted the petition in 1862, and the new county, carved from Kerr and Blanco counties, was named in honor of George Wilkins Kendall. The first Kendall County officials were elected later that year, and Boerne was chosen as the county seat.

The major issue at the time of the county's formation was the Civil War. At the time, Kerr County encompassed Kendall County, and passed the ordinance of secession; however, the majority of voters in Kerr County's Precinct 2, which later became Kendall County, opposed secession. The level of Unionist sentiment in the region was due in large part to the number of German immigrants, most of whom opposed both slavery and secession.

After the Civil War, Kendall County suffered considerable economic hardship throughout the Reconstruction period. The county began to show signs of recovery by 1880. Field crops such as corn, wheat, oats, and cotton took up a third of the improved land, while livestock dominated the rest. Sheep ranching, which had been introduced to the area by George W. Kendall in the 1850s, had become the county's principal industry. The 1870 census reported the county as having 4,293 sheep and producing 8,781 pounds of wool; in 1880, the county's 16,259 sheep produced more than 65,200 pounds of wool.

The completion to San Antonio of the Galveston, Harrisburg and San Antonio Railway in 1877 made outside markets more accessible to Kendall County residents, and freight services thrived, hauling local farm produce, wool, and lumber. Transportation became easier still in 1887, when San Antonio and Aransas Pass Railway reached Boerne.

By 1900 the county had nearly 20,000 cattle and 8,600 sheep. The planting of field crops also became a popular venture. By the 1920, corn and oats had eclipsed cotton, proving to be more profitable for an economy that was based on livestock. Some of the corn and oats were used locally as feed, and the rest was put on the San Antonio market.

American involvement in World War II brought new industries to neighboring Bexar County. The presence of several large military bases in the San Antonio area meant an increased demand for civilian support services. Many Kendall County residents joined the military or took advantage of availability of nearby jobs.

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The rapid growth of Kendall County in 1970s and 1980s was prompted by the development of northwestern Bexar County. The newly completed Interstate Highway 10 lessened the need for rail services and also provided area residents a more convenient means of commuting than did the old US Highway 87. As more people moved to Kendall County, several residential developments and subdivisions were built in the southern half of the county, accommodating the larger population without being a strain on the limits of Boerne proper.<sup>1</sup>

Boerne is the county's seat of government and its largest town; other communities include Comfort, Kandalia, Waring, and Sisterdale. Kendall County retains much of its German heritage, reflected in the surnames of many of its residents, as well as in the atmosphere of its communities. Kendall County has a total area of 663 square miles, of which 662 square miles in land and 0.6 square miles (0.09%) is water.

This section profiles the City as a whole, providing data, including:

- Population and Demographics;
- Economy and Industry; and
- Land Use and Development Trends.

Figure 3-1 shows the general location of Kendall County. Figure 3-2 and Figure 3-3 show the Kendall County and the City of Boerne Study Areas.

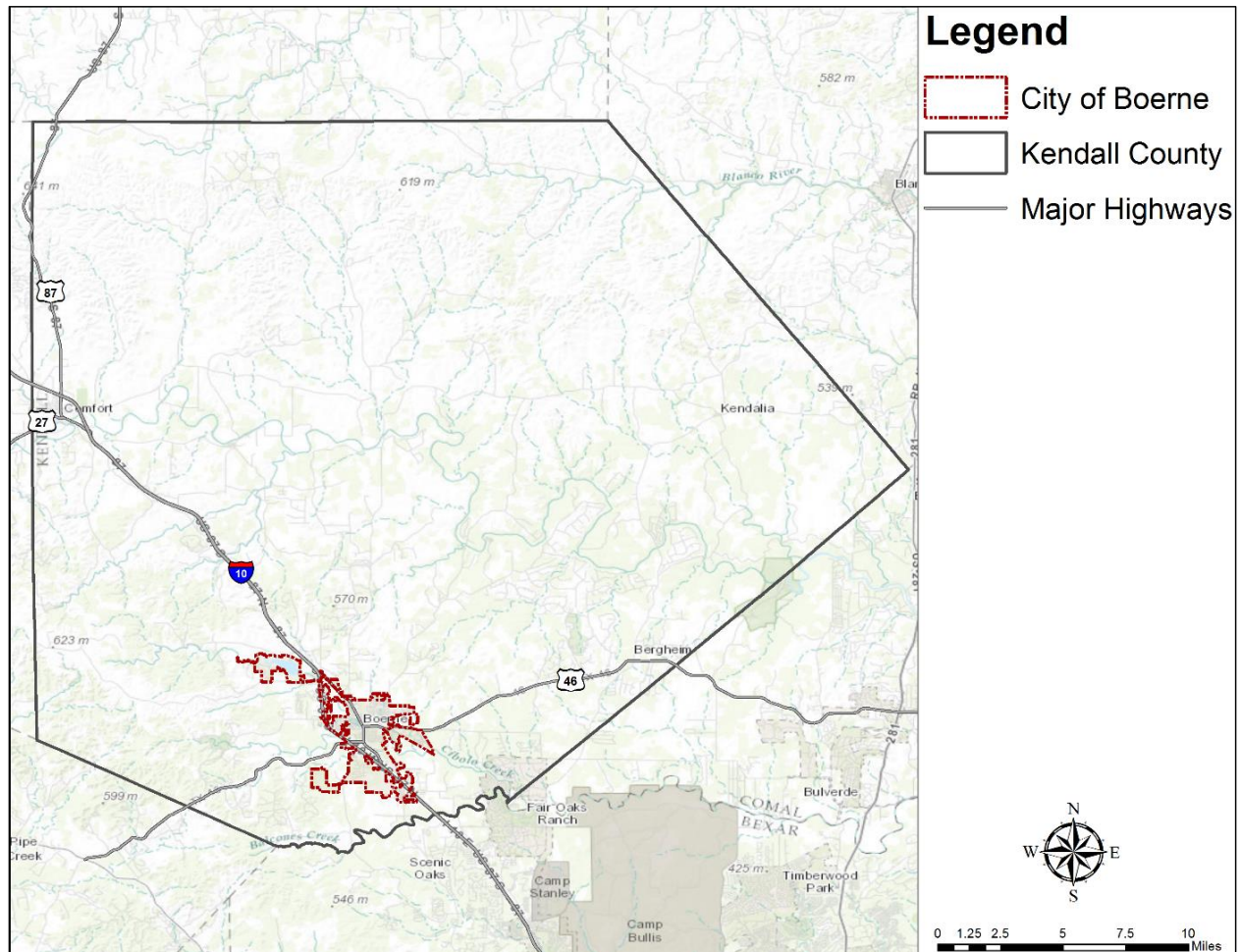
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<sup>1</sup> Source: <https://tshaonline.org/handbook/online/articles/hck03>

**Figure 3-1. Location of Kendall County**

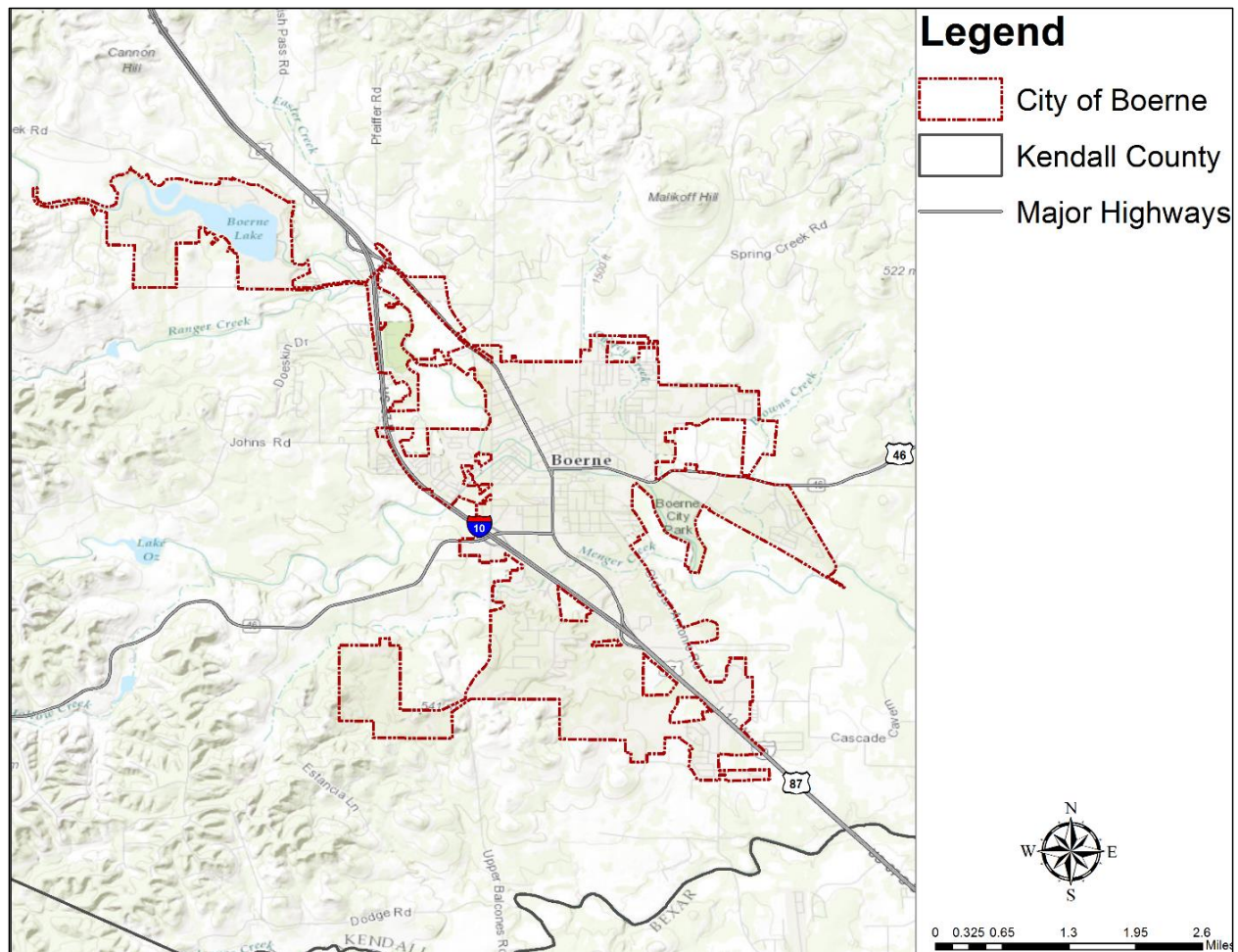


**Figure 3-2. Kendall County Study Area**





**Figure 3-3. City of Boerne Study Area**



### Population and Demographics

In the official Census population count, as of April 1, 2010, Kendall County had 33,410 residents. By July 2012, the number had grown to 35,732, and by July 2015, the population was 40,384. Table 3-1 highlights special needs populations in the Kendall County Study Area.<sup>2</sup>

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 there are many variables involved in achieving an accurate estimation of people living in a given area at a given time.

<sup>2</sup> <http://www.census.gov/quickfacts/>



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**Table 3-1. Population Distribution for Kendall County**

JURISDICTION	TOTAL 2010 POPULATION	ESTIMATED VULNERABLE OR SENSITIVE POPULATIONS	
		Elderly (Over 65)	Below Poverty Level
Kendall County	33,410	5,579	2,773
City of Boerne	10,471	1,780	1,194

### Population Growth

The official 2010 Kendall County population is 33,410. Since the 2000 Census, Kendall County's population count has increased by 40.7 percent from a population of 23,743. The City of Boerne has also increase in population by 69.5 percent from a population of 6,178. Table 3-2 provides historic and current growth rates in Kendall County and the City of Boerne.

Kendall County experienced an increase in population between 1980 and 2010 by 241.2 percent, or 22,775. The City of Boerne experienced an increase in population between 1980 and 2010 by 224.3 percent, or 7,242 people.

**Table 3-2. Population for the Kendall County Study Area, 1980-2010**

JURISDICTION	1980	1990	2000	2010	POP CHANGE 1980-2010	PERCENT OF CHANGE	POP CHANGE 2000-2010	PERCENT OF CHANGE
Kendall County	10,635	14,589	23,743	33,410	22,775	241.2%	9,667	40.7%
City of Boerne	3,229	4,361	6,178	10,471	7,242	224.3%	4,293	69.5%

### Future Development

To better understand how future growth and development in the County 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, the number of permits that have been issued throughout the county, and economic impacts.

Population projections from 2010 to 2040 are listed in Table 3-3, as 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 that occurred during 2000-2010. This information is only available at the County level; however, the population projection shows an increase in land area and in population density for the County, which would mean overall growth for Kendall County.

**Table 3-3. Kendall County Population Projections**

LAND AREA (SQ MI)	2010		2020		2030		2040	
	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)
663	33,410	50.4	38,847	58.6	44,741	67.5	50,357	76.0

### Economic Impacts

Building and maintaining infrastructure depends on the economy; therefore, protecting infrastructure from risk due to natural hazards in the planning area is important to Kendall County. 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.

Major employers in the area are critical to the health of the economy, as well as effective transportation connectivity.

### Existing and Future Land Use and Development Trends

The City of Boerne has a Master Plan (Comp Plan 2006) that will be coordinated with mitigation strategies to determine how they can best be integrated into master plan updates pertaining to future development regulations or link with other public or private efforts, such as open space preservation or other capital improvement projects. Kendall County is in the process of developing a Comprehensive Plan. The County will utilize the comprehensive planning process to integrate the mitigation strategies set forth in this plan. In addition, the County has a Parks Master Plan which will also incorporate mitigation ideas and strategies into the next plan update. The assurance of integration of the hazard mitigation plan into the master and comprehensive planning process can help make certain that the appropriate hazard assessment information is considered during future land use and development planning.

### Building Permits

Building permits indicate what types of buildings are being constructed and their relative uses. Table 3-4 lists the number of residential building permits for Kendall County that have been granted between 1996 and 2015. The data includes all sizes of family homes for reported permits, as well as the construction costs, to show the potential increase in vulnerability of structures to the various hazards reviewed in the risk assessment. The increase in vulnerability can be attributed to the higher construction costs that would be factored into repairing or replacing a structure using current market values. Permits are reported annually in September.

**Table 3-4. County Residential Building Permits<sup>3</sup>**

KENDALL COUNTY			
Year	Buildings	Units	Construction Cost
1996	198	247	\$21,833,056
2000	278	278	\$57,800,826
2005	552	552	\$99,343,356
2010	202	202	\$40,732,082
2011	204	204	\$44,152,565
2012	271	271	\$56,700,552
2013	284	284	\$62,947,522
2014	380	380	\$85,657,674
2015	190	190	\$58,426,415

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<sup>3</sup> <http://censtats.census.gov/cgi-bin/bldgprmt/bldgdisp.pl>

# Section 4: Risk Overview

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## Hazard Identification

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Section 4 is the first phase of the Risk Assessment, providing background information for the hazard identification process, and descriptions for the hazards identified. The Risk Assessment continues with Sections 5 through 18, which include hazard descriptions and vulnerability assessments.

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, Kendall County, including the City of Boerne, identified eleven natural hazards and three human-caused hazards that are to be addressed in the Hazard Mitigation Action Plan, or *the Plan*. Of the hazards identified, ten natural hazards and one quasi-technological hazard (dam failure) 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 2013 State of Texas Hazard Mitigation Plan Update (State Plan Update). Readily available online information from reputable sources such as federal and state agencies were also evaluated to supplement information as needed.

In general, there are three main categories of hazards including atmospheric, hydrologic, and technological. Atmospheric hazards are events or incidents associated with weather generated phenomenon. Atmospheric hazards identified as significant include: extreme heat, hail, hurricane wind, lightning, thunderstorm wind, tornado, 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 includes flood and drought.

Technological hazards refers to the origins of incidents that can arise from human activities, such as the construction and maintenance of dams. Incidents are distinct from natural hazards primarily in that they originate from human activity. While the risks presented by natural hazards may be increased or decreased as a result of human activity, 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 purposes of description.

For the purposes of the risk assessment, the wildfire hazard is considered “other,” since they may be natural or human-caused, and are neither atmospheric nor hydrologic.

**Table 4-1. Hazard Descriptions**

HAZARD	DESCRIPTION
<b>ATMOSPHERIC</b>	
<b>Extreme Heat</b>	Extreme heat is the condition whereby temperatures hover ten degrees or more above the average high temperature in a region for an extended period.
<b>Hail</b>	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.
<b>Hurricane</b>	A hurricane is an intense tropical weather system of strong thunderstorms with a well-defined surface circulation and maximum sustained winds of 74 mph or higher.
<b>Lightning</b>	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.
<b>Thunderstorm Wind</b>	A thunderstorm is a storm with thunder and lightning and typically is accompanied with heavy rain or hail. Severe thunderstorms can produce a tornado, winds of at least 58 mph, and/or hail at least 1" in diameter.
<b>Tornado</b>	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 intensity, size, and duration of the storm.
<b>Winter Storm</b>	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 miles per hour, 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.
<b>HYDROLOGIC</b>	
<b>Drought</b>	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.

## Section 4: Risk Overview

HAZARD	DESCRIPTION
<b>Flood</b>	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, or shallow flooding.
<b>OTHER</b>	
<b>Wildfire</b>	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.
<b>TECHNOLOGICAL</b>	
<b>Dam Failure</b>	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.
<b>HUMAN-CAUSED</b>	
<b>Hazardous Materials (Transportation &amp; Fixed-Site)</b>	A hazardous material (as solid, liquid, and/or gaseous contaminants) of flammable or poisonous material that would be a danger to life or to the environment if released without precaution.
<b>Pipeline Failure</b>	Fuel pipeline breach or pipeline failure addresses the rare, but serious hazard of an oil or natural gas pipeline that, when breached, has the potential to cause extensive property damage and loss of life.
<b>Terrorism</b>	Incidents involving the application of one or more modes of harmful force to the built environment. These modes may include contamination (chemical, biological, radiological, or nuclear), energy (explosives, arson, electromagnetic waves), or denial of service (sabotage, infrastructure breakdown, and transportation service disruption). Terrorism is categorized as one of two types - domestic or international.

Hazards that weren't considered significant and were not included in the Plan are located in Table 4-2, along with the evaluation process used for determining the significance of each of these hazards. These natural hazards are not addressed in detail due to their no to minimal level of risk within the Kendall County planning area. Hazards not identified for inclusion at this time may be addressed during future evaluations and updates.

**Table 4-2. Hazard Identification Process**

HAZARD	DESCRIPTION
<b>Expansive Soils</b>	Expansive soils occurrences and damages are not well documented. There are no historical occurrences of expansive soils for the Kendall County planning area and it is located in an area where occurrences are considered rare. Expansive Soils poses little to no risk for the area and was not addressed further in the plan.
<b>Coastal Erosion</b>	Kendall County is not located on the coast, therefore coastal erosion does not pose a risk.
<b>Earthquakes</b>	According to the State Plan, an earthquake occurrence for the Kendall County planning area is considered exceedingly rare. Although a small event is possible, it would pose little to no risk for the area. There are no recorded earthquake events or damages for the planning area. Due to the low frequency of the hazard and limited impact, the hazard was not addressed further in the plan.
<b>Land Subsidence</b>	There are no historical occurrences of land subsidence for the Kendall County planning area and it is located in an area where occurrences are considered rare. The impact would be limited and the frequency of occurrence is unlikely according to the State Plan. Land Subsidence poses little to no risk for the area and was not addressed further in the plan.

## Natural Hazards and Climate Change

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Climate change is defined as a long-term hazard which can increase or decrease the risk of other weather hazards, and also directly endangers property due to sea level rise and biological organisms due to habitat destruction.

Global climate change is expected to exacerbate the risks of certain types of natural hazards impacted through rising sea levels, warmer ocean temperatures, higher humidity, the possibility of stronger storms and an increase in wind and flood damages due to storm surges. While sea level rise is a natural phenomenon and has been occurring for several thousand years, the general scientific consensus is that the rate has increased in the past 200 years, from 0.5 millimeters per year to 2 millimeters per year.

Texas is considered one of the more vulnerable states in the U.S. to both abrupt climate changes and to the impact of gradual climate changes to the natural and built environments. Mega-droughts can trigger abrupt changes to regional ecosystems and the water cycle, drastically increase extreme summer temperature and fire risk, and reduce availability of the water resources, as Texas experienced during 2011-2012.

Paleoclimate records also show that the climate over Texas had large swings between periods of frequent mega-droughts and the periods of mild droughts that Texas is currently experiencing. While the cause of these fluctuations is unclear, it would be wise to anticipate that such change could occur again, and may even be occurring now.



### Overview of Hazard Analysis

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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 Climatic Data Center (NCDC) and National Oceanic and Atmospheric Administration were reported for the Kendall County planning area, including the City of Boerne. Remaining records identifying the occurrence of hazard events in the planning area and the maximum recorded magnitude of each event were also evaluated.

The use of geographic information system (GIS) technology to identify and assess risks for the Kendall County planning area, and evaluate community assets and their vulnerability to the 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.

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 4-3, and impact statements are defined in Table 4-4 below.

**Table 4-3. Frequency of Return Statements**

PROBABILITY	DESCRIPTION
<b>Highly Likely</b>	Event is probable in the next year.
<b>Likely</b>	Event is probable in the next 3 years.
<b>Occasional</b>	Event is probable in the next 5 years.
<b>Unlikely</b>	Event is probable in the next 10 years.

**Table 4-4. Impact Statements**

POTENTIAL SEVERITY	DESCRIPTION
<b>Substantial</b>	Multiple deaths. Complete shutdown of facilities for 30 days or more. More than 50 percent of property destroyed or with major damage.
<b>Major</b>	Injuries and/or illnesses result in permanent disability. Complete shutdown of critical facilities for at least two weeks. More than 25 percent of property destroyed or with major damage.
<b>Minor</b>	Injuries and/or illnesses do not result in permanent disability. Complete shutdown of critical facilities for more than one week. More than 10 percent of property destroyed or with major damage.
<b>Limited</b>	Injuries and/or illnesses are treatable with first aid. Minor quality of life lost. 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 damages 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 damages (including property and crop damages) for each hazard is divided by the total number of assets (building value totals) in that community in order to find out the percentage of damage that each hazard can cause to the community.

Hazard vulnerability for Kendall County was reviewed based on recent development changes that occurred throughout the County. To better understand how future growth and development in the County 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 Kendall County was reviewed based on recent development changes that occurred throughout the County. Kendall County has grown slightly between 2010 and 2015 according to the U.S. Census Bureau, therefore there has been no significant factors or development trends with a consequential effect or increase in vulnerability to the population, infrastructure, and buildings for hazards.

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

Table 4-5 portrays the results of the County's self-assessment for hazard ranking, based on the preliminary results of the risk assessment presented at the Risk Assessment Workshop. This table also takes into account local knowledge regarding frequency of occurrence and the potential impact of each hazard.

## Section 4: Risk Overview

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**Table 4-5. Hazard Risk Ranking**

HAZARD	FREQUENCY OF OCCURENCE	POTENTIAL SEVERITY	RANKING
Flood	Highly Likely	Substantial	High
Wildfire	Highly Likely	Limited	High
Drought	Highly Likely	Limited	High
Extreme Heat	Highly Likely	Minor	Moderate
Thunderstorm Wind	Highly Likely	Limited	Moderate
Tornado	Likely	Minor	Moderate
Hail	Highly Likely	Limited	Moderate
Winter Storm	Highly Likely	Limited	Moderate
Hazardous Materials	Occasional	Limited	Moderate
Dam Failure	Unlikely	Substantial	Low
Hurricane Wind	Unlikely	Limited	Low
Lightning	Highly Likely	Limited	Low
Pipeline Failure	Unlikely	Major	Low
Terrorism	Unlikely	Major	Low

# Section 5: Flood

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## Hazard Description

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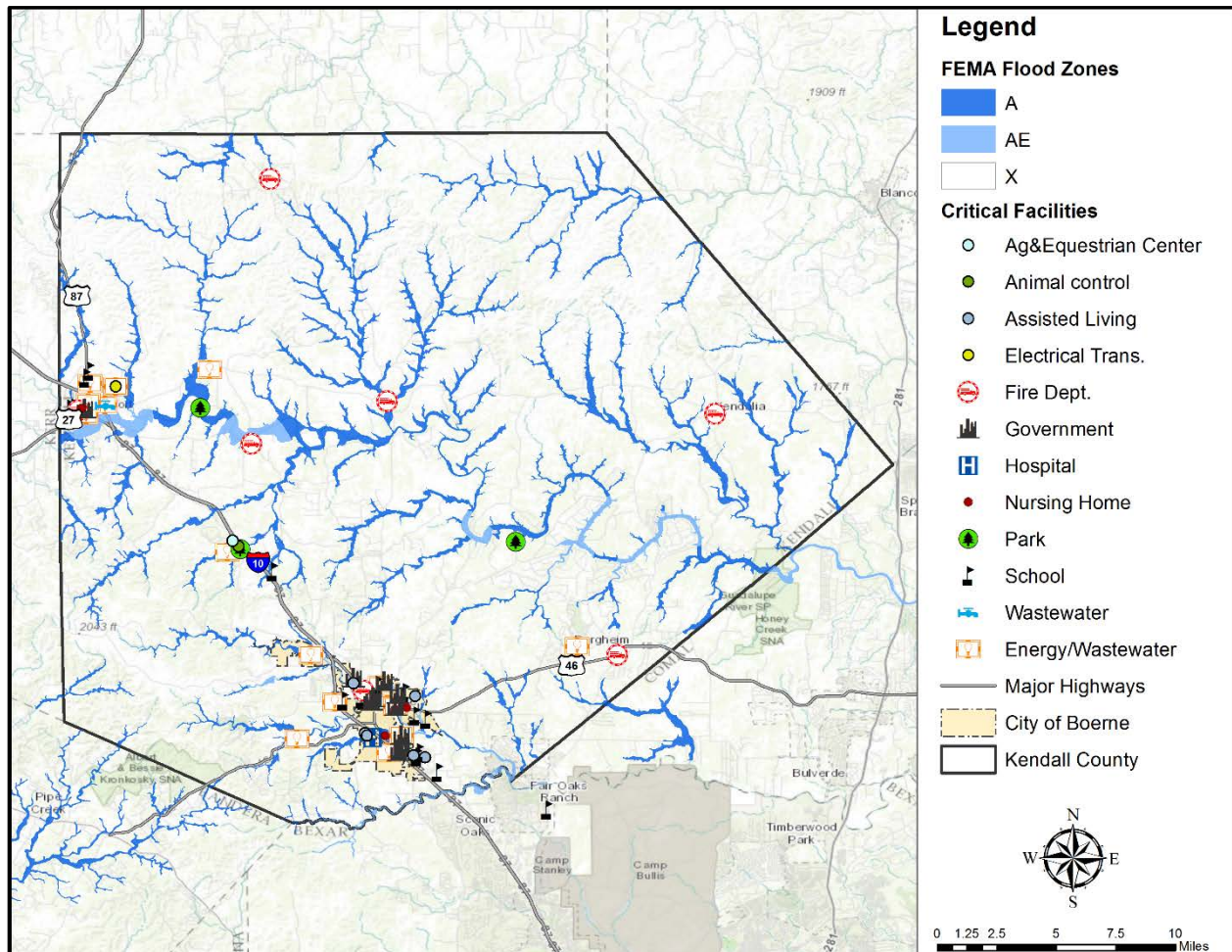
Floods generally result from excessive precipitation. The severity of a flood event is determined by a combination of several major factors, including: stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and the degree of vegetative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

The primary types of general flooding are inland and coastal flooding. Due to Kendall County's inland location, only inland flooding is profiled in Section 5. 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, thus 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.

## Location

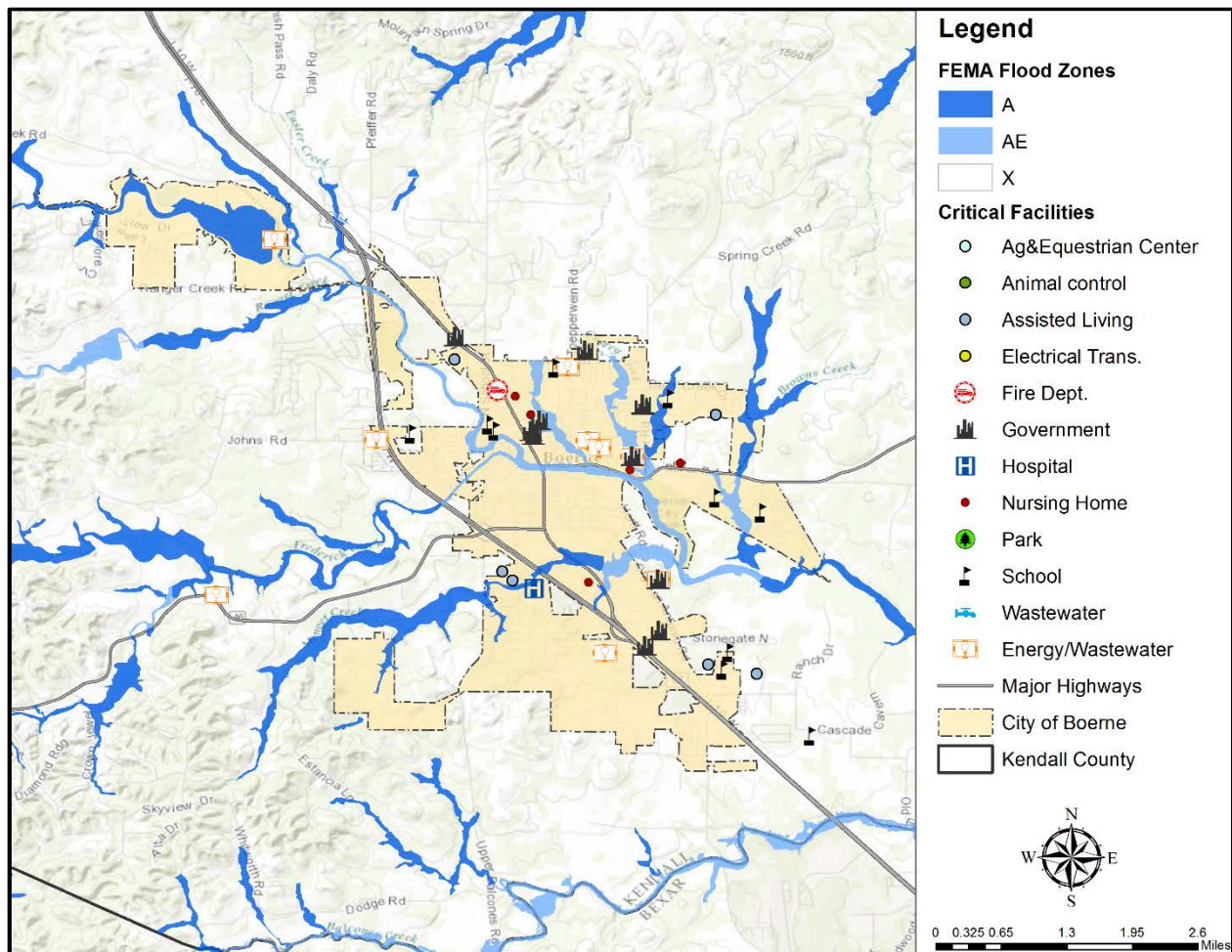
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Locations of flood Zones A, and AE in Kendall County based on the Digital Flood Insurance Rate Map (DFIRM) from FEMA, are illustrated in Figures 5-1 through 5-2 below.





**Figure 5-2. Estimated Flood Zones in the City of Boerne**



### Extent

The severity of a flood event is determined by a combination of several factors including: stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and degree of vegetative clearing and impervious surface. 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, and the depths of flood waters. FEMA categorizes areas according to how the area will convey flood water. The extent of flood damages can be expected to be more damaging in the areas where a base flood can occur. A base flood is defined by FEMA as a flood having a one-percent chance of being equaled or exceeded in any given year. This is the regulatory standard also referred to as the “100-year flood.” The base flood is the national standard used by the National Flood Insurance Program (NFIP) and all Federal agencies for the purposes of requiring the

## Section 5: Flood

purchase of flood insurance and regulating new development.<sup>1</sup> Flood zones are the categories that are mapped on Flood Insurance Rate Maps. Table 5-1 provides a description of FEMA flood zones and the flood impact in terms of severity or potential harm. Figures 5-1 and 5-2 should be read in conjunction with the extent for flooding in Tables 5-1, 5-2, and 5-3 to determine the intensity of a potential flooding event.

**Table 5-1. Flood Zones**

INTENSITY	ZONE	DESCRIPTION
HIGH	ZONE A	Areas with a one 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 base flood elevations 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 one percent or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from one to three 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 one percent annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from one to three feet. These areas have a 26 percent chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
	ZONE A99	Areas with a one 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 base flood elevations 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.

<sup>1</sup> Base Flood. (n.d.). Retrieved from <http://www.fema.gov/base-flood>



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INTENSITY	ZONE	DESCRIPTION
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 one foot or with drainage areas less than one square mile; or an area protected by levees from 100-year flooding.

Zone A is interchangeably referred to as the 100-year flood, the one-percent-annual chance flood, or 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.

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. Utility systems, such as heating, ventilation, air conditioning, fuel, electrical systems, sewage maintenance systems and water systems, if not elevated above base flood elevation, may also be damaged.

The intensity and magnitude of a flood event is also determined by the depth of flood waters. Table 5-2 below describes the category of risk and potential magnitude of an event in correlation to water depth. The water depths depicted in Table 5-2 are an approximation based on elevation data (above sea level). Table 5-3 describes the extent associated with stream gauge data provided by the United States Geological Survey (USGS).

**Table 5-2. Extent Scale – Water Depth (Mean Sea Level, MSL)**

SEVERITY	MSL (in feet)	DESCRIPTION
BELOW FLOOD STAGE	0 to 15	Water begins to exceed low sections of banks and the lowest sections of the floodplain.
ACTION STAGE	16 to 23	Flow is well into the floodplain, minor lowland flooding reaches low areas of the floodplain. Livestock should be moved from low lying areas.
FLOOD STAGE	24 to 28	Homes are threatened and properties downstream of river flows or in low lying areas begin to flood.
MODERATE FLOOD STAGE	29 to 32	At this stage the lowest homes downstream flood. Roads and bridges in the floodplain flood severely and are dangerous to motorists.
MAJOR FLOOD STAGE	33 and above	Major flooding approaches homes in the floodplain. Primary and secondary roads and bridges are severely flooded and very dangerous. Major flooding extends well into

## Section 5: Flood

SEVERITY	MSL (in feet)	DESCRIPTION
		the floodplain, destroying property, equipment and livestock.

**Table 5-3. Extent for Kendall County**

JURISDICTION	ESTIMATED SEVERITY PER FLOOD EVENT <sup>2</sup>	PEAK FLOOD EVENT
Kendall County	Action Stage, 16 to 23 feet, 17.4	Major Flood Stage: Guadalupe River near Comfort, TX, Kendall County had floodwaters reach an overflow elevation of 40.9 feet in August 1978.
City of Boerne	Below Flood Stage, 0 to 15 feet, 7.95	Action Stage: Cibolo Creek near Boerne, TX, Kendall County had floodwaters reach an overflow elevation of 19.83 feet in May 2015.

The range of flood intensity that the County can experience is high, or Zone A. Based on reporting from the USGS peak MSL data, the County's average flood event places the planning area at the "Action Stage" as shown in Tables 5-2 and 5-3. However, Kendall County has experienced flooding over 33 feet MSL. Based on historical occurrences, the planning area could experience 11 to 21 inches of water within a 48-hour period due to flooding.

The data described in Tables 5-1 through 5-3, together with Figures 5-1 through 5-2, and historical occurrences for the area, provides an estimated potential magnitude and severity for the Kendall County planning area. The County may experience a range of flooding events from below 15 feet to above 33 feet or from "Below Flood Stage" to a "Major Flood Stage."

## Historical Occurrences

Historical evidence indicates that areas within the planning area are susceptible to flooding, especially in the form of flash flooding. Only flood events that have been reported have been factored into this risk assessment, therefore it is likely that additional flood occurrences have gone unreported before and during the recording period. Table 5-4 identifies historical flood events that resulted in damages, injuries, or fatalities within the Kendall County planning area.

Historical Data is provided by the Storm Prediction Center (NOAA), NCDC, and SHELDUS databases for Kendall County.

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<sup>2</sup> Severity estimated by averaging floods at certain stage level over the history of flood events.

## Section 5: Flood

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**Table 5-4. Historical Flood Events, 1996-2016**

JURISDICTION	DATE	TIME	DEATHS	INJURIES	PROPERTY DAMAGE (2016 DOLLARS)	CROP DAMAGE (2016 DOLLARS)
Kendall County	2/20/1997	11:00 AM	0	0	\$22,160	\$0
Kendall County	4/4/1997	7:00 AM	0	0	\$14,773	\$0
Kendall County	5/19/1997	9:30 PM	0	0	\$4,432	\$0
Kendall County	5/27/1997	7:30 PM	0	0	\$29,547	\$0
Kendall County	6/6/1997	3:00 PM	0	0	\$7,387	\$0
Kendall County	6/21/1997	8:30 PM	0	0	\$22,160	\$0
Kendall County	6/22/1997	12:30 AM	0	5	\$7,386,636	\$1,477,327
Kendall County	8/8/1997	12:00 PM	0	0	\$7,387	\$0
Kendall County	2/21/1998	6:00 PM	0	0	\$4,364	\$0
Kendall County	3/16/1998	1:00 AM	0	0	\$29,093	\$0
Kendall County	8/22/1998	1:00 PM	0	0	\$14,547	\$29,093
Kendall County	10/17/1998	12:00 PM	0	10	\$72,733	\$72,733
Kendall County	10/23/2000	5:00 AM	0	0	\$68,848	\$13,770
Kendall County	11/2/2000	5:30 PM	0	0	\$34,424	\$0
Kendall County	8/27/2001	5:30 PM	0	0	\$13,389	\$0
Kendall County	8/31/2001	7:30 PM	0	0	\$26,777	\$40,166
Kendall County	9/5/2001	5:00 PM	0	0	\$26,777	\$0
Kendall County	11/15/2001	6:45 AM	0	5	\$66,943	\$0
Kendall County	6/30/2002	7:30 AM	0	0	\$39,540	\$0
Kendall County	7/3/2002	8:00 PM	1	0	\$0	\$0
Kendall County	10/7/2002	8:45 PM	0	0	\$13,180	\$0
Kendall County	10/24/2002	8:30 AM	0	0	\$39,540	\$0
Kendall County	2/20/2003	8:00 AM	0	0	\$6,443	\$0
Kendall County	2/21/2003	4:15 AM	0	0	\$12,886	\$0
Kendall County	3/25/2003	6:30 PM	0	0	\$6,443	\$0

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JURISDICTION	DATE	TIME	DEATHS	INJURIES	PROPERTY DAMAGE (2016 DOLLARS)	CROP DAMAGE (2016 DOLLARS)
Kendall County	6/13/2003	6:30 PM	0	0	\$6,443	\$0
Kendall County	6/28/2003	5:00 PM	0	0	\$6,443	\$0
Kendall County	1/16/2004	5:30 PM	0	0	\$6,276	\$0
Kendall County	5/2/2007	9:00 PM	2	0	\$0	\$0
Boerne	8/16/2007	4:00 PM	2	0	\$343,072	\$0
Kendall County	5/29/2016	6:00 AM	1	0	\$0	\$0
Total Losses			6	20	\$9,965,732	

**Table 5-5. Summary of Historical Flood Events, 1996-2016**

EVENTS	DEATHS	INJURIES	PROPERTY DAMAGE (2016 DOLLARS)	CROP DAMAGE (2016 DOLLARS)
79 events	5	20	\$8,332,643	\$1,633,089

### Significant Events

#### Flash Flood on August 16, 2007 – Boerne

Extremely heavy rainfall associated with the remains of Tropical Storm Erin moved into Kendall County in the afternoon of August 16, producing between 3 and 5 inches over most of the county. Highest rain totals were 8 inches between Boerne and Sisterdale. Most roads in the county were closed and several families had to be evacuated along Cypress Creek due to flooding. City Lake was reported to be only six feet below the spillway. It had only been topped twice in the past 10 years. Near 1900 CST on the evening of April 16, a man and his son were in a truck traveling along FM 473 when they attempted to drive across a bridge near FM 1376 that was already flooded by Sister Creek. The truck stalled and both men crawled out of the cab through the rear window and stood in the truck bed. Rescuers who arrived within minutes were unable to pass them life jackets or to secure a rope to the truck before a surge of water lifted the vehicle and swept it over the bridge. The father and son were washed into the creek and drowned.

#### Flash Flood on June 22, 1997 – Kendall County

The heavy rain Friday night into Saturday afternoon had left South Central Texas soils saturated. The situation worsened Saturday evening into Sunday as heavy rain associated with the upper low pressure system redeveloped over the western Texas Hill Country. Very heavy rains over the Texas Hill Country Saturday night and Sunday morning caused widespread flooding as well as flash flooding across numerous counties.

The Guadalupe River first crested at Comfort at 25.9 feet early on June 22nd, then an additional 4.5 inches of rain in the Cypress Creek drainage area sent a flood wave downstream that flooded homes

## Section 5: Flood

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in Comfort. Further downstream, the Guadalupe at Spring Branch rose to within a foot of the flood of record, 45.45 feet. Canyon Lake rose to within 5 feet of the record elevation and within 6 feet of the emergency spillway height.

An estimated 12 to 15 inches of rain fell between Bandera and Boerne, with up to 20 inches west of Boerne, produced flooding along Cibolo Creek that filled two flood retention dams as well as Boerne City Lake. The Boerne Police Chief was trapped in his home by the flood wave down the spillway, and reported a television set washing through the window of one of the flooded homes. Cibolo Creek in Boerne crested at over 16 feet, the highest level since 1964. About 20 percent of the homes facing Cibolo Creek were flooded to some extent. Downstream, the Creek flooded several homes in Bulverde. The most massive damage was in Schertz, where blocks of the Pecan Grove Trailer Park were inundated. Trailers washed downstream into each other, lodging in trees. The Red Cross reported 330 persons evacuated and seeking alternate housing. The flood wave reached LaVernia early Monday afternoon, flooding two homes, and causing 25 families to be evacuated.

The Red Cross and FEMA totals for homes and businesses damaged or destroyed in this flood in South Central Texas included nearly 300 homes across the Highland Lakes northwest of the Austin area. In addition, homes and businesses damaged or destroyed numbered approximately 200 in Guadalupe County, 150 in each of Bandera and Bexar Counties, 100 in each of Medina and Kendall Counties, and 50 in each of Real, Uvalde and Comal Counties.

## Probability of Future Events

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Based on recorded historical occurrences and extent within the Kendall County planning area, flooding is highly likely and an event will occur within the next year.

## Vulnerability and Impact

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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 County encourages development outside of the floodplain, although there are some critical facilities, homes, and businesses already located in the floodplain.

Critical facilities in the planning area that are located in the floodplain and are vulnerable to flooding include:

Kendall County<sup>3</sup>:

- 1 School
- 2 Fire Departments
- 2 Wastewater Treatment Plants
- 1 Park
- 1 Dam (Lake Dam)

Boerne:

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<sup>3</sup> Kendall County list includes critical facilities located in a census designated place (Comfort) and unincorporated communities including Bergheim, Kendalia, Alamo Springs, Kreutzberg, and Waring where applicable.

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- None

None of the critical facilities for the City of Boerne are located in the floodplain.

Impact of floods experienced in the planning area has resulted in 20 injuries and 6 fatalities supporting a Substantial severity of impact meaning a complete shutdown of facilities for 30 days or more, multiple deaths, and more than 50% of property destroyed or with major damage.

Historic loss estimates due to flood (in 2016 dollars) total \$9,965,732 having an approximate annual loss estimate of \$498,287. Historic loss estimates are based on recorded data, therefore there could be damages that were not included in the estimates because they were not reported. Considering 79 flood events over a 20-year period, frequency is approximately three to four events every year.

### 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 planning area. 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 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.
- 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 impacted by a flood event and unable to report for duty, limiting response capabilities.
- City or county departments may be flooded, delaying response and recovery efforts for the entire community.
- Private sector entities that the City 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.

## Section 5: Flood

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

### National Flood Insurance Program (NFIP) Participation

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Flood insurance offered through the NFIP is the best way for home and business owners to protect themselves financially against a flood hazard. Kendall County and the City of Boerne currently participate in the National Flood Insurance Program (NFIP).

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. Kendall County and the City of Boerne do not currently participate in CRS, but this is also a goal and objective of the Plan that was discussed during Planning Team meetings. Kendall County currently has in place minimum NFIP standards for new construction and substantial Improvements of structures, but are considering adopting higher regulatory NFIP standards. Additional freeboard would minimize flooding caused by flash flooding and many drainage issues as a result of generally flat terrain typical of the area. The City of Boerne's current flood damage prevention ordinance includes one foot of freeboard



## Section 5: Flood

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as the minimum requirement for new construction. The City is considering additional higher regulatory NFIP standards to further protect new and substantially improved structures.

The flood hazard areas of Kendall County are subject to periodic inundation, which may result in loss of life and property, health and safety hazards, disruption of commerce and governmental services, and extraordinary public expenditures for flood protection and relief, of which adversely affect public safety.

Overall loss resulting from a flood event is caused by the cumulative effect of flood waters to obstructions in floodplains; flood hazard areas; habitats vulnerable to floods; and hazardous to other landforms that are inadequately elevated, flood-proofed or otherwise protected from flood damage. For example, flood plain obstructions cause an increase in flood water heights and velocities.

It is the purpose of Kendall County to promote the public health, safety and general welfare and to minimize public and private losses due to flood conditions in specific areas by 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 participating NFIP jurisdictions seek to follow these guidelines to achieve flood mitigation by:

- 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

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As mentioned, both participating jurisdictions have developed mitigation actions that relate to either NFIP maintenance or compliance. Compliance and maintenance actions can be found in Section 21.

Flooding was identified as a high risk by both jurisdictions hazard during hazard ranking activities at the Risk Assessment Workshop by the Planning Team and many of the mitigation actions were developed with flood mitigation in mind. A majority of these flood actions address reducing flood risk through structural alterations and drainage projects, and implementing flood awareness programs.

## Section 5: Flood

Kendall County recognizes the need and is adopting higher NFIP regulatory standards to further minimize flood risk in their community.

Both jurisdictions participating in the NFIP has a designated floodplain administrator. The floodplain administrators for Kendall County and the City of Boerne will continue to maintain compliance with the NFIP including continued floodplain administration, zoning ordinances, and development regulation. The floodplain ordinance adopted by each participating jurisdiction outlines the minimum requirements for development in special flood hazard areas.

### Repetitive Loss

The Severe Repetitive Loss (SRL) 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 severe repetitive loss residential structures insured under the NFIP. The Texas Water Development Board (TWDB) administers the SRL grant program for the State of Texas.

Severe Repetitive Loss properties are defined as residential properties that are:

- Covered under the NFIP and have at least four 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 two 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 two of the referenced claims must have occurred within any ten-year period, and must be greater than 10 days apart.<sup>4</sup> Table 5-6 shows repetitive loss and severe repetitive loss properties for Kendall County.

**Table 5-6. Repetitive Loss and Severe Repetitive Loss Properties**

JURISDICTION	INSURED?	BUILDING TYPE	LOSSES	TOTAL PAID	SRL INDICATOR <sup>5</sup>
Kendall County	Yes	Residential	2	82,699.92	-
Kendall County	No	Residential	2	13,424.31	-
Kendall County	Yes	Residential	3	71,075.48	-
Kendall County	Yes	Residential	2	26,490.41	-
Kendall County	No	Residential	4	77,877.35	PU
Kendall County	No	Residential	2	129,276.81	-

<sup>4</sup> Source: Texas Water Development Board

<sup>5</sup> In this column: "V" stands for "Validated"; "VN" stands for "Validated Nonresidential"; "VU" stand for "Validated Uninsured"; "VNU" stands for "Validated Nonresidential Uninsured"; "P" stands for "Pending"; "PU" stands for "Pending Uninsured"; and "PN" stands for "Pending Nonresidential".

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JURISDICTION	INSURED?	BUILDING TYPE	LOSSES	TOTAL PAID	SRL INDICATOR <sup>5</sup>
Kendall County	Yes	Residential	2	117,241.48	-
Kendall County	No	Residential	2	48,830.94	-
Kendall County	Yes	Residential	2	52,751.45	-
Kendall County	No	Residential	2	46,113.04	-
Kendall County	Yes	Residential	3	87,090.12	-
Kendall County	No	Residential	2	152,277.22	-
Kendall County	Yes	Residential	3	118,081.32	-
Kendall County	Yes	Residential	5	86,841.20	-
Kendall County	No	Residential	2	29,811.67	-
Boerne	Yes	Non-Residential	4	34,229.66	-
Boerne	SDF	Residential	4	41,830.55	V

# Section 6: Wildfire

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## Hazard Description

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A wildfire event can rapidly spread out of control and occurs most often in the summer, when the brush is dry and flames can move unchecked through a highly vegetative area. Wildfires can start as a slow burning fire along the forest floor, killing and damaging trees. The fires often spread more rapidly as they reach the tops of trees, with wind carrying the flames from tree to tree. Usually, dense smoke is the first indication of a wildfire.

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, tossed cigarette, burning debris, or arson. A wildfire event can be a potentially damaging consequence of drought.

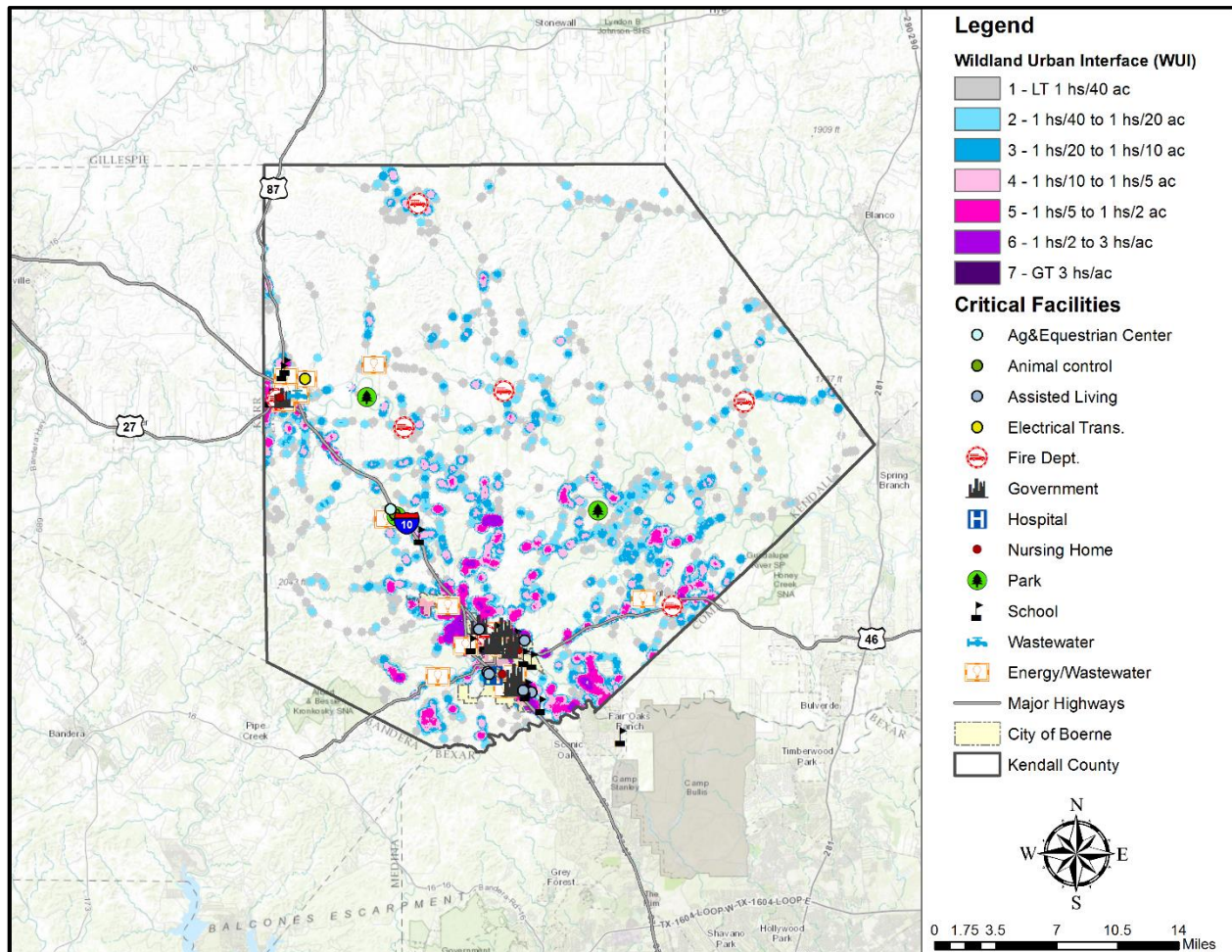
Texas has seen a significant increase in the number of wildfires in the past 30 years, which included wildland, interface or intermix fires. Wildland Urban Interface or Intermix (WUI) fires occur in areas where structures and other human improvements meet or intermingle with undeveloped wildland or vegetative fuels.

## Location

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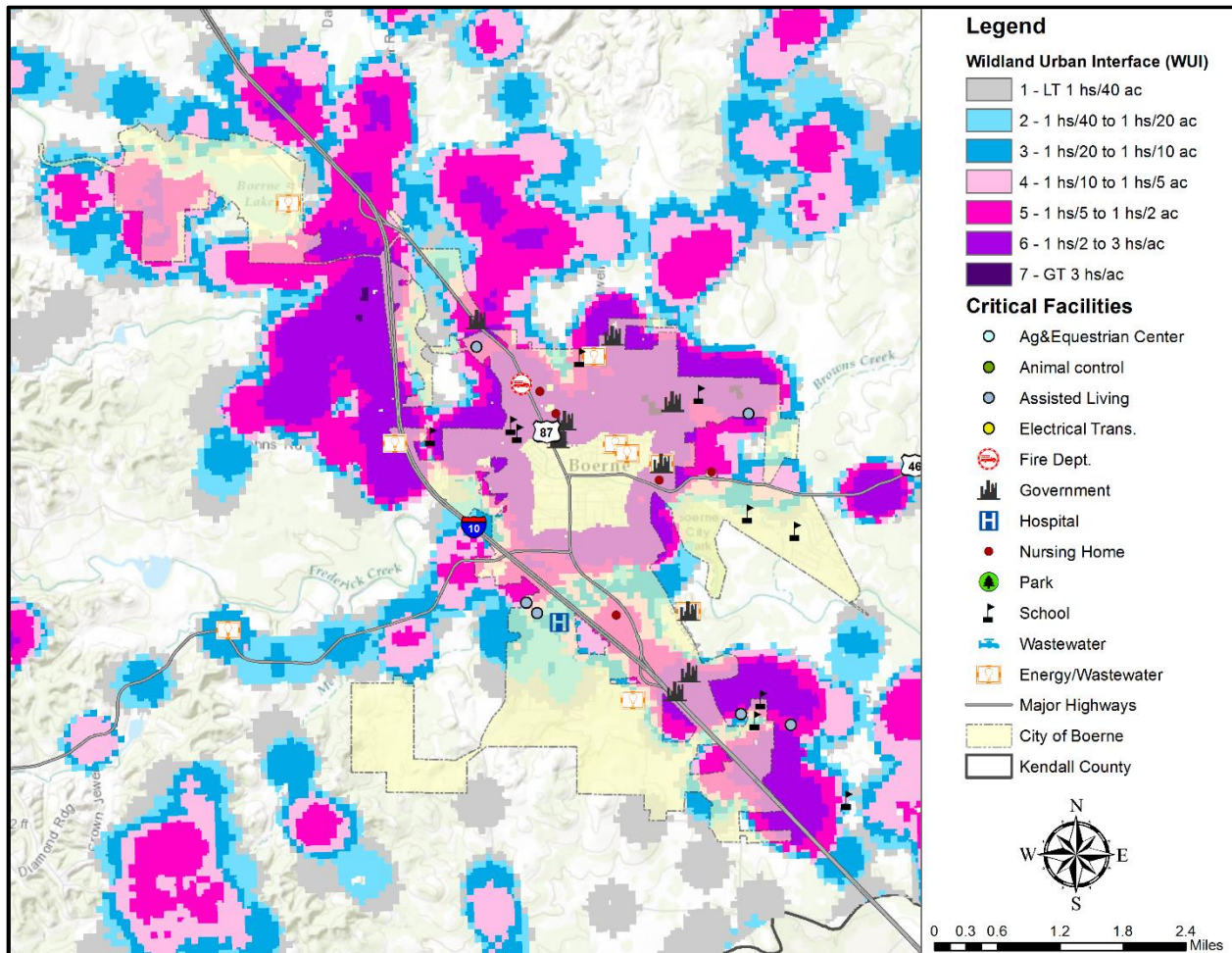
Wildfires can vary greatly in terms of size, location, intensity and duration. While wildfires are not confined to any specific geographic location, they are most likely to occur in open grasslands. The threat to people and property from a wildfire event is greater in the fringe areas where developed areas meet open grass lands, such as the WUI. (Figures 6-1 through 6-2). It is estimated that 94 percent of the total population in Kendall County live within the WUI. However, the entire Kendall County planning area is at risk for wildfires.

Figure 6-1. Wildland Urban Interface Map – Kendall County





**Figure 6-2. Wildland Urban Interface Map – City of Boerne**



It is estimated that 81 percent of the total population in Boerne live within the WUI. However, the entire City of Boerne is at risk for wildfires.

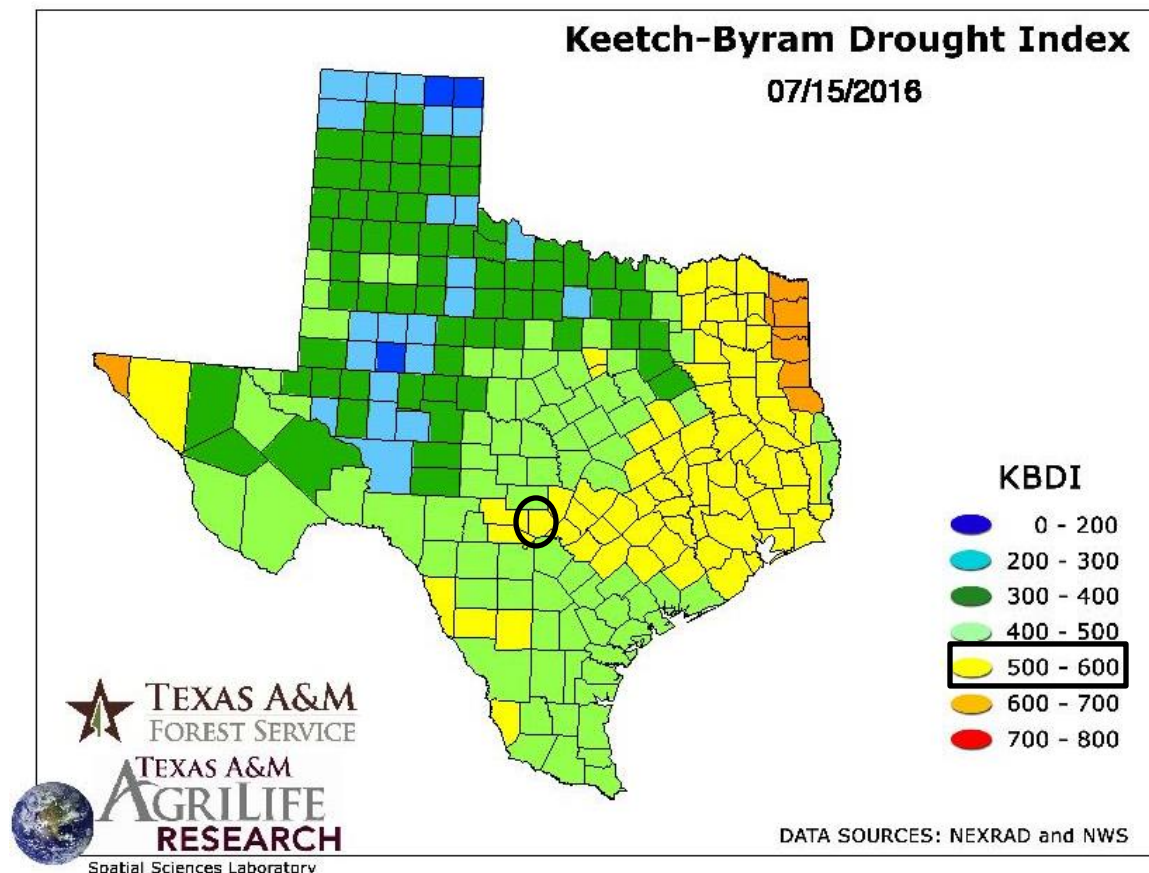
### Extent



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 6-3 represents the drought index at that location. 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 6-3. Keetch-Byram Drought Index (KBDI) for the State of Texas, 2016<sup>1</sup>



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.
- **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. The KBDI should be referenced as the area experiences changes in precipitation and soil moisture, and caution exercised in dryer, hotter conditions.

<sup>1</sup> Kendall County is located within the black circle.

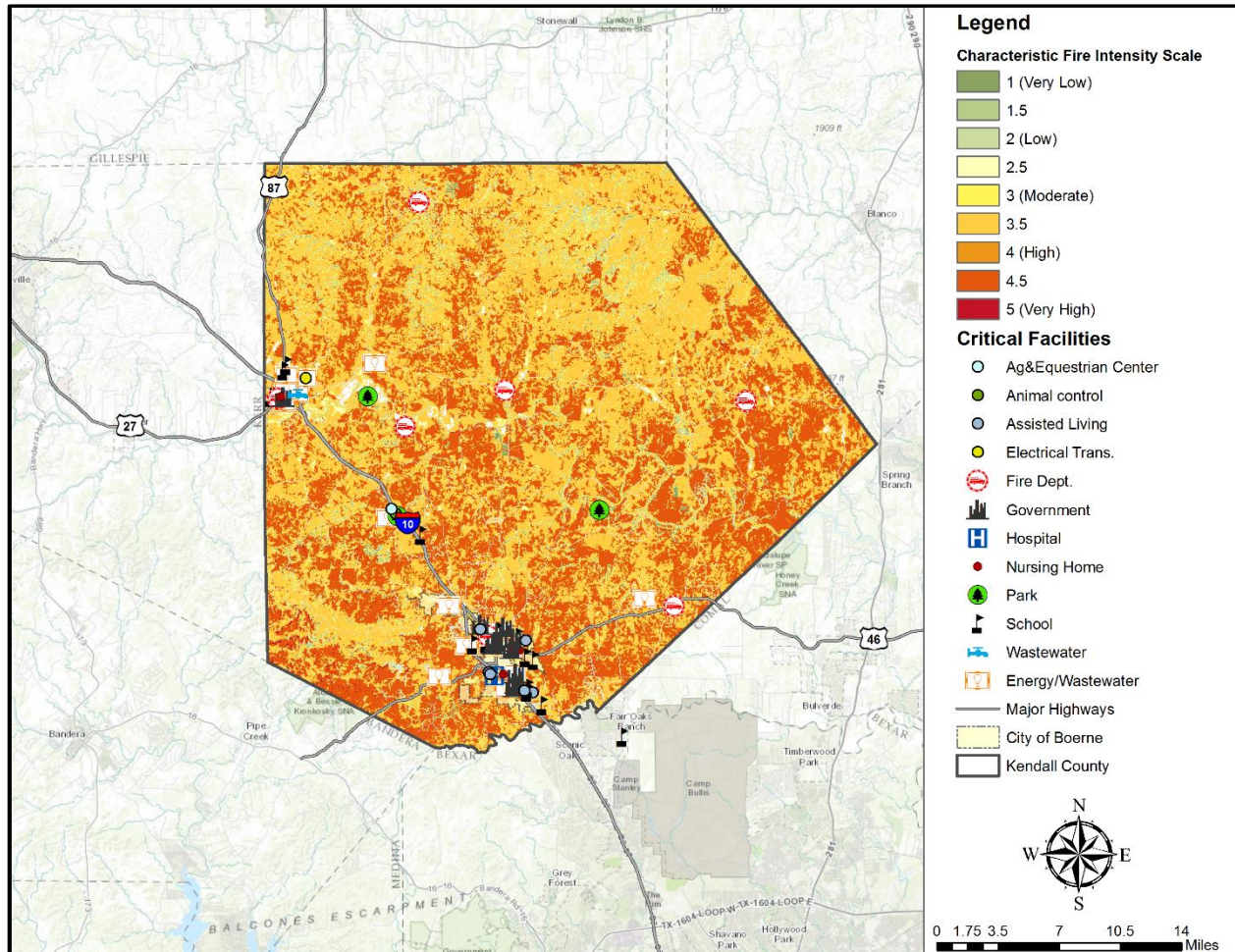


## Section 6: Wildfire

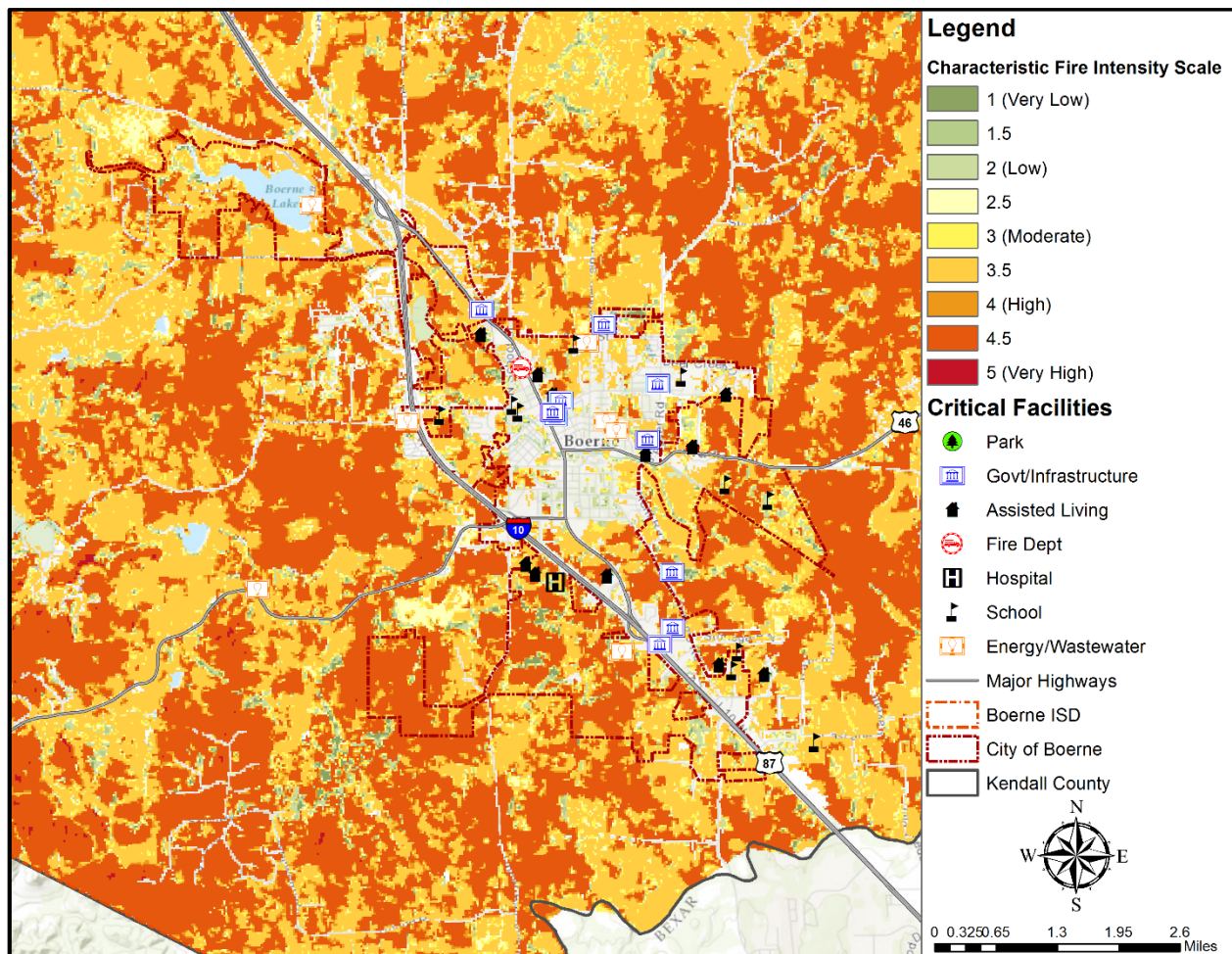
The range of intensity for Kendall County in a wildfire event is within 500 to 600. The average extent to be mitigated for the Kendall County planning area is a KBDI of 528. At this level fires intensity begins to significantly increase and fires readily burn in all directions, exposing mineral soils in some locations.

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. Kendall County is between a potential moderate to high wildfire intensities. Figures 6-4 through 6-5 identifies the wildfire intensity for the Kendall County planning area.

**Figure 6-4. Fire Intensity Scale Map – Kendall County**



**Figure 6-5. Fire Intensity Scale Map – City of Boerne**



## Historical Occurrences

The Texas Forest Service (TFS) reported 323 wildfire events between 2005 and 2009 within the Kendall County planning area. The National Climatic Data Center (NCDC) reported one event from 2005 through 2016. The Texas Forest Service started collecting wildfire data in 1985 and volunteer fire departments started reporting events until 2005. Due to a lack of recorded data for wildfire events prior to 2005, frequency calculations are based on an eleven-year 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 6-6 and 6-7). Table 6-1 identifies the number of wildfires by jurisdiction, and total acreage burned.



Figure 6-6. Historical Wildfire Events for Kendall County

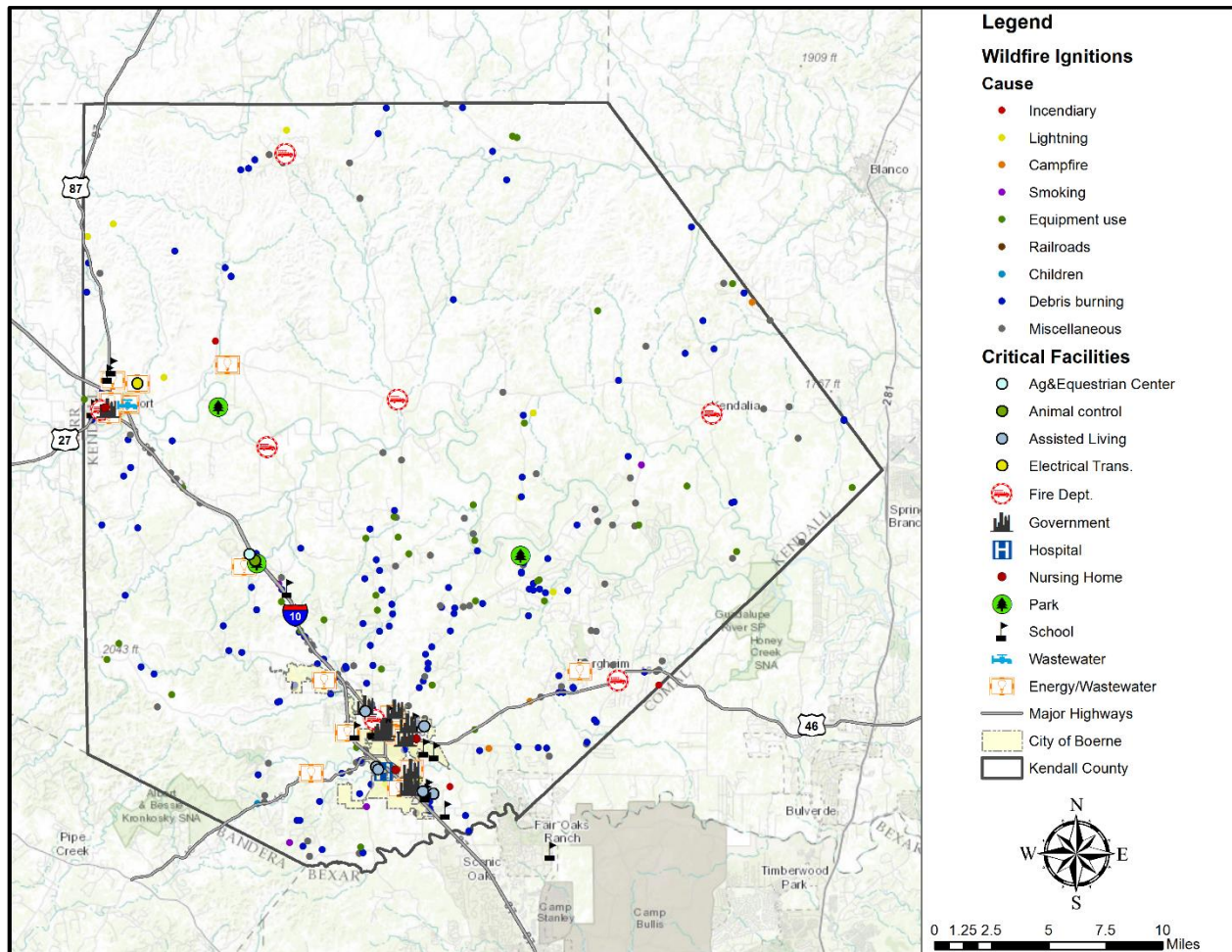


Figure 6-7. Historical Wildfire Events for the City of Boerne

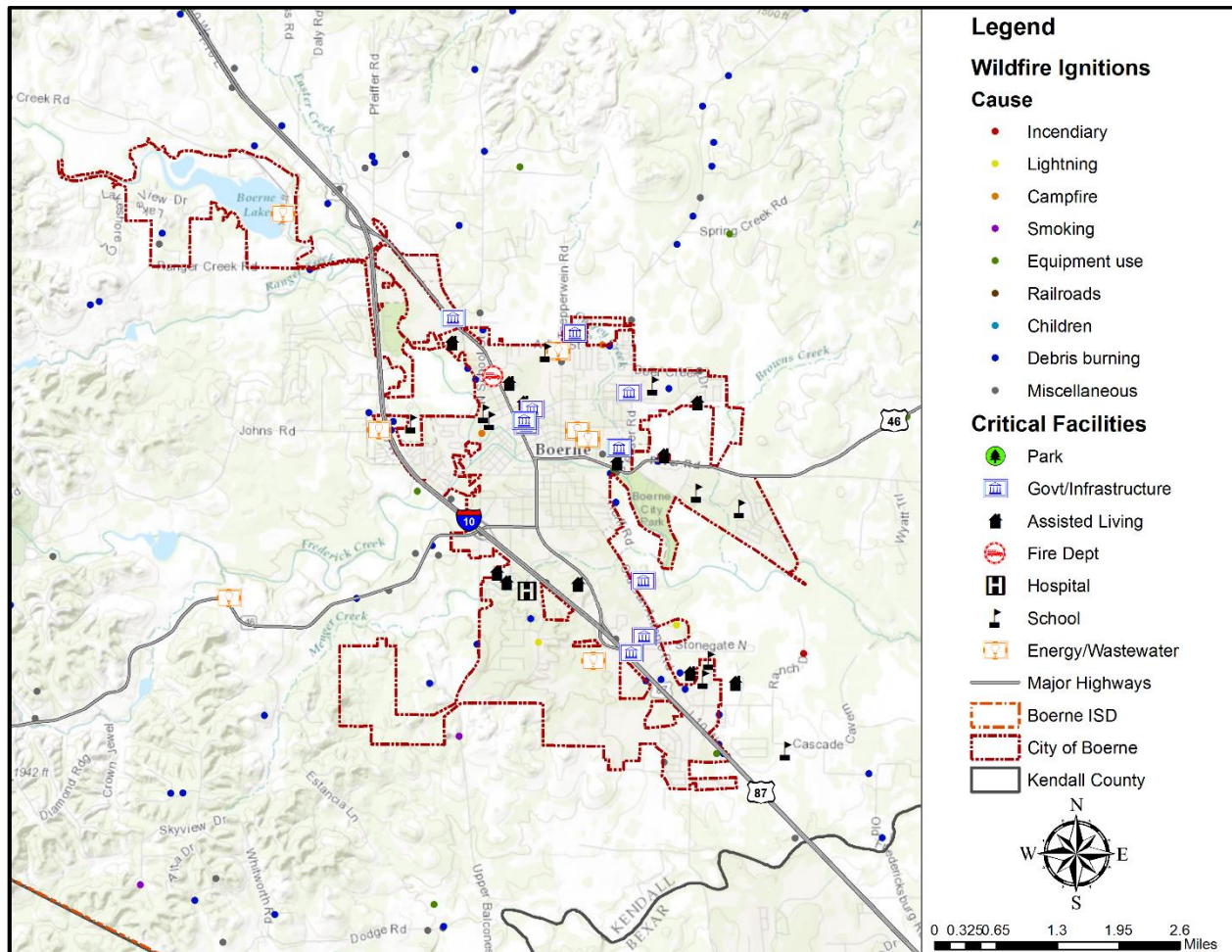


Table 6-1. Historical Wildfire Events Summary

JURISDICTION	NUMBER OF EVENTS	ACRES BURNED
Kendall County	298	7,336
City of Boerne	25	64

Table 6-2. Acreage of Suppressed Wildfire by Year

JURISDICTION	2005	2006	2007	2008	2009
Kendall County	35	489.75	411.2	4,298.05	2052
City of Boerne	0	6.4	1.5	53	3.25

## Section 6: Wildfire

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### Significant Past Events

#### **June 6, 2011**

The Green Cedar wildfire in Kendall County between Boerne and Comfort was spread by southerly winds that gusted between 25 and 30 mph. Temperatures were near 100 degrees. The fire burned 140 acres including an RV park on Interstate 10. One structure and seven recreational vehicles were destroyed by the fire.

### Probability of Future Events

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Wildfires can occur at any time of the year. As the jurisdictions within the county move into wildland, the potential area of occurrence of wildfire increases. With 323 events in an 11 year period, an event within Kendall County, including the City of Boerne, is highly likely, meaning an event is probable within the next year.

### Vulnerability and Impact

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

The heavily populated, urban areas of Kendall County are not likely to experience large, sweeping fires. Areas outside of city limits and in the unincorporated areas of Kendall County are vulnerable. Unoccupied buildings and open spaces that have not been maintained have the greatest vulnerability to wildfire. The overall level of concern for wildfires is located mostly along the perimeter of the study area where wildland and urban areas interface.

The sparsely populated rural areas of Kendall County are capable of experiencing large sweeping fires, especially where areas of vegetation are not maintained. Areas along major highways in Comfort, and along Interstate Highway 10 in Kendall County have an increased vulnerability where empty lots and unoccupied areas are located.

The following critical facilities would be vulnerable to wildfire events in the Kendall County planning area:

#### Kendall County<sup>2</sup>

- 6 Fire Stations
- 1 EMS Facility
- 5 Schools
- 1 Nursing Homes/Assisted Living Facilities
- 1 Government Facilities
- 1 Wastewater Treatment Facilities
- 1 Electrical Transmission Substation

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<sup>2</sup> Kendall County list includes critical facilities located in a census designated place (Comfort) and unincorporated communities including Bergheim, Kendalia, Alamo Springs, Kreutzberg, and Waring where applicable.

## Section 6: Wildfire

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- 3 Parks
- 1 Animal Control Facility
- 1 Agriculture and Equestrian Center
- 1 Fertilizer Storage Facility

### Boerne:

- 1 Fire Station
- 1 Police Station
- 1 Sheriff's Department
- 1 Hospital
- 1 EMS Facility
- 11 Schools
- 11 Nursing Homes/Assisted Living Facilities
- 6 Government Facilities
- 2 Wastewater Treatment Facilities
- 4 Electrical Transmission Substation
- 1 Animal Control Facility

The following critical facilities are located in the WUI and are more susceptible to wildfire:

### Kendall County:

- 1 Animal Control Facility
- 2 Electrical Transmission Substations
- 4 Fire Departments
- 1 EMS Facility
- 1 Government Facility
- 1 Park
- 4 Schools
- 2 Wastewater Treatment Facilities
- 1 Fire Station

### Boerne:

- 11 Nursing Homes/Assisted Living Facilities
- 2 Electrical Transmission Substations
- 1 Fire Department
- 1 Hazardous Material Storage Facility
- 2 Wastewater Treatment Facilities
- 1 Police Station
- 7 Government Facilities
- 1 Hospital
- 1 Park
- 10 Schools



## Section 6: Wildfire

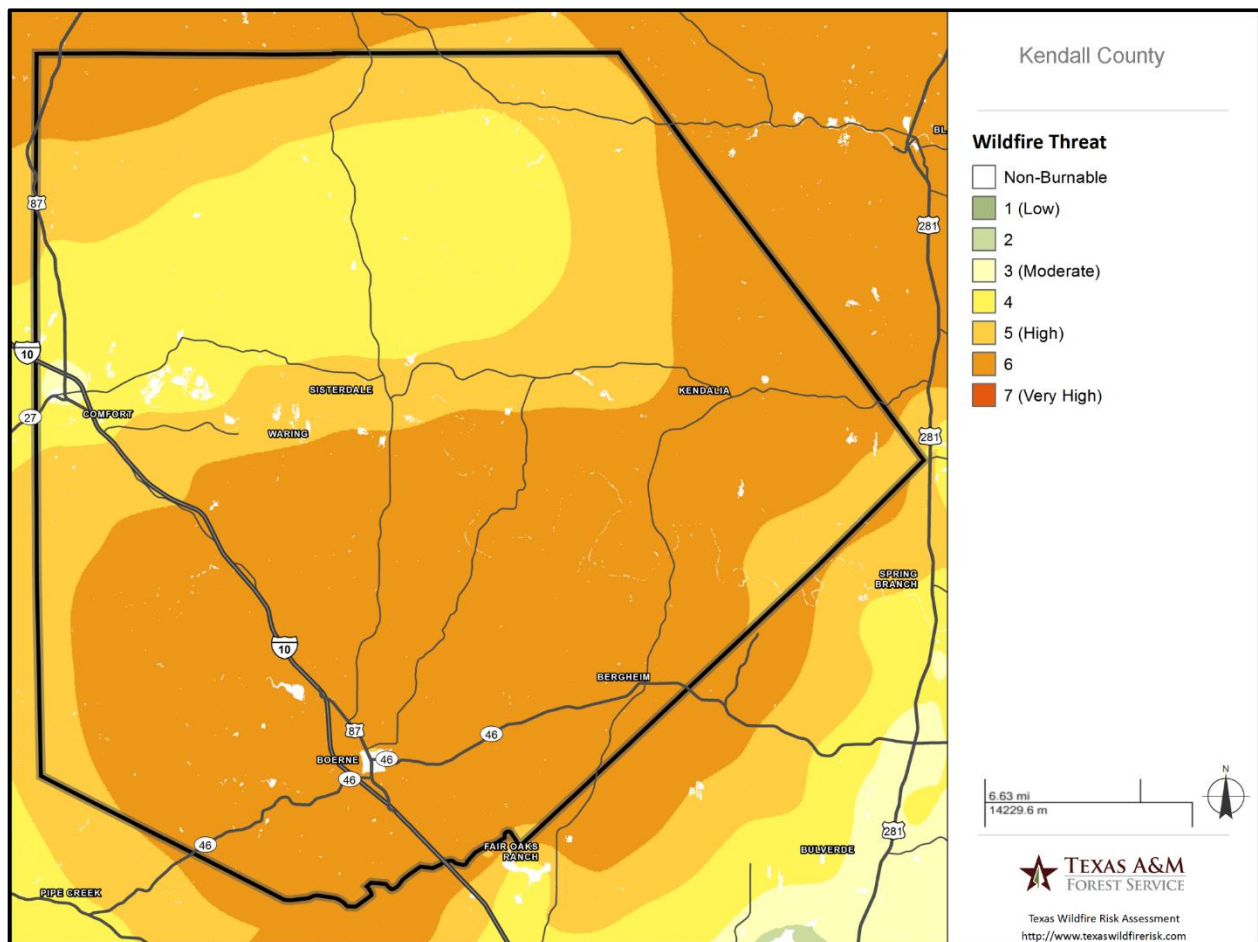
Within Kendall County, a total of 323 fire events were reported from 2005 to 2016. All of these events were suspected wildfires. Historic loss and annualized estimates due to wildfires are presented in Table 6-3 below. The frequency is approximately 29 events every year.

**Table 6-3. Historic Loss Estimates Due to Wildfire<sup>3</sup>**

JURISDICTION	NUMBER OF EVENTS	ACRES BURNED	ANNUAL ACRE LOSSES
Kendall County	298	7,336	666.91
Boerne	25	64	5.82
Totals	323	7,400	672.73

Figures 6-8 through 6-9 show Kendall County and the threat of wildfire to Kendall County and the City of Boerne.

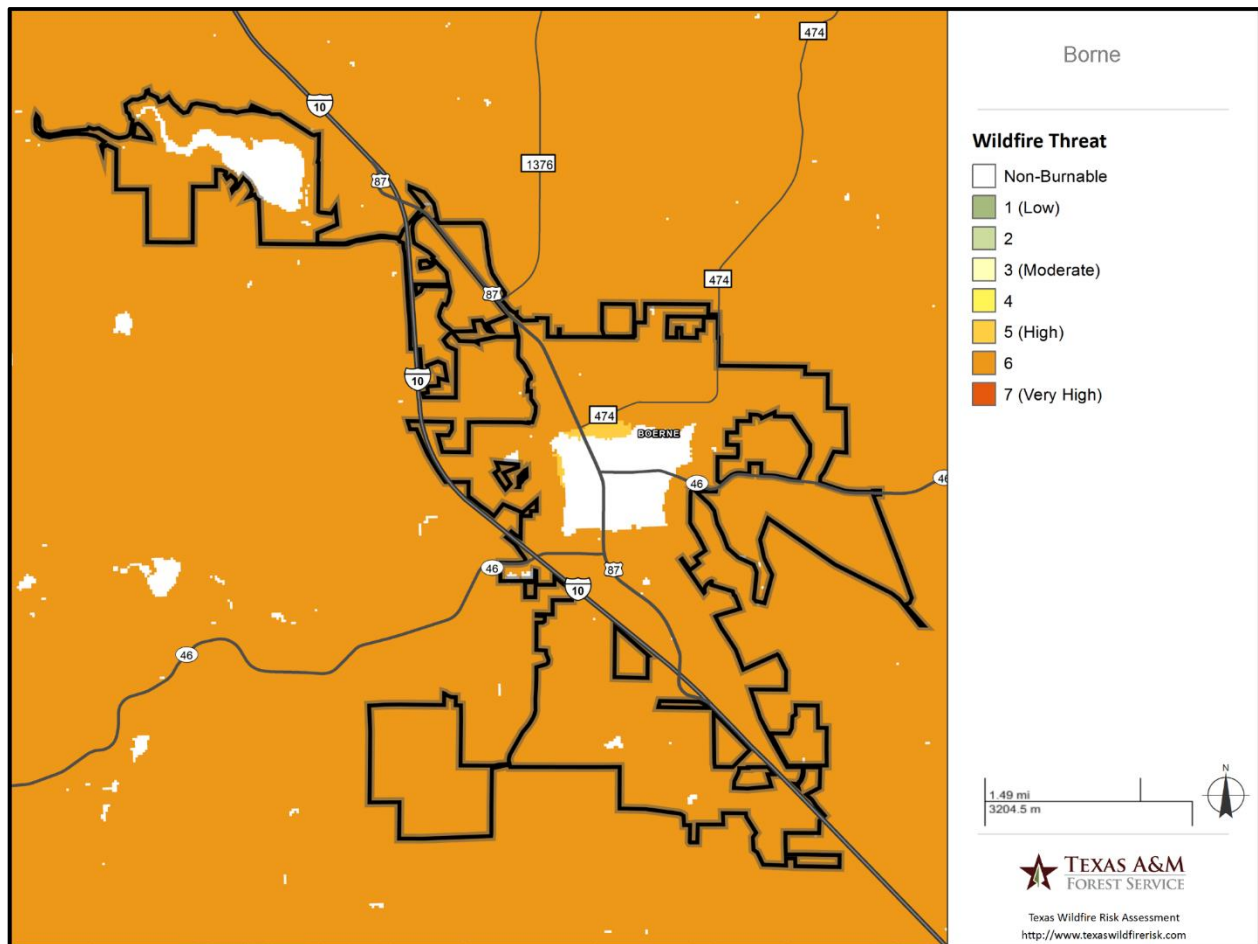
**Figure 6-8. Wildfire Threat – Kendall County**



<sup>3</sup> Events divided by 11 years of data.



**Figure 6-9. Wildfire Threat – City of Boerne**



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 microscopic 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.

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. For the Kendall County planning area, the impact from a wildfire event can be 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% of property is destroyed or with major damage.

## Section 6: Wildfire

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### 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 the direct damages. Potential impacts for the planning area include:

- Persons 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 since they are 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 and/or county 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, further 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.
- 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
- Wildfires can cause erosion, degrading stream water quality
- 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
- Vegetated dunes can be stripped, significantly damaging the function of the dunes to protect inland areas from the destructive forces of wind and waves.
- 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

## Section 6: Wildfire

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preparedness and pre-event planning done by government, businesses and citizens will contribute to the overall economic and financial conditions in the aftermath of a wildfire event.

# Section 7: Drought

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## 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 7-1 presents definitions for these different types of drought.



**Table 7-1. Drought Classification Definitions<sup>1</sup>**

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

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

<sup>1</sup> Source: Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy, FEMA

### Location

Droughts are a normal condition that occur regularly throughout Texas and the Kendall County planning area. However, drought events can vary greatly in their intensity and duration. There is no distinct geographic boundary to drought; therefore, it can occur throughout the Kendall County planning area and the City of Boerne equally.

### 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, thus the intensity of drought during a single month is dependent upon that month's 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 7-2 provides classification descriptions for the Palmer Drought Severity Index, and Table 7-3 depicts the magnitude of drought according to the Index.

**Table 7-2. Palmer Drought Severity Index – Category Descriptions<sup>2</sup>**

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

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<sup>2</sup> Source: National Drought Mitigation Center

**Table 7-3. Palmer Drought Severity 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

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

Based on the historical occurrences for drought and the location of Kendall County in south central Texas between the Edwards Plateau to the northwest and the Gulf Coastal Plains to the southeast, the planning area can anticipate a range of drought from abnormally dry to exceptional, or D1 to D4, based on the Palmer Drought Category.

### Historical Occurrences

The Kendall County planning area may typically experience an extreme drought. Table 7-4 and 7-5 lists historical events that have occurred in Kendall County, as reported in the National Climatic Data Center (NCDC). Historical drought information, as provided by the NCDC, shows drought activity across a multi-county forecast area for each event; therefore, the drought data for the City of Boerne is included with the Kendall County data. 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.

**Table 7-4. Historical Drought Years, 1996-2016**

DROUGHT YEAR
1996
2000
2011
2012
2012
2013
2014
2015
8 unique events

**Table 7-5. Historical Drought Events, 1996-2016**

JURISDICTION	DATE	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	4/1/1996	-	0	0	\$0	\$0
Kendall County	5/1/1996	-	0	0	\$0	\$0
Kendall County	6/1/1996	-	0	0	\$0	\$0
Kendall County	7/1/1996	-	0	0	\$0	\$0
Kendall County	8/1/1996	-	0	0	\$0	\$0
Kendall County	9/1/1996	-	0	0	\$0	\$0
Kendall County	10/1/1996	-	0	0	\$0	\$0
Kendall County	11/1/1996	-	0	0	\$0	\$0
Kendall County	6/1/2000	D3	0	0	\$0	\$0
Kendall County	7/1/2000	D2	0	0	\$0	\$0
Kendall County	8/1/2000	D2	0	0	\$0	\$0
Kendall County	9/1/2000	D2	0	0	\$0	\$0
Kendall County	10/1/2000	-	0	0	\$0	\$0
Kendall County	5/1/2011	D3	0	0	\$0	\$0



## Section 7: Drought

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JURISDICTION	DATE	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	6/1/2011	D4	0	0	\$0	\$0
Kendall County	7/1/2011	D4	0	0	\$0	\$0
Kendall County	8/1/2011	D4	0	0	\$0	\$0
Kendall County	9/1/2011	D4	0	0	\$0	\$0
Kendall County	10/1/2011	D4	0	0	\$0	\$0
Kendall County	11/1/2011	D4	0	0	\$0	\$0
Kendall County	12/1/2011	D3	0	0	\$0	\$0
Kendall County	1/1/2012	D4	0	0	\$0	\$0
Kendall County	2/1/2012	D2	0	0	\$0	\$0
Kendall County	3/1/2012	D2	0	0	\$0	\$0
Kendall County	6/1/2012	D3	0	0	\$0	\$0
Kendall County	6/1/2012	D2	0	0	\$0	\$0
Kendall County	7/1/2012	D2	0	0	\$0	\$0
Kendall County	8/1/2012	D2	0	0	\$0	\$0
Kendall County	12/1/2012	D2	0	0	\$0	\$0
Kendall County	2/1/2013	D2	0	0	\$0	\$0
Kendall County	3/1/2013	D2	0	0	\$0	\$0
Kendall County	4/1/2013	D2	0	0	\$0	\$0
Kendall County	6/1/2013	D4	0	0	\$0	\$0
Kendall County	7/1/2013	D2	0	0	\$0	\$0
Kendall County	8/1/2013	D3	0	0	\$0	\$0
Kendall County	9/1/2013	D2	0	0	\$0	\$0
Kendall County	10/1/2013	D2	0	0	\$0	\$0
Kendall County	11/1/2013	D2	0	0	\$0	\$0
Kendall County	12/1/2013	D2	0	0	\$0	\$0
Kendall County	1/1/2014	D2	0	0	\$0	\$0
Kendall County	2/1/2014	D2	0	0	\$0	\$0

## Section 7: Drought

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JURISDICTION	DATE	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	3/1/2014	D2	0	0	\$0	\$0
Kendall County	4/1/2014	D2	0	0	\$0	\$0
Kendall County	5/1/2014	D2	0	0	\$0	\$0
Kendall County	6/1/2014	D2	0	0	\$0	\$0
Kendall County	7/1/2014	D2	0	0	\$0	\$0
Kendall County	8/1/2014	D3	0	0	\$0	\$0
Kendall County	9/1/2014	D2	0	0	\$0	\$0
Kendall County	10/1/2014	D2	0	0	\$0	\$0
Kendall County	11/1/2014	D2	0	0	\$0	\$0
Kendall County	12/1/2014	D2	0	0	\$0	\$0
Kendall County	1/1/2015	D2	0	0	\$0	\$0
Kendall County	2/1/2015	D2	0	0	\$0	\$0
Kendall County	3/1/2015	D2	0	0	\$0	\$0
Kendall County	4/1/2015	D1	0	0	\$0	\$0
Kendall County	9/1/2015	D2	0	0	\$0	\$0
Kendall County	10/1/2015	D1	0	0	\$0	\$0

### Significant Past Events

#### June 1, 2013

June was feast or famine for rainfall across South Central Texas. Most of the region had less than 50 percent of normal. However, the southwestern corner of the area received in excess of 150 percent of normal rainfall and parts of Maverick and Dimmit Counties had as much as four times normal. This rain allowed Kinney (now in extreme drought category, Stage D3), Dimmit (severe category, Stage D2), Maverick (D2), and Zavala (D2) Counties to improve their drought conditions. At the same time, the lack of rain led to drought conditions worsening to stage D3 in Bastrop and Lee Counties, and to stage D2 in Blanco, Burnet, Caldwell, Comal, Fayette, Gonzales, Guadalupe, Hays, Kendall, and Travis Counties. Val Verde (D4), Edwards (D3), Bandera (D2), De Witt (D2), Frio (D2), Gillespie (D2), Kerr (D2), Llano (D2), Medina (D2), Real (D2), Uvalde (D2), and Williamson (D2) Counties all remained unchanged from May. Fire danger at the end of the month was moderate. Of the counties in D2 or worse drought Caldwell, Dimmit, Edwards, Fayette, Frio, Kinney, Lee, Llano, Maverick, Medina, and Val Verde had outdoor burn bans in effect at the end of the month. The seven day stream flow averages were much below normal (less than 10 percent) across the Colorado River basin. The Upper and Middle Guadalupe, Nueces, Rio Grande, and Frio River basins were reporting below normal (10 to 24 percent) flow. Area lakes and reservoirs continued well below normal pool elevations.

## Section 7: Drought

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Lake Amistad was around 59 feet below normal. Lake Travis was 54 feet below normal and Medina Lake 83 feet below normal which left it at 5 percent of capacity. The Edwards Aquifer was nearly 17 feet below normal, and 3.2 feet below the level at the end of June 2012. Uvalde was in stage 5 water restrictions, Austin was in stage 2, and Kerrville, San Marcos, and Seguin were in stage 1. The Barton Springs Edwards Aquifer Conservation District was in stage 3 alarm drought status.

### September 1, 2011

El Nino Southern Oscillation conditions moved back into a La Nina phase and the drought continued over South Central Texas. Most of the area remained in exceptional drought conditions (Stage D4). Fire danger in South Central Texas was high to very high and burn bans continued for all of the counties. The Texas A&M Agricultural program report indicated ranchers continued to provide heavy supplemental feeding for livestock or began to liquidate herds. There was little or no sign of appreciable forage growth. At the end of the month, the seven day stream flow average remained in the below or much below normal range for basins across South Central Texas and the Rio Grande Plains. Area lakes and reservoirs remained below normal pool elevations with the Edwards Aquifer 21.5 feet below normal and 32.8 feet below the level from one year ago. Many communities across South Central Texas continued with some level of water restrictions.

### October 1, 1996

Drought persisted October through January across the southwestern part of South Central Texas, although heavy rainfall alleviated conditions over much of the Hill Country near the end of the month in October. Brief periods of light rain, sleet, and snow during the month again added some moisture to soils across the area December through January.

## Probability of Future Events

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Based on available records of historic events, there have been 8 extended time periods of drought within a 20 year reporting period, which provides a frequency of occurrence of 1 event probable every year. This lends to a highly likely frequency of occurrence, meaning a drought event is probable in the next year. The City of Boerne is included under the County.

## Vulnerability and Impact

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Loss estimates were based on 20 years of statistical data from the NCDC. 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. Table 7-6 shows annualized exposure.

**Table 7-6. Drought Event Damage Totals, 1996-2016**

JURISDICTION	NUMBER OF EVENTS	PROPERTY DAMAGES (2014 DOLLARS)	CROP DAMAGES (2014 DOLLARS)
Kendall County	8	\$0	\$0

Drought impacts large areas and crosses jurisdictional boundaries. All existing and future buildings, facilities, and populations are exposed to this hazard and could potentially be impacted. However,

## Section 7: Drought

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drought impacts are mostly experienced in water shortages and crop/livestock losses on agricultural lands and typically have no impact on buildings.

In terms of vulnerability, population, agriculture, property, and environment are all vulnerable to drought. The average person will survive only a few days without water, and this timeframe can be drastically shortened for those people with more fragile health – typically children, the elderly, and the ill. The population is also vulnerable to food shortages when drought conditions exist and potable water is in short supply. Potable water is used for drinking, sanitation, patient care, sterilization, equipment, heating and cooling systems, and many other essential functions in medical facilities. While all residents in the Kendall County planning area could be adversely affected by drought conditions, which could limit water supplies and present health threats. During summer drought, or hot and dry conditions, elderly persons, small children, infants and the chronically ill who do not have adequate cooling units in their homes may become more vulnerable to injury and/or death.

Populations over 65 in the Kendall County planning area exceeds 19% of the total population and children under the age of 5 exceed 4% or an estimated total of 8,018<sup>3</sup> potentially vulnerable residents in the planning area based on age.

The following critical facilities would be vulnerable to drought events in the Kendall County planning area:

Kendall County<sup>4</sup>:

- 6 Fire Stations
- 1 EMS Facility
- 5 Schools
- 1 Nursing Homes/Assisted Living Facilities
- 1 Government Facilities
- 1 Wastewater Treatment Facilities
- 1 Electrical Transmission Substation
- 3 Parks
- 1 Animal Control Facility
- 1 Agriculture and Equestrian Center
- 1 Fertilizer Storage Facility

Boerne:

- 1 Fire Stations
- 1 Police Stations
- 1 Sheriff's Department
- 1 Hospital
- 1 EMS Facility
- 11 Schools

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<sup>3</sup> US Census Bureau 2015 data for Kendall County

<sup>4</sup> Kendall County list includes critical facilities located in a census designated place (Comfort) and unincorporated communities including Bergheim, Kendalia, Alamo Springs, Kreutzberg, and Waring where applicable.

## Section 7: Drought

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- 11 Nursing Homes/Assisted Living Facilities
- 6 Government Facilities
- 2 Wastewater Treatment Facilities
- 4 Electrical Transmission Substation
- 1 Animal Control Facility

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 a number of years, the direct and indirect economic impact can be significant.

Habitat damage is a vulnerability of the environment during periods of drought, for both aquatic and terrestrial species. The environment also becomes vulnerable during periods of extreme or prolonged drought due to severe erosion and land degradation.

Impact of droughts experienced in the Kendall County planning area has resulted in no injuries and fatalities supporting a limited severity of impact meaning injuries and/or illnesses are treatable with first aid, shutdown of facilities and services for 24 hours or less, and less than 10% of property is destroyed or with major damage. Annualized loss over the 20-year reporting period in Kendall County is \$0 annually.

### 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: the 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. Table 7-7 lists the drought impacts to Kendall County from 2005 to 2015, based on reports received by the Drought Impact Reporter.

**Table 7-7. Drought Impacts, 2005-2015**

DROUGHT IMPACTS 2005-2015	
Agriculture	32
Business & Industry	5
Energy	2
Fire	22
Plants & Wildlife	23
Relief, Response & Restrictions	28
Society & Public Health	4
Tourism & Recreation	3
Water Supply & Quality	36

Drought has the potential to impact people in the Kendall County planning area. 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

## Section 7: Drought

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water shortages could result in inadequate supply for human needs. Drought also is frequently associated with a variety of impacts, including:

- Recreational activities that rely on water may be curtailed, such as hunting and fishing at Boerne Lake, resulting in fewer tourists and lower revenue.
- 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).
- Jurisdictions and residents may disagree 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.
- 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.
- 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.
- Dry and dead vegetation will increase the risk of wildfire.
- Land subsidence threat increases as groundwater is depleted.
- Recreational activities that rely on water may be curtailed, such as boating, canoeing or fishing at Kreutzberg Canyon, Jousha Springs Park, or James Kiel Park, resulting in fewer tourists and lower revenue.
- 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.

## Section 7: Drought

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



# Section 8: Extreme Heat

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## Hazard Description

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Extreme heat is the condition whereby temperatures hover ten degrees or more above the average high temperature in a region for an extended period. Extreme heat during the summer months is a common occurrence throughout the State of Texas, including Kendall County. Severe excessive summer heat is characterized by a combination of exceptionally high temperatures and humidity. When these conditions persist over a period of time, it is defined as a heat wave. The Kendall County planning area typically experiences extended heat waves.



Although heat can damage buildings and facilities, it presents a more significant threat to safety and welfare of citizens and animals. The major human risks associated with severe summer heat include: heat cramps, sunburn, dehydration, fatigue, heat exhaustion, and 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.

## Location

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Though no deaths from extreme heat have been recorded in Kendall County, there have been heat related deaths reported in neighboring counties including Bexar, Bandera, Blanco and Kerr County. There is no specific geographic scope to the extreme heat hazard. Extreme heat could occur in any area of Kendall County, including the City of Boerne.

## Extent

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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. The Heat Index measures how hot it feels outside when humidity is combined with high temperatures.

**Figure 8-1. Extent Scale for Extreme Summer Heat<sup>1</sup>**

Temperatures (°F)		Temperatures (°F)		Temperatures (°F)		Temperatures (°F)	
40	80 - 88: CAUTION	40	90 - 96: EXTREME CAUTION	40	98 - 106: DANGER	40	108 - 110: EXTREME DANGER
45	80 - 88: CAUTION	45	90 - 94: EXTREME CAUTION	45	96 - 104: DANGER	45	106 - 110: EXTREME DANGER
50	80 - 86: CAUTION	50	88 - 94: EXTREME CAUTION	50	96 - 102: DANGER	50	104 - 110: EXTREME DANGER
55	80 - 86: CAUTION	55	88 - 92: EXTREME CAUTION	55	94 - 100: DANGER	55	102 - 110: EXTREME DANGER
60	80 - 84: CAUTION	60	86 - 90: EXTREME CAUTION	60	92 - 98: DANGER	60	100 - 110: EXTREME DANGER
65	80 - 84: CAUTION	65	86 - 90: EXTREME CAUTION	65	92 - 96: DANGER	65	98 - 110: EXTREME DANGER
70	80 - 84: CAUTION	70	86 - 88: EXTREME CAUTION	70	90 - 94: DANGER	70	96 - 110: EXTREME DANGER
75	80 - 82: CAUTION	75	84 - 88: EXTREME CAUTION	75	90 - 94: DANGER	75	96 - 110: EXTREME DANGER
80	80 - 82: CAUTION	80	84 - 86: EXTREME CAUTION	80	88 - 92: DANGER	80	94 - 110: EXTREME DANGER
85	80 - 82: CAUTION	85	84 - 86: EXTREME CAUTION	85	88 - 90: DANGER	85	92 - 110: EXTREME DANGER
90	80: CAUTION	90	82 - 84: EXTREME CAUTION	90	86 - 90: DANGER	90	92 - 110: EXTREME DANGER
95	80: CAUTION	95	82 - 84: EXTREME CAUTION	95	86 - 88: DANGER	95	90 - 110: EXTREME DANGER
100	80: CAUTION	100	82 - 84: EXTREME CAUTION	100	86 - 88: DANGER	100	90 - 110: EXTREME DANGER

### Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

The Extent Scale in Figure 8-1 displays varying degrees of caution depending on the relative humidity combined with the temperature. For example, when the temperature is at 90 degrees Fahrenheit (°F) or lower and the humidity level is at or above 40 percent, caution should be exercised.

The shaded zones on the chart indicate varying symptoms or disorders that could occur depending on the magnitude or intensity of the event. “Caution” is the first category of intensity and it indicates when fatigue due to heat exposure is possible. “Extreme Caution” indicates that sunstroke, muscle cramps or heat exhaustion are possible, and a “Danger” level means that these symptoms are likely. “Extreme Danger” indicates that heat stroke is likely. The National Weather Service (NWS) initiates alerts based on the Heat Index as shown in Table 8-1.

<sup>1</sup> Source: NOAA

## Section 8: Extreme Heat

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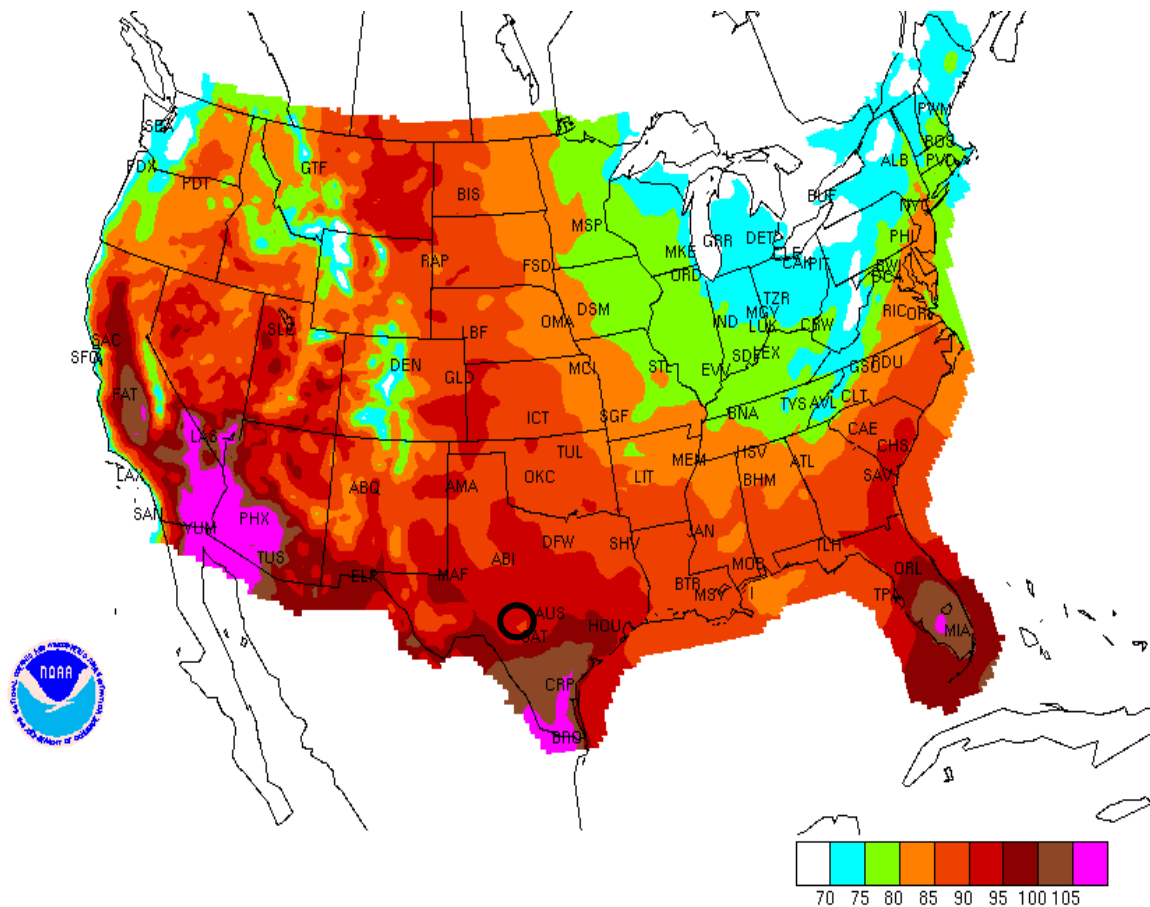
**Table 8-1. Heat Index & Warnings**

CATEGORY	HEAT INDEX	POSSIBLE HEAT DISORDERS	WARNING TYPE
Extreme Danger	125°F and higher	Heat stroke or sun stroke likely.	A heat advisory will be issued to warn that the Heat Index may exceed 105°F.
Danger	103 – 124°F	Sunstroke, muscle cramps, and/or heat exhaustion are likely. Heatstroke possible with prolonged exposure and/or physical activity.	
Extreme Caution	90 – 103°F	Sunstroke, muscle cramps, and/or heat exhaustion 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.
Caution	80 – 90°F	Fatigue is possible with prolonged exposure and/or physical activity.	

The Kendall County planning area is comprised of gently rolling terrain and is located in South Central Texas on the southern edge of the Edwards Plateau and northwest of the Gulf Coastal Plains. Soils are black-land clay and silt loam on the Plains and thin limestone soils on the Edwards Plateau. The area's gently rolling terrain is dotted with oak trees, mesquite, and cacti. Due to its geography, and its warm, muggy semitropical climate with hot summers, Kendall County 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. Also at risk are those working or remaining outdoors.

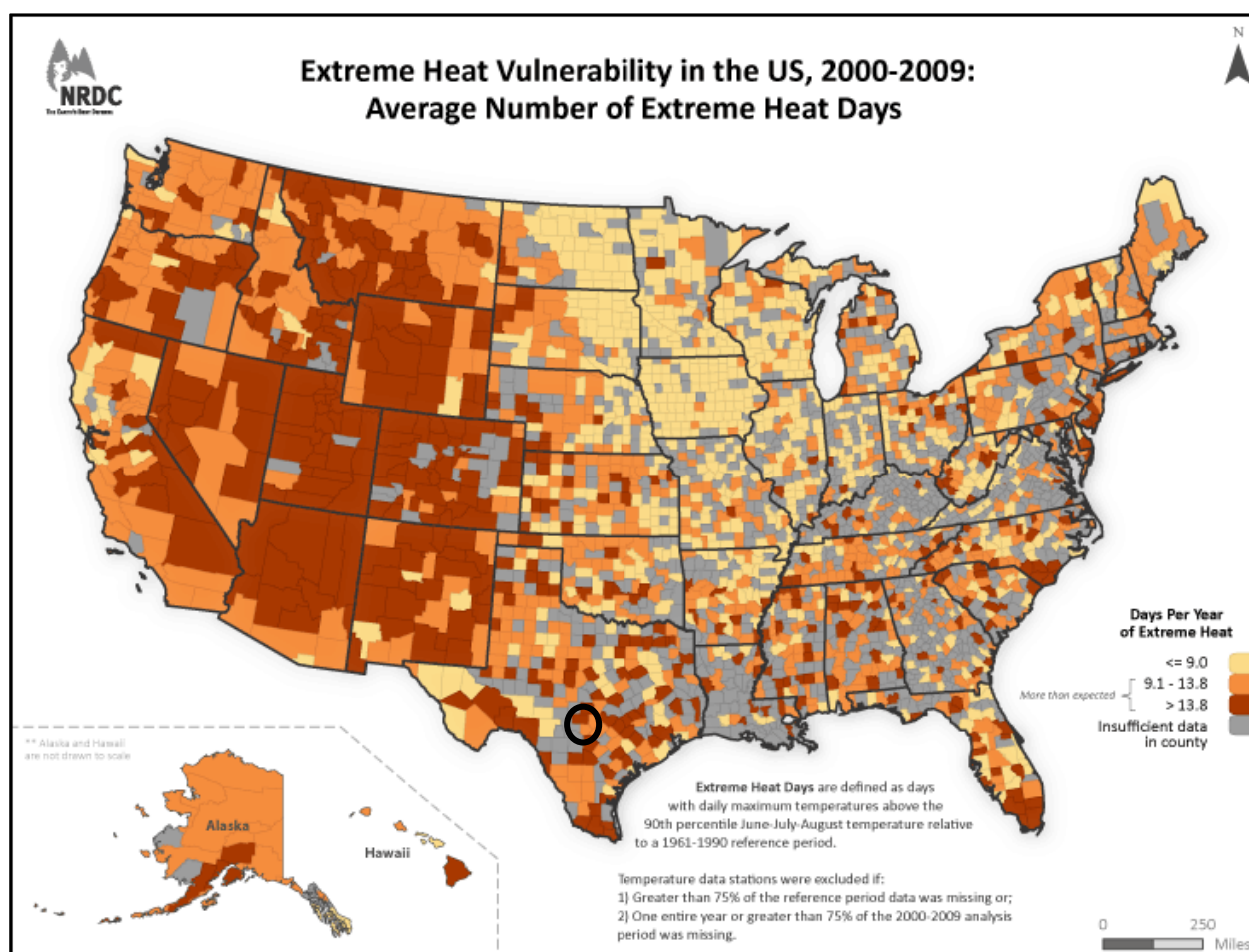
According to the daily maximum Heat Index, as derived from NOAA and based on data compiled from 1849 to 2015, the Kendall County planning area has an average daily maximum Heat Index of 85-95°F as shown on Figure 8-2. Since Kendall County's average daily maximum Heat Index falls into the "Danger" category, the City should mitigate for sunstroke, muscle cramps, and heat exhaustion. Figure 8-3 displays the average number of extreme heat days per year according to the Natural Resources Defense Council. The Kendall County planning area can expect on average between 9 and 13 days per year of extreme heat.

Figure 8-2. Average Daily Maximum Heat Index Days<sup>2</sup>



<sup>2</sup> Source: NRDC and the black circle indicates the Kendall County planning area.

**Figure 8-3. Average Number of Extreme Heat Days<sup>3</sup>**



## Historical Occurrences

Every summer, the hazard of heat-related illness becomes a significant public health issue throughout much of the U.S. Mortality from all causes increases during heat waves, and excessive heat is an important contributing factor to deaths from other causes, particularly among the elderly. Data from the Texas Department of State Health Services (TDSHS) suggest that between 2003 and 2008, record high summer temperatures in Texas resulted in 439 heat-related deaths statewide. While Kendall County did not experience any heat related deaths during this period, neighboring Bexar County comprised nine of these deaths between 2000 and 2009. The NCDC database does not include any reports of heat related deaths in Kendall County since 1950.

Table 8-2 depicts historical occurrences of mortality from heat from 1994 to 2004 from the Texas Department of State Health Services, and 2005 to 2016 from the NCDC database.

<sup>3</sup> Source: NRDC and the black circle indicates Kendall County.

**Table 8-2. Extreme Heat Related Deaths in Texas**

YEAR	DEATHS
1994	1
1995	12
1996	10
1997	2
1998	66
1999	22
2000	71
2001	20
2002	1
2003	0
2004	3
2005	49
2006	2
2007	2
2008	7
2009	6
2010	4
2011	20
2012	2
2013	1
2014	0
2015	3

Because the Texas Department of State Health Services reports on total events statewide, previous occurrences for extreme heat are derived from the NCDC database. According to heat related incidents located solely within Kendall County, there are no heat waves on record for the planning area. However, the average maximum daily heat coupled with the average number of extreme heat days per year for the planning area indicates an extreme heat event is typically experience in the planning area every year.



## Section 8: Extreme Heat

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### Significant Past Events

#### July 2, 2009

A prolonged heat wave from the end of June through early July brought record temperatures and heat advisories to South Central Texas. 82 year old twins died in their home in San Antonio, approximately 15-20 miles from the planning area. The cause of death was heat stroke according to the medical examiner. The twins did not want to use a fan or air conditioning, stating that they were on a fixed income and were trying to save money. High temperatures were at or near 100°F in the planning area that day and previous days as well.

### Probability of Future Events

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According to historical NOAA records and local input from the planning team, Kendall County, including the City of Boerne, experiences an extreme heat event every year. Hence, the likelihood or future probability of excessive summer heat in the Kendall County planning area is highly likely.

### Vulnerability and Impact

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There is no defined geographic boundary for extreme heat events. While all of the planning area is exposed to extreme temperatures, existing and future buildings, infrastructure and critical facilities are not considered vulnerable to significant damage caused by extreme heat events. Therefore, estimated property losses associated with extreme heat are anticipated to be minimal across the planning area.

Although heat can cause minimal damage to buildings and facilities, it presents a more significant threat to individual safety and welfare. The major human risks associated with severe summer heat include: heat cramps, sunburn, dehydration, fatigue, heat exhaustion, and heat stroke. The most sensitive population segment to extreme heat includes the elderly or the infirmed that live within the Kendall County planning area and cannot afford to run air conditioning.

Populations over 65 in the Kendall County planning area exceeds 19% of the total population and children under the age of 5 exceed 4% or an estimated total of 8,018<sup>4</sup> potentially vulnerable residents in the planning area based on age.

Area mobile home housing may not be equipped to cool residents. Thus, these individuals may need a place to go during the hottest daytime hours. Students in the Independent School Districts are also susceptible as sporting events and practices are often held outside during early fall or late spring when temperatures are at the highest. Another segment of the population at risk are those whose jobs consist of strenuous labor outdoors. Additionally, Livestock and crops can become stressed, decreasing in quality or in production, during times of extreme heat.

Extreme 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.

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<sup>4</sup> US Census Bureau 2015 data for Kendall County

## Section 8: Extreme Heat

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Typically more than 12 hours of warning time would be given before the onset of an extreme heat event. Only minor property damage would result. The potential impact of excessive summer heat is considered “Minor” as injuries and/or illnesses do not result in permanent disability.

In terms of vulnerability to structures, the impact from extreme heat would be 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. Less than ten percent of residential and commercial property could be damaged if extreme heat events lead to structure fires.

The following critical facilities would be vulnerable to extreme heat events in the Kendall County planning area:

Kendall County<sup>5</sup>:

- 6 Fire Stations
- 1 EMS Facility
- 5 Schools
- 1 Nursing Homes/Assisted Living Facilities
- 1 Government Facilities
- 1 Wastewater Treatment Facilities
- 1 Electrical Transmission Substation
- 3 Parks
- 1 Animal Control Facility
- 1 Agriculture and Equestrian Center
- 1 Fertilizer Storage Facility

Boerne:

- 1 Fire Station
- 1 Police Station
- 1 Sheriff’s Department
- 1 Hospital
- 1 EMS Facility
- 11 Schools
- 11 Nursing Homes/Assisted Living Facilities
- 6 Government Facilities
- 2 Wastewater Treatment Facilities
- 4 Electrical Transmission Substation
- 1 Animal Control Facility

The potential impact of extreme heat for the Kendall County planning area can be considered “Minor,” resulting in few injuries and minimal disruption to the quality of life. Based on historical records over a 22-year period, annualized losses for the Kendall County planning area are negligible.

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<sup>5</sup> Kendall County list includes critical facilities located in a census designated place (Comfort) and unincorporated communities including Bergheim, Kendalia, Alamo Springs, Kreutzberg, and Waring where applicable.

## Section 8: Extreme Heat

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### Assessment of Impacts

The greatest risk from extreme heat is to public health and safety. Potential impacts the community may include:

- Recreational activities that rely on water may be curtailed, such as boating, canoeing or fishing at Kreutzberg Canyon, Jousha Springs Park, James Kiel Park, or Boerne Lake, resulting in fewer tourists and lower revenue.
- Vulnerable populations, particularly the elderly and infants, 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.
- Vehicles 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.
- Food suppliers can anticipate an increase in food costs due to increases in production costs and crop and livestock losses.
- Fisheries may be negatively impacted by extreme heat, suffering damage to fish habitats (either natural or man-made) and a loss of fish and/or other aquatic organisms due to decreased water flows or availability.
- Negatively impacted water suppliers may face increased costs resulting from the transport water or develop supplemental water resources.
- 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 jurisdiction, local businesses and citizens will impact the overall economic and financial conditions before, during, and after an extreme heat event.

# Section 9: Thunderstorm Wind

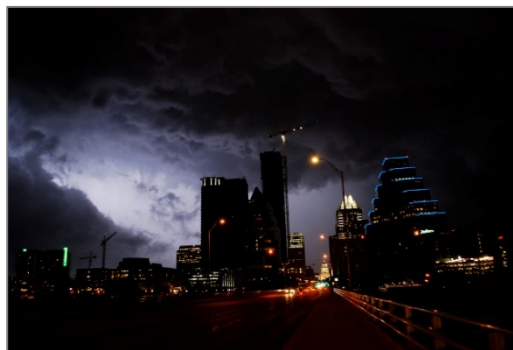
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## Hazard Description

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Thunderstorms create extreme wind events which include 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 the high toward the 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 is accelerated.



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.

Straight line winds can have gusts of 100 mph or more, and are often accompanied by hail or rain. Unlike tornadoes, windstorms have a broader path that is several miles wide and can cover several counties. Straight line wind may down trees and power lines, overturn mobile homes, and cause damage to well-built structures.

## Location

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Thunderstorm winds are generally considered a common occurrence in the Kendall County planning area. Thunderstorm winds occur randomly, and therefore it is impossible to predict where they will strike within Kendall County. Thus, it is assumed that the Kendall County planning area is uniformly exposed to the threat of thunderstorm winds.

## Section 9: Thunderstorm Wind

### Extent

The extent or magnitude of a thunderstorm wind event is measured by the Beaufort Wind Scale. Table 9-1 describes the different intensities of wind in terms of speed and effects, from calm to violent and destructive.

**Table 9-1. Beaufort Wind Scale<sup>1</sup>**

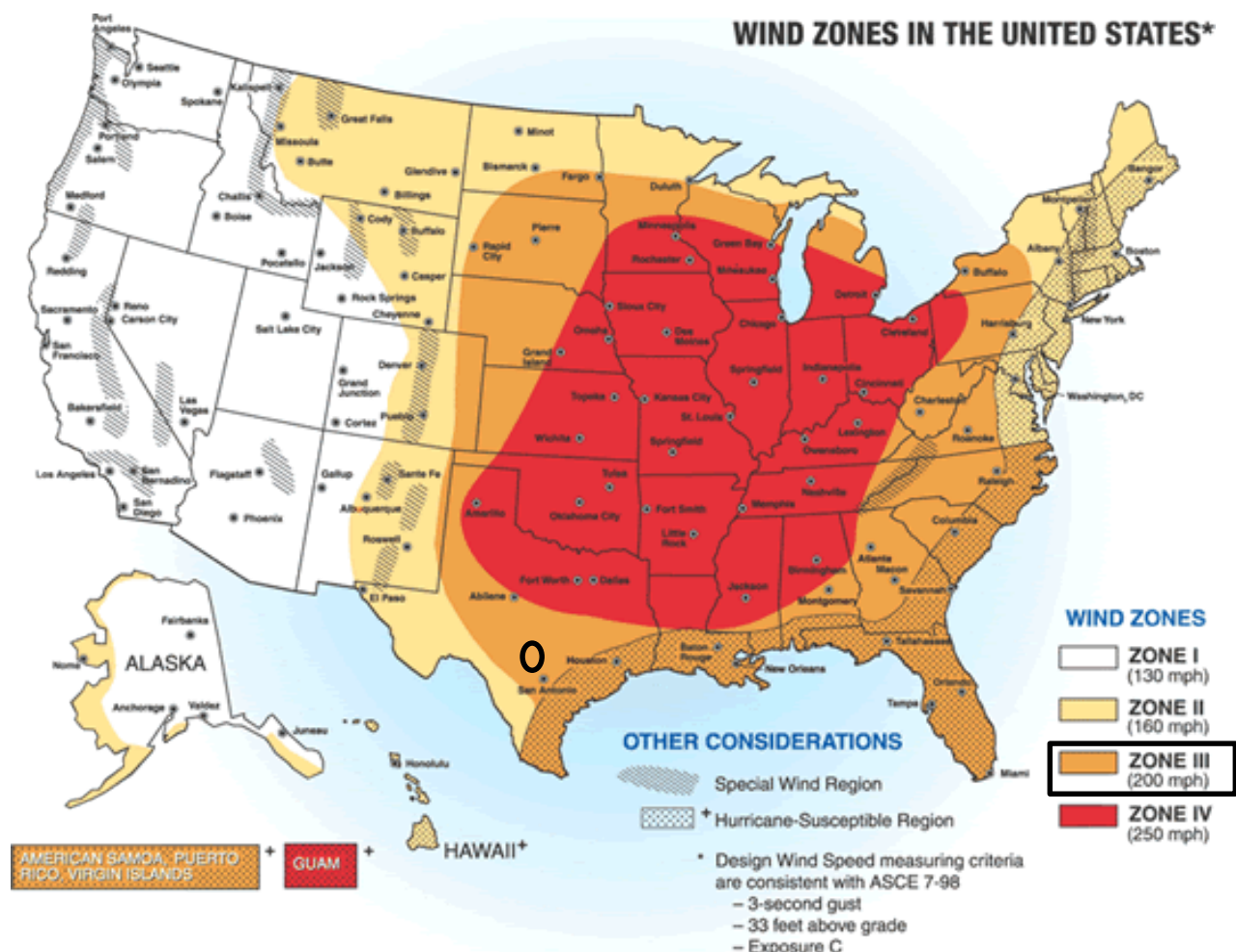
FORCE	WIND (KNOTS)	WMO CLASSIFICATION	APPEARANCE OF WIND EFFECTS
0	Less than 1	Calm	Calm, smoke rises vertically
1	1-3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4-7	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	8-12	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	13-18	Moderate Breeze	Dust, leaves and loose paper lifted, small tree branches move
5	19-24	Fresh Breeze	Small trees in leaf begin to sway
6	25-31	Strong Breeze	Larger tree branches moving, whistling in wires
7	32-38	Near Gale	Whole trees moving, resistance felt walking against wind
8	39-46	Gale	Whole trees in motion, resistance felt walking against wind
9	47-54	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	55-63	Storm	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	64-72	Violent Storm	If experienced on land, widespread damage
12	73+	Hurricane	Violence and destruction

Figure 9-1 displays the wind zones as derived from NOAA.

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<sup>1</sup> Source: World Meteorological Organization

Figure 9-1. Wind Zones in the United States<sup>2</sup>



On average, the planning area experiences thunderstorm wind event each year, which are not usually accompanied by maximum or extreme wind speeds. The County is located within the Zone III, meaning they can experience winds up to 200 mph. Kendall County 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 73 knots. Therefore, the planning area on average could experience a range of wind speeds with significant destruction.

## Historical Occurrences

Tables 9-2, 9-3 and 9-4 depict historical occurrences of thunderstorm wind events for the Kendall County planning area according to the National Climatic Data Center (NCDC) data. Since January 1955, 29 severe thunderstorm wind events are known to have impacted Kendall County, based upon NCDC records. Table 9-3 presents information on known historical events impacting the Kendall

<sup>2</sup> Kendall County is indicated by the circle.



## Section 9: Thunderstorm Wind

County planning area, with resulting damages. It is important to note that high wind events associated with other hazards, such as tornadoes, are not accounted for in this section.

The NCDC is a national data source organized under the National Oceanic and Atmospheric Administration. The NCDC is the largest archive available for climate data; however, it is important to note that the only incidents recorded are those that are reported to the NCDC that have been factored into this risk assessment. In the tables that follow throughout this section, some occurrences seem to appear multiple times in one table. This is due to reports from various locations throughout the County. In addition, property damage estimates are not always available. When available, estimates are provided. Where an estimate has been provided in a table for losses, the dollar amounts have been altered to indicate the damage in 2016 dollars.

**Table 9-2. Historical Thunderstorm Wind Events, With Reported Damages, 1955-2016**

MAXIMUM WIND SPEED RECORDED (KNOTS)	NUMBER OF REPORTED EVENTS
0-30	0
31-40	1
41-50	4
51-60	6
61-70	1
71-80	1
81-90	0
91-100	0
Unknown	16

**Table 9-3. Historical Thunderstorm Wind Events, 1955-2016<sup>3</sup>**

JURISDICTION	DATE	TIME	MAGNITUDE (knots)	INJURIES	DEATHS	PROPERTY DAMAGE (2016 DOLLARS)	CROP DAMAGE (2016 DOLLARS)
Boerne	10/12/1993	10:30 PM	0	0	0	\$8,205	\$0
Boerne	6/23/1994	6:30 PM	0	0	0	\$8,000	\$80
Kendall County	9/3/1997	6:10 PM	0	0	0	\$44,320	\$0
Kendall County	9/3/1997	6:30 PM	0	0	0	\$44,320	\$0

<sup>3</sup> Only recorded events with fatalities, injuries or damages are listed. Magnitude is listed when available. Damage values are in 2016 dollars.

## Section 9: Thunderstorm Wind

JURISDICTION	DATE	TIME	MAGNITUDE (knots)	INJURIES	DEATHS	PROPERTY DAMAGE (2016 DOLLARS)	CROP DAMAGE (2016 DOLLARS)
Kendall County	3/27/1999	8:30 PM	0	0	0	\$21,349	\$0
Boerne	5/20/2001	11:45 PM	0	0	0	\$66,943	\$0
Kendall County	10/12/2001	9:45 PM	0	0	0	\$133,885	\$0
Boerne	5/28/2002	12:30 AM	0	0	0	\$65,901	\$0
Kendall County	3/25/2003	6:30 PM	75	0	0	\$103,092	\$0
Boerne	6/3/2003	1:00 PM	55	0	0	\$12,887	\$0
Boerne	6/4/2003	12:15 AM	60	0	0	\$64,432	\$0
Boerne	6/15/2003	1:30 AM	55	0	0	\$128,865	\$0
Kendall County	7/23/2003	1:45 PM	60	1	0	\$64,432	\$0
Kendall County	7/30/2009	2:20 PM	39	0	0	\$22,104	\$0
Kendall County	6/2/2010	6:55 PM	43	0	0	\$2,175	\$0
Kendall County	9/27/2011	5:35 PM	52	0	0	\$21,028	\$0

Only thunderstorm wind events that have been reported have been factored into this Risk Assessment. It is likely that additional thunderstorm wind occurrences have gone unreported before and during the recording period. Table 9-4 shows the summary of losses based on historical incident information for the planning area which resulted in death, injury, property, or crop damage.

**Table 9-4. Summary of Historical Thunderstorm Wind Events, 1955-2016**

JURISDICTION	NUMBER OF EVENTS	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	17	75 knots	0	1	\$456,705	\$0
Boerne	12	60 knots	0	0	\$355,233	\$80
<b>TOTAL LOSSES</b>		<b>(Max Extent)</b>	<b>0</b>	<b>1</b>	<b>\$812,018</b>	

### Significant Past Events

#### September 3, 1997 – Kendall County

Severe thunderstorm winds blew down trees over much of Comal and Kendall Counties, and damaged roofs in the Sisterdale area of Kendall County. Severe winds damaged roofs and the sides off several barns west of Bastrop. They also damaged a garage roof and blew a shed over 100 feet near Maxwell.

## Section 9: Thunderstorm Wind

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### **May 20, 2001 – Boerne**

Severe storms struck the City of Boerne the evening of May 20, 2001. Severe thunderstorm winds damaged the roofs of homes, and windows in homes and cars. The winds also blew down trees and light poles.

### **July 23, 2003 – Kendall County**

The east-west oriented line of thunderstorms associated with the cold front continued to move southward through Blanco County. As it moved into the southern part of the county, it produced a downburst between Waring and Sisterdale that knocked over many trees. One person was injured when struck by debris.

## Probability of Future Events

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Most thunderstorm winds occur during the spring, in the months of March, April and May, and in the fall, during the month of September. Even though the intensity of thunderstorm winds is not always damaging for the entire planning area, the frequency of occurrence for a thunderstorm wind event is highly likely, meaning that on event is probable every year.

## Vulnerability and Impact

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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 this event, all existing and future structures, and facilities in the Kendall County planning area could potentially be impacted and remain vulnerable to possible injury and/or property loss from thunderstorm winds.

The following critical facilities would be vulnerable to thunderstorm wind events in the Kendall County planning area:

Kendall County<sup>4</sup>:

- 6 Fire Stations
- 1 EMS Facility
- 5 Schools
- 1 Nursing Homes/Assisted Living Facilities
- 1 Government Facilities
- 1 Wastewater Treatment Facilities
- 1 Electrical Transmission Substation
- 3 Parks
- 1 Animal Control Facility
- 1 Agriculture and Equestrian Center
- 1 Fertilizer Storage Facility

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<sup>4</sup> Kendall County list includes critical facilities located in a census designated place (Comfort) and unincorporated communities including Bergheim, Kendalia, Alamo Springs, Kreutzberg, and Waring where applicable.

## Section 9: Thunderstorm Wind

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### Boerne:

- 1 Fire Stations
- 1 Police Stations
- 1 Hospital
- 1 EMS Facility
- 11 Schools
- 11 Nursing Homes/Assisted Living Facilities
- 6 Government Facilities
- 2 Wastewater Treatment Facilities
- 4 Electrical Transmission Substation
- 1 Animal Control Facility

Trees, power lines and poles, signage, manufactured housing, radio towers, concrete block walls, storage barns, windows, garbage receptacles, 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 have been reported to have been blown around by wind and, very commonly, debris from damaged structures in turn have caused damage to other buildings not directly impacted by the event. In numerous instances roofs have been reported as having been torn off of buildings. According to the US Census Bureau, 19.6% (approximately 2,846 structures) of the residential structures in the Kendall County planning area were built before 1980.<sup>5</sup> These structures would typically be built to lower or less stringent construction standards than newer construction and may be more susceptible to damages during significant thunderstorm wind events. In addition, the US Census data indicates that the planning area has approximately 1,192 manufactured homes, which would also be more vulnerable to thunderstorm wind events.

Impact of thunderstorm wind events experienced in the Kendall County planning area would be “Limited,” meaning injuries and illnesses can be treated with first aid, shutdown of facilities and services will be for 24 hours or less, and less than ten percent of property is destroyed or with major damage. Overall, the average loss estimate (in 2016 dollars) is \$812,018, having an approximate annual loss estimate of \$13,312.

### 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. Impacts to the planning area can include:

- Boerne Lake is a large recreational lake that attracts fishing and boating activities throughout the year. Thunderstorm winds could impact recreational water activities, placing boaters and campers in imminent danger, potentially requiring emergency services or lake evacuation. The boat docks at Boerne Lake shoreline could also sustain damage.
- 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.

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<sup>5</sup> Source: US Census Bureau data estimates for 2014.

## Section 9: Thunderstorm Wind

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- 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.
- During exceptionally heavy wind events, first responders may be prevented from responding to calls, as the winds may reach a speed in which their vehicles and equipment are unsafe to operate.
- 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.
- First responders are exposed to downed power lines, unstable and unusual debris, hazardous materials, and generally unsafe conditions.
- Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications.
- Critical staff may be unable to report for duty, limiting response capabilities.
- City or county departments may be damaged, delaying response and recovery efforts for the entire community.
- 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 built to less stringent building codes may suffer greater damage as they are typically more vulnerable to thunderstorm winds.
- Large scale wind events can have significant economic impact on the affected area, as it must now fund expenses such as infrastructure repair and restoration, temporary services and facilities, overtime pay for responders, as well as normal day-to-day operating expenses.
- Businesses that are more reliant on utility infrastructure than others may suffer greater damages without a backup power source.
- Recreational areas and parks may be damaged or inaccessible due to downed trees or debris, causing temporary impacts to area businesses.

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.

# Section 10: Tornado

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## 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, with wind speeds of 250 miles per hour or more. In extreme cases, winds may approach 300 miles per hour. Damage paths can be in excess of one mile wide and 50 miles long.

The most powerful tornadoes are produced by “Supercell Thunderstorms.” Supercell 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 10-1. Tornado Variations**

WEAK TORNADOES	STRONG TORNADOES	VIOLENT TORNADOES
<ul style="list-style-type: none"><li>• 69% of all tornadoes</li><li>• Less than 5% of tornado deaths</li><li>• Lifetime 1-10+ minutes</li><li>• Winds less than 110 mph</li></ul>	<ul style="list-style-type: none"><li>• 29% of all tornadoes</li><li>• Nearly 30% of all tornado deaths</li><li>• May last 20 minutes or longer</li><li>• Winds 110 – 205 mph</li></ul>	<ul style="list-style-type: none"><li>• 2% of all tornadoes</li><li>• 70% of all tornado deaths</li><li>• Lifetime can exceed one hour</li><li>• Winds greater than 205 mph</li></ul>

## Location

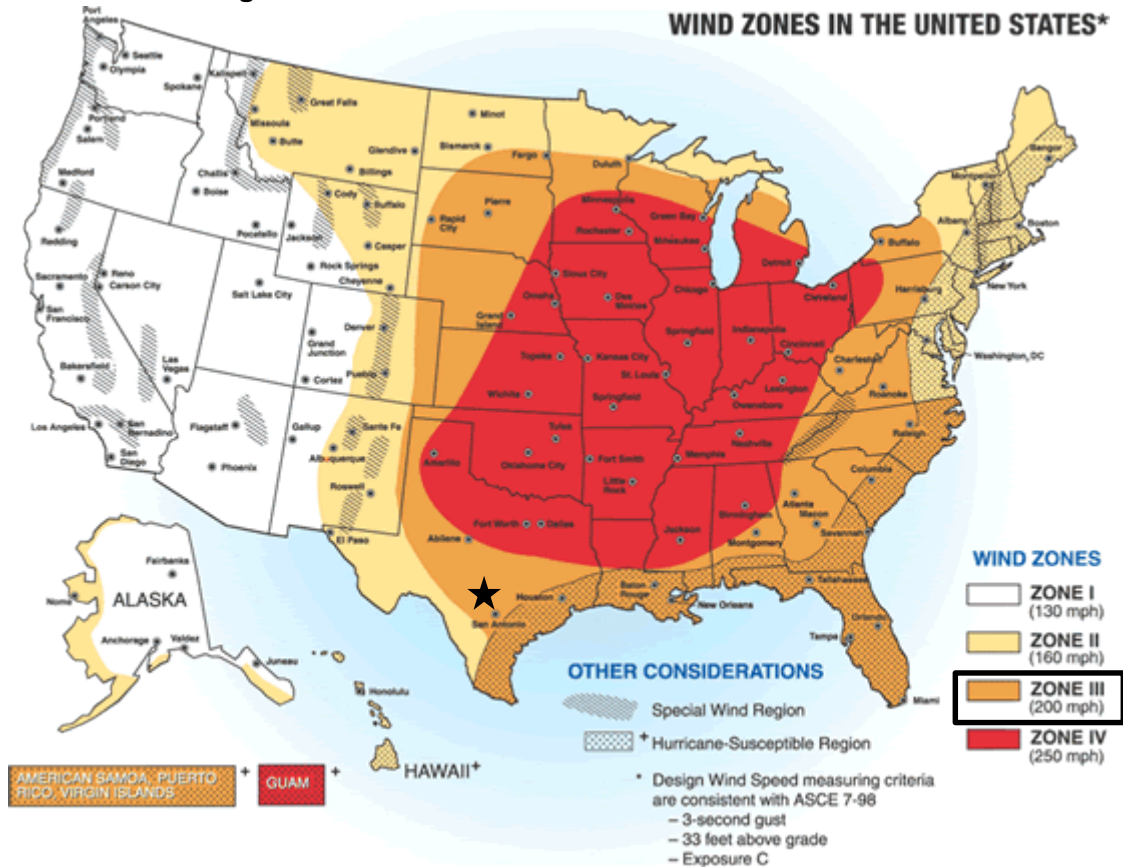
As with thunderstorms, tornadoes do not have any specific geographic boundary and can occur throughout Kendall County uniformly. It is assumed that the Kendall County planning area is uniformly



## Section 10: Tornado

exposed to tornado activity. The Kendall County planning area is located in Wind Zone III (Figure 10-1), where tornado winds can be as high as 200 mph.

**Figure 10-1. FEMA Wind Zones in the United States<sup>1</sup>**



### 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 2005 were determined using the traditional version of the Fujita Scale (Table 10-2). Since February 2007, the Fujita Scale has been replaced by the Enhanced Fujita Scale (EFS) (Table 10-3), which 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.

<sup>1</sup> The Kendall County is indicated by the star.

## Section 10: Tornado







**Table 10-2. The Fujita Tornado Scale<sup>2</sup>**

F-SCALE NUMBER	INTENSITY	WIND SPEED (MPH)	TYPE OF DAMAGE DONE	PERCENT OF APPRAISED STRUCTURE VALUE LOST DUE TO DAMAGE
F0	Gale Tornado	40 – 72	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.	None Estimated
F1	Moderate Tornado	73 – 112	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads; attached garages may be destroyed.	0% – 20%
F2	Significant Tornado	113 – 157	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.	50% – 100%
F3	Severe Tornado	158 – 206	Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.	100%
F4	Devastating Tornado	207 – 260	Well-constructed homes leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.	100%
F5	Incredible Tornado	261 – 318	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles flying through the air in excess of 330 yards; trees debarked; steel reinforced concrete badly damaged.	100%

<sup>2</sup> Source: <http://www.tornadoproject.com/fscale/fscale.htm>

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**Table 10-3. Enhanced Fujita Scale for Tornadoes**

STORM CATEGORY	DAMAGE LEVEL	3 SECOND GUST (MPH)	DESCRIPTION OF DAMAGES	PHOTO EXAMPLE
EF0	Gale	65 – 85	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.	
EF1	Weak	86 – 110	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads; attached garages may be destroyed.	
EF2	Strong	111 – 135	Considerable damage; roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.	
EF3	Severe	136 – 165	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.	
EF4	Devastating	166 – 200	Well-constructed homes leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.	
EF5	Incredible	200+	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles flying through the air in excess of 330 yards; trees debarked; steel reinforced concrete badly damaged.	

Both the Fujita Scale and Enhanced Fujita Scale should be referenced in reviewing previous occurrences since tornado events prior to 2007 will follow the original Fujita Scale. The largest magnitude reported within the planning area is EF3 on the Fujita Scale, a “Severe Tornado.” Based on the planning areas location in wind zone III, the planning area could experience anywhere from an EF0 to an EF3 depending on the wind speed.

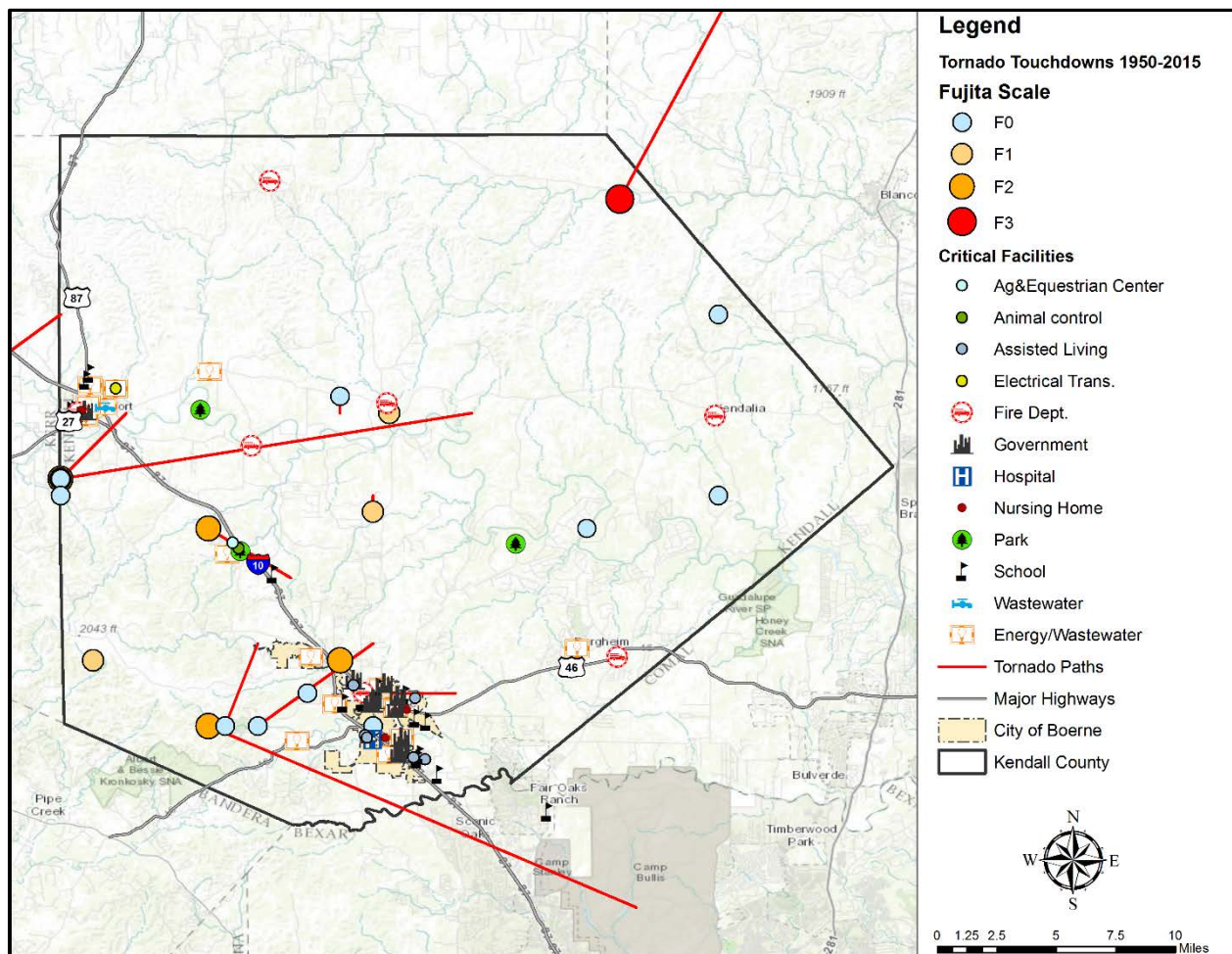
The events in Kendall County have been between EF0 to an EF3 (Table10-4). Therefore, the range of intensity that the Kendall County planning area would be expected to mitigate is a tornado event that would be a low to severe risk, an EF0 to EF3.

### Historical Occurrences

Only reported tornadoes were factored into the Risk Assessment. It is likely that a high number of occurrences have gone unreported over the past 66 years.

Figure 10-2 and 10-3 identifies the locations of previous occurrences in Kendall County, and the City of Boerne, respectively, from 1950 to 2016. A total of 20 events have been recorded by the Storm Prediction Center (NOAA) and NCDC databases for the Kendall County planning area including; one event categorized as a “Severe Tornado” (F3), four events categorized as “Significant Tornadoes” (F2), five events as “Moderate Tornadoes” (F1), and ten events as “Gale Tornadoes” (F0).

**Figure 10-2. Spatial Historical Tornado Events, Kendall County, 1950-2016<sup>3</sup>**

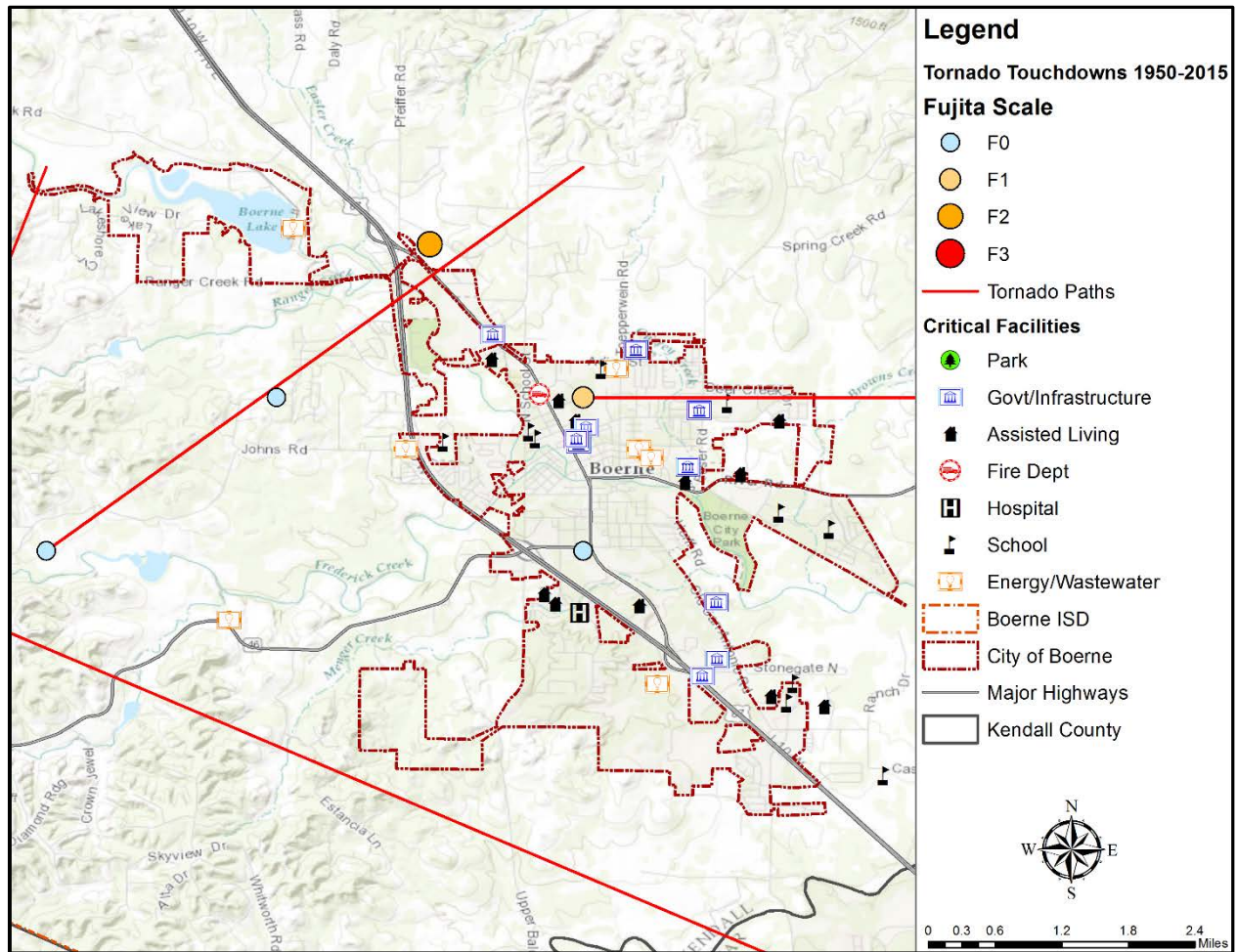


<sup>3</sup> Source: NOAA Records



## Section 10: Tornado

**Figure 10-3. Spatial Historical Tornado Events, City of Boerne, 1950-2016**



**Table 10-4. Historical Tornado Events, 1950-2016**

JURISDICTION	DATE	TIME	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE (2016 Dollars)	CROP DAMAGE (2016 Dollars)
Boerne	5/15/1950	12:01 AM	F2	0	0	\$245,966	\$0
Boerne	3/20/1957	7:15 PM	F1	0	0	\$21,095	\$0
Boerne	3/31/1957	7:55 AM	F2	0	0	\$21,095	\$0
Boerne	5/1/1959	11:00 PM	F1	0	0	\$0	\$0
Boerne	4/28/1963	3:00 PM	F0	0	0	\$0	\$0
Kendall County	5/6/1969	12:30 PM	F3	0	0	\$161,520	\$0
Boerne	5/19/1975	5:40 PM	F0	0	0	\$0	\$0

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JURISDICTION	DATE	TIME	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE (2016 Dollars)	CROP DAMAGE (2016 Dollars)
Kendall County	3/30/1976	2:40 AM	F2	0	0	\$10,417,882	\$0
Boerne	3/2/1979	8:55 PM	F1	0	0	\$81,650	\$0
Kendall County	3/4/1983	7:15 AM	F1	0	0	\$59,516	\$0
Kendall County	3/4/1983	7:20 AM	F2	0	1	\$595,158	\$0
Kendall County	3/4/1983	7:35 AM	F0	0	0	\$595	\$0
Kendall County	4/7/1984	3:40 PM	F0	0	0	\$68	\$0
Kendall County	5/27/1997	6:30 PM	F0	0	0	\$0	\$0
Kendall County	3/8/2001	5:15 PM	F0	0	0	\$0	\$0
Boerne	11/15/2001	5:05 AM	F0	0	0	\$13,389	\$0
Boerne	11/15/2001	5:20 AM	F0	0	2	\$133,885	\$0
Kendall County	3/25/2003	6:35 PM	F0	0	0	\$0	\$0
Kendall County	6/1/2005	2:04 AM	F0	0	0	\$0	\$0
Boerne	8/16/2007	4:53 PM	F1	0	0	\$11,436	\$0
<b>Totals</b>				<b>0</b>	<b>3</b>	<b>\$11,763,255</b>	<b>\$0</b>

**Table 10-5. Summary of Historical Tornado Events, 1950-2016**

JURISDICTION	Number of Events	MAGNITUDE	FATALITIES	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	10	F3	0	1	\$11,234,739	\$0
Boerne	10	F2	0	2	\$528,516	\$0
<b>TOTAL LOSSES</b>		<b>(Max Extent)</b>	<b>0</b>	<b>3</b>	<b>\$11,763,255</b>	

### Significant Past Events

#### March 30, 1976 – Kendall County

A tornado touched down just south of the Guadalupe River on the east side of central Kendall County and moved in an easterly direction. The path of the tornado was 15.2 miles long with a maximum width of 200 yards. The damage from the tornado was rated EF2 with maximum winds estimated over 110 mph. The tornado damage exceeded 2.5 million dollars.



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### **March 4, 1983 – Kendall County**

A severe thunderstorm developed in western Kerr County and moved eastward into Kendall County. It produced at least three known tornadoes. The tornado near Comfort moved northeast, crossing highway 473. The path of the tornado was four miles and the maximum width was 100 yards. Multiple trees and fences were damaged. Power lines were downed and several barns and sheds were destroyed. One woman sought shelter in a shed that was destroyed. The woman received numerous cuts and bruises but survived.

### **November 15, 2001 – Boerne**

A large tornado was observed by the Kendall County Sheriff's Department 4 miles west of Boerne along State Highway 46. This tornado moved toward the northeast, causing extensive damage to mobile homes, trees, fences, and roofs. The path of the tornado was 4 miles long with a maximum width of 200 yards. The damage from the tornado was rated F0. No injuries were reported.

## Probability of Future Events

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Tornadic storms 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. According to historical records, the Kendall County planning area experiences a tornado touchdown every three to four years. Hence, the probability of future tornado occurrences affecting the Kendall County planning area is “Likely” and an event may occur within the next three years.

## Vulnerability and Impact

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Because tornadoes often cross jurisdictional boundaries, all existing and future buildings, facilities and populations in Kendall County 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 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 on crawlspaces (more susceptible to lift); and
- Buildings with large spans, such as shopping malls, gymnasiums, and factories.

The following critical facilities would be vulnerable to tornado events in the Kendall County planning area:

Kendall County<sup>4</sup>:

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<sup>4</sup> Kendall County list includes critical facilities located in a census designated place (Comfort) and unincorporated communities including Bergheim, Kendalia, Alamo Springs, Kreutzberg, and Waring where applicable.

## Section 10: Tornado

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- 6 Fire Stations
- 1 EMS Facility
- 5 Schools
- 1 Nursing Homes/Assisted Living Facilities
- 1 Government Facilities
- 1 Wastewater Treatment Facilities
- 1 Electrical Transmission Substation
- 3 Parks
- 1 Animal Control Facility
- 1 Agriculture and Equestrian Center
- 1 Fertilizer Storage Facility

### Boerne:

- 1 Fire Station
- 1 Police Station
- 1 Sheriff's Department
- 1 Hospital
- 1 EMS Facility
- 11 Schools
- 11 Nursing Homes/Assisted Living Facilities
- 6 Government Facilities
- 2 Wastewater Treatment Facilities
- 4 Electrical Transmission Substation
- 1 Animal Control Facility

According to the US Census Bureau, 19.6% (approximately 2,846 structures) of the residential structures in the Kendall County planning area were built before 1980.<sup>5</sup> These structures would typically be built to lower or less stringent construction standards than newer construction and may be more susceptible to damages during significant tornado events. In addition, communities with manufactured housing in the Kendall County planning area would also be vulnerable to tornados. The US Census data indicates approximately 1,192 manufactured homes in the Kendall County planning area.

Utility systems on roofs at school districts and commercial building would be vulnerable and could be damaged by debris and high winds. Tornadoes can possibly cause a significant threat to people as they could be struck by flying debris, falling trees/branches, utility lines, and poles. First responders could also not be able to respond to calls due to blocked roads. Tornadoes commonly cause power outages which could cause health and safety risks to faculty and students at schools, as well as to patients in hospitals.

The average loss estimate of property and crop is \$11,763,255 (in 2016 dollars), having an approximate annual loss estimate of \$178,231. Based on historic loss and damages, the impact of tornado on the Kendall County planning area can be considered "Minor", with more than 10 percent

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<sup>5</sup> Source: US Census Bureau data estimates for 2014.

## Section 10: Tornado

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of property expected to be destroyed, treatable injuries that are not permanently disabling, and critical facilities shut down for one week or more.

### 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. Impacts to the planning area can include:

- 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 may suffer substantial damage as they would be more vulnerable than typical site built 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 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.
- 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, damaged emergency vehicles and equipment.
- City or county departments may be damaged or destroyed, delaying response and recovery efforts for the entire community.
- Private sector entities that the City 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.
- Economic disruption negatively impacts the programs and services provided by the community due to short and long term loss in revenue.
- Damage to infrastructure may slow economic recovery since repairs may be extensive and lengthy.
- Some businesses not directly damaged by the tornado may be negatively impacted while roads and utilities are being restored, 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.

## Section 10: Tornado

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- 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.

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 government, businesses and citizens will contribute to the overall economic and financial conditions in the aftermath of a tornado event.

# Section 11: Hail

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## Hazard Description

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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 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.

## Location

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Hailstorms are not confined to any specific geographic location, and can vary greatly in size, location, intensity and duration. All areas for the Kendall County planning area are considered to be exposed to this hazard equally.

## Extent

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The National Weather Service (NWS) classifies a storm as “severe,” if there is hail three-quarters of an inch in diameter 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 Climatic Data Center (NCDC) Intensity Scale in Table 11-1.

## Section 11: Hail

**Table 11-1. Hail Intensity and Magnitude<sup>1</sup>**

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 11-1 ranges from H0 to H10, with increments of intensity or damage potential in relation to hail size, texture, fall speed, speed of storm translation, and strength of the accompanying wind. Based on available data regarding the previous occurrences for the area, the Kendall County planning area may experience hailstorms ranging from an H0 to an H10. Kendall County and the City of Boerne can mitigate a storm from low risk or hard hail to a severe, super hailstorm with baseball size hail that leads to extensive structural damage and could cause fatal injuries.

### Historical Occurrences

Historical evidence shown in Figures 11-1 and 11-2 show that the planning area is vulnerable to hail events overall, which typically result from severe thunderstorm activity. A total of 88 reported historical hail events impacted the Kendall County planning area between 1950 and 2016 (Table 11-2). These events were reported to NCDC and NOAA databases, and may not represent all hail events to have

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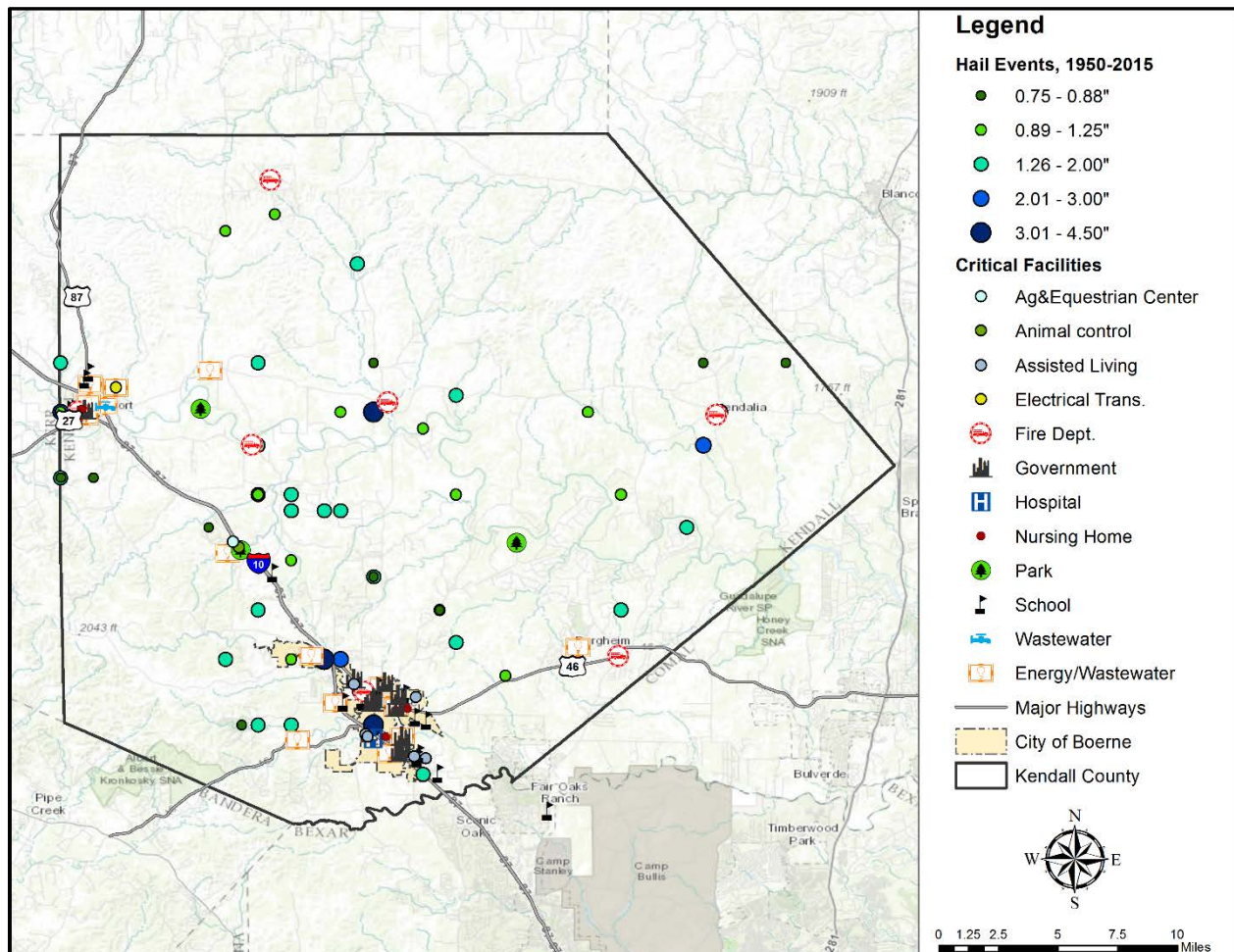
<sup>1</sup> NCDC Intensity Scale, based on the TORRO Hailstorm Intensity Scale.



## Section 11: Hail

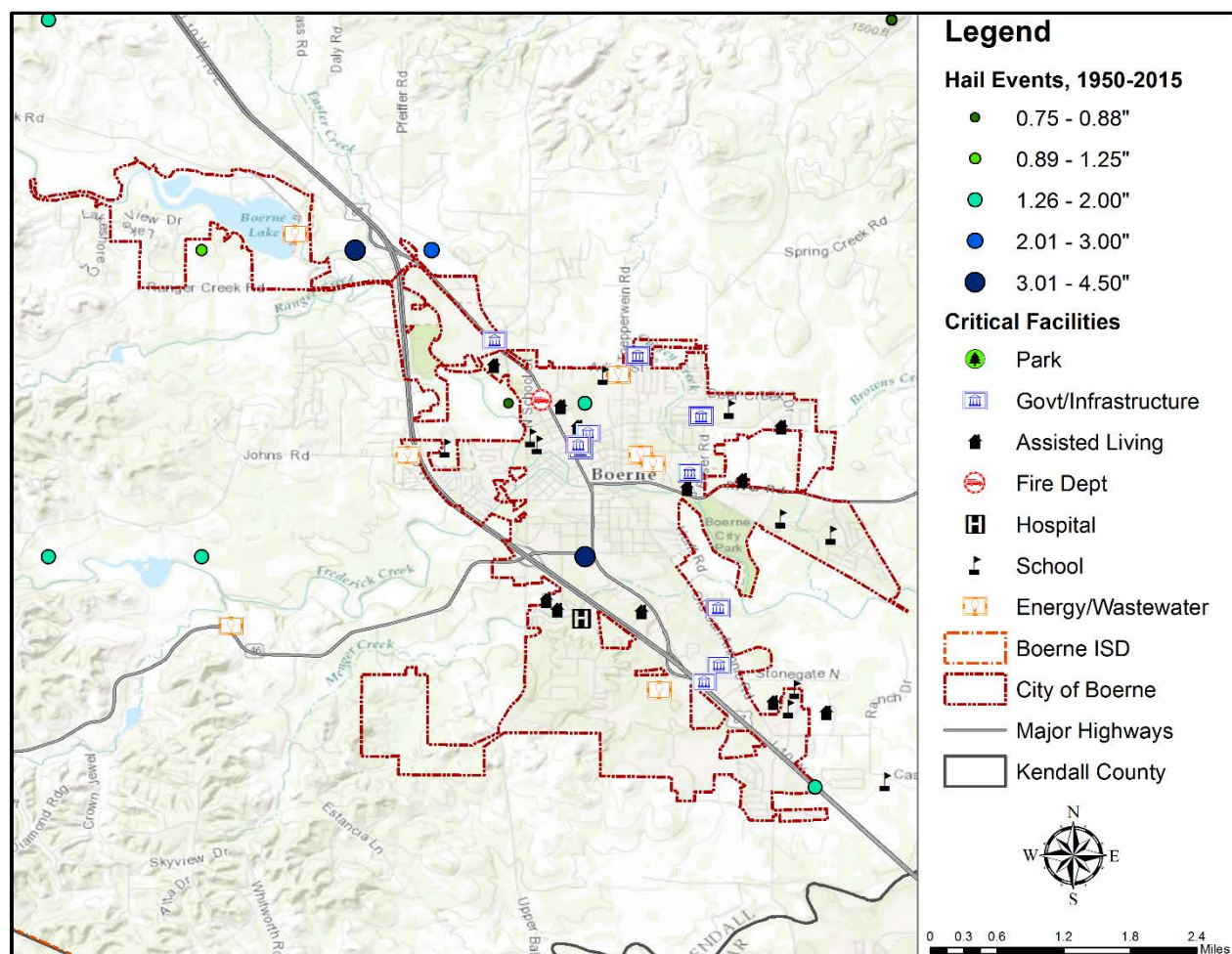
occurred during the past 66 years. Only those events for Kendall County with latitude and longitude available were plotted (Figure 11-1 and 11-2).

**Figure 11-1. Spatial Historical Hail Events, Kendall County 1950-2016**



## Section 11: Hail

**Figure 11-2. Spatial Historical Hail Events, City of Boerne 1950-2016**



**Table 11-2. Historical Hail Events, 1950-2016<sup>2</sup>**

JURISDICTION	DATE	MAGNITUDE (Inches)	INJURIES	FATALITIES	PROPERTY DAMAGE (2016 Dollars)	CROP DAMAGE (2016 Dollars)
Kendall County	10/12/1993	1.75	0	0	\$8,240	\$0
Kendall County	10/12/1993	2.75	0	0	\$82,399	\$0
Kendall County	3/6/1994	0.75	0	0	\$5	\$8,034
Kendall County	6/5/1998	2	0	0	\$43,828	\$0
Boerne	5/20/2001	4	0	0	\$26,892	\$0

<sup>2</sup> Only recorded events with fatalities, injuries, and/or damages are listed.

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JURISDICTION	DATE	MAGNITUDE (Inches)	INJURIES	FATALITIES	PROPERTY DAMAGE (2016 Dollars)	CROP DAMAGE (2016 Dollars)
Kendall County	4/18/2006	2.5	0	0	\$59,061	\$0
Kendall County	5/4/2006	4.25	0	0	\$11,812	\$0
Kendall County	4/7/2010	1.5	0	0	\$5,460	\$0
TOTALS		(Max Extent)	0	0	\$245,731	

**Table 11-3. Summary of Historical Hail Events, 1950-2016**

JURISDICTION	Number of Events	MAGNITUDE	INJURIES	FATALITIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	72	4.25 inches	0	0	\$210,805	\$8,034
Boerne	16	4 inches	0	0	\$26,892	\$0
TOTAL LOSSES	88	(Max Extent)	0	0	\$245,731	

### Significant Past Events

#### October 12, 1993 – Kendall County

On October 12, 1993 golf ball to baseball-size hail was reported in Comfort. The County Sheriff's Office reported large signs blown down and wind damage to a gas pump in Boerne. Multiple cars were damaged across the County. The hail was reported as 2.75 inches in diameter.

#### June 5, 1998 – Kendall County

On June 5, 1998 2 inch hail was reported in Kendall County near Sisterdale. Damages were estimated at more than \$20,000. Hail reportedly broke out windows in multiple buildings in the area.

#### May 4, 2006 – Kendall County

On May 4, 2006 softball size hail was reported in Kendall County near Sisterdale. A Department of Public Safety vehicle was significantly damaged with body damage and a busted windshield. The hail was reported as 4.25 inches in diameter.

#### April 4, 2015 – Kendall County

A line of severe thunderstorms moved southeast across the Hill Country, the Interstate 35 corridor and through eastern South Central Texas during the evening hours. Half dollar size hail was reported by an observer southeast of the city of Comfort. Ping pong ball size hail was reported among mostly quarter sized hail by a trained spotter about two miles east of the town of Welfare.

### Probability of Future Events

Based on the 88 reported events over the last 66 years (1950 – 2016), a hail event is a highly likely occurrence with approximately one to two events each year. Most hailstorms occur during the spring

## Section 11: Hail

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months of March, April and May, and in the fall during the month of September. Warning time for a hailstorm is generally minimal or there is no warning.

### Vulnerability and Impact

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Damage from hail approaches \$1 billion in the U.S. each year. 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 most commonly damaged by hail.

Utility systems on roofs at school districts, commercial 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 tourists when a hailstorm strikes with little warning. Hail events during school hours could elevate the risk to students and faculty due to broken windows and flying debris. Also, hail could cause power outages which could cause health and safety risks to vulnerable populations that rely on power for medical necessities.

According to the US Census Bureau, 19.6% (approximately 2,846 structures) of the residential structures in the Kendall County planning area were built before 1980.<sup>3</sup> These structures would typically be built to lower or less stringent construction standards than newer construction and may be more susceptible to damages during significant hail events. In addition, communities with manufactured housing in the Kendall County planning area would also be vulnerable to hail. The US Census data indicates approximately 1,192 manufactured homes in the Kendall County planning area.

The following critical facilities would be vulnerable to hail events in the Kendall County planning area:

Kendall County<sup>4</sup>:

- 6 Fire Stations
- 1 EMS Facility
- 5 Schools
- 1 Nursing Homes/Assisted Living Facilities
- 1 Government Facilities
- 1 Wastewater Treatment Facilities
- 1 Electrical Transmission Substation
- 3 Parks
- 1 Animal Control Facility
- 1 Agriculture and Equestrian Center
- 1 Fertilizer Storage Facility

Boerne:

- 1 Fire Stations
- 1 Police Stations
- 1 Sheriff's Department

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<sup>3</sup> Source: US Census Bureau data estimates for 2014.

<sup>4</sup> Kendall County list includes critical facilities located in a census designated place (Comfort) and unincorporated communities including Bergheim, Kendalia, Alamo Springs, Kreutzberg, and Waring where applicable.



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- 1 Hospital
- 1 EMS Facility
- 11 Schools
- 11 Nursing Homes/Assisted Living Facilities
- 6 Government Facilities
- 2 Wastewater Treatment Facilities
- 4 Electrical Transmission Substation
- 1 Animal Control Facility

Hail has been known to cause injury to humans, and occasionally has been fatal. Overall, the average loss estimate of property and crop (in 2016 dollars) is \$245,731, having an approximate annual loss estimate of \$3,723. Based on historic loss and damages, the impact of hail damages on the Kendall County planning area can be considered “Limited” severity of impact meaning injuries and illness can be treated with first aid, critical facilities and services shut down for 24 hours or less, and less than ten percent of property destroyed or with major damage.

### Assessment of Impacts

Hail events have the potential to pose a significant risk to people, and can create dangerous situations. Impacts to the planning area can include:

- Hail may create hazardous road conditions during and immediately following an event, delaying first responders from providing for or preserving public health and safety.
- 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.
- Residential structures can be damaged by falling trees, which can result in physical harm to occupants.
- 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.
- 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.
- Downed power lines and large debris, such as downed trees, can result in the inability of emergency response vehicles to access areas of the community.
- Hazardous road conditions may prevent critical staff from reporting for duty, limiting response capabilities.
- 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 the hail event may be negatively impacted while roads are cleared and utilities are being restored, further slowing economic recovery.

## Section 11: Hail

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- Businesses that are more reliant on utility infrastructure than others may suffer greater damages without a backup power source.
- 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 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.
- A large hail event could impact the accessibility of recreational areas and parks due to extended power outages or debris clogged access roads.

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.



# Section 12: Winter Storm

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## Hazard Description

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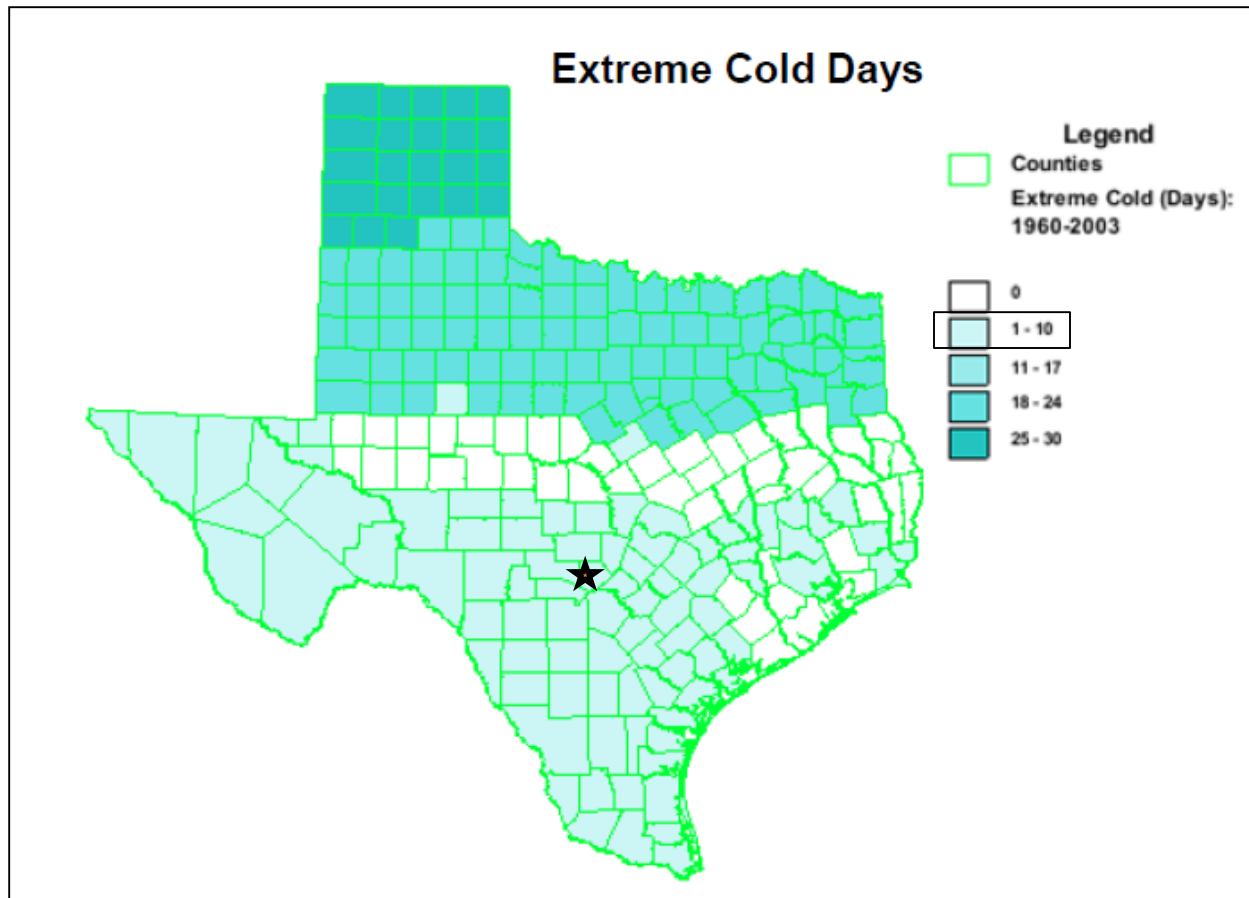


A severe winter storm event is identified as a storm with snow, ice, or freezing rain. This type of storm can cause significant problems for area residents. Winter storms are associated with freezing or frozen precipitation such as freezing rain, sleet, snow and the combined effects of winter precipitation 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 Kendall County planning area usually begin as powerful cold fronts that push south from central Canada. Although the county is at risk to ice hazards, extremely cold temperatures, and snow, the effects and frequencies of winter storm events are generally mild and short-lived.

Data from the National Oceanic and Atmospheric Administration (NOAA) and National Climatic Data Center (NCDC) Storm Events Database shows the total frequency of occurrence of all events identified as blizzards, heavy snow, ice storm, lake-effect snow, and winter storm or winter weather. As indicated in Figure 12-1, on average, the area experiences less than ten extreme cold days a year, meaning one to ten days are at or around freezing temperatures. During times of ice and snow accumulation, response times will increase until public works road crews are able to make major roads passable. Table 12-1 describes the types of winter storms possible to occur in the Kendall County planning area.

**Figure 12-1. Extreme Cold Days, 1960-2003<sup>1</sup>**



**Table 12-1. Types of Winter Storms**

TYPE OF WINTER STORM	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.

<sup>1</sup> Source: National Weather Service. Kendall County indicated by star.

## Section 12: Winter Storm

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<b>Blizzard Warning</b>	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.
<b>Frost/Freeze Warning</b>	Below freezing temperatures are expected and may cause significant damage to plants, crops and fruit trees.
<b>Wind Chill</b>	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

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Winter storm events are not confined to specific geographic boundaries. Therefore, all existing and future buildings, facilities, and populations in the Kendall County planning area are considered to be exposed to a winter storm hazard and could potentially be impacted.

### Extent

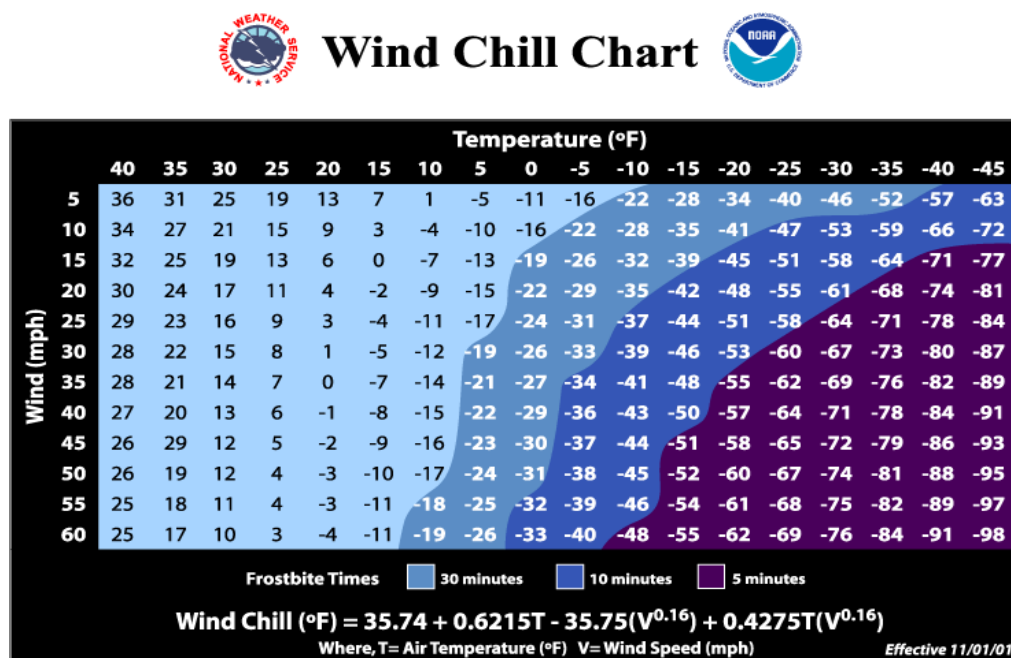
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The extent or magnitude of a severe winter storm is measured in intensity based on the temperature and level of accumulations as shown in Table 12-2. Table 12-2 should be read in conjunction with the wind-chill factor described in Figure 12-2 to determine the intensity of a winter storm. The chart is not applicable when temperatures are over 50°F or winds are calm. This is an index developed by the National Weather Service.

**Table 12-2. 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 12-2. 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 Kendall County planning area has never experienced a blizzard, but based on 16 previous occurrences recorded from 1996 to 2016, it has been subject to winter storm watches, warnings, freezing rain, sleet, snow and wind chill.

Based on historical data for the Kendall County planning area, the average event to mitigate would be a mild to moderate winter storm. The county can expect anywhere between 0.1 to 3.0 inches of ice and snow during a winter storm event and temperatures between 30°F and 50°F with winds ranging from zero to 15 mph.

## Historical Occurrences

Table 12-3 shows historical occurrences for Kendall County from 1996 to 2016 provided by the NCDC database. There have been 16 recorded winter storm events in Kendall County. Historical winter storm information, as provided by the NCDC, identifies winter storm 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.

Table 12-3. Historical Winter Storm Events, 1996-2016

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	2/1/1996	0	0	\$0	\$0
Kendall County	1/7/1997	0	0	\$0	\$0

## Section 12: Winter Storm

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JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Kendall County	1/11/1997	0	0	\$0	\$0
Kendall County	12/23/1998	0	0	\$0	\$0
Kendall County	12/12/2000	0	0	\$0	\$0
Kendall County	11/28/2001	0	0	\$0	\$0
Kendall County	2/24/2003	0	0	\$0	\$0
Kendall County	1/15/2007	0	0	\$0	\$0
Kendall County	2/3/2011	0	0	\$0	\$0
Kendall County	11/23/2013	0	0	\$0	\$0
Kendall County	11/25/2013	0	0	\$0	\$0
Kendall County	11/26/2013	0	0	\$0	\$0
Kendall County	1/9/2015	0	0	\$0	\$0
Kendall County	1/23/2015	0	0	\$0	\$0
Kendall County	2/16/2015	0	0	\$0	\$0
Kendall County	2/27/2015	0	0	\$0	\$0

### Significant Past Events

#### December 12, 2000 – Kendall County

Bitterly cold arctic winds swept down on South Central Texas during the morning and early afternoon of December 12th. Temperatures that had warmed in many locations to the 70s plunged rapidly into the 40s and 50s shortly after the front's arrival. Northerly winds gusting to 30 and 35 mph further emphasized this dramatic temperature change. By mid-afternoon, temperatures over the Texas Hill Country had fallen below the freezing mark and light rain and drizzle had begun to change into freezing rain and freezing drizzle. By the late afternoon, a thin layer of ice was reported over Hill Country bridges, overpasses and elevated highways. However, because the soils over South Central Texas had been quite warm for the previous several weeks, no accumulations on the ground were indicated until late in the evening period.

The combination of freezing rain, freezing drizzle, and sleet continued to spread across the area through the late afternoon and nighttime hours, reaching the Austin area near 4 pm and the San Antonio area near 10 pm. In anticipation of the winter storm threat, many area schools and universities, as well as city and county agencies and private businesses closed down early on the afternoon of the 12th and planned to open late on the morning of the 13th. The wintery precipitation mix continued through the night and early the next morning, requiring the cancellation of several flights at both San Antonio International Airport and Austin Bergstrom International Airport. The layer of icing also forced the closing of numerous bridges and overpasses across the 25 counties involved. Late on the evening

## Section 12: Winter Storm

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of the 12th, counties began to report widespread ice forming on roadways. Interstate 10 was closed between Kerrville and San Antonio from the evening of the 12th until the mid-morning of the 13th. The city of San Antonio closed all interstates within its boundaries from shortly after midnight until mid-morning on the 13th. Drivers were forced to travel on frontage road. By 10 am on the morning of the 13th, the freezing rain had ended over all but the extreme northeast section of South Central Texas, and by 4 pm that afternoon the last of the warnings and advisories were lifted.

### **February 3, 2011 – Kendall County**

An upper level storm approached the area the evening of February 3rd and produced light freezing drizzle which quickly formed a thin layer of ice on all exposed surfaces, making travel very dangerous. The greatest ice accumulation was one quarter of an inch in DeWitt County. The precipitation later turned mostly to light snow along with a few reports of sleet. The greatest snow amounts were from 1 to 2 inches, mainly across portions of Travis and Williamson Counties with generally less than one inch, across the Hill Country, portions of San Antonio, and areas east of I-35. There were over 500 traffic accidents reported in San Antonio and Austin during the overnight hours as well as others in most of the other counties including Kendall County. The icy roads forced all of the major highways in San Antonio to close during the night. For a time, I-35 was closed from San Marcos through San Antonio into Atascosa County, a stretch of nearly 100 miles. Many other highways were closed across the area including parts of I-10, US Hwy 90, US Hwy 77, and US Hwy 290. Most area schools were closed February 4th.

### **February 27, 2015 – Kendall County**

A cold front moved through South Central Texas on February 26th and brought freezing temperatures. On February 27th low level flow from the south to southeast started to produce isentropic upglide and light precipitation. In places where the temperatures remained below freezing the precipitation fell as freezing drizzle and freezing rain. Light ice accumulation on elevated surfaces, bridges, and overpasses resulted in travel impacts. Icy bridges and overpasses were reported in Williamson, Travis, Gillespie, Burnet, and Kendall Counties. There were numerous accidents due to icy roads. One fatality occurred two miles west of Bertram in Burnet County on Highway 29 where there was an accident involving an 18 wheel tractor trailer and a car. Freezing precipitation continued into the morning of February 28th ending shortly before 10 AM.

## Probability of Future Events

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According to historical records, the Kendall County planning area experiences one winter storm event every one to two years. Hence, the probability of a future winter storm event affecting the planning area is highly likely, with a winter storm likely to occur within the next year.

## Vulnerability and Impact

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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.



## Section 12: Winter Storm

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All populations, buildings, critical facilities, and infrastructure in the entire Kendall County planning area are vulnerable to severe winter events.

The following critical facilities would be vulnerable to winter storm events in the Kendall County planning area:

Kendall County<sup>2</sup>:

- 6 Fire Stations
- 1 EMS Facility
- 5 Schools
- 1 Nursing Homes/Assisted Living Facilities
- 1 Government Facilities
- 1 Wastewater Treatment Facilities
- 1 Electrical Transmission Substation
- 3 Parks
- 1 Animal Control Facility
- 1 Agriculture and Equestrian Center
- 1 Fertilizer Storage Facility

Boerne:

- 1 Fire Stations
- 1 Police Stations
- 1 Sheriff's Department
- 1 Hospital
- 1 EMS Facility
- 11 Schools
- 11 Nursing Homes/Assisted Living Facilities
- 6 Government Facilities
- 2 Wastewater Treatment Facilities
- 4 Electrical Transmission Substation
- 1 Animal Control Facility

People and animals are subject to health risks from extended exposure to cold air. Elderly people are at greater risk of death from hypothermia during these events, especially in rural areas where populations are sparse, icy roads may impede travel, and there are fewer neighbors to check in on the elderly. 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. The most sensitive population segment to winter storms include the elderly or the infirmed that live within the Kendall County planning area.

Populations over 65 in the Kendall County planning area is approximately 19.4% of the total population or an estimated total of 7,834<sup>3</sup> potentially vulnerable residents in the planning area based on age.

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<sup>2</sup> Kendall County list includes critical facilities located in a census designated place (Comfort) and unincorporated communities including Bergheim, Kendalia, Alamo Springs, Kreutzberg, and Waring where applicable.

<sup>3</sup> US Census Bureau 2015 data for Kendall County

## Section 12: Winter Storm

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Based on the level of risk and historical occurrences for winter storms in the Kendall County planning area, the impact for winter storm is “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% of property is destroyed or with major damage. No property or crop damages were reported in the 21 year period of analysis. Based on historical records, annual loss estimates are considered to be negligible.

### Assessment of Impacts

The greatest risk from a winter storm hazard is to public health and safety. Potential impacts for the planning area may include:

- Vulnerable populations, particularly the elderly and infants, 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.
- A winter storm event could lead to tree, shrub, and plant damage or death.
- Severe cold and ice could significantly damage agricultural crops.
- Schools may be forced to shut early and remain closed during the event 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 businesses and citizens will also contribute to the overall economic and financial conditions in the aftermath of a winter storm event.

# Section 13: Dam Failure

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## Hazard Description

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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;
- Landslides into reservoirs, which cause surges that result in overtopping;
- 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. At the same time, 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. 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 America's 84,000 dams is 52 years. More than 2,000 dams near population centers are in need of repair, according to statistics released in 2009 by the Association of State Dam Safety Officials<sup>1</sup>. In addition to the continual aging

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<sup>1</sup> Association of State Dam Safety Officials, Journal of Dam Safety

## Section 13: Dam Failure

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of dams there have not been significant increases in the number of safety inspectors resulting in haphazard maintenance and inspection.

The Association of State Dam Safety Officials estimate that \$18.2 billion will be needed to repair all high-hazard dams, but the total for all state dam-safety budgets is less than \$35 million<sup>2</sup>. The current maintenance budget does not match the scale of America's long-term modifications of its watersheds. Worse still, more people are moving into risky areas. As the American population grows, dams that once could have failed without major repercussions are now upstream of cities and development.



### Location

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The State of Texas has 7,126 dams, all regulated by the Texas Commission on Environmental Quality (TCEQ). Of these, 1,046 are considered “high-hazard,” 725 are considered “significant-hazard,” and 5,355 are considered “low-hazard”.<sup>3</sup> For dams in the Kendall County planning area location, volume, elevation, condition, and classification information was factored into the risk ranking in Figure 13-1 and 13-2, which illustrates general locations for each dam in the area. Currently, there are 16 dams located in the Kendall County planning area: 4 are classified as “high-hazard”, 4 as “significant-hazard”, and 8 as “low-hazard” dams. All dams are listed in Table 13-1 along with regulation information.

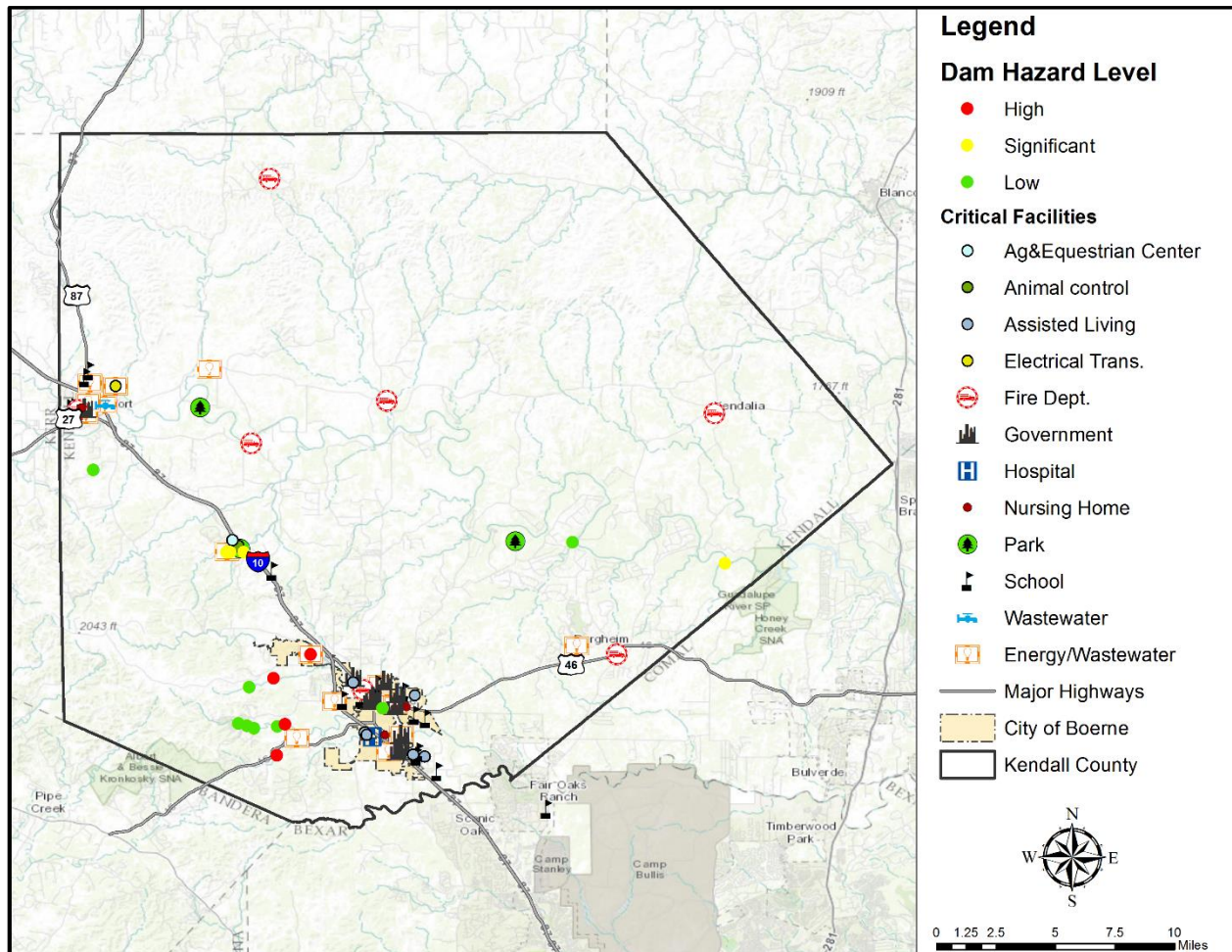
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<sup>2</sup> Source: <http://www.damsafety.org/news/?p=c0fdade4-ab98-4679-be22-e3d7f14e124f>

<sup>3</sup> Source: <http://www.infrastructurereportcard.org/wp-content/uploads/2013/02/2012-Texas-Report-Card-FINAL.pdf>

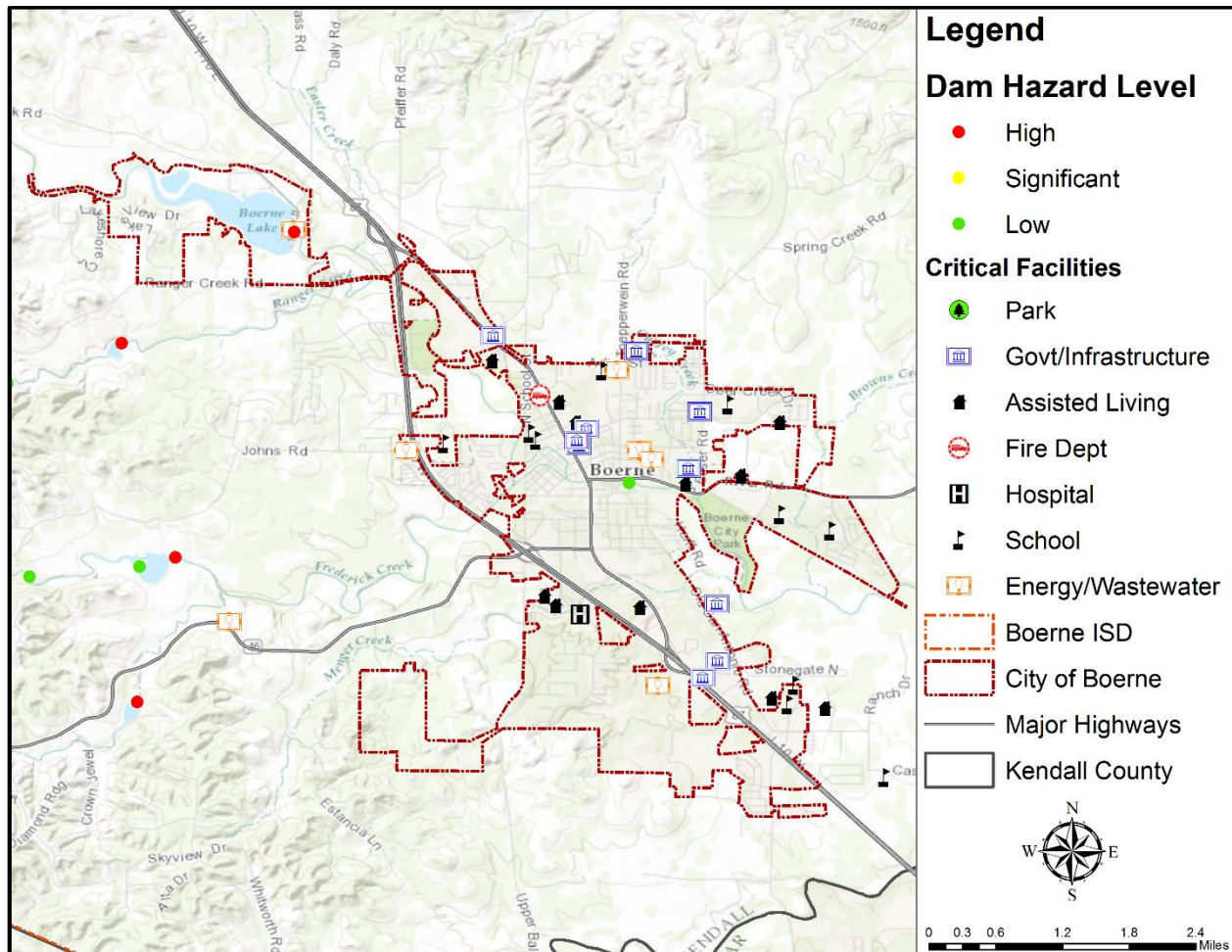


Figure 13-1. Dam Locations in Kendall County



## Section 13: Dam Failure

**Figure 13-2. Dam Locations in the City of Boerne**



**Table 13-1. Kendall County Dam Survey**

JURISDICTION	DAM NAME	HEIGHT (Ft.)	STORAGE (Acre Ft.)	CONDITION <sup>4</sup>	POTENTIAL HAZARD CLASSIFICATION
Kendall County	Smith Investment Co Lake NO 1 Dam	17	120	Not Rated	Low
Kendall County	Lake Oz Dam	12	50	Not Rated	Low
Kendall County	711 Ranch Lake Dam	31	212	Not Rated	Low
Kendall County	Smith Investment Co Lake NO 3 Dam	18	55	Not Rated	Low

<sup>4</sup> Condition provided if available.



## Section 13: Dam Failure

JURISDICTION	DAM NAME	HEIGHT (Ft.)	STORAGE (Acre Ft.)	CONDITION <sup>4</sup>	POTENTIAL HAZARD CLASSIFICATION
Kendall County	KWW Ranch Lake NO 1 Dam	39	1170	Not Rated	Significant
Kendall County	Masters Lake Dam	24	83	Not Rated	Low
Kendall County	Upper Cibolo Creek WS SCS Site 2 Dam	54	1060	Not Rated	High
Boerne	Upper Cibolo Creek WS SCS Site 1 Dam	89	19022	Not Rated	High
Boerne	Boerne Public Park Dam	12	55	Not Rated	Low
Kendall County	Upper Cibolo Creek WS SCS Site 4 Dam	56	1278	Not Rated	High
Kendall County	Worth Dam	50	92	Not Rated	Low
Kendall County	Joshua Springs Park Dam NO 3	36	39	Not Rated	Significant
Kendall County	Spring Creek Dam	12	50	Not Rated	Low
Kendall County	Joshua Springs Park Dam NO 2	20.1	49	Not Rated	Significant
Kendall County	Joshua Springs Park Dam NO 1	16.2	13	Not Rated	Significant
Kendall County	Upper Cibolo Creek WS SCS Site 3 Dam	76	4750	Not Rated	High

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 failure hazards. With developments downstream of the dams, all populations located downstream of the dams are considered to be at risk to potential safety hazard if a dam failure occurred, especially areas downstream at a lower elevation.

### 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. The National Interagency Committee on Dam Safety defines high hazard dams as those where failure or mis-operation would cause loss of human life. Prior to 2009, high hazard dams were defined as those at which failure or mis-operation would probably cause loss of human life. Dams classified as "significant" were those at which failure or mis-operation probably would not result in loss of human life but could cause economic loss, environmental damage, and disruption of lifeline facilities or other significant damage. Low hazard potential dams are those at which failure or mis-operation probably would not result in loss of human life but would cause limited economic and/or environmental losses. Losses would be limited mainly to the owner's property. Classifications for extent after 2009 are found in Table 13-2 below. Figures 13-3 through 13-6 are inundation maps that show the flood risk areas for each high hazard dam. An estimated depth for dam breach is indicated in the paragraph below Figures 13-3 through 13-6.<sup>5</sup>

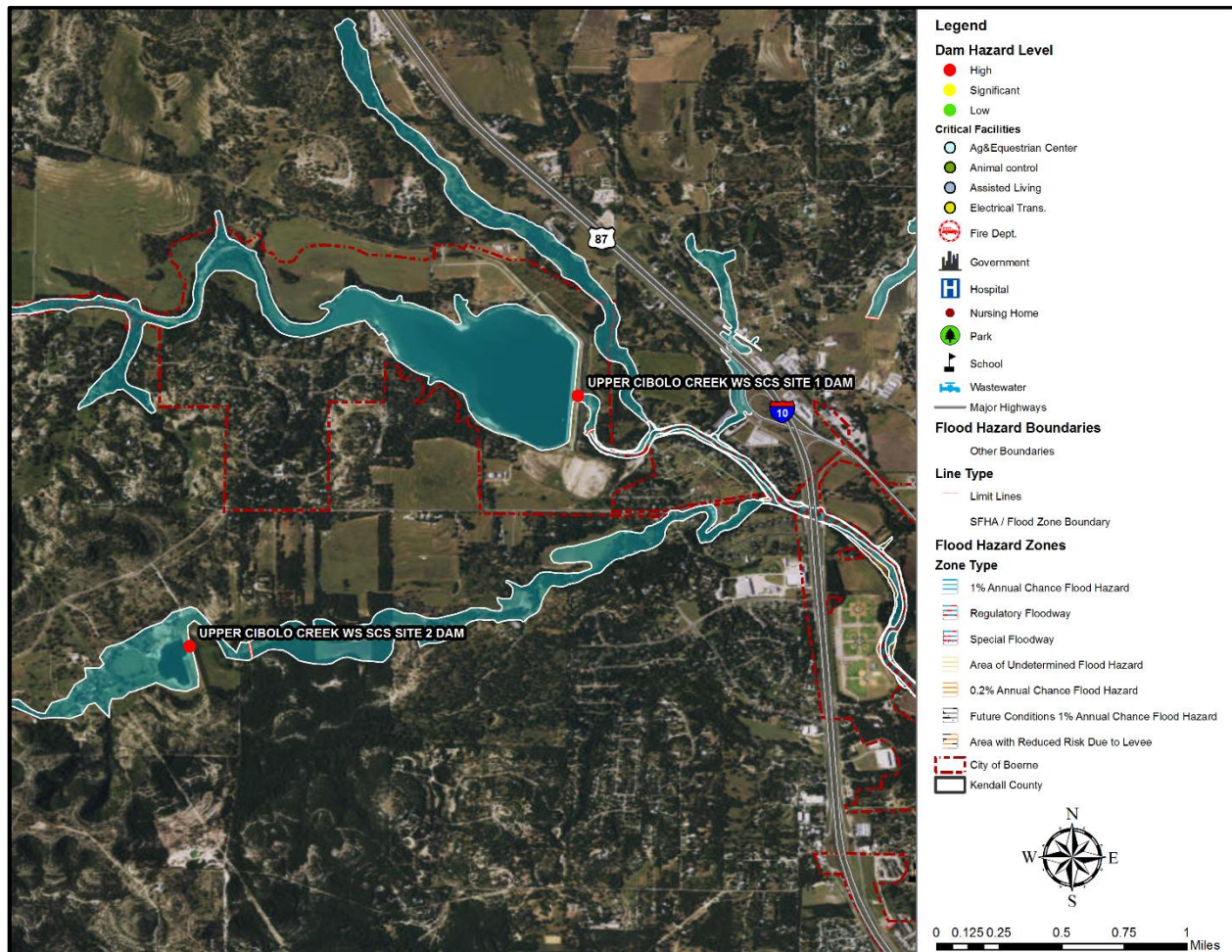
**Table 13-2. Extent Classifications**

HAZARD POTENTIAL CLASSIFICATION	LOSS OF HUMAN LIFE	DAM STORAGE CAPACITY
Low	None Expected	Less than 10,000 acre-feet
Significant	Probable (1 to 6)	Between 10,000 and 100,000 acre-feet
High	Loss of Life Expected (7 or More)	100,000 acre-feet or more

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<sup>5</sup> Dam breach depth is an estimate based on best available data, not statistical data.

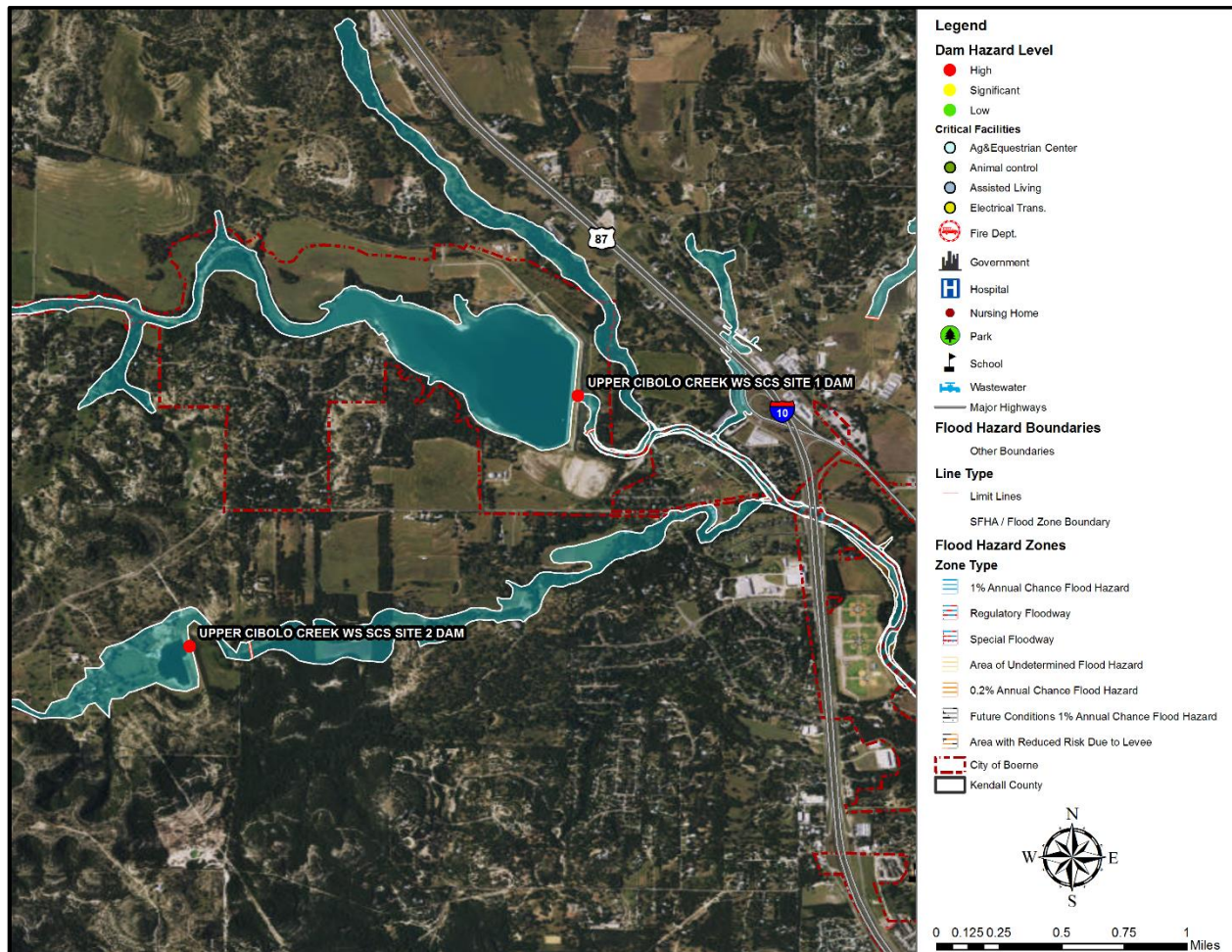
**Figure 13-3. Upper Cibolo Creek WS SCS Site 1 Dam Flood Risk Areas**



Upper Cibolo Creek WS SCS Site 1 Dam is a flood control dam located on Cibolo Creek. The dam also serves as a water supply dam and recreational lake. The dam is owned and operated by the City of Boerne and was constructed in 1978. The extent classification is considered significant and the area located near the dam is a semi-densely populated area with commercial and residential development. A dam failure may result in loss of life and could cause power outages and disrupt utilities systems and residential populations in the planning area would be vulnerable. There is also three self-storage facilities, a Texas Department of Transportation office, Kendall Appraisal District, Jet Specialty Inc., Mission Pharmacal, and several other commercial developments in close proximity that could be impacted. Interstate Highway 10 and State Highway 87 are also in close proximity and could become impassable following a breach. In the event of a breach, it is estimated the average breach width would be 342.7 feet with a maximum breach flow of 167,907 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of 0 to 25 feet.

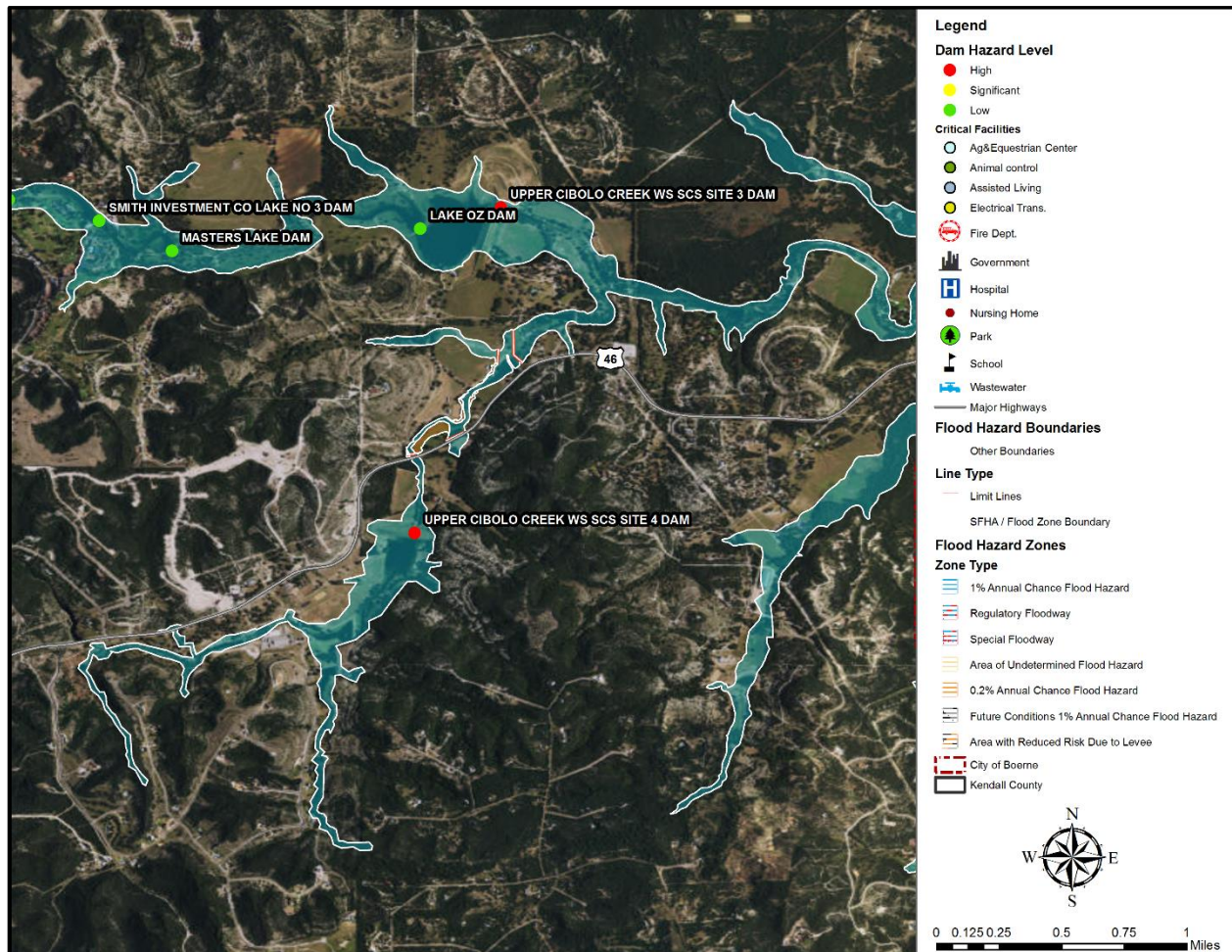


**Figure 13-4. Upper Cibolo Creek WS SCS Site 2 Dam Flood Risk Areas**



Upper Cibolo Creek WS SCS Site 2 Dam is a flood control dam located on Ranger Creek. It is owned by the Kendall County SWCD and was constructed in 1980. It is earthen construction and the extent classification is considered low and the area located near the dam is a rural area with limited development. A dam failure could cause power outages and disrupt utilities systems. In the event of a dam failure livestock and crops would be vulnerable. There may also be significant environmental effects that result in flooding that disperses debris and hazardous materials downstream, damaging local ecosystems. In the event of a breach, it is estimated the average breach width would be 146.9 feet with a maximum breach flow of 20,691 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of 0 to 15 feet.

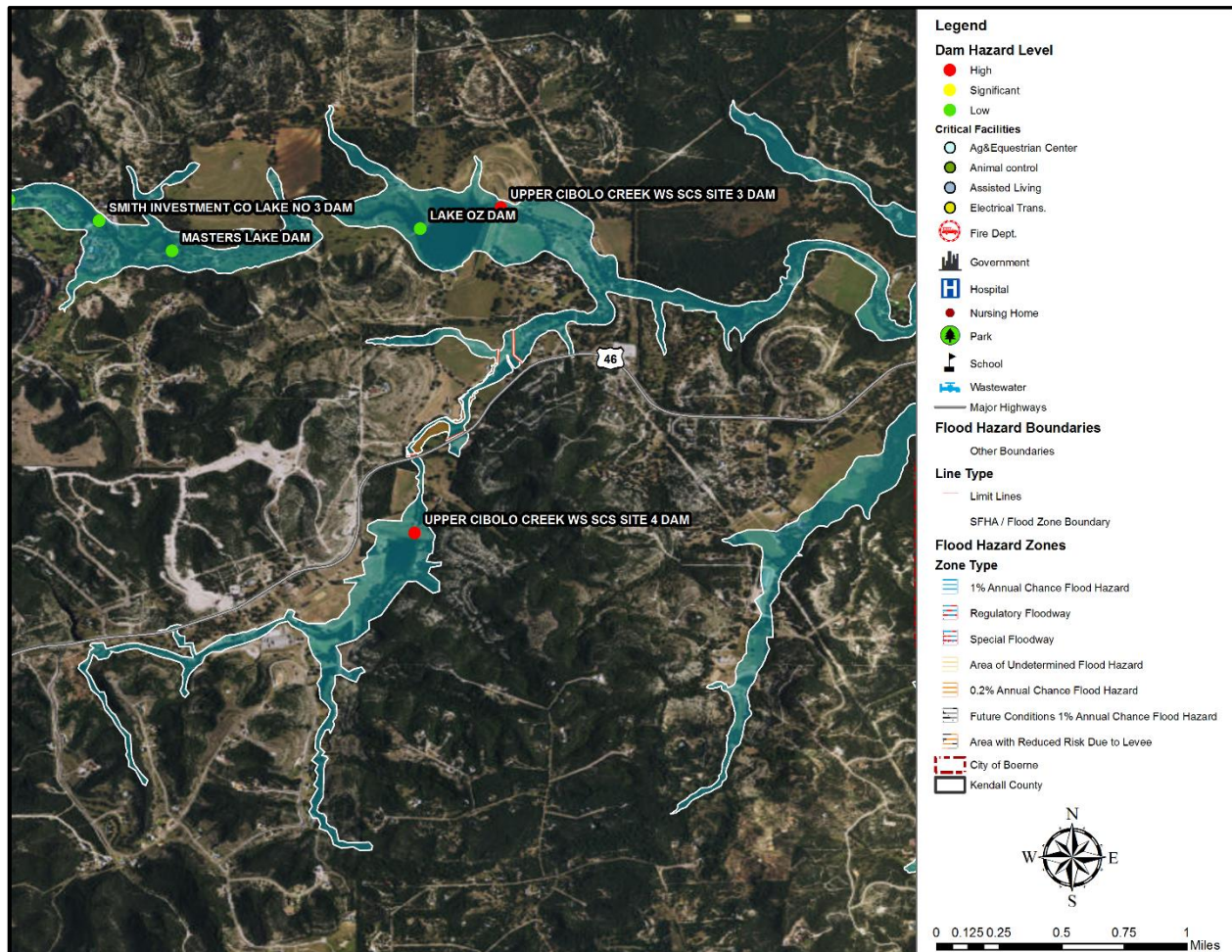
**Figure 13-5. Upper Cibolo Creek WS SCS Site 3 Dam Flood Risk Areas**



Upper Cibolo Creek WS SCS Site 3 Dam is a flood control and recreation dam located on Frederick Creek. The earthen dam is owned by the Kendall SWCD and was constructed in 1980. The extent classification is considered low and the area located near the dam is a rural area. A dam failure could cause power outages and disrupt utilities systems. In the event of a dam failure livestock and crops would be vulnerable. There may also be significant environmental effects that result in flooding that disperses debris and hazardous materials downstream, damaging local ecosystems. In the event of dam failure, there would be 3 residential properties and one ranch vulnerable. The Enchanted Springs Ranch is closest in proximity to the dam and features the Boerne Youth Theatre at Enchanted Springs Ranch, which would be vulnerable in the event of a breach. In the event of a breach, it is estimated the average breach width would be 232.9 feet with a maximum breach flow of 56,130 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of 0 to 15 feet.



**Figure 13-6. Upper Cibolo Creek WS SCS Site 4 Dam Flood Risk Area**



Upper Cibolo Creek WS SCS Site 4 Dam is a flood control and recreation dam located on Deep Hollow Creek. The earthen dam is owned by the Kendall SWCD and was constructed in 1980. The extent classification is considered low and the area located near the dam is a rural area. A dam failure could cause power outages and disrupt utilities systems. In the event of a dam failure livestock and crops would be vulnerable. There may also be significant environmental effects that result in flooding that disperses debris and hazardous materials downstream, damaging local ecosystems. In the event of dam failure, there would be 3 residential properties vulnerable. In the event of a breach, it is estimated the average breach width would be 155.4 feet with a maximum breach flow of 5,701 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.



## Section 13: Dam Failure

Table 13-3 represents the “average” extent or magnitude of a dam failure event that could be expected for the Kendall County planning area. The ‘Extent Classification’ column was determined by taking the average of dams in the planning area and weighing low hazard dams as a one, significant hazard dams as a two, and high hazard dams as a three based on the potential severity, warning time, and duration.

**Table 13-3. Extent for the Kendall County**

JURISDICTION	DAMS & CLASSIFICATION	EXTENT CLASSIFICATION	LEVEL OF INTENSITY TO MITIGATE
Kendall County	16 – Total 8 – Low 4 – Significant 4 – High	High	Dam failure presents a high threat for the County as there are 4 high hazard dams located within the Kendall County planning area. Loss of life is probable and economic loss is significant in the event of a dam failure.
Boerne	2 – Total 1 – Low 1 – High	High	Dam failure presents a high threat for the City as there is 1 high hazard dam located within the City. Loss of life is probable and economic loss is significant in the event of a dam failure.

## Historical Occurrences

There are approximately 84,000 dams in the United States today.<sup>6</sup> Catastrophic dam failures have occurred frequently throughout the past century. Between 1918 and 1958, 33 major U.S. dam failures caused 1,680 deaths. From 1959 to 1965, nine major dams failed worldwide. Some of the largest disasters in the U.S. have resulted from dam failures. More than 90 dam incidents, including 23 dam failures, were reported in the past ten years to the National Performance of Dams Program, which collects and archives information on dam performance from state and federal regulatory agencies and dam owners.

The State of Texas 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.

There has not been a recorded dam failure event for the entire Kendall County planning area including the City of Boerne.

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<sup>6</sup> Federal Emergency Management Agency, Dam Safety Program, available at: <http://www.fema.gov/hazards/damsafety/>

### Probability of Future Events

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No historical events of dam failure have been recorded in the Kendall County planning area, though the risk of dam failure is monitored closely. Due to the lack of historical occurrences, the probability of a future event is unlikely, meaning an event is possible in the next ten years.

### Vulnerability and Impact

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There are 16 dams in the Kendall County planning area; eight of them considered low hazard dams, four are considered significant hazard dams and 4 are considered high hazard dams based on their classification. While low hazard dams are those at which failure or mis-operation probably would not result in loss of human life and would cause limited economic and/or environmental losses, damage to agriculture and housing is possible due to the number of low hazard dams 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 narratives below each high hazard dam in this section.

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, however, the severity of impact could be substantial.

A dam breach could result in multiple deaths with facilities being shut down for 30 days or more, and more than 50 percent of property destroyed or damaged. For these reasons, creating mitigations actions to remove or protect people and structures from the path of destruction is necessary in order to minimize impact from dam failure.

### Assessment of Impacts

Any individual dam has a very specific area that will be impacted by a catastrophic failure. Dams identified as high or significant hazard 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 planning area 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.

## Section 13: Dam Failure

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- 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.

# Section 14: Hurricane

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## Hazard Description

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According to the National Oceanic and Atmospheric Administration (NOAA), a hurricane is an intense tropical weather system of strong thunderstorms with well-defined surface circulation and maximum sustained winds of 74 mph or higher. In the Northern Hemisphere circulation of winds near the Earth's surface is counterclockwise.



Hurricanes often begin as tropical depressions that intensify into tropical storms when maximum sustained winds increase to between 35 – 64 knots (39 – 73 mph). At these wind speeds, the storm becomes more organized and circular in shape and begins to resemble a hurricane. Tropical storms resulting in high winds and heavy rainfall can be equally problematic without ever becoming a hurricane and can be dangerous to people and property, resulting in high winds and heavy rainfall, as Tropical Storm Hermine did for Kendall County in September 2010. Once sustained winds reach or exceed 74 mph, the storm becomes a hurricane. The intensity of a land falling hurricane is expressed in categories relating wind speeds to potential damage. Tropical storm-force winds are strong enough to be dangerous to those caught in them.

## Location

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The Kendall County planning area is located inland from the coast and is outside of the hurricane wind speed hazard areas. Thus, the Kendall County planning area is in a low risk area for hurricane wind speeds of 90 miles per hour (mph) or less. However, the Kendall County planning area is susceptible to the indirect threats of a hurricane, including high winds and flooding. Additionally, Kendall County has hosted coastal area residents who evacuate during hurricane events.

## Extent

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As a hurricane develops, the barometric pressure (measured in millibars or inches) at its center falls and winds increase. If the atmospheric and oceanic conditions are favorable, it can intensify into a tropical depression. When maximum sustained winds reach or exceed 39 miles per hour, the

## Section 14: Hurricane

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system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center in Miami, Florida. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane.

Hurricanes are categorized according to the strength and intensity of their winds using the Saffir-Simpson Hurricane Scale (Table 14-1). A Category 1 storm has the lowest wind speeds, while a Category 5 hurricane has the highest. However, a lower category storm can inflict greater damage than higher category storms depending on where they strike, the amount of storm surge, other weather they interact with, and how slow they move.

**Table 14-1. Extent Scale for Hurricanes<sup>1</sup>**

CATEGORY	MAXIMUM SUSTAINED WIND SPEED (Mph)	MINIMUM SURFACE PRESSURE (Millibars)	STORM SURGE (Feet)
1	74 – 95	Greater than 980	3 – 5
2	96 – 110	979 – 965	6 – 8
3	111 – 130	964 – 945	9 – 12
4	131 – 155	944 – 920	13 – 18
5	155 +	Less than 920	19+

Based on the historical storm tracks for hurricanes and the location of Kendall County outside of the hurricane wind hazard area, the average extent to be mitigated is for a Category 1 storm for the planning area.

## Historical Occurrences

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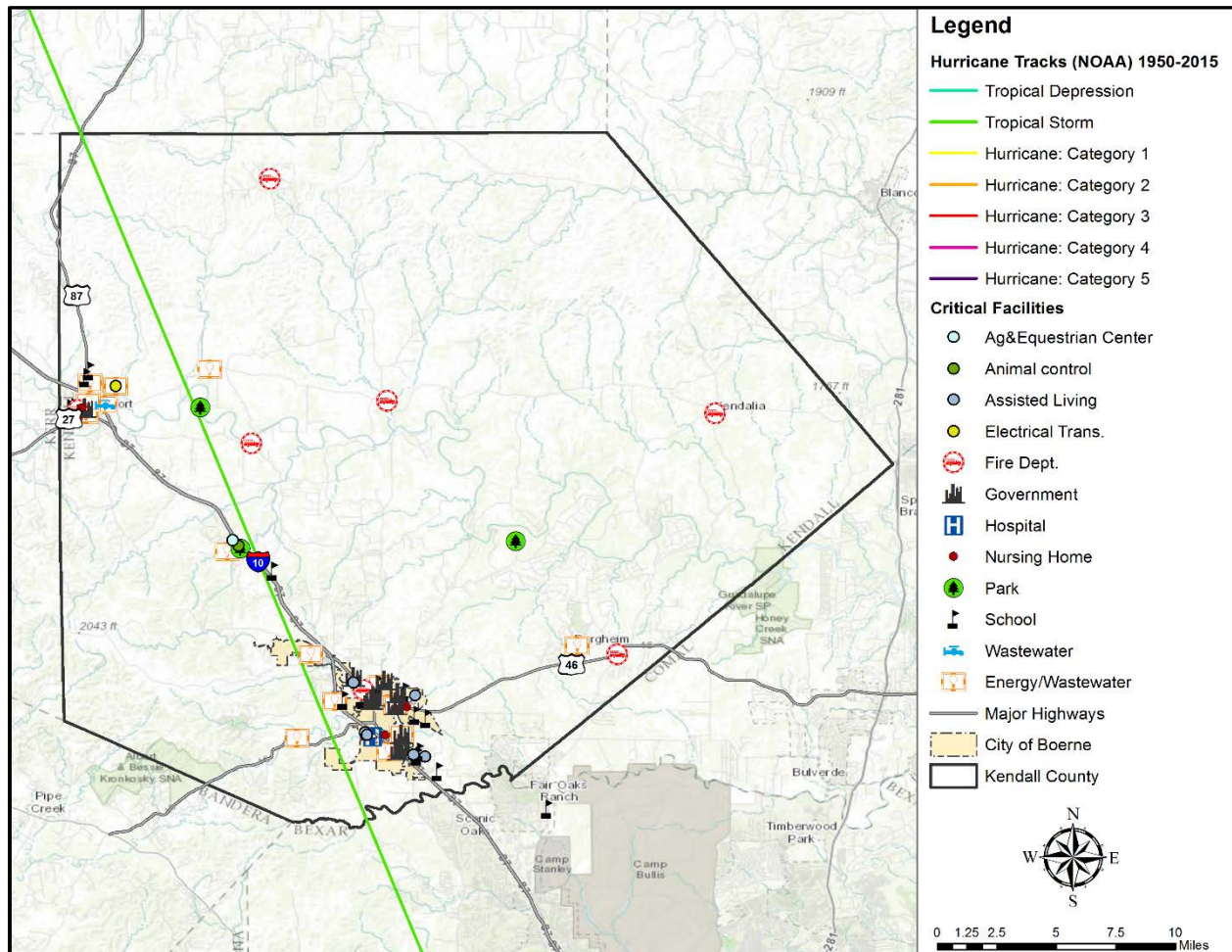
By the time hurricanes and tropical storms have made landfall at various magnitudes (categories) in Kendall County, the storms have usually weakened to tropical storms or depressions, being near the end of their life cycle. With the storms having reduced winds, extreme rainfall is the hazard of concern. In Figures 14-1 and 14-2 below, hurricane tracks are reflective of their strength in the Kendall County planning area. Table 14-2 lists the storms that have tracked through the planning area. Historical hurricane data for the Kendall County planning area are provided on a County-wide basis per the National Climatic Data Center (NCDC), National Oceanic and Atmospheric Administration (NOAA), and Spatial Hazard Events & Losses Database for the United States (SHELDUS) databases.

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<sup>1</sup> Source: National Hurricane Center

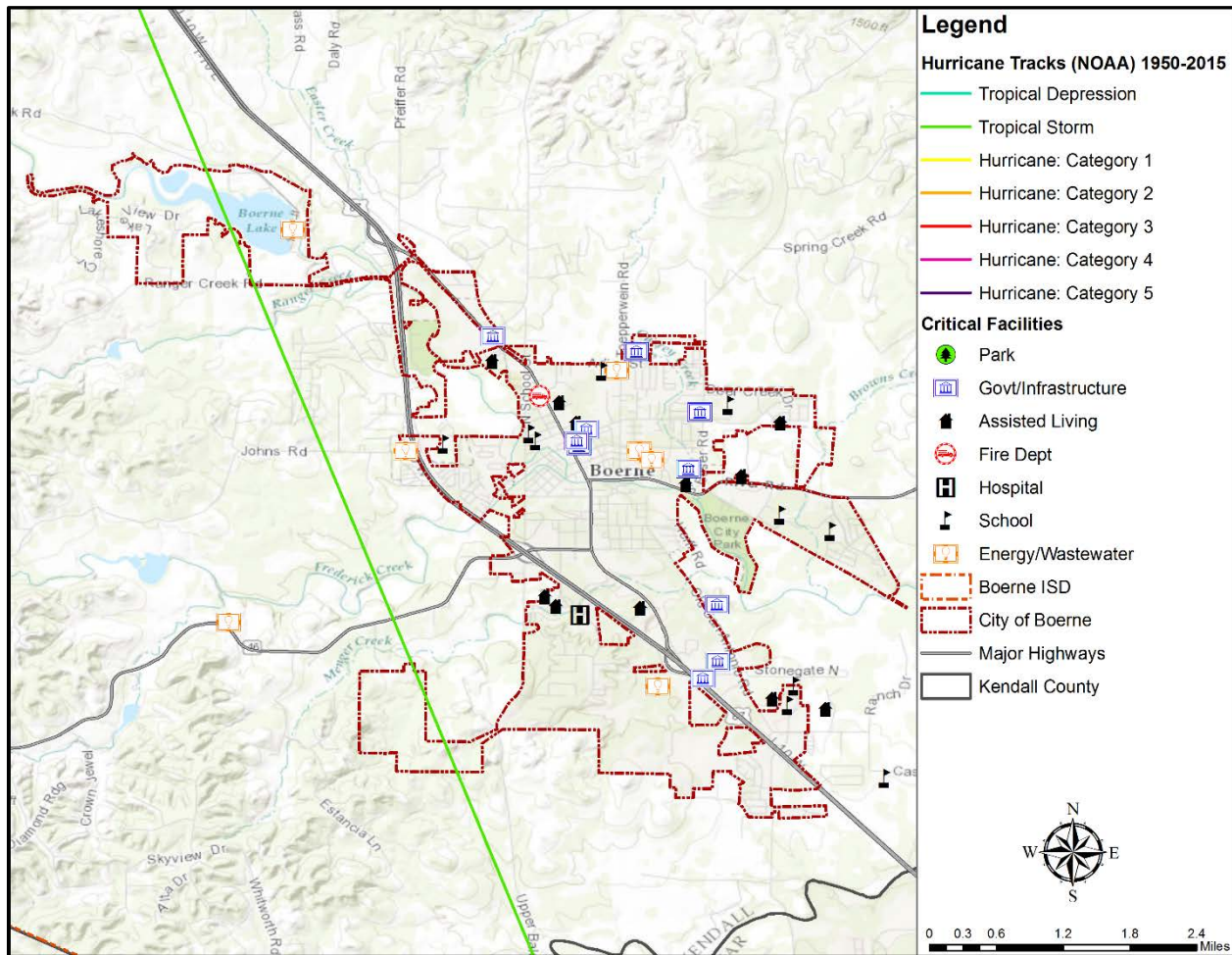


Figure 14-1. Location of Historic Storm Tracks, Kendall County, 1950-2016



## Section 14: Hurricane

**Figure 14-2. Location of Historic Storm Tracks, City of Boerne, 1950-2016**



**Table 14-1. Historic Storms<sup>2</sup>**

YEAR	STORM NAME	CATEGORY	PROPERTY DAMAGE	CROP DAMAGE	PROPERTY DAMAGE (2016 DOLLARS)	CROP DAMAGE (2016 DOLLARS)
2010	Hermine	Tropical Storm	N/A	N/A	N/A	N/A

Based on historical hurricane events (listed above), only one event has impacted the planning area in a 56 year reporting period. This event was Tropical Storm Hermine and is explained in detail below.

<sup>2</sup> N/A means data was not available.



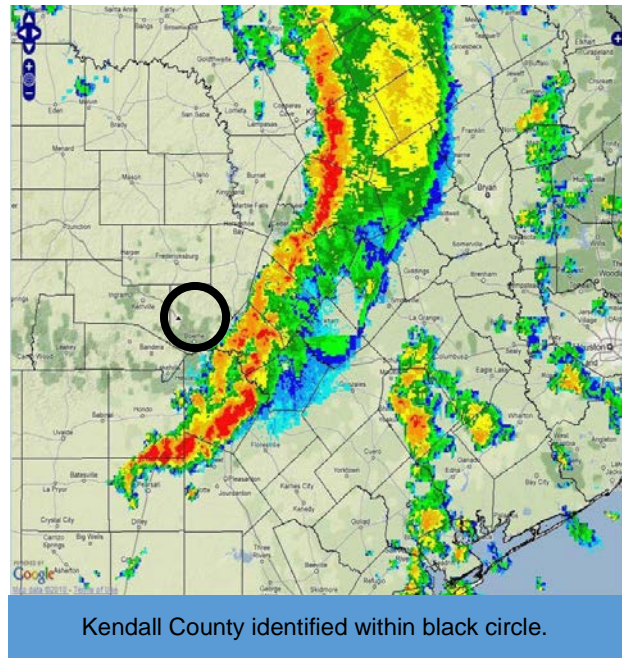
## Section 14: Hurricane

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### Significant Past Events

#### **Tropical Storm Hermine, September 3-9, 2010 Kendall County**

Tropical storm Hermine made landfall near the Texas/Mexico border on the night of September 6. The storm moved northward through South Texas into South Central Texas. Strong winds and flooding rain began in South Central Texas on September 7. On September 8 the winds subsided, but the flooding rain continued as the remnants of Hermine moved northward into Oklahoma. South Central Texas was hit very hard with widespread rains of 8-12 inches across much of the I-35 corridor from Austin down to San Antonio. Hardest hit area was north Austin, Round Rock, Cedar Park, and Georgetown. Sixteen inches of rain fell in Georgetown, with the Georgetown Co-op observer reporting 16.37 inches for the 2 day rain event.



Flash flooding in the Kendall County planning area forced multiple road closings including FM473, FM1376, FM1320, FM962, Highway 46, and County Road 1320. In addition, flash flooding closed the 400 block of FM 474 in Boerne and Old Fredericksburg Road near the Gillespie County line.

### Probability of Future Events

Based on historical occurrences of significant hurricane events, the probability of future events is “Unlikely”, with a frequency of occurrence of one event every ten years for the Kendall County planning area.

### Vulnerability and Impact

Hurricanes can cause major damage to large areas; hence all existing buildings, facilities and populations are equally exposed and vulnerable to this hazard and could potentially be impacted. Most structures in the planning area can resist the effects of all but the most severe remnants of a hurricane or tropical storm. The Kendall County planning area features one manufactured home park and Eagle Pass features seven manufactured home parks, which are more vulnerable to hurricane winds than site built structures. In addition, manufactured homes are located sporadically throughout rural portions of the county which would also be more vulnerable. The US Census data indicates approximately 1,192 manufactured homes in the Kendall County planning area.

According to the US Census Bureau, 19.6% (approximately 2,846 structures) of the residential structures in the Kendall County planning area were built before 1980.<sup>3</sup> These structures would

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<sup>3</sup> Source: US Census Bureau data estimates for 2014.

## Section 14: Hurricane

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typically be built to lower or less stringent construction standards than newer construction and may be more susceptible to damages during significant events.

The following critical facilities would be vulnerable to hurricane or tropical storm events in the Kendall County planning area:

Kendall County<sup>4</sup>:

- 6 Fire Stations
- 1 EMS Facility
- 5 Schools
- 1 Nursing Homes/Assisted Living Facilities
- 1 Government Facilities
- 1 Wastewater Treatment Facilities
- 1 Electrical Transmission Substation
- 3 Parks
- 1 Animal Control Facility
- 1 Agriculture and Equestrian Center
- 1 Fertilizer Storage Facility

Boerne:

- 1 Fire Stations
- 1 Police Stations
- 1 Sheriff's Department
- 1 Hospital
- 1 EMS Facility
- 11 Schools
- 11 Nursing Homes/Assisted Living Facilities
- 6 Government Facilities
- 2 Wastewater Treatment Facilities
- 4 Electrical Transmission Substation
- 1 Animal Control Facility

Warning time for hurricanes has lengthened due to modern and early warning technology. Hurricane-force winds can easily destroy poorly constructed buildings and mobile homes; and debris such as signs, roofing materials, and small items left outside can become extremely hazardous in hurricanes and tropical storms. Extensive damage to trees, towers, and underground utility lines (from uprooted trees) and fallen poles can cause considerable civic disruption.

Storm track data was available for the past 150 years; and property and crop loss data was available from 1950 to the present. Only hurricane events that have been reported have been factored into this Risk Assessment. It is likely that additional hurricane occurrences have gone unreported before and during the recording period. With no reported damages in the Kendall County planning area in a 56 year reporting period, the annualized loss estimate for Kendall County is considered negligible.

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<sup>4</sup> Kendall County list includes critical facilities located in a census designated place (Comfort) and unincorporated communities including Bergheim, Kendalia, Alamo Springs, Kreutzberg, and Waring where applicable.

## Section 14: Hurricane

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The impact of hurricane events experienced in Kendall County has resulted in no injuries or fatalities. Based on the level of risk and historical occurrences for hurricanes in the Kendall County planning area, there is a “Limited” severity of impact for the Kendall County planning area; meaning injuries and/or illnesses are treatable with first aid, shutdown of facilities and services for 24 hours or less, and less than 10% of property is destroyed or with major damage.

### Assessment of Impacts

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

- 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.
- Driving conditions in all jurisdictions may be dangerous during a hurricane or tropical storm event, elevating the risk of injury and accidents.
- 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.
- Hurricane 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.
- First responders are exposed to downed power lines, unstable and unusual debris, hazardous materials, and generally unsafe conditions.
- Critical staff may be unable to report for duty, limiting response capabilities.
- City or county departments may be damaged, delaying response and recovery efforts for the entire community.
- Private sector entities that the city 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.
- 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 the hurricane may be negatively impacted while roads are cleared and utilities are being restored, further slowing economic recovery.
- Older structures built to less stringent building codes may suffer greater damage as they are typically more vulnerable to hurricane damage.
- Businesses that are more reliant on utility infrastructure than others may suffer greater damages without a backup power source.

The economic and financial impacts of a hurricane 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 hurricane event.

# Section 15: Lightning

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## Hazard Description

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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 FEMA, an average of 300 people are injured and 80 people are killed in the United States each year by lightning. Direct lightning strikes also have the ability to cause significant damage to buildings, critical facilities and infrastructure. 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

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

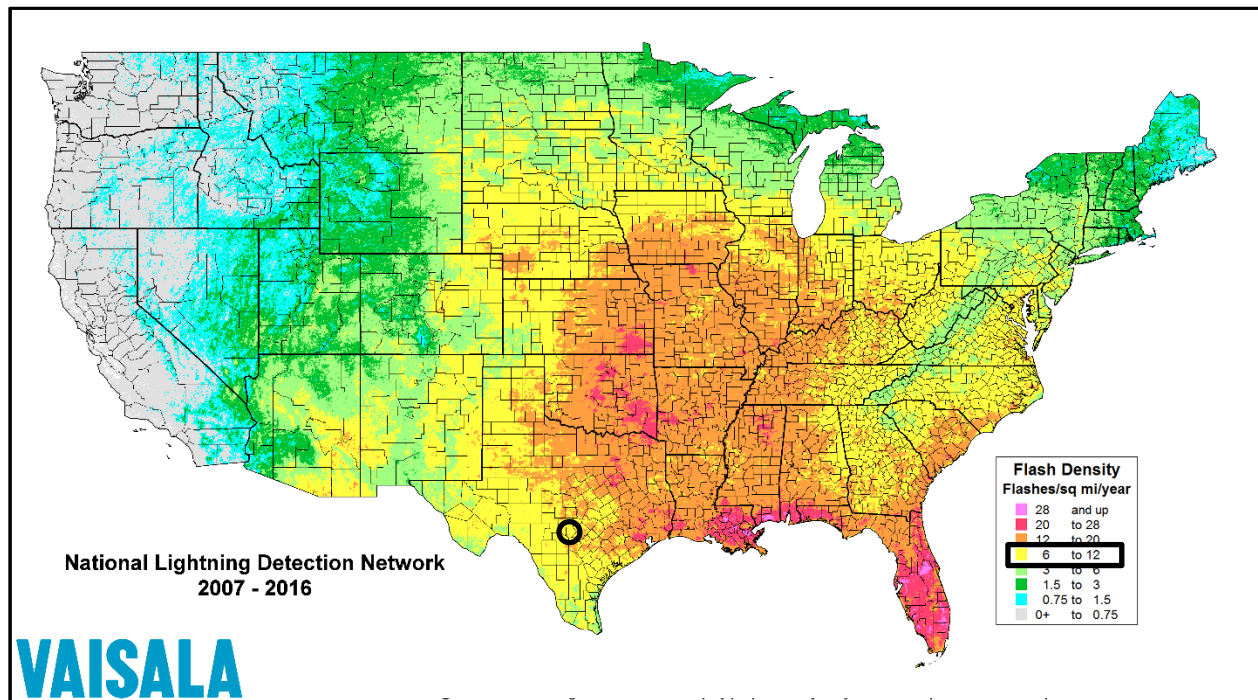
## Extent

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The planning area considers a flash density of less than two to be a minor severity and a flash density of three and greater to be a major severity. Any lightning strike that causes death or property damage is considered a major severity. The Vaisala's U.S. National Lightning Detection Network lightning flash density map (Figure 15-1) shows a range of 6 to 12 lightning flashes per square mile per year for the Kendall County planning area.



**Figure 15-1. Lightning Flash Density, 2007-2016**



### Historical Occurrences

Lightning occurrences and damages are not well documented. No events have been reported for the planning area in a 21 year reporting period. However, team members indicate that lightning events are a regular occurrence for the planning area based on local knowledge and experience. Damages resulting from lighting events are considered negligible. With no reported incidents in the planning area, the team utilized the most current lightning flash density estimate for the risk assessment.

### Probability of Future Events

Based on historical records and input from the planning team the probability of occurrence for future lightning events in the Kendall County planning area, including the City of Borne, is considered highly likely, or an event probable in the next year. According to NOAA, the Kendall County planning area is located in a part of the country that experiences 6-12 lightning flashes per square mile per year (approximately 3,978 to 7,956 flashes per year). Given this estimated frequency of occurrence, it can be expected that future lightning events will continue to threaten life and cause minor property damages throughout the planning area.

### Vulnerability and Impact

Vulnerability is difficult to evaluate since lighting events can occur at different strength levels, in random locations, and can create a broad range of damages depending on the strike location. Due to the randomness of these events, all existing and future structures, and facilities in the Kendall County

## Section 15: Lightning

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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 Kendall County, including the City of Boerne, 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. Population located outdoors is considered at risk and more vulnerable to a lightning strike compared to being 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 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. Agricultural losses can be extensive due to lightning and resulting fires.

The following critical facilities would be vulnerable to lightning events in the Kendall County planning area:

### Kendall County<sup>1</sup>:

- 6 Fire Stations
- 1 EMS Facility
- 5 Schools
- 1 Nursing Homes/Assisted Living Facilities
- 1 Government Facilities
- 1 Wastewater Treatment Facilities
- 1 Electrical Transmission Substation
- 3 Parks
- 1 Animal Control Facility
- 1 Agriculture and Equestrian Center
- 1 Fertilizer Storage Facility

### Boerne:

- 1 Fire Stations
- 1 Police Stations
- 1 Hospital
- 1 EMS Facility
- 11 Schools
- 11 Nursing Homes/Assisted Living Facilities
- 6 Government Facilities
- 2 Wastewater Treatment Facilities
- 4 Electrical Transmission Substation
- 1 Animal Control Facility

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<sup>1</sup> Kendall County list includes critical facilities located in a census designated place (Comfort) and unincorporated communities including Bergheim, Kendalia, Alamo Springs, Kreutzberg, and Waring where applicable.

## Section 15: Lightning

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Impact of lightning experienced in the Kendall County planning area, including the City of Boerne, has resulted in no injuries and no fatalities. Impact of lightning events experienced in the Kendall County planning area would be “Limited,” and injuries and illnesses would be treatable with first aid, the quality of life lost would be minor, and facilities would be shut down for 24 hours or less. Overall, the average loss estimate for Kendall County (in 2016 dollars) is \$0, having an approximate annual loss estimate of \$0 (Table 15-1).

**Table 15-1. Potential Annualized Losses for Kendall County**

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Kendall County	\$0	\$0
Boerne	\$0	\$0

### 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. Impacts to the planning area can include:

- Boerne Lake is a large recreational lake that attracts fishing and boating activities throughout the year. Lightning events could impact recreational water activities, placing boaters and campers in imminent danger, potentially requiring emergency services or lake evacuation.
- Individuals exposed to the storm can be directly struck, posing significant health risks and potential death.
- Structures can be damaged or crushed by falling trees damaged by lightning, which can result in physical harm to the occupants.
- 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 or county 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 damages 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

## Section 15: Lightning

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businesses and citizens will also contribute to the overall economic and financial conditions in the aftermath of any lightning event.

# Section 16: Hazardous Materials

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## Hazard Description

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Hazardous materials come in the form of explosives, flammable, and combustible substances, poisons, and radioactive materials. A hazardous materials (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. You and your community are at risk if a chemical is used unsafely or released in harmful amounts into the environment where you live, work, or play.

In a hazardous materials incident, solid, liquid, and/or gaseous contaminants may be released from fixed or mobile containers. 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.

Tier 2 data is a publicly available database from the Texas Department of State Health Services Tier 2 Chemical Reporting Program. 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



## Section 16: Hazardous Materials

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with the Texas Department of State Health Services (DSHS), Local Emergency Planning Committees (LEPCs), and local fire departments. The Texas Tier 2 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, according to Tier 2 requirements.
- 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 356 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 have to be reported if the quantity is either greater than 500 pounds, or if the Threshold Planning Quantity (TPQ) amount is less than 500 pounds.

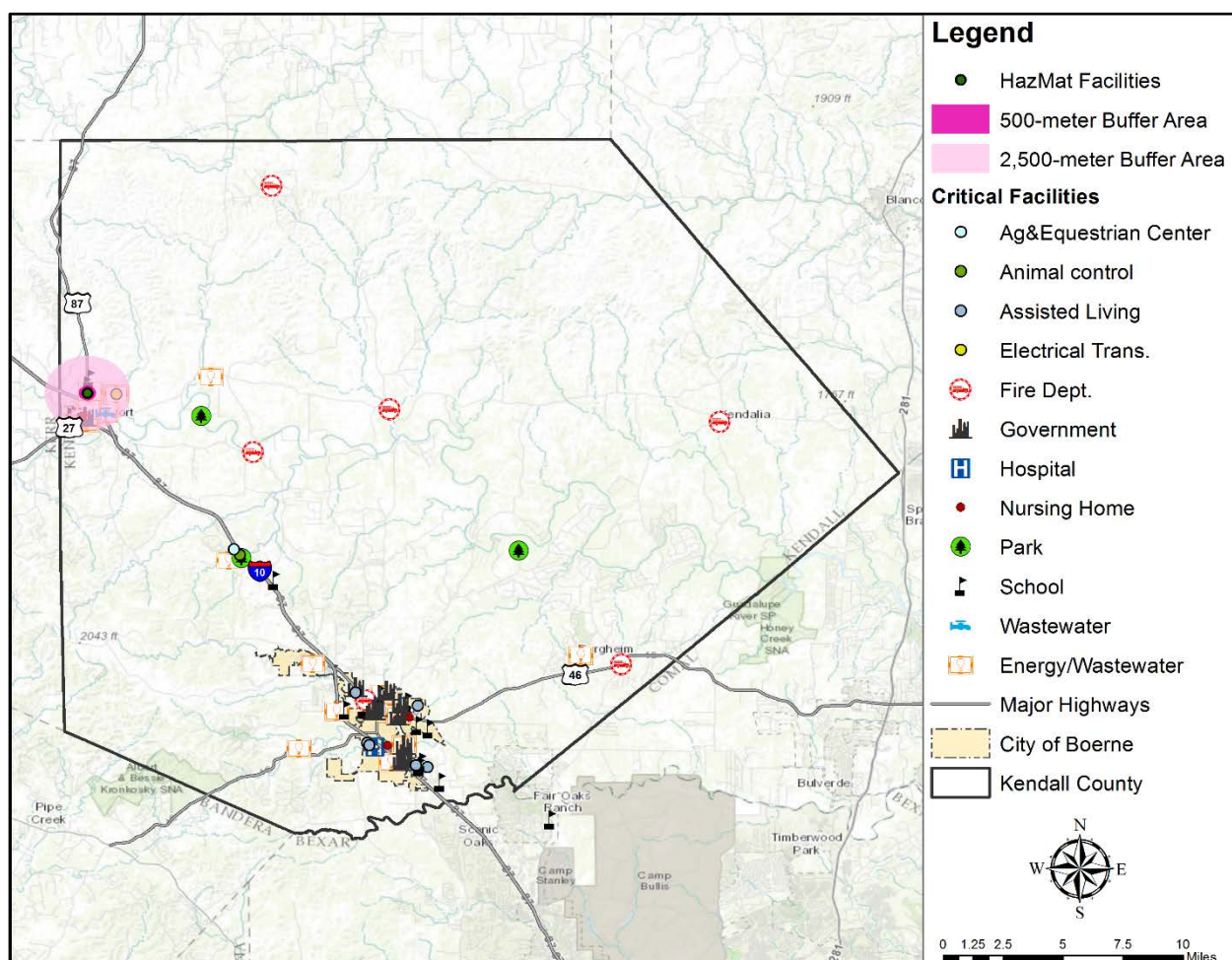
### Location

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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 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 16-1 shows the locations of available georeferenced TRI and Tier 2 toxic sites in and around the Kendall County planning area. Only toxic sites that have georeferenced data available were analyzed and the circle buffers are drawn around each hazardous material site. Two size buffers, 500 and 2,500 meters are assumed in respect to the different levels of effect – immediate (primary) and secondary.

**Figure 16-1. Fixed HAZMAT Analysis Locations and Buffers**



**Table 16-1. TRI HAZMAT Facilities in or near the Kendall County Planning Area**

JURISDICTION	FACILITY NAME	ADDRESS
Kendall County	James Avery Craftsman	105 US Highway 87

### 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

## Section 16: Hazardous Materials

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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.

The spatial extent of a hazardous material release is minimal or expected to affect less than 10% of people or property.

### Historical Occurrences

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Hazardous materials are substances which if released or misused can cause death, serious injury, long-lasting health effects, and damage to structure and other properties as well as to 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.

A total of 7 transportation incidents have been reported in the Kendall County planning area over the last 66 years. The data collected is from 1950 to 2016 and identifies the hazardous materials transportation incidents as in-transit, loading, and unloading of transport vehicles. The reported events are listed in Table 16-2 below.

**Table 16-2. Hazardous Material Incident Events, Kendall County**

JURISDICTION	DATE	INJURIES	FATALITIES	PROPERTY DAMAGE (2016 DOLLARS)	CROP DAMAGE (2016 DOLLARS)
Boerne	7/11/1973	0	0	\$0	\$0
Boerne	3/11/1999	0	0	\$177,502	\$0
Comfort	7/28/2007	0	0	\$0	\$0
Comfort	12/9/2012	0	0	\$3,144	\$0
Boerne	12/27/2013	0	0	\$9,715	\$0
Boerne	9/7/2014	0	0	\$0	\$0
Comfort	7/12/2015	0	0	\$3,526	\$0
<b>TOTAL LOSSES</b>		<b>0</b>	<b>0</b>	<b>\$193,887</b>	

### Probability of Future Events

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Based on the historic incident records, the frequency of occurrence is Occasional and an event is probable in the next 5 years in the Kendall County planning area.

### Vulnerability and Impact

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Based on the prevalence and geographic proximity of hazardous materials transportation routes and fixed locations, less than half of the Kendall County planning area is vulnerable. The risk to the population depends on a variety of factors, including: type and amount of chemical released, weather conditions, prevailing winds, time of day, and season.

The environment is often vulnerable in a hazardous materials incident and can be heavily damaged by a hazardous materials incident. The particular transportation route and fixed site involved are significant factors in determining the risk to public health and safety, and will determine the number of people in proximity to the hazard. Depending on the nature of the hazardous materials incident, the public could be required to either evacuate the area or shelter in place, which will interrupt normal routines.

It is possible that a hazardous materials incident could involve a number of fatalities. It is likely that inhaled hazardous gasses may result in respiratory problems, including burning sensations in the lungs, nose, and throat. Releases that involve 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.

The following facilities in Table 16-3 are located within the 2,500 meter buffer zone for the fixed site facility in the planning area and are considered vulnerable in the event of a hazardous materials event.

**Table 16-3. Facilities within 2,500 Meter Buffer Zone**

JURISDICTION	FACILITY NAME	ADDRESS	TYPE
Kendall County	Comfort Middle School	216 High St	School
Kendall County	Comfort Elementary	605 3rd St	School
Kendall County	Comfort High School	143 US-87	School
Kendall County	St Boniface Episcopal School	130 US-87	School
Kendall County	Comfort VFD	224 FM 473	Fire Department
Kendall County	JP Precinct 4 / Constable	105A Amber Drive	Government
Kendall County	Trinity Nursing Home	615 Faltin St	Nursing Home
Kendall County	KCWCID#1	10 FM 473	Wastewater
Kendall County	LCRA	42 Flat Rock Creek Rd	Electrical Transmission

Impact of hazardous materials incidents experienced in the Kendall County planning area has resulted in no injuries or fatalities supporting a possible limited severity of impact meaning injuries and/or illnesses are treatable with first aid, shutdown of facilities and services for 24 hours or less, and less than 10% of property is destroyed or with major damage.

# Section 17: Pipeline Failure

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## Hazard Description

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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.

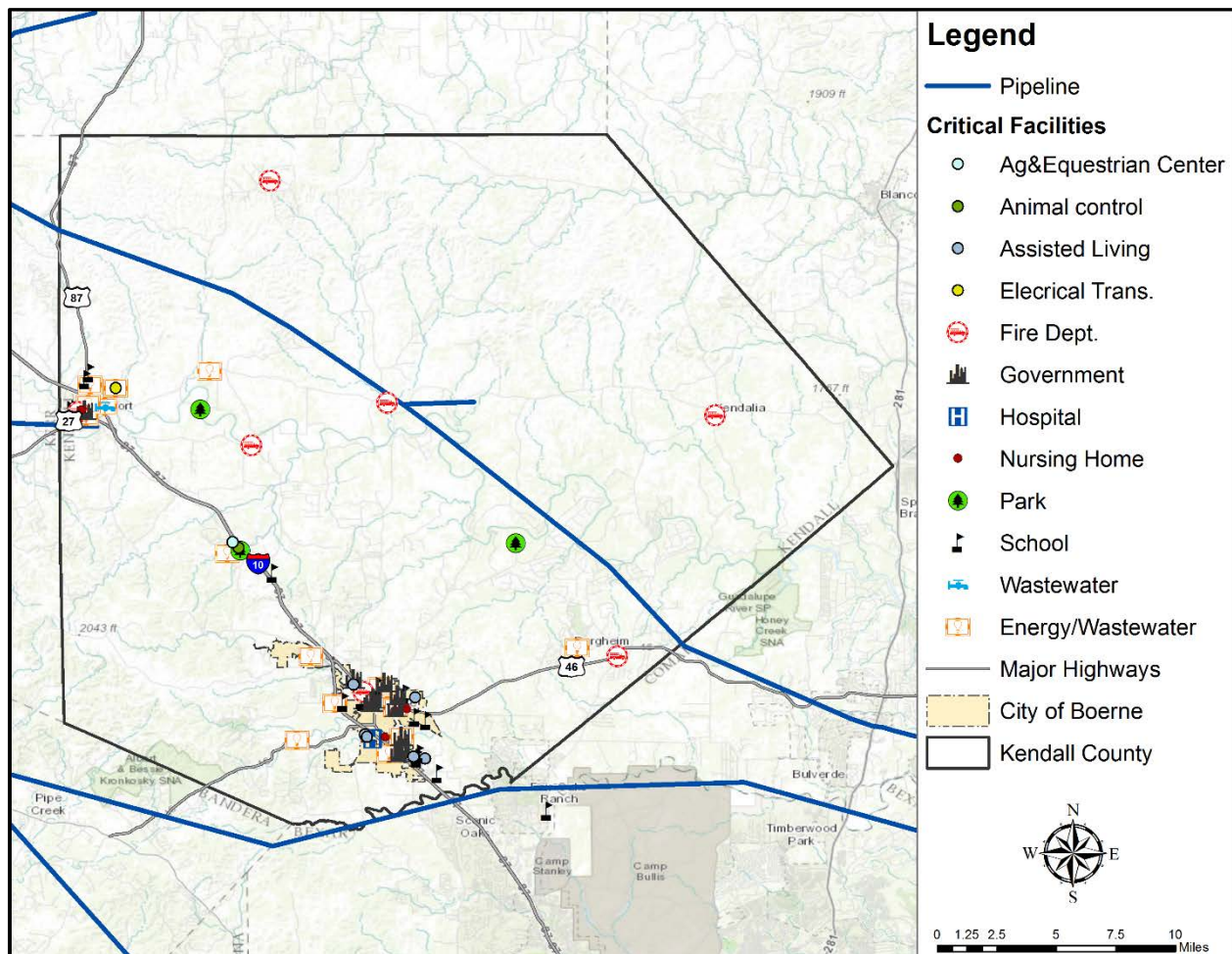
## Location

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Figure 17-1 shows the location of gas and oil energy pipelines in the Kendall County planning area according to the Pipeline and Hazardous Materials Safety Administration and Railroad Commission of Texas.



**Figure 17-1. Kendall County Planning Area Pipeline Locations**



### Extent

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.

### 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.

## Section 17: Pipeline Failure

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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.

Table 17-1 summarizes 2 historical pipeline events for the Kendall County planning area.

**Table 17-1. Historical Pipeline Accidents, 1968-2016<sup>1</sup>**

JURISDICTION	NUMBER OF EVENTS	INJURIES	FATALITIES	PROPERTY DAMAGE (2016 DOLLARS)	CROP DAMAGE (2016 DOLLARS)
Kendall County	1	0	0	\$0	\$0
Boerne	1	1	0	\$1,000	\$0
<b>Total Losses</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>\$1,000</b>	

## Probability of Future Events

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According to the historical incident data, a pipeline incident for the Kendall County planning area is Unlikely, and an event can occur on average once every ten years.

## Vulnerability and Impact

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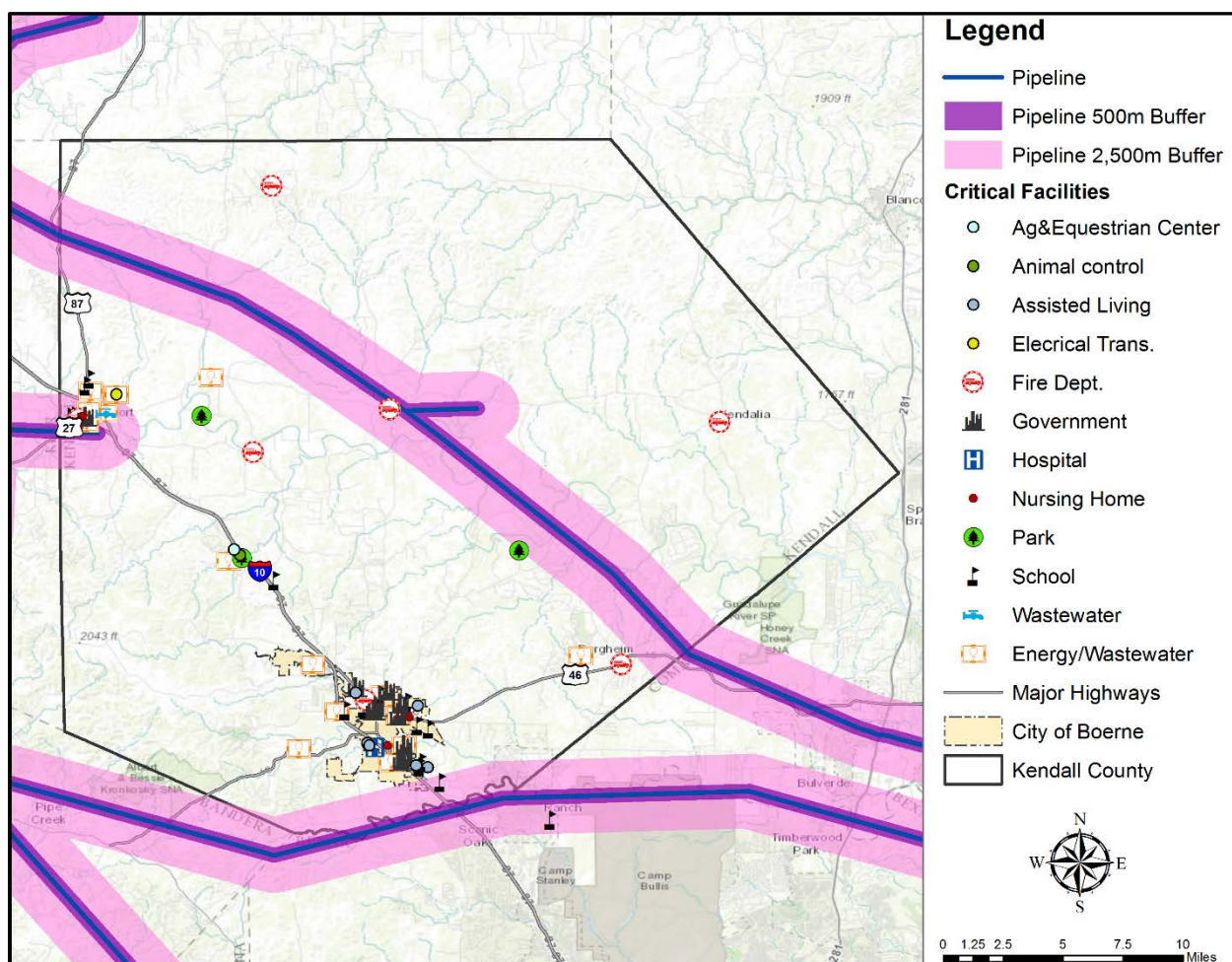
The analysis for gas pipelines is for natural gas and the analysis for oil pipelines is for natural gas liquids. The immediate and primary area of impact for both types of pipeline events is a 500-meter buffer. The secondary area of impact for both types of pipeline events is a 2,500-meter buffer. Figure 17-2 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.

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<sup>1</sup> Source: Pipeline and Hazardous Materials Safety Administration and Railroad Commission of Texas

## Section 17: Pipeline Failure

**Figure 17-2. Pipeline Location with 500 and 2,500 meter buffer**



Pipeline failure can have a “major” impact on human health and area properties. Pipeline failure events can cause injuries, illnesses, and result in permanent disability. These events can also cause facilities in the Kendall County planning area to shut-down for 30 days or more and cause more than twenty-five percent of affected properties to be destroyed or suffer major damage.

The following facilities in Table 17-2 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.

**Table 17-2. Facilities within 500 and 2,500 Meter Buffer Zone**

JURISDICTION	FACILITY NAME	ADDRESS	TYPE
Boerne	Geneva School of Boerne	113 Cascade Caverns Rd	School
Kendall County	Comfort Middle School	216 High St	School
Kendall County	Comfort Elementary	605 3rd St	School
Kendall County	Comfort VFD	224 FM 473	Fire Department



## Section 17: Pipeline Failure

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JURISDICTION	FACILITY NAME	ADDRESS	TYPE
Boerne	Sisterdale VFD	1207 FM 1376	Fire Department
Kendall County	JP Precint 4 / Constable	105A Amber Dr	Government
Kendall County	Trinity Nursing	615 Faltin St	Nursing Home
Kendall County	KCWCID#1	10 FM 473	Wastewater
Kendall County	KCWCID#1	10 FM 473	Wastewater
Kendall County	Lindner Feed	818 Front St	Fertilizer storage
Kendall County	James Avery Craftsman	29 US Hwy 87	Chemical

### 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 a 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. A 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 will 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.

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.

## Section 17: Pipeline Failure

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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.



# Section 18: Terrorism

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## Hazard Description

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The Federal Bureau of Investigation (FBI) categorizes terrorism in the United States as 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 directed by countries or groups outside the United States, or whose activities transcend their national boundaries.



A terrorist attack event can take several forms depending on the technological means available to the terrorist, nature of the issue motivating the attack, and 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 is necessary 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. Chemical agents can have an immediate effect, within a few seconds to a few minutes, or a delayed effect, within several hours to several days.

The U. S. Department of Defense estimates that 26 nations may possess chemical agents and weapons, and an additional 12 may be seeking to develop them. The Central Intelligence Agency reports that at least ten countries are believed to be in possession or conducting research on biological agents for weaponization.

Terrorist events involve the application of one or more modes of harmful force to the built environment. These modes include contamination, such as chemical, biological radiological, or nuclear hazards; energy, such as explosives, arson, and even electromagnetic waves; or denial of service, such as 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 Kendall County planning area.

Terrorists most often search for highly visible targets that can be impacted while avoiding detection. However, the motivation behind a terrorist event can be varied and the target's surrounding area is considered at risk.

### 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. 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 18-1.<sup>1</sup>

**Figure 18-1. National Terrorism Advisory System**



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<sup>1</sup> Source: Department of Homeland Security, <https://www.dhs.gov/national-terrorism-advisory-system>

## Section 18: Terrorism

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The 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](http://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 is minimal to none.

### Historical Occurrences

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In 2007, the Texas Department of Public Safety, which is responsible for Homeland Security in Texas, reported that individuals with ties to Hezbollah, Hamas, and al-Qaida were arrested crossing the border from Mexico. From March 2006 to September 2007, almost 350 individuals "from terrorism-related countries" were arrested at the border.

While there have been no terrorism events for the planning area, the United States border is considered vulnerable to terrorist infiltration.

### Probability of Future Events

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The type, frequency, and location of many natural hazards are identifiable and somewhat predictable because natural hazards are governed by the laws of physics and nature. However, malevolence cannot be forecast with any accuracy. Therefore, there is potential for intentional terrorist acts to occur anywhere and at any time. According to the historical incident data, a terrorism incident for the Kendall County is unlikely, with an event occurring on average once every ten years.

### Vulnerability and Impact

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There is no defined geographic boundary for a terrorist event. All of the population, buildings, critical facilities, infrastructure and lifelines and hazardous materials facilities are considered exposed to the hazards of terrorism and could potentially be affected.

There are no past local terrorist events. Therefore, all assets and facilities are potentially at risk to damages that may for the most part be secondary.

Terrorist events can have a "Major" severity of impact. They can cause injuries, illnesses, or both and result in permanent disability, complete shutdown of county and/or city area facilities for at least two weeks, and cause more than 25 percent of affected properties to be destroyed or suffer major damage.



### Assessment of Impacts

Terrorism poses a potentially significant risk to public health and safety. Persons in the area at the time of a terrorist attack are at risk for injury or death from a variety of threats.

The chance for death, injury, and financial loss increases as population density increases. Therefore, locations in the Kendall County planning area with high population density should be considered to have the most risk.

## Section 18: Terrorism

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Response personnel face similar potential impacts as the general public. Response personnel can be at increased risk of physical injury because the nature of their responsibilities may bring them closer to the hazard and secondary incendiary devices are often directed at response personnel. Response personnel can be subjected to more long-term impacts resulting from prolonged exposure to chemicals or biological weapons.

Depending on the characteristics and location of the event, it is possible that operations and service delivery could be impacted by a terrorist attack. While the Kendall County Office of Emergency Management has a protected facility from which to operate, the facility may not be accessible in the event of a terrorist attack near the facility. If the SAOEM office was inaccessible, then staff members would be limited to performing work with the resources that were accessible to them from their remote location.

Other county and city departments may not be as protected and may suffer more interruptions as a result of damages from a terrorist attack. If hard or electronic files are damaged, destroyed or otherwise inaccessible, a department may be unable to perform its assigned tasks and deliver its designated services. This interruption could have significant impacts throughout the county, and could negatively impact its ability to respond to and recover from the terrorist event. Without a Continuity of Operations Plan (COOP) that takes into account department-specific issues, or regular exercise of that COOP, critical departments may not be able to function and provide necessary services.

Damage from a terrorist event can impact utility infrastructure, either directly or indirectly. This could result in a temporary loss of function for businesses in the planning area that rely on utilities for operation, even if those businesses were not directly impacted by the terrorist event. Additionally, businesses can suffer interruption from closed or blocked roadways; for example, firefighters and law enforcement personnel may need to close a roadway during response and investigative operations. This could negatively impact other businesses in the area that were not otherwise damaged.

Most property, facilities, and infrastructure within the planning area are at risk from damage or destruction from a terrorism event, including residential and commercial structures and their supporting utilities, vehicles and transportation infrastructure, and community buildings, such as hospitals, police stations, and schools. Roadways in or near the terrorist event could be impacted because of damage or closure due to response or investigative operations.

When a terrorist attack occurs there are many potential environmental impacts due to the varied ways an event can occur. The environmental impacts associated with terrorism include, but are not limited to:

- Air pollution,
- Soil contamination,
- Water pollution and hydrologic impacts, and
- Radiological contamination.

Examples of potential terrorist impacts on the environment:

- During severe drought, a terrorist group conducts an arson campaign with multiple fire-bomb attacks that result in large-scale fires throughout the area. Fire affected regions sustain losses to agriculture and forest areas.
- An intentional release of hazardous materials into soil, water, or into the air that leads to environmental contamination and potential changes of the ecosystem, such as habitat loss.

## Section 18: Terrorism

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- Failure of control systems of major utility companies due to cyber-attack, leading to damages of critical infrastructure and consequent environmental impacts, such as uncontrolled release of chemicals into the environment, initiation of random fires, or radiological contamination.

The Kendall County planning area is home to a large number of cultural and historic resources. Many of the historic neighborhoods may be at risk from a terrorist event because they are of a construction type and material that is more vulnerable to fire and explosions. Historic homes are generally exempt from modern building code requirements, which may require fire suppression equipment in the structure, and are often constructed close together. The city/county's historic and cultural resources are a significant draw for tourists and visitors to the area and help to generate revenue through taxes and fees. This revenue in turn pays services and programs, which benefit residents and the community.

The financial and economic impacts associated with a terrorist event may be significant. A major attack, where a large number of structures are damaged or destroyed, can have serious economic and financial consequences for a community. These consequences will depend on what is damaged, the extent of the damage, and the services the damaged structures provided to the community.

The economic and financial impacts of a terrorist 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 businesses and citizens will also contribute to the overall economic and financial conditions in the aftermath of a terrorist event.

Public confidence in local government may be impacted by how response and recovery efforts resulting from the event are handled. A response demonstrating that the county, its leaders, and officials were prepared for the event, anticipated the magnitude, and understood what could happen, will boost the county's reputation and standing with residents. However, if the perception developed, correctly or incorrectly, that the response was slow, that needs or complaints of its residents were ignored, or that the leadership fails to anticipate the magnitude of the event, then public confidence can decline.

A terrorist attack that is responded to and handled with little damage to structures or infrastructure will enhance public perception. Visual images of the first responders can be a powerful tool to aid in the public trust and confidence regarding public safety.



# Section 19: Mitigation Strategy

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## Mitigation Goals

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Based on the results of the risk and capability assessments, the Planning Team was able to develop and prioritize the mitigation strategy. At the Risk Assessment Workshop held May 5, 2016, and the Mitigation Workshop held July 26, 2016, Planning Team members refined the Plan's mitigation strategy. The following goals and objectives were identified.

### Goal 1

Protect public health and safety.

#### Objective 1.1

Partner with agencies serving vulnerable populations to minimize harm in the event of an emergency.

#### Objective 1.2

Promote disaster contingency planning and facility safety among institutions that provide essential services such as food, clothing, shelter and health care to vulnerable populations.

#### Objective 1.3

Educate individuals and communities about disaster preparedness and mitigation.

#### Objective 1.4

Improve disaster warning systems.

#### Objective 1.5

Strengthen local building code enforcement.

#### Objective 1.6

Train emergency responders.

### Goal 2

Protect critical public facilities and infrastructure.

#### Objective 2.1

Implement mitigation programs that protect critical city facilities and services and promote reliability of lifeline systems to minimize impacts from hazards, maintain operations, and expedite recovery in an emergency.

#### Objective 2.2

Consider known hazards when siting new facilities and systems.

## Section 19: Mitigation Strategy

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### Objective 2.3

Create redundancies for critical networks such as water, sewer, digital data, power and communications.

### Objective 2.4

Educate public officials, developers, realtors, contractors, building owners, and the public about hazard risks and building requirements.



### Goal 3

Protect the environment.

### Objective 3.1

Consider the secondary effects of disasters, such as hazardous waste and hazardous materials spills, when planning and developing mitigation projects.

### Objective 3.2

Use environmentally and conservation friendly materials in mitigation projects whenever possible and economically feasible.

### Goal 4

Increase public education and awareness.

### Objective 4.1

Enhance understanding of local hazards and the risks they pose.

### Objective 4.2

Educate the public on actions they can take to prevent or reduce the loss of life or property from all hazards and increase individual efforts to respond to potential hazards.

### Objective 4.3

Publicize and encourage the adoption of appropriate hazard mitigation measures.

### Goal 5

Encourage partnerships.

### Objective 5.1

Partner with private sector, including small businesses, to promote structural and non-structural hazard mitigation as part of standard business practice.

## Section 19: Mitigation Strategy

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### Objective 5.2

Educate businesses about contingency planning citywide, targeting small businesses and those located in high risk areas.

### Objective 5.3

Partner with private sector to promote employee education about disaster preparedness and practice conservation while at work and at home.



# Section 20: Mitigation Actions

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## Summary

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As discussed in Section 2, at the mitigation workshop the planning team and stakeholders met to develop mitigation actions for each of the natural and human-caused hazards included in the Plan. 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 a result of this exercise, an overall priority was assigned to each mitigation 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.

All mitigation actions created by Planning Team members are presented in this section in the form of Mitigation Action Worksheets. 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 two actions, per hazard, and of two different types.

## Section 20: Mitigation Actions

**Table 20-1. Kendall County Mitigation Action Matrix\***

\* FEMA does not review mitigation actions for human-caused hazards; therefore, they are not included in the comprehensive list of mitigation actions in Table 20-1.

MITIGATION ACTION MATRIX				
Actions presented in this matrix represent a comprehensive range and minimum number of required mitigation actions per current State and FEMA Guidelines, including two actions per hazard, and of two different types.				
KENDALL COUNTY: MITIGATION ACTION MATRIX				
HAZARDS	Types of Action:			
	LOCAL PLANS/ REGULATIONS	STRUCTURAL/ INFRASTRUCTURE	NATURAL SYSTEM PROTECTION	EDUCATION & AWARENESS
Dam Failure	XX	X		X
Drought	XX			X
Extreme Heat		X		XXX
Flood	XXX	XX		XXX
Hail	XX	X		XX
Hurricane Wind	XXX	XX		XX
Thunderstorm Wind	XXX	XX		XX
Tornado	XX	XX		XX
Wildfire	XXX	X		XX
Winter Storm	X	X		X
Lightning		XX		X
CITY OF BOERNE: MITIGATION ACTION MATRIX				
HAZARDS	Types of Action:			
	LOCAL PLANS/ REGULATIONS	STRUCTURAL/ INFRASTRUCTURE	NATURAL SYSTEM PROTECTION	EDUCATION & AWARENESS
Dam Failure	X	X		X
Drought	X			X
Extreme Heat		X		X
Flood	X			XX
Hail	X			XX
Hurricane Wind	X			X
Thunderstorm Wind	X			X
Tornado	X			X
Wildfire	X			XX



## Section 20: Mitigation Actions

Winter Storm		X		XX
Lightning	X	X		X

## Kendall County

Kendall County – Action #1	
<b>Proposed Action:</b>	All critical facilities should have a back-up power supply. Conduct survey to identify these facilities that do not have back-up power and prioritize facilities. Install back-up power with permanent quick connections at facilities as funding become available.
<b>BACKGROUND INFORMATION</b>	
<b>Jurisdiction/Location:</b>	Countywide facilities
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Assure that during power outages that all County Facilities have the ability to have back-up power to conduct day-to-day and critical activities. Ensure continuity of services during hazard events.
<b>Type of Action</b> ( <i>Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness</i> )	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure; Extreme Heat; Flood; Hail; Thunderstorm Wind; Tornado; Wildfire; Winter Storm; Hurricane Wind; Terrorism, Lightning
<b>Effect on New/Existing Buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	TBD per site
<b>Potential Funding Sources:</b>	Local Budget; HMA Grants
<b>Lead Agency/Department Responsible:</b>	Facility Maintenance; Emergency Management
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending available funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS
It is critical that government facilities be up and running as quickly after an event that causes power outages for short and/or long term.

## Section 20: Mitigation Actions

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**Additional Considerations:**

The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)

Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 5; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

## Section 20: Mitigation Actions

Kendall County – Action #2	
<b>Proposed Action:</b>	Create and implement stricter water restrictions in Cow Creek Ground Water district to mitigate drought impacts. Assist Cow Creek Ground Water District in enforcing water restrictions. Use law enforcement to enforce water restrictions when Cow Creek issues critical water level concerns and expresses a need for strict conservation.
<b>BACKGROUND INFORMATION</b>	
<b>Jurisdiction/Location:</b>	Countywide
<b>Risk Reduction Benefit (Current Cost/Losses Avoided):</b>	Provide for water retention and avoid deprecation of ground water sources.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Drought
<b>Effect on New/Existing Buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	Minimal – Staff Time
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Cow Creek w/ Law Enforcement assistance
<b>Implementation Schedule:</b>	Within 12 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Operations Plan

COMMENTS
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 3; Technically Feasible = 2; Administratively Possible = 3; Politically Acceptable = 2; Legal = 3; Economically Sound = 5; and Environmentally Sound = 5</p>

## Section 20: Mitigation Actions

Kendall County – Action #3	
<b>Proposed Action:</b>	Purchase, build, and place hazardous warning signs, or auto barricades at low water crossings. Place auto barricades or permanent pull out barricades at these locations so when auto sensed, a barricade would drop and close the roadway. If using the pull out type, all responders would have a key to open the container and close the roadway.
<b>BACKGROUND INFORMATION</b>	
<b>Jurisdiction/Location:</b>	Countywide at low water crossings
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Provide early warning that the roadway is flooded and not to drive through; Turn Around – Don't Drown
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Structure and Infrastructure; Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood
<b>Effect on New/Existing Buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$500,000
<b>Potential Funding Sources:</b>	HMA Grants; Local budget (limited amount each year)
<b>Lead Agency/Department Responsible:</b>	Road and Bridge
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Road and Bridge Flooding Plans

COMMENTS
Kendall County lies within part of the area of Texas that is prone to more flooding, flash flooding than other parts of the State and Nation.
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 2; Administratively Possible = 3; Politically Acceptable = 4; Legal = 4; Economically Sound = 2; and Environmentally Sound = 3

## Section 20: Mitigation Actions

Kendall County – Action #4	
<b>Proposed Action:</b>	<b>Creation of a GIS map showing all low water crossing in the County and improve county flood risk assessment. Build site, make public, then educate public how to access and use.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Jurisdiction/Location:</b>	Countywide
<b>Risk Reduction Benefit (Current Cost/Losses Avoided):</b>	Having this site easily accessible to the public, citizens, visitors, and others to pull up and see during times of potential flooding events.
<b>Type of Action: (Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness)</b>	Local Plans and Regulations; Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood; Thunderstorm Wind; Hurricane Wind
<b>Effect on New/Existing Buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	Minimal
<b>Potential Funding Sources:</b>	Budget through the GIS department
<b>Lead Agency/Department Responsible:</b>	GIS Department
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Operations Plan

COMMENTS
Would allow the public as well as responders to become familiar with low water crossing locations, maybe history on how fast they flood, and the extent of dangers when flooding.
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies) Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5



## Section 20: Mitigation Actions

Kendall County – Action #5	
<b>Proposed Action:</b>	Purchase and place generators with permanent quick connections at the County Courthouse and all Fire Stations in the County that do not have them. Survey each station to see what energy requirements are required. Purchase generators with auto switches to power the station during outages.
<b>BACKGROUND INFORMATION</b>	
<b>Jurisdiction/Location:</b>	Alamo Springs; Bergheim; Kendalia; Sisterdale; and Waring Fire Stations, Kendall County Courthouse
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	During Flooding, Sever Thunderstorm, Winter Storm, or other events that could cause power disruption, the fire stations would have emergency power to continue their mission.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood; Thunderstorm Wind; Winter Storm; Hail; Wildfire; Extreme Heat; Tornado; Hurricane Wind, Lightning
<b>Effect on New/Existing Buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$250,000
<b>Potential Funding Sources:</b>	HMA Grants; Local Budget (limited amount each year)
<b>Lead Agency/Department Responsible:</b>	Fire Chiefs
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Continuity of Operations Plan

COMMENTS
It is important that responders be able to operate effectively during adverse conditions.
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies) Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 4; and Environmentally Sound = 4

## Section 20: Mitigation Actions

Kendall County – Action #6	
<b>Proposed Action:</b>	Conduct Hail storm, Lightning and Tornado safety awareness and education about the dangers of these events. Educate citizens on mitigation measures to protect property and lives during hail, lightning, and tornado events.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit (Current Cost/Losses Avoided):</b>	Prevent property damage, loss of life and prevention of injury due to hail storms and tornados.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hail; Tornado, Lightning
<b>Effect on new/existing buildings:</b>	Reduce damage to existing structures
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget; Donations; HMA Grants
<b>Lead Agency/Department Responsible:</b>	Public Safety Responders
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local Plans & Public Regulations SOP's

COMMENTS:
When Fire Departments, EMS, Law Enforcement go to schools, homeowner association meetings, and other events, they could take time to educate and inform the public about the dangers of Hail storms and tornados and how to protect themselves and family
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 3; Politically Acceptable = 4; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

## Section 20: Mitigation Actions

Kendall County – Action #7	
<b>Proposed Action:</b>	Provide training for first responders that could be involved in a Hazardous Material Incident. Provide 2016 Emergency Response Guidebook training to all 1 <sup>st</sup> responders. Provide Awareness training to all FD, EMS, and Law Enforcement staff.
<b>BACKGROUND INFORMATION</b>	
<b>Jurisdiction/Location:</b>	Countywide – all 1 <sup>st</sup> responders
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce the risk of injury and/or death to 1 <sup>st</sup> responders and reduce the risk posed by the Hazardous Material.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hazardous Material
<b>Effect on New/Existing Buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Training Budget; HMA Grants
<b>Lead Agency/Department Responsible:</b>	Emergency Management, Fire Department, Law Enforcement
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local SOP's

COMMENTS
Within 26 miles of IH 10 running through Kendall County in addition to other State Highways and Farm-to-Market roads that could be used as a hazardous materials transportation route, the majority of the Kendall County planning area is vulnerable to a hazardous materials incident.
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 3; Politically Acceptable = 5; Legal = 3; Economically Sound = 5; and Environmentally Sound = 5

## Section 20: Mitigation Actions

Kendall County – Action #8	
<b>Proposed Action:</b>	<b>Provide advanced training for first responders that want to advance to the operations and/or technical level to operate in the hot zone of a Hazardous Materials Incident. Provide opportunity for staff that want to achieve an advance level of training to do so.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide – department members wanting to advance
<b>Risk Reduction Result</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce the risk of injury and/or death to responders and reduce the risk posed by the Hazardous Material as well as reduce the time to mitigate the incident versus waiting for response companies to get here from outside the county.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hazardous Material
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$250 to \$750 per student
<b>Potential Funding Sources:</b>	Training Budget; HMA Grants; Loans
<b>Lead Agency/Department Responsible:</b>	Emergency Management, Fire Department, Law Enforcement
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local SOP's

COMMENTS:
Within 26 miles of IH 10 running through Kendall County in addition to other State Highways and Farm-to-Market roads that could be used as a hazardous materials transportation route, the majority of the Kendall County planning area is vulnerable to a hazardous materials incident.
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 3; Politically Acceptable = 5; Legal = 3; Economically Sound = 5; and Environmentally Sound = 5

## Section 20: Mitigation Actions

Kendall County – Action #9	
<b>Proposed Action:</b>	<b>Ensure that businesses which use, store, manufacture, or sell hazardous materials is in compliance with the Adopted County Fire Code. Annual fire inspections of facilities that use, store, manufacture or sell hazardous materials.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce potential for Hazardous Material release.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hazardous Materials
<b>Effect on new/existing buildings:</b>	Reduce risk to existing facilities
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	None – staff time
<b>Potential Funding Sources:</b>	N/A
<b>Lead Agency/Department Responsible:</b>	Fire Marshal – Health Inspector
<b>Implementation Schedule:</b>	Within 12 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Fire, Health, and Safety Codes

COMMENTS:
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 5; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

## Section 20: Mitigation Actions

Kendall County – Action #10	
<b>Proposed Action:</b>	<b>Provide cooling sites and public education for extreme heat conditions. Provide locations for the public and citizens to gather where they are in a cooler environment. Public service announcements and handouts on cooling locations and personal protection.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce risk of injury and/or illness to citizens during extreme heat days.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Extreme Heat
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Nonprofit organizations buildings and sponsored pamphlets
<b>Lead Agency/Department Responsible:</b>	Emergency Management
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 3; Politically Acceptable = 4; Legal = 4; Economically Sound = 5; and Environmentally Sound = 5</p>



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Kendall County – Action #11	
<b>Proposed Action:</b>	<b>Provide subsidized fans and other cooling devices to citizens that are in need of them. Through public service have people purchase fans and cooling devices and drop off at a public safety building location. After devices are dropped off we can work with family services, faith base organizations and others to get the cooling devices in the hands of those in need.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit (Current Cost/Losses Avoided):</b>	Reduce the injury, illness and deaths from long exposure to extreme heat days.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Extreme Heat
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	Minimal
<b>Potential Funding Sources:</b>	Donations of devices
<b>Lead Agency/Department Responsible:</b>	Public Safety w/ Family Services and Faith Base organizations assistance
<b>Implementation Schedule:</b>	Within 24 hours of plan adoption
<b>Incorporation into Existing Plans:</b>	Local and Emergency Response Plans

COMMENTS:
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

## Section 20: Mitigation Actions

Kendall County – Action #12	
<b>Proposed Action:</b>	Strengthen subdivision rules and regulations to encourage higher densities only outside of known hazard areas and stronger construction standards to mitigate against hazards including wind, hail, wildfire, and flood. As development rules and regulations are reviewed and updated, we propose to add this to future rules and regulations and educate developers to find areas outside known hazard areas and to build disaster resistant structures.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Deduce damage to structures while reducing risk to life safety.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure; Flood; Thunderstorm Wind; Wildfire; Tornado; Hail; Hurricane Wind
<b>Effect on new/existing buildings:</b>	Reduce risk to new structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Development Management, Floodplain Manager, GIS
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local Ordinances and building codes

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 4; Politically Acceptable = 2; Legal = 3; Economically Sound = 5; and Environmentally Sound = 3</p>

## Section 20: Mitigation Actions

Kendall County – Action #13	
<b>Proposed Action:</b>	<b>Provide early warning and post event information. Either purchase or encourage citizens to purchase NOAA All Hazard Radios for early warning and post-event information for public, businesses, schools, event venues.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Provide for life safety issues for the public and 1 <sup>st</sup> responders.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood; Thunderstorm Wind; Hail; Wildfire; Winter Storm; Hurricane Wind; Tornado; Dam Failure; Extreme Heat
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures through early warning
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	TBD
<b>Potential Funding Sources:</b>	Donations, HMA Grants, Local Budget
<b>Lead Agency/Department Responsible:</b>	Emergency Management
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

## Section 20: Mitigation Actions

Kendall County – Action #14	
<b>Proposed Action:</b>	Through use of Fire Codes & Subdivision Rules and Regulations, adopt minimum residential street width to accommodate emergency response vehicles. Through code, rules, and regulation enforcement we can make residential streets safer for responders.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Allows for a safer and quicker response time.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure; Flood; Hurricane Wind; Thunderstorm Wind; Wildfire; Winter Storm; Tornado, Hail
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$1,000
<b>Potential Funding Sources:</b>	Developer Responsibility
<b>Lead Agency/Department Responsible:</b>	Fire Marshal, Development Management
<b>Implementation Schedule:</b>	Within 24 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Fire Code and Development Rules and Regulations

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 3; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 3; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5</p>

## Section 20: Mitigation Actions

Kendall County – Action #15	
<b>Proposed Action:</b>	<b>Make sure 1<sup>st</sup> responders are trained in the recognition and procedure for a pipeline failure. Include how to locate pipelines in the County. Provide opportunity for responders to attend Pipeline safety courses taught in the area and around the state and/or conduct local training on pipeline failure.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide 1 <sup>st</sup> responders
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce the risk of injury and/or death to responders and reduce the risk posed by a pipeline failure and what actions to take if responding to a failure.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Pipeline Failure
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	Most courses are free, maybe minimal travel cost
<b>Potential Funding Sources:</b>	Training Budget
<b>Lead Agency/Department Responsible:</b>	Emergency Management, Fire Department, Law Enforcement
<b>Implementation Schedule:</b>	Within 36 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Local SOPs

COMMENTS:
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 5; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

## Section 20: Mitigation Actions

Kendall County – Action #16	
<b>Proposed Action:</b>	<b>Educate the public and landowners of the dangers of a Pipeline Failure, how to recognize and contact assistance as well as activities conducted on and around pipelines. Provide opportunity for the public and landowners to understand the dangers of Pipeline Failure and how to recognize and report.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide in area where Pipelines exist
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce the risk of injury and/or death to citizens and landowners and how to request assistance during a failure.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Pipeline Failure
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$2,500
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Emergency Management, Fire Department, Law Enforcement
<b>Implementation Schedule:</b>	Within 36 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local SOPs and Public Awareness

COMMENTS:
Kendall county has 3 lines running through it.
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 5; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5



## Section 20: Mitigation Actions

Kendall County – Action #17	
<b>Proposed Action:</b>	<b>Establish local response procedures for suspicious packages received. Have local procedures in all offices that receive mail and/or packages.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide facilities
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce the risk of opening and/or receiving suspicious packages and/or mail.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Terrorism
<b>Effect on new/existing buildings:</b>	Reduce risk to existing facilities
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$1,000
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Law Enforcement, Emergency Management
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local Plans, Department SOPs

COMMENTS:
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies) Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 3; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

## Section 20: Mitigation Actions

Kendall County – Action #18	
<b>Proposed Action:</b>	<b>Provide awareness training with reference to terrorism. Provide terrorism awareness training to all county staff on what to look for that may indicate suspicious activity or left behind objects.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide facilities
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce the risk of having a terrorism incident in a county facility or during a county sponsored function.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Terrorism
<b>Effect on new/existing buildings:</b>	Reduce risk to existing facilities
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Law Enforcement, Emergency Management
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local Plans, Department SOPs

COMMENTS:
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 3; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

## Section 20: Mitigation Actions

Kendall County – Action #19	
<b>Proposed Action:</b>	Reimbursement program for safe rooms in new and existing homes, businesses, schools and places of assembly. Provide a reimbursement program for new home builders, existing home builders and others that elect to have a safe room place in their home.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce the injury and death during a tornado or severe storm.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Tornado; Thunderstorm Wind; Hurricane Wind
<b>Effect on new/existing buildings:</b>	Provide safe haven for occupants
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	TBD per structure
<b>Potential Funding Sources:</b>	HMA Grant
<b>Lead Agency/Department Responsible:</b>	Emergency Management & Auditor
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 4; Technically Feasible = 4; Administratively Possible = 5; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 4</p>

## Section 20: Mitigation Actions

Kendall County – Action #20	
<b>Proposed Action:</b>	<b>Implement FireWise Community Program for County. Work with subdivision home owner, home owner associations, Texas Forest Service and the National Firewise Program to reduce risk. Public Education on Wildfire Safety and Strategies.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide with then emphasis on subdivision throughout the County and area close to the City of Boerne
<b>Risk Reduction Benefit (Current Cost/Losses Avoided):</b>	With the risk of wildfire during dry and drought conditions we could reduce the loss of homes and other structures. This would also build defensive area should a wildfire occur.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Wildfire
<b>Effect on new/existing buildings:</b>	Reduce losses to existing and future structures and infrastructure
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$1,000
<b>Potential Funding Sources:</b>	Home Owners doing for themselves, HMA Grants, Local Budget, National Firewise Program and Texas Forest Service
<b>Lead Agency/Department Responsible:</b>	County Fire Marshal, Fire Departments, County Development Management
<b>Implementation Schedule:</b>	Within 24 months of plan adoption
<b>Incorporation into Existing Plans:</b>	As new Development Rules and Regulations are updated, reviewed and renewed, we could incorporate Firewise strategies into these rules

COMMENTS:
Kendall County is growing rapidly and increasing the Urban Wildland Interface as new development occurs across the county.
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 3; Administratively Possible = 3; Politically Acceptable = 3; Legal = 4; Economically Sound = 5; and Environmentally Sound = 4

## Section 20: Mitigation Actions

Kendall County – Action #21	
<b>Proposed Action:</b>	<b>Fire Code Adoption in 2015. Continue to enforce fire code per the Kendall County Fire Code. Provide annual fire safety inspections on commercial business, public buildings, multi-family living units and other types of both new and existing per the adopted Fire Code.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide for commercial, public assembly, multi-family living units (4 or more)
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	With the adoption of Fire Codes, we can reduce the risk of structure fire in commercial, public, multi-family buildings thus reducing the risk of structure fire in the Urban Wildland Interface areas.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Wildfire
<b>Effect on new/existing buildings:</b>	Reduce risk to existing and future structures and infrastructure
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$50,000 to \$70,000 annually
<b>Potential Funding Sources:</b>	Use of fee collected for permits
<b>Lead Agency/Department Responsible:</b>	County Fire Marshal
<b>Implementation Schedule:</b>	Within 24 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Kendall County Adopted Fire Codes January 1, 2016, as this program develops and grows, we will slowly incorporate Fire Codes in with Development Rules and Regulations

COMMENTS:
With the adoption of Fire Codes we make Kendall County a safer place to live and visit.
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 3; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 2

## Section 20: Mitigation Actions

Kendall County – Action #22	
<b>Proposed Action:</b>	<b>Develop and implement water use restrictions to mitigate damage caused by drought such as restrictions and ordinances for residential and commercial requirements for drought tolerant landscaping.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduces water usage and waste.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Drought
<b>Effect on new/existing buildings:</b>	Reduce risk to existing and future structures and facilities
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$2,500
<b>Potential Funding Sources:</b>	Annual budget
<b>Lead Agency/Department Responsible:</b>	Development Management
<b>Implementation Schedule:</b>	Within 48 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local Ordinances

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 3; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 3</p>



## Section 20: Mitigation Actions

Kendall County – Action #23	
<b>Proposed Action:</b>	Educate citizens on taking water-saving measures such as low-flow toilets and shower heads, adjusting sprinklers, water saving measures in daily activities, and installation of graywater systems.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Countywide
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Educate water consumers on proper water use, as not to waste water.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Drought
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Development Management
<b>Implementation Schedule:</b>	Within 48 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Public works SOP

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5</p>

### City of Boerne

Boerne – Action #1	
<b>Proposed Action:</b>	<b>Include wind engineering measures such as structural bracing in local building codes to reduce damage risk during tornados.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce the risk of severe property damage due to tornados through stronger construction practices.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Tornado; Thunderstorm Wind; Hurricane Wind
<b>Effect on new/existing buildings:</b>	Reduce damage risk to new structures
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget, General Funds, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	Within 36 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan, Local Building Codes

COMMENTS:
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies) Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 4; Legal = 4; Economically Sound = 4; and Environmentally Sound = 4

## Section 20: Mitigation Actions

Boerne – Action #2	
<b>Proposed Action:</b>	<b>Adopt more stringent building codes designed to protect against natural hazards including wind, hail, fire, lightning and flood resistant construction.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce damages to structures through improved construction practices.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Thunderstorm Wind; Tornado; Flood; Hail; Wildfire; Hurricane Wind, Lightning
<b>Effect on new/existing buildings:</b>	Reduce risk to new and substantially improved structures
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Local Budget, General Funds
<b>Lead Agency/Department Responsible:</b>	City Code Enforcement and Fire Marshal
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local building codes

COMMENTS:
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)
Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 4; Legal = 4; Economically Sound = 4; and Environmentally Sound = 4

## Section 20: Mitigation Actions

Boerne – Action #3	
<b>Proposed Action:</b>	<b>Adopt codes and ordinances to aid in the reduction of fire spreads. Regulations may include required signage, fire hydrants, water availability requirements, vegetation management, and construction design guidelines.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits with emphasis being on future subdivision annexation
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce fire related loss, costs and hazards.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Wildfire
<b>Effect on new/existing buildings:</b>	Reduce fire hazard to new and existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan, CWPP

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 4; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 4; Legal = 4; Economically Sound = 4; and Environmentally Sound = 4</p>

## Section 20: Mitigation Actions

Boerne – Action #4	
<b>Proposed Action:</b>	<b>Implement yearly inspection of dams with NRCS and County representatives.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Dam site I – City Lake Dam site II – Lake Oz
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Yearly inspection of dam sites to record maintenance needed.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	Minimal staff time
<b>Potential Funding Sources:</b>	Operating Budget
<b>Lead Agency/Department Responsible:</b>	Emergency Management / Public Works
<b>Implementation Schedule:</b>	Within 12 months of plan adoption
<b>Incorporation into Existing Plans:</b>	Standard Operations Plan

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 4; Technically Feasible = 4; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5</p>

## Section 20: Mitigation Actions

Boerne – Action #5	
<b>Proposed Action:</b>	<b>Brush clearing and erosion control performed at dam sites I and II.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Dam site I – City Lake Dam site II – Lake Oz
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Keep dam in good condition to reduce possibility of dam failure.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Structure and Infrastructure Project

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$25,000
<b>Potential Funding Sources:</b>	Local Budget, Federal Grants, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Emergency Management / Public Works
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Dam Safety Plan

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 4; Technically Feasible = 4; Administratively Possible = 4; Politically Acceptable = 5; Legal = 4; Economically Sound = 4; and Environmentally Sound = 4</p>



## Section 20: Mitigation Actions

Boerne – Action #6	
<b>Proposed Action:</b>	<b>Implement Education Program and acquire adequate equipment for first responders.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits and fire department response area
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce risk of injuries to first responders.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hazardous Materials
<b>Effect on new/existing buildings:</b>	Dependent on extent of exposure
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	TBD
<b>Potential Funding Sources:</b>	Local Budget, Federal Grants
<b>Lead Agency/Department Responsible:</b>	Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5</p>

## Section 20: Mitigation Actions

Boerne – Action #7	
<b>Proposed Action:</b>	<b>Implement Firewise Community program for the City of Boerne.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits with emphasis being on future subdivisions annexation
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce fire related loss.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Wildfire
<b>Effect on new/existing buildings:</b>	Reduce fire hazard to new and existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Local Budget, Texas Forest Service Grants
<b>Lead Agency/Department Responsible:</b>	Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan, CWPP

COMMENTS:
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies) Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

## Section 20: Mitigation Actions

Boerne – Action #8	
<b>Proposed Action:</b>	<b>Flood Education for the public, including “Turn Around, Don’t Drown”, flood mitigation measures, and flood notification through I-Info.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit (Current Cost/Losses Avoided):</b>	Educate the public about the dangers of high water, mitigation measures that can be implement in homes, and notify the public of possible flooding through I-Info.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$25,000
<b>Potential Funding Sources:</b>	Local Budget, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Emergency Management
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies) Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5

## Section 20: Mitigation Actions

Boerne – Action #9	
<b>Proposed Action:</b>	<b>Continue inspection of pipelines; repair or replace inadequate gas distribution systems; train yearly on proper procedures for employees and first responders.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City of Boerne gas customers and gas systems
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Inspection and replacement of lines reduces the possibility of future problems.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness, Structure and Infrastructure

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Pipeline Failure
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$30,000 per year
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Public Works
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Operations Plan

COMMENTS:
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies) Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 4; Politically Acceptable = 4; Legal = 4; Economically Sound = 4; and Environmentally Sound = 4

## Section 20: Mitigation Actions

Boerne – Action #10	
<b>Proposed Action:</b>	<b>Educate citizens on safety procedures during hail storms and mitigation measure to reduce damages. Training through public service announcements, pamphlets and presentations.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Possible reduction of injuries and damage during hail storms through education.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hail
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	HMA Grants
<b>Lead Agency/Department Responsible:</b>	Emergency Management
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies) Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

## Section 20: Mitigation Actions

Boerne – Action #11	
<b>Proposed Action:</b>	<b>Place hazard warning signs and auto barricades at low water crossings. Include installation of new barricades and maintenance of existing barricades in the annual City budget.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	Low water crossings in the City limits and newly annexed areas
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce risk to citizens and first responders.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Flood
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	TBD per site
<b>Potential Funding Sources:</b>	Local Budget, HMA Grants, and other Federal Programs
<b>Lead Agency/Department Responsible:</b>	Emergency Management / Street Department
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
The City experiences several flash floods yearly. Citizens routinely drive into flood waters requiring rescue. This action lower the risks involved with low water crossings.
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies) Socially Acceptable = 4; Technically Feasible = 4; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 4; and Environmentally Sound = 5



## Section 20: Mitigation Actions

Boerne – Action #12	
<b>Proposed Action:</b>	Educate citizens to reduce the risk of injury and illness due to extreme heat. Educate citizens on the dangers of extreme heat and the steps they can take to protect themselves, as well as mitigation measures that can reduce the effect of extreme heat on residential property.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits and future annexations
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce the risk of heat related injury and illness.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Extreme Heat
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Fire Department
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5</p>

## Section 20: Mitigation Actions

Boerne – Action #13	
<b>Proposed Action:</b>	Educate and notify citizens of possible hurricane winds through I-Info. Educate citizens on mitigation measures to implement when a hurricane event is eminent.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce injuries and damage of property through preparations and early warning of hurricane force winds.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hurricane Winds
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Local Budget, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Emergency Management
<b>Implementation Schedule:</b>	Within 36-48 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Operations Plan, Emergency Management Plan

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5</p>

## Section 20: Mitigation Actions

Boerne – Action #14	
<b>Proposed Action:</b>	<b>Notification / early warning of possible hail storms with the use of I-Info.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City of Boerne and surrounding area
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce injuries and damages through early warning.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hail
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures and property through early warning
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$7,000
<b>Potential Funding Sources:</b>	HMA Grant, Local Budget
<b>Lead Agency/Department Responsible:</b>	Emergency Management
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Operations Plan

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5</p>

## Section 20: Mitigation Actions

Boerne – Action #15	
<b>Proposed Action:</b>	<b>Protect City Infrastructure, including: water plant, gas lines, sewer plants, dam sites, through installment of better fencing, installment of additional cameras and training for personnel.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City of Boerne infrastructure
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce risk of possible terrorist attack.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Structure and Infrastructure, Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Terrorism
<b>Effect on new/existing buildings:</b>	Potential risk reduction to existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$50,000
<b>Potential Funding Sources:</b>	Local Budget, Federal Grants
<b>Lead Agency/Department Responsible:</b>	All City Departments
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Operations Plan

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 4; Technically Feasible = 4; Administratively Possible = 4; Politically Acceptable = 4; Legal = 5; Economically Sound = 4; and Environmentally Sound = 4</p>

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## Section 20: Mitigation Actions

Boerne – Action #17	
<b>Proposed Action:</b>	Educate citizens to reduce risk of injury during winter storms. Educate on preparations to make before a storm as well as safety measures to take during and immediately after an event to protect lives and reduce damages.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce injuries and emergency services needed during severe winter storms. Reduce damages to structures including fire from heating sources.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Winter Storm
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Local Budget, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5</p>



## Section 20: Mitigation Actions

Boerne – Action #18	
<b>Proposed Action:</b>	Reduce risk of wildfires through public education on residential fuels reduction, interior and exterior sprinkler systems, safe waste disposal, defensible space, and safe storage of flammable materials.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce wildfire risk and property loss.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Wildfire
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Local Budget, Texas Forest Service Grants
<b>Lead Agency/Department Responsible:</b>	Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5</p>

## Section 20: Mitigation Actions

Boerne – Action #19	
<b>Proposed Action:</b>	<b>Public education to decrease the possibility of injury or long term illness due to exposure to hazardous materials.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce risk of injury and potential illness due to exposure.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Hazardous Materials
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies) Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

## Section 20: Mitigation Actions

Boerne – Action #20	
<b>Proposed Action:</b>	<b>Designate shelters for travelers who are unable to drive during winter storms due to ice on the roadways.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Accommodate travelers with housing due to icy conditions which prevent travel when highways are closed by the State.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Winter Storm
<b>Effect on new/existing buildings:</b>	Reduce risk to existing infrastructure
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	TBD
<b>Potential Funding Sources:</b>	Local Budgets, Grants
<b>Lead Agency/Department Responsible:</b>	Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 4; Politically Acceptable = 4; Legal = 4; Economically Sound = 4; and Environmentally Sound = 4</p>

## Section 20: Mitigation Actions

Boerne – Action #21	
<b>Proposed Action:</b>	<b>Terrorism recognition training for public and first responders.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce loss of life and injuries.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Terrorism
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$25,000
<b>Potential Funding Sources:</b>	Local Budget and Federal Grants
<b>Lead Agency/Department Responsible:</b>	Emergency Management / Fire Marshal / Fire Department
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 4; Economically Sound = 5; and Environmentally Sound = 5</p>

## Section 20: Mitigation Actions

Boerne – Action #22	
<b>Proposed Action:</b>	<b>Educate citizens on the benefits of wind retrofits and lightning rods, and notify citizens early through the use of I-Info for potential thunderstorms.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Allows the citizens to be better prepared and reduce potential damages in the event of thunderstorm winds or lightning events.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Thunderstorm Wind, Lightning
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures
<b>Priority (High, Moderate, Low):</b>	Moderate
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	HMA Grants, Local Budget
<b>Lead Agency/Department Responsible:</b>	Emergency Management
<b>Implementation Schedule:</b>	Within 24 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies) Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

## Section 20: Mitigation Actions

Boerne – Action #23	
<b>Proposed Action:</b>	<b>Educate citizens of tornado risk and warning signs of possible tornadic activity. Educate citizens on mitigation measures to protect lives and property during tornado events.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce the risk due to tornado directly impacting the City.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Tornado
<b>Effect on new/existing buildings:</b>	Reduce risk to existing structures through education and preparedness
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget and HMA Grants
<b>Lead Agency/Department Responsible:</b>	Fire Department / Fire Marshal
<b>Implementation Schedule:</b>	Within 36-48 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5</p>



## Section 20: Mitigation Actions

Boerne – Action #24	
<b>Proposed Action:</b>	<b>Develop and implement water use restrictions to mitigate damage caused by drought such as restrictions and ordinances for residential and commercial requirements for drought tolerant landscaping.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce water usage and waste.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Local Plans and Regulations

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Drought
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	City staff – Municipal Department
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Local Ordinances

COMMENTS:
<p><b>Additional Considerations:</b>  The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies)</p> <p>Socially Acceptable = 4; Technically Feasible = 4; Administratively Possible = 4; Politically Acceptable = 4; Legal = 4; Economically Sound = 5; and Environmentally Sound = 5</p>

## Section 20: Mitigation Actions

Boerne – Action #25	
<b>Proposed Action:</b>	Educate citizens on taking water-saving measures such as low-flow toilets and shower heads, adjusting sprinklers, water saving measures in daily activities, and installation of graywater systems.
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City of Boerne Water Customers
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Educate water consumers on proper water use, as not to waste water.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Drought
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	High
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Multiple City Departments
<b>Implementation Schedule:</b>	Within 12 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	City policies and public works SOP (insert into water bills)

COMMENTS:
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies) Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

## Section 20: Mitigation Actions

Boerne – Action #26	
<b>Proposed Action:</b>	<b>Educate citizens on the risk of Dam Failure, warning systems for dam failure, and evacuation routes.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce risk to citizens through education.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Education and Awareness

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Dam Failure
<b>Effect on new/existing buildings:</b>	Reduce damage to existing structures
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$5,000
<b>Potential Funding Sources:</b>	Local Budget
<b>Lead Agency/Department Responsible:</b>	Emergency Management / Public Works
<b>Implementation Schedule:</b>	Within 36 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies) Socially Acceptable = 5; Technically Feasible = 5; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 5; and Environmentally Sound = 5

## Section 20: Mitigation Actions

Boerne – Action #27	
<b>Proposed Action:</b>	<b>Install canopy covers in public parks for shade and relief for heat during extreme temperatures.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City public parks
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Protect health of citizens by providing shaded areas in public parks.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Structure and Infrastructure

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Extreme Heat
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	\$10,000
<b>Potential Funding Sources:</b>	Local Budget, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Public Works
<b>Implementation Schedule:</b>	Within 36 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Comprehensive Plan

COMMENTS:
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies) Socially Acceptable = 5; Technically Feasible = 4; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 4; and Environmentally Sound = 4

## Section 20: Mitigation Actions

Boerne – Action #28	
<b>Proposed Action:</b>	<b>Implement tree trimming program around power lines to reduce the risk of power outages during winter storms and lightning events.</b>
<b>BACKGROUND INFORMATION</b>	
<b>Site and Location:</b>	City limits
<b>Risk Reduction Benefit</b> ( <i>Current Cost/Losses Avoided</i> ):	Reduce risk of power outages due to downed power lines.
<b>Type of Action:</b> ( <i>Local Plans and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, or Education and Awareness</i> )	Structure and Infrastructure

MITIGATION ACTION DETAILS	
<b>Hazard(s) Addressed:</b>	Winter Storm, Lightning
<b>Effect on new/existing buildings:</b>	N/A
<b>Priority (High, Moderate, Low):</b>	Low
<b>Estimated Cost:</b>	TBD
<b>Potential Funding Sources:</b>	Local Budget, HMA Grants
<b>Lead Agency/Department Responsible:</b>	Public Works
<b>Implementation Schedule:</b>	Within 36-48 months of plan adoption pending funding
<b>Incorporation into Existing Plans:</b>	Emergency Management Plan

COMMENTS:
<b>Additional Considerations:</b> The following STAPLEE criteria were evaluated on a scale of 1 to 5 indicating the extent to which this action satisfies each consideration. (1= Does Not Satisfy 3 = Moderately Satisfies 5 = Strongly Satisfies) Socially Acceptable = 4; Technically Feasible = 4; Administratively Possible = 4; Politically Acceptable = 5; Legal = 5; Economically Sound = 4; and Environmentally Sound = 4

# Section 21: Plan Maintenance

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## Plan Maintenance Procedures

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The following is an explanation of how Kendall County, the City of Boerne, and the general public will be involved in implementing, evaluating, and enhancing the Hazard Mitigation Action Plan (Plan) over time. The sustained hazard mitigation planning process consists of four main parts:

- Incorporation
- Monitoring and Evaluation
- Updating
- Continued Public Involvement

## Incorporation

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Kendall County and the City of Boerne will be responsible for further development and implementation of mitigation actions. Each action has been assigned to a specific department within the County and City. The following describes the process by which Kendall County will incorporate elements of the mitigation plan into other planning mechanisms.

### Process of Incorporation

Once the Plan is adopted, Kendall County and the City of Boerne will implement actions based on priority and the availability of funding. The County and City currently implements policies and programs to reduce loss to life and property from hazards. The mitigation actions developed for this Plan 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 jurisdiction 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.

Kendall County and the City of Boerne 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 will further



## Section 21: Plan Maintenance

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, planning team members from each participating jurisdiction will work to integrate the hazard mitigation strategies into other plans and codes, as they are developed. Participating team members will conduct periodic review of plans and polices, once per year at a minimum, and analyze the need for amendments 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, transportation plans, and any building codes to guide and control development. Participating jurisdictions will ensure that capital improvement planning in the future will also contribute to the goals of this hazard mitigation Plan to reduce the long-term risk to life and property from all hazards. Within one year of formal adoption of the hazard mitigation Plan, existing planning mechanisms will be reviewed by each jurisdiction.

Kendall County is committed to supporting the City of Boerne as they implement their mitigation actions. Kendall County and participating 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, Kendall County will work with the City of Boerne to advance the goals of this hazard mitigation plan through its routine, ongoing, long-range planning, budgeting, and work processes.

**Table 21-1. Methods of Incorporation of the Plan**

PLANNING MECHANISM	DEPARTMENT / TITLE RESPONSIBLE	INCORPORATION OF PLAN
Grant Applications	Kendall County: Emergency Management Coordinator  City of Boerne: Emergency Management Coordinator	The Plan will be consulted by Planning Team Members whenever grant funding is sought for mitigation projects. If a project is not in the Plan, an amendment may be necessary to include the action in the Plan.
Annual Budget Review	Kendall County: Auditor  City of Boerne: Public Works Director	Various departments and key personnel that participated in the planning process will review the Plan and mitigation actions therein when conducting their annual budget review. Allowances will be made in accordance with grant applications sought or mitigation actions that will be undertaken according to the implementation schedule of the specific action.
Regulatory Plans	Kendall County: Emergency Management Coordinator  City of Boerne: Emergency Management Coordinator	Currently, Kendall County has regulatory plans in place, such as Emergency Management Plans, Continuity of Operations, Disaster Recovery Plans, Economic Development and Evacuation Plans. The Plan will be consulted when city departments review or revise their current regulatory planning mechanisms, or in the development of

## Section 21: Plan Maintenance

PLANNING MECHANISM	DEPARTMENT / TITLE RESPONSIBLE	INCORPORATION OF PLAN
		regulatory plans that are not currently in place.
Capital Improvement Plans	Kendall County: Road and Bridge Crew Lead  City of Boerne: Public Works Director	Kendall County has a Capital Improvement Plan (CIP) in place. Prior to any revisions to the CIP, city departments will review the risk assessment and mitigation strategy sections of the Plan, as limiting public spending in hazardous zones is one of the most effective long-term mitigation actions available to local governments.
Comprehensive Plans	Kendall County: Emergency Management Coordinator  City of Boerne: Public Works Director	Kendall County has a Long-Term Comprehensive Development Plan in place. Since comprehensive plans involve developing a unified vision for a community, the mitigation vision and goals of the Plan will be reviewed in the development or revision of a Comprehensive Plan.
Floodplain Management and Fire Protection Plans	Kendall County: Emergency Management Coordinator  City of Boerne: Emergency Management Coordinator	Floodplain Management Plans include preventative and corrective actions to address the flood hazard. Therefore, the actions for flooding, and information found in Section 7 of this plan discussing the people and property at risk to flood, will be reviewed and revised when Kendall County updates their Management Plans or develop new plans.

## Monitoring and Evaluation

Periodic revisions of the Plan are required to ensure that goals, objectives, and mitigation actions are kept current. 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 21-2 indicates the department and title responsible for Plan monitoring, updating and review of the Plan.

**Table 21-2. Team Members Responsible for Plan Monitoring, Updating and Review of the Plan**

JURISDICTION	DEPARTMENT	TITLE
Kendall County	Kendall County Office of Emergency Management	Emergency Management Coordinator

## Section 21: Plan Maintenance

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JURISDICTION	DEPARTMENT	TITLE
Kendall County	Kendall County Office of Emergency Management	Assistant Emergency Management Coordinator/Fire Marshal
City of Boerne	City of Boerne Fire Marshal's Office	Emergency Management Coordinator

### Monitoring

Designated Planning Team members are responsible for monitoring, updating, and reviewing the Plan, as shown in Table 21-2. Individuals holding the title listed in Table 21-2 will be responsible for monitoring the Plan on an annual basis. Plan monitoring, includes reviewing mitigation and incorporation 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 County department 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 if changes to the Plan are needed, such as recommending an action for funding. A written summary of meeting notes will report the particulars involved in turning an action into a project.

### 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. The annual evaluation process will help to determine if any changes are necessary.

## Updating

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### Plan Amendments

At any time, minor technical changes may be made to update the Kendall County Hazard Mitigation Plan. 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 County and participating jurisdictions.

The County will review proposed amendments and vote to accept, reject, or amend the proposed change. Upon ratification, the amendment will be transmitted to TDEM.

In determining whether to recommend approval or denial of a Plan amendment request, the County will consider the following factors:

- Errors or omissions made in the identification of issues or needs during the preparation of the Plan;
- New issues or needs that were not adequately addressed in the Plan; and

## Section 21: Plan Maintenance

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- Changes in information, data, or assumptions from those on which the Plan was based.

### Five 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 County 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 Planning Team (Section 2, Table 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. Planning grant options in advance of the five-year Plan update deadline is recommended considering the timelines for grant cycles.

Following the Plan review, any revisions deemed necessary will be summarized and implemented according to the reporting procedures and Plan amendment process outlined herein. Upon completion of the review, update, and amendment process the revised Plan will be submitted to TDEM for final review and approval in coordination with FEMA.

### Continued Public Involvement

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Public input was an integral part of the preparation of this Plan and will continue to be essential for Plan updates. Changes or suggestions to improve or update the Plan will provide opportunities for additional public input.

The public can review the Plan on Kendall County's website ([www.co.kendall.tx.us](http://www.co.kendall.tx.us)), where officials and the public are invited to provide ongoing feedback. Additionally, copies of the Plan will be kept in the offices of the County and participating jurisdictions.

The Planning Team may also designate voluntary citizens from the City, or willing stakeholder members that were involved in the Plan's development, to provide feedback on an annual basis. It is important that stakeholders and the 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 Advisory Planning Team is responsible for notifying stakeholders and community members on an annual basis, and maintaining the Plan as a part of their job description.

Media, including local newspaper and radio stations, will be used to notify the public of any maintenance or periodic review activities during the implementation, monitoring, and evaluation phases. Additionally, local news media will be contacted to cover information regarding Plan updates, status of grant applications, and project implementation. Local and social media outlets, such as Facebook and Twitter, will keep the public and stakeholders apprised of mitigation projects for which HMGP or PDM funding is made available for implementation of mitigation projects identified in the Plan.

# Appendix A: Planning Team

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Stakeholders .....	2

## Planning Team Members

The Kendall County Hazard Mitigation Plan 2016 (Plan), was organized using a direct representative model. An Advisory Planning Team from the Kendall County Office of Emergency Management and the City of Boerne's Fire Marshal Office 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 Planning Team members, consisting of representatives from area organizations and departments for Kendall County and the City of Boerne that participated throughout the planning process. Table A-3 is comprised of members of a "Stakeholder Working Group" that were invited to provide Plan input. The public were also invited to participate via e-mail and throughout the planning process. Public outreach efforts and meeting documentation is provided in Appendix E.

**Table A-1. Advisory Planning Team**

ORGANIZATION	TITLE
Kendall County Office of Emergency Management	Emergency Management Coordinator
Kendall County	County Judge
City of Boerne Fire Marshal's Office	Emergency Management Coordinator

**Table A-2. Planning Team Members**

ORGANIZATION	TITLE
Kendall County Office of Emergency Management	Assistant Emergency Management Coordinator/Fire Marshal
Waring Fire Department	Fire Chief
Boerne Independent School District	Director of Facilities and Construction
Comfort Independent School District	Superintendent
City of Boerne	Chief of Police
City of Boerne Public Works	Director
City of Boerne Fire Department	Fire Chief
City of Boerne Fire Department	Assistant Fire Chief
Kendall County Sherriff's Office	Sheriff
Kendall County Sherriff's Office	Chief Deputy

## Appendix A: Planning Team

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ORGANIZATION	TITLE
Sisterdale Volunteer Fire Department	Volunteer
Kendall County Road & Bridge	Staff
Kendall County Road & Bridge	Crew Leader
Kendall County Human Resources	Director
Kendall County	Auditor
Kendall County Development and Floodplain Management	Director
Kendall County Geographical Information System	Administrator
Comfort Floodplain Coalition	Committee Member

## 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: non-profit organizations; private businesses; river authorities; and electric cooperatives. The following list of persons were sent an e-mail and invited by other means requesting their input in the planning process to participate at each of the Stakeholder meetings. Many of the invited organizations and stakeholders participated and were integral to providing comments and data for the Plan Update. For a list of attendees at meetings, please see Appendix E<sup>1</sup>.

**Table A-3. Stakeholder Working Group**

AGENCY	TITLE
Texas State Senate District 25	State Senator for Boerne
Texas State House District 73	State Representative for Boerne
Comfort Chamber of Commerce	President
Pedernales Electric Cooperative	Vice President, Power Supply and Energy Services
Comfort Flood Coalition	Engineer
Lower Colorado River Authority	Senior Real Estate Representative
Bandera Electric Cooperative	District 8 Director, District 4 Director
Boerne Chamber of Commerce	Chairman
Boerne Kendall County Economic Development Corporation	CEO/President

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<sup>1</sup> Information contained in Appendix E is exempt from public release under the Freedom of Information Act (FOIA).



## Appendix A: Planning Team

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AGENCY	TITLE
Southwest Texas Regional Advisory Council	Division Director
Methodist Health	Emergency Management Specialist
Methodist Healthcare System - Emergency Department	Vice President, Emergency Services
Cow Creek Groundwater Conservation District	Secretary
2-1-1 Texas Health and Human Services Commission	Human Services Coordinator

# Appendix B: Public Survey Results

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## Overview

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Kendall County prepared a public survey that requested public opinion on a wide range of questions relating to natural and man-caused hazards. The survey was made available on websites for the City of Boerne as well. Kendall County also posted the notice to take the survey on the community Facebook page. This survey link was also distributed at public meetings throughout the planning process.

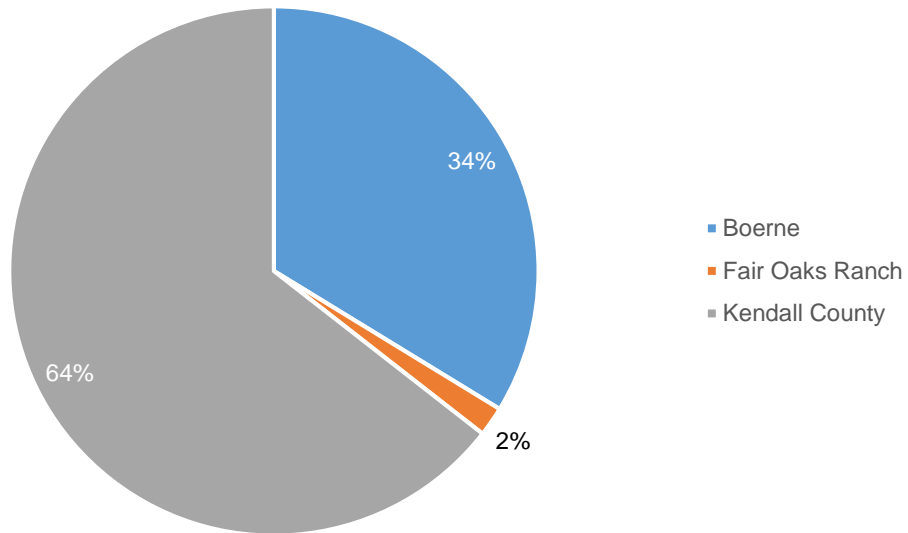
A total of 166 surveys were collected, the results of which are analyzed in Appendix B. The purpose of the survey was twofold: 1) to solicit public input during the planning process, and 2) to help the jurisdictions identify any potential actions or problem areas.

The following survey results depict the percentage of responses for each answer. Similar responses have been summarized for questions that did not provide a multiple-choice answer or that required an explanation.

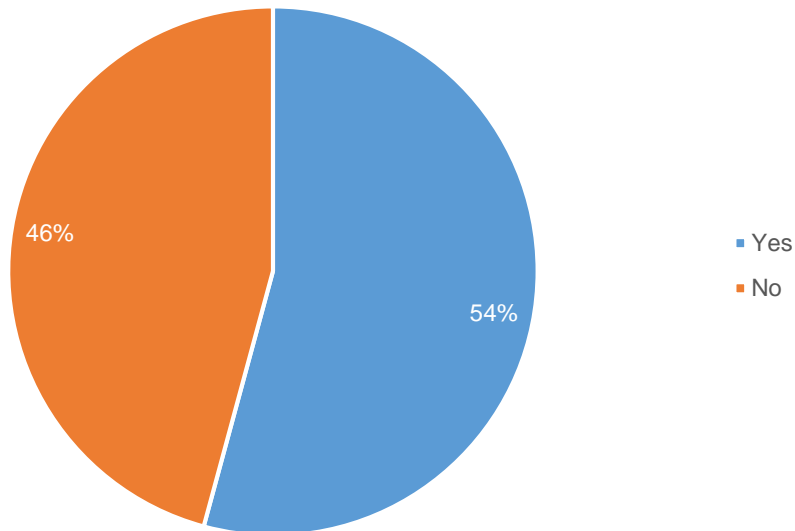
### Public Survey Results

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1. Please state the jurisdiction (city and community where you reside).



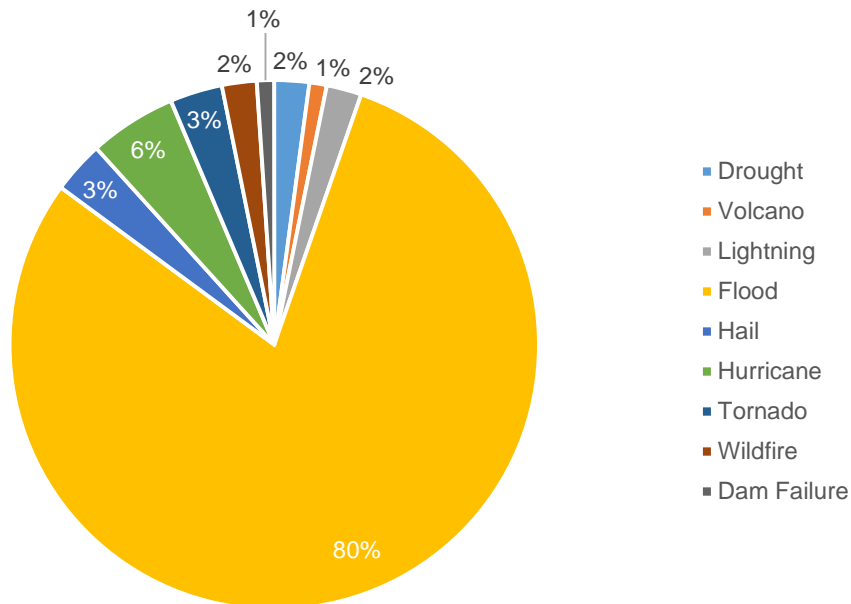
2. A. Have you ever experienced or been impacted by a disaster?



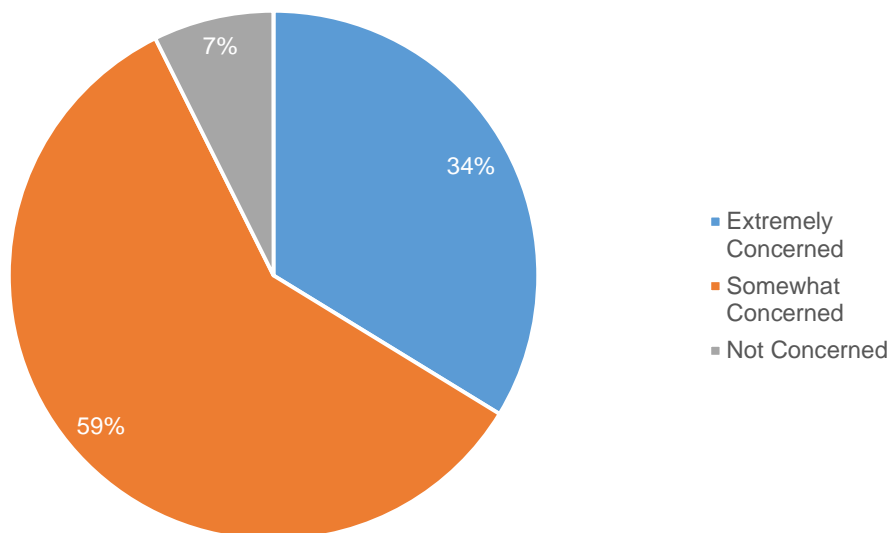
## Appendix B: Public Survey Results

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2. B. If “yes”, please explain:



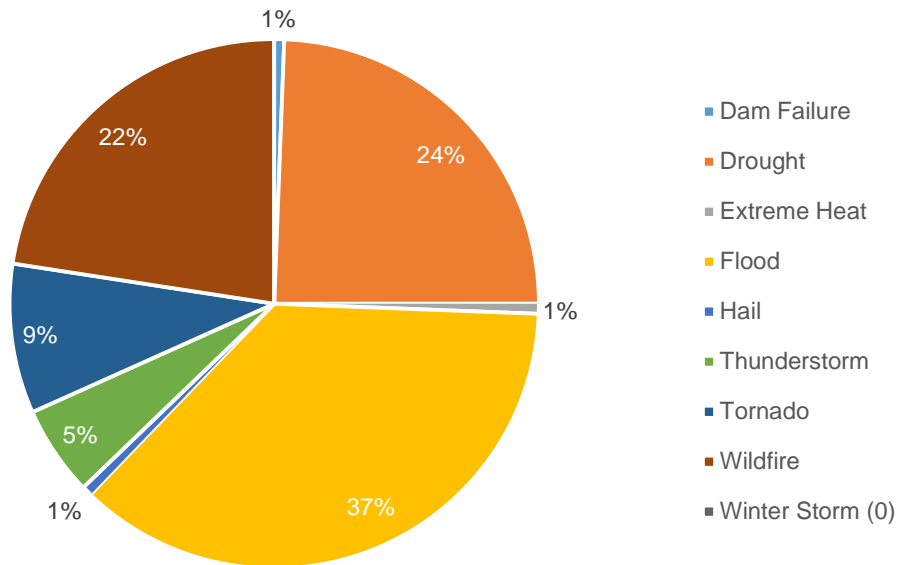
3. How concerned are you about the possibility of your community being impacted by a disaster?



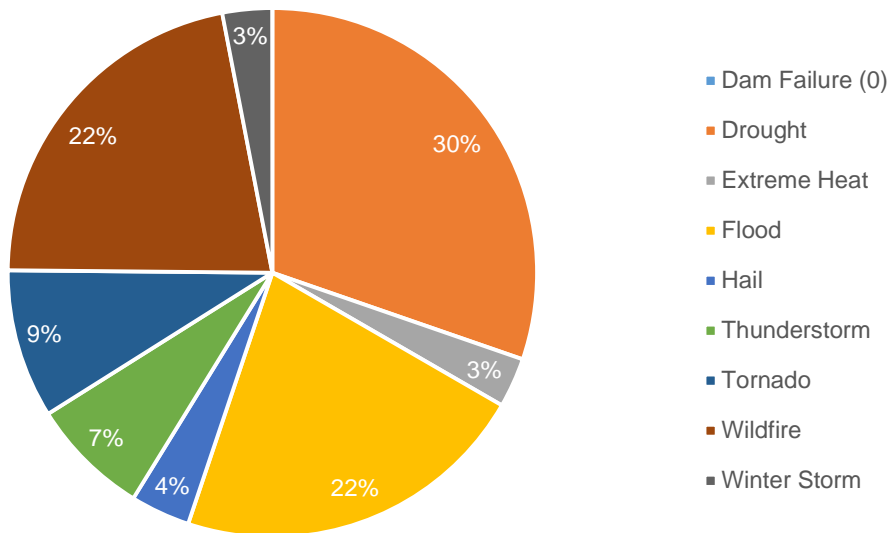
## Appendix B: Public Survey Results

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4. Please select the one hazard you think is the highest threat to your neighborhood:



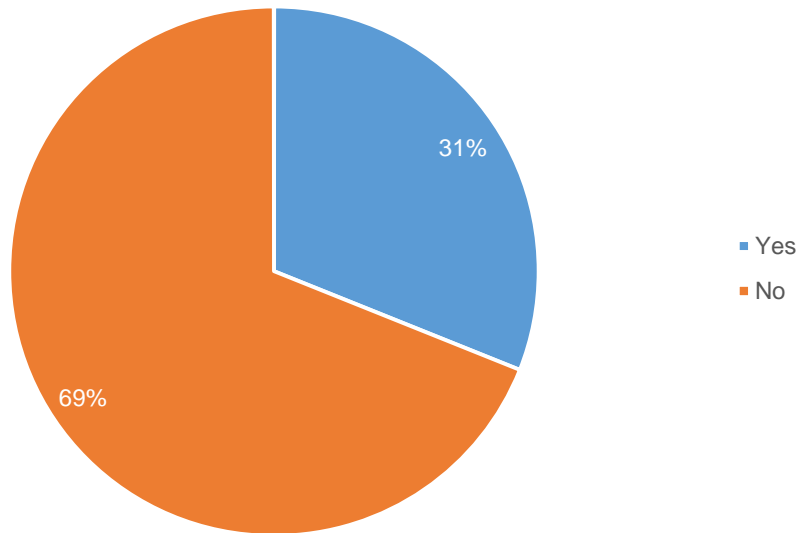
5. Please select the one hazard you think is the second highest threat to your neighborhood:



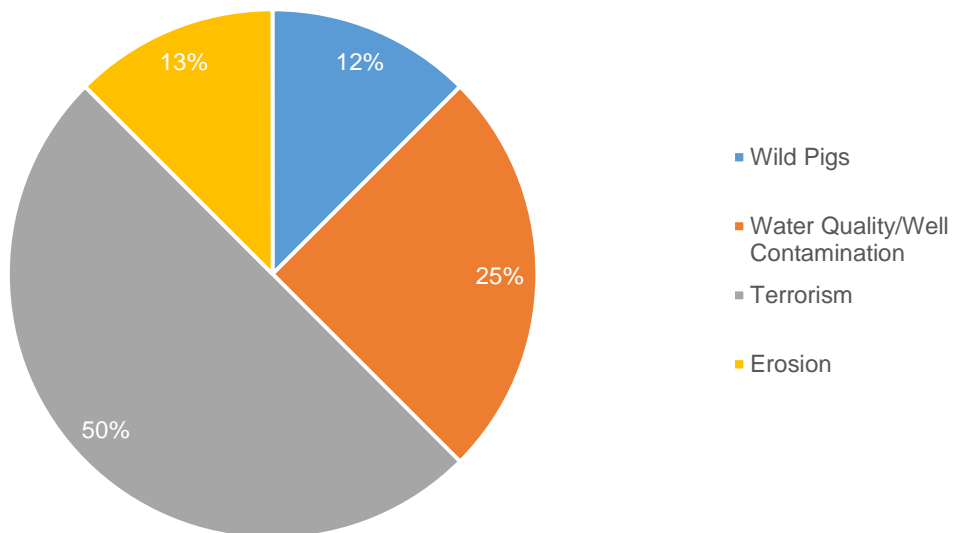
## Appendix B: Public Survey Results

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6. A. Are there hazards not listed above that you think is a wide-scale threat to your neighborhood?



6. B. If "yes", please explain:

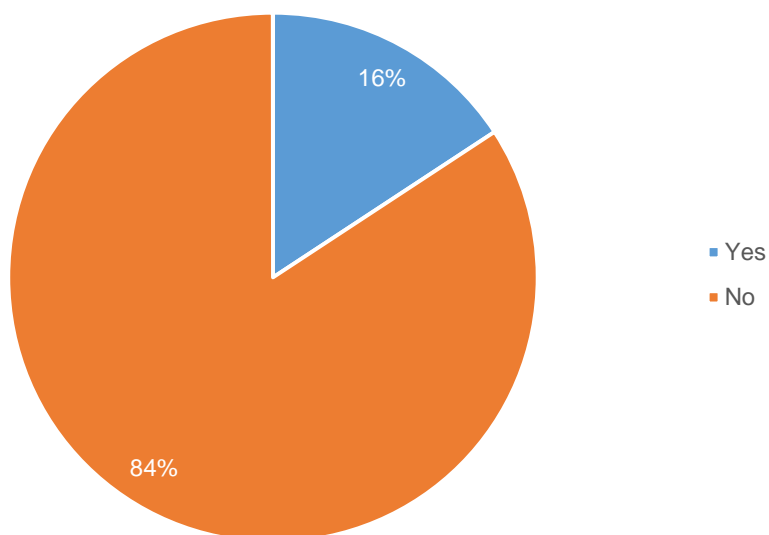




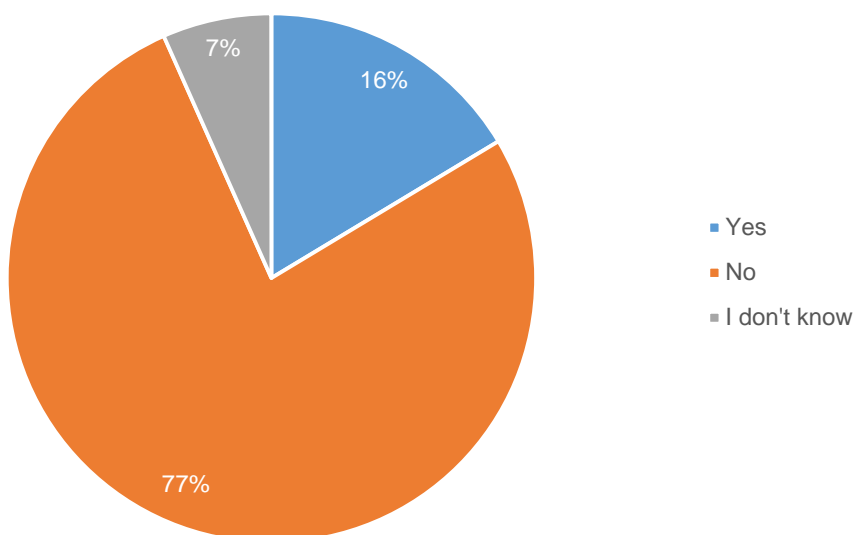
## Appendix B: Public Survey Results

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7. Is your home located in a floodplain?



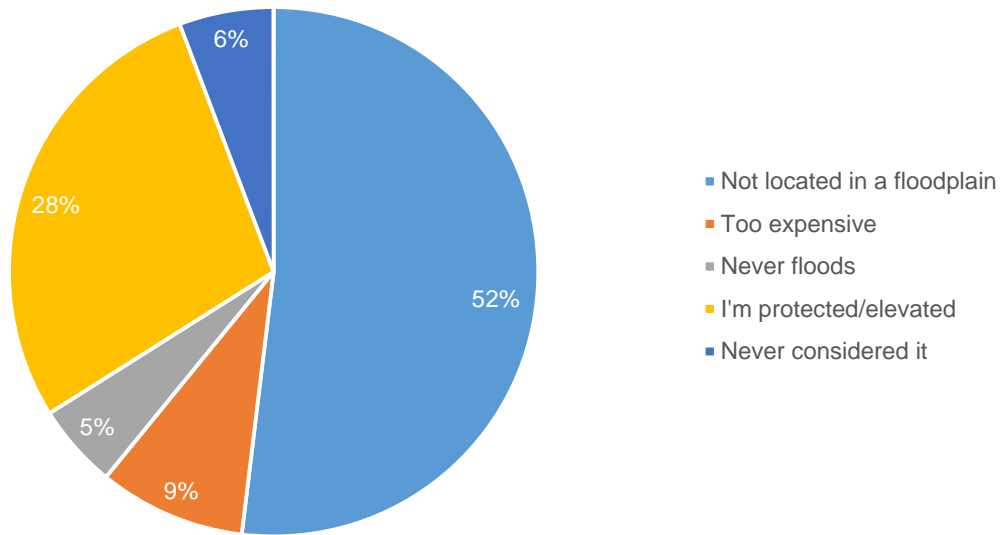
8. Do you have flood insurance?



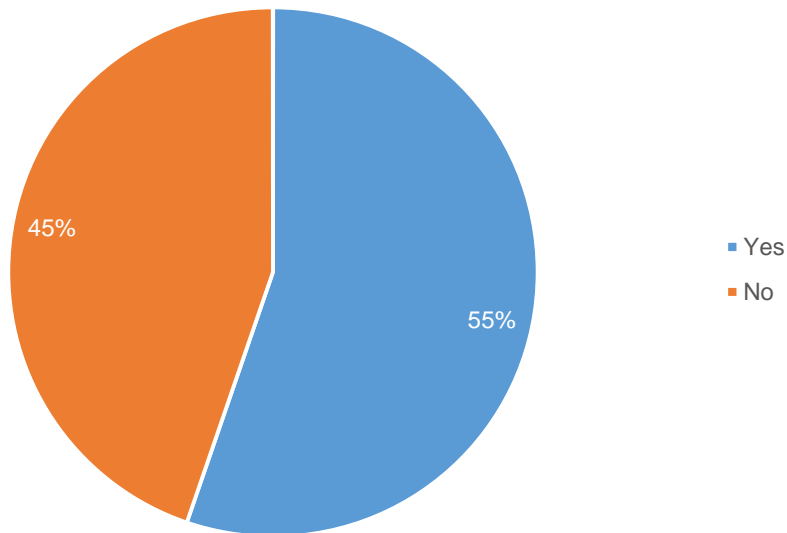
## Appendix B: Public Survey Results

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9. If you do not have flood insurance, why not?



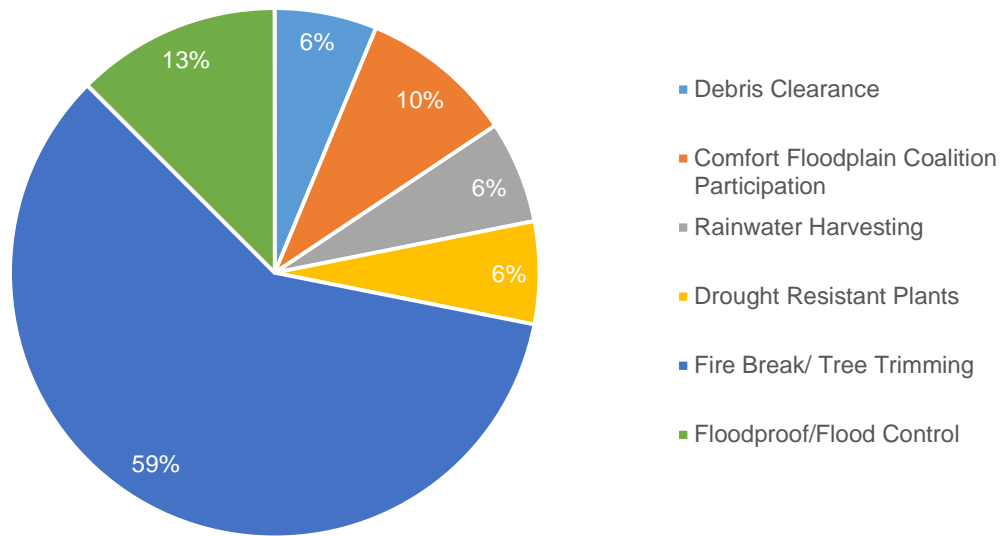
10. A. Have you taken actions to make your home or neighborhood more resistant to hazards?



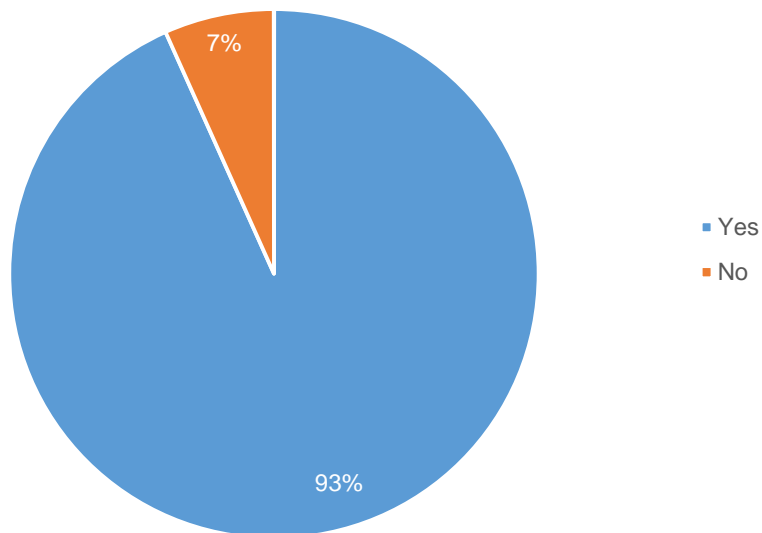
## Appendix B: Public Survey Results

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10. B. What have you done?



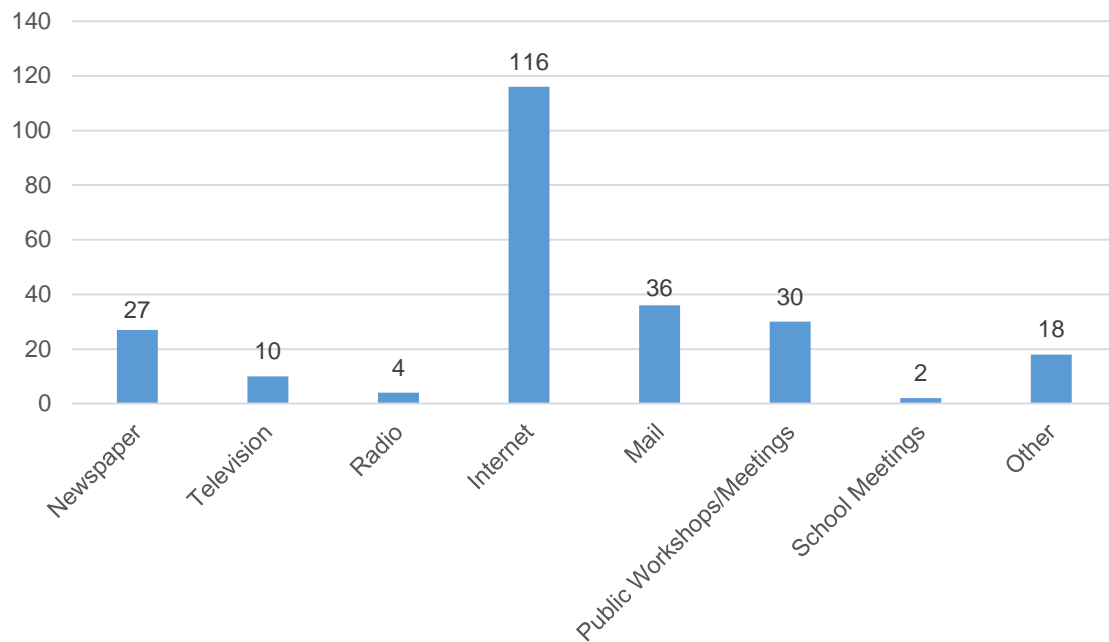
11. Are you interested in making your home or neighborhood more resistant to hazards?



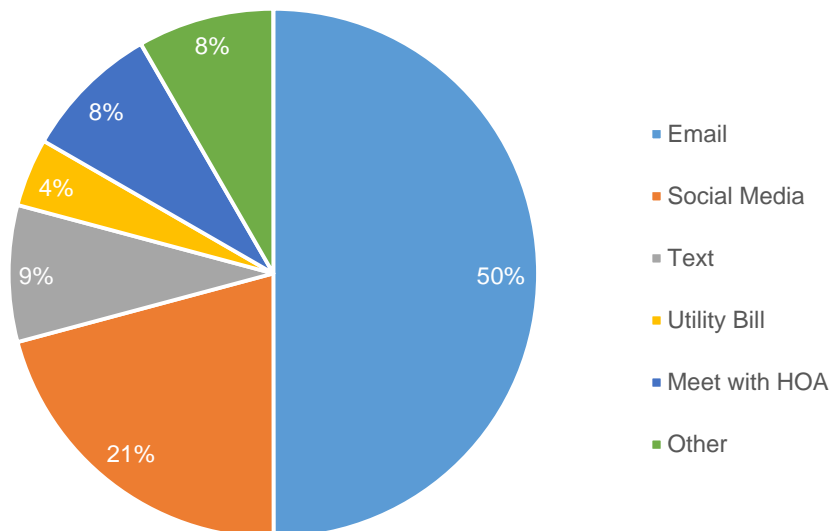
## Appendix B: Public Survey Results

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12. A. What is the most effective way for you to receive information about how to make your home and neighborhood more resistant to hazards?



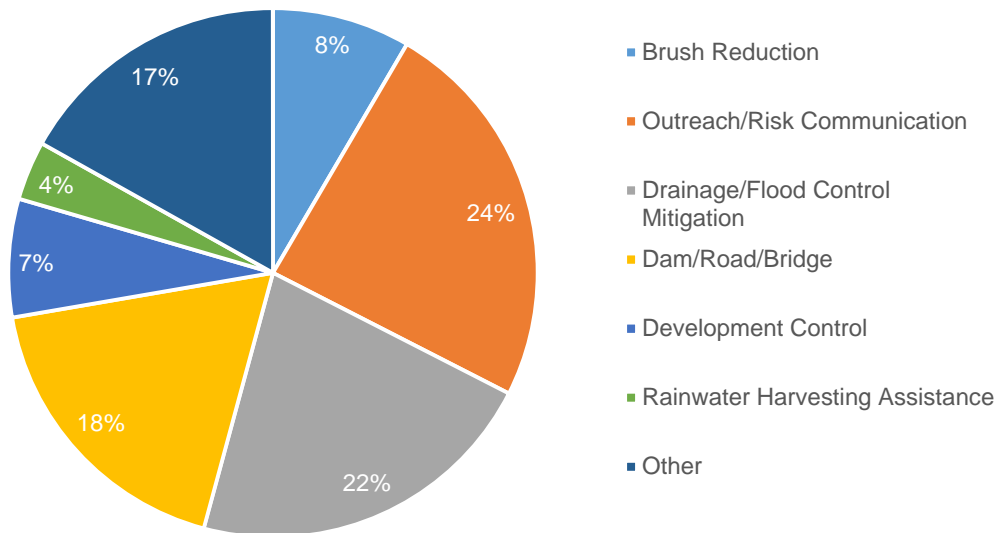
12. B. If "other", please specify:



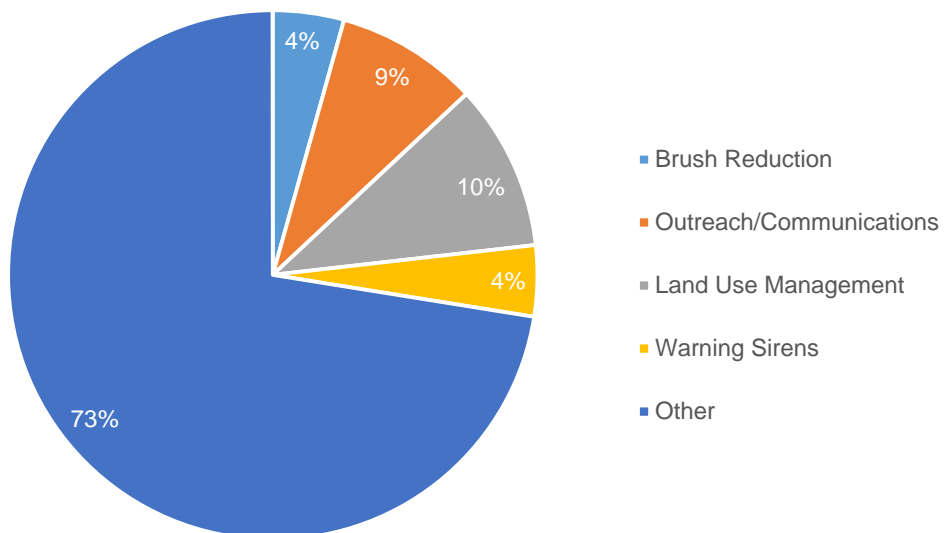
## Appendix B: Public Survey Results

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13. In your opinion, what are some steps your local government could take to reduce or eliminate the risk of future hazard damages in your neighborhood?



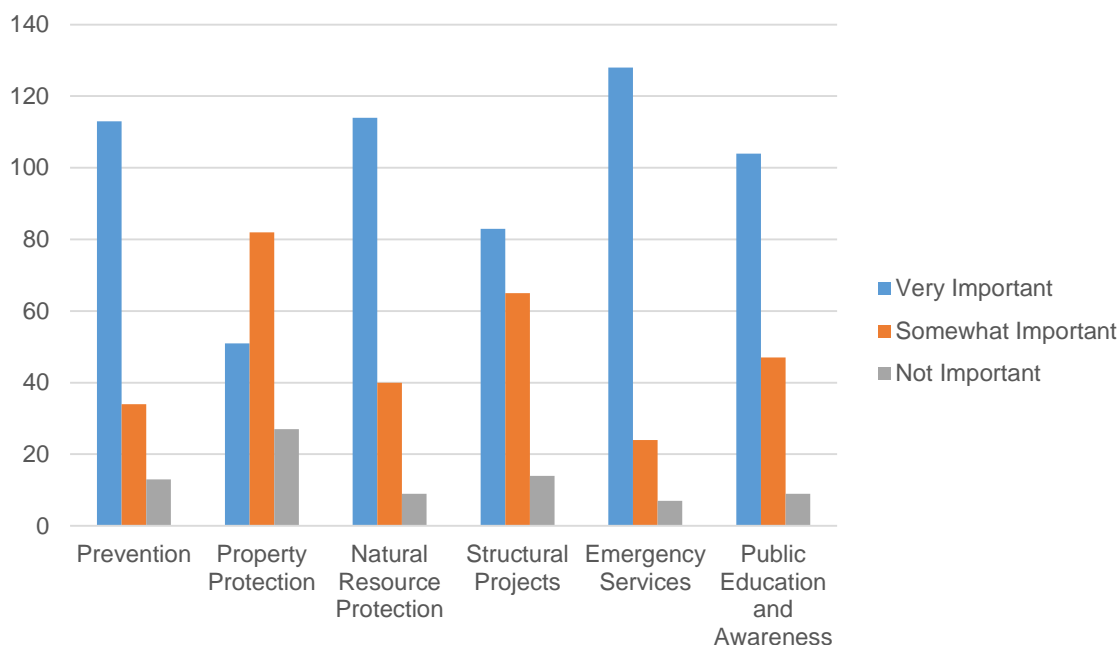
14. Are there any other issues regarding the reduction of risk and loss associated with hazards or disasters in the community that you think are important?



## Appendix B: Public Survey Results

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15. A number of community-wide activities can reduce our risk from hazards. In general, these activities fall into one of the following six broad categories. Please tell us how important you thin each one is for your community to consider pursuing.



**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.

**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.

**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.

**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.

**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.



# Appendix C: Critical Facilities

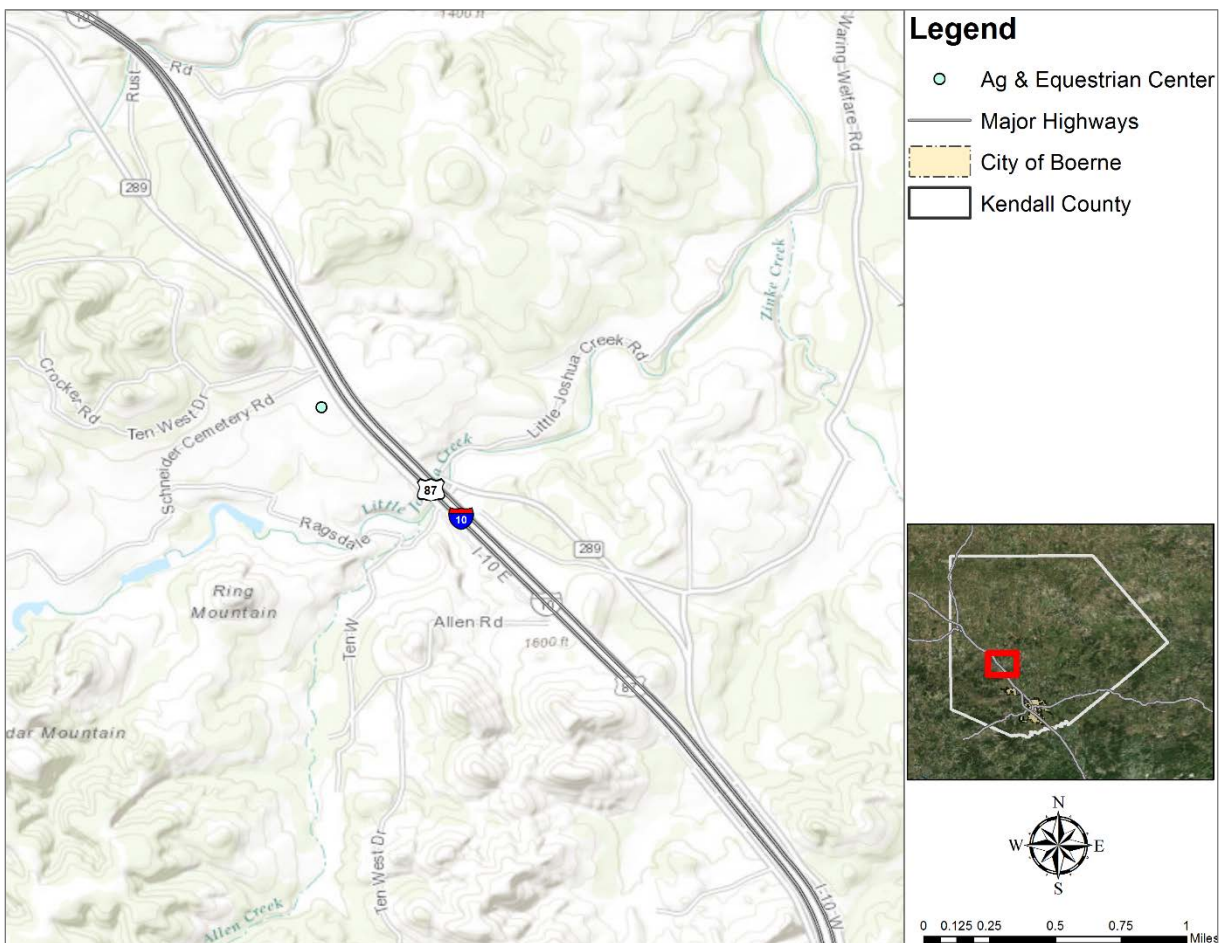
Overview .....	1
Critical Facilities .....	1

## Overview

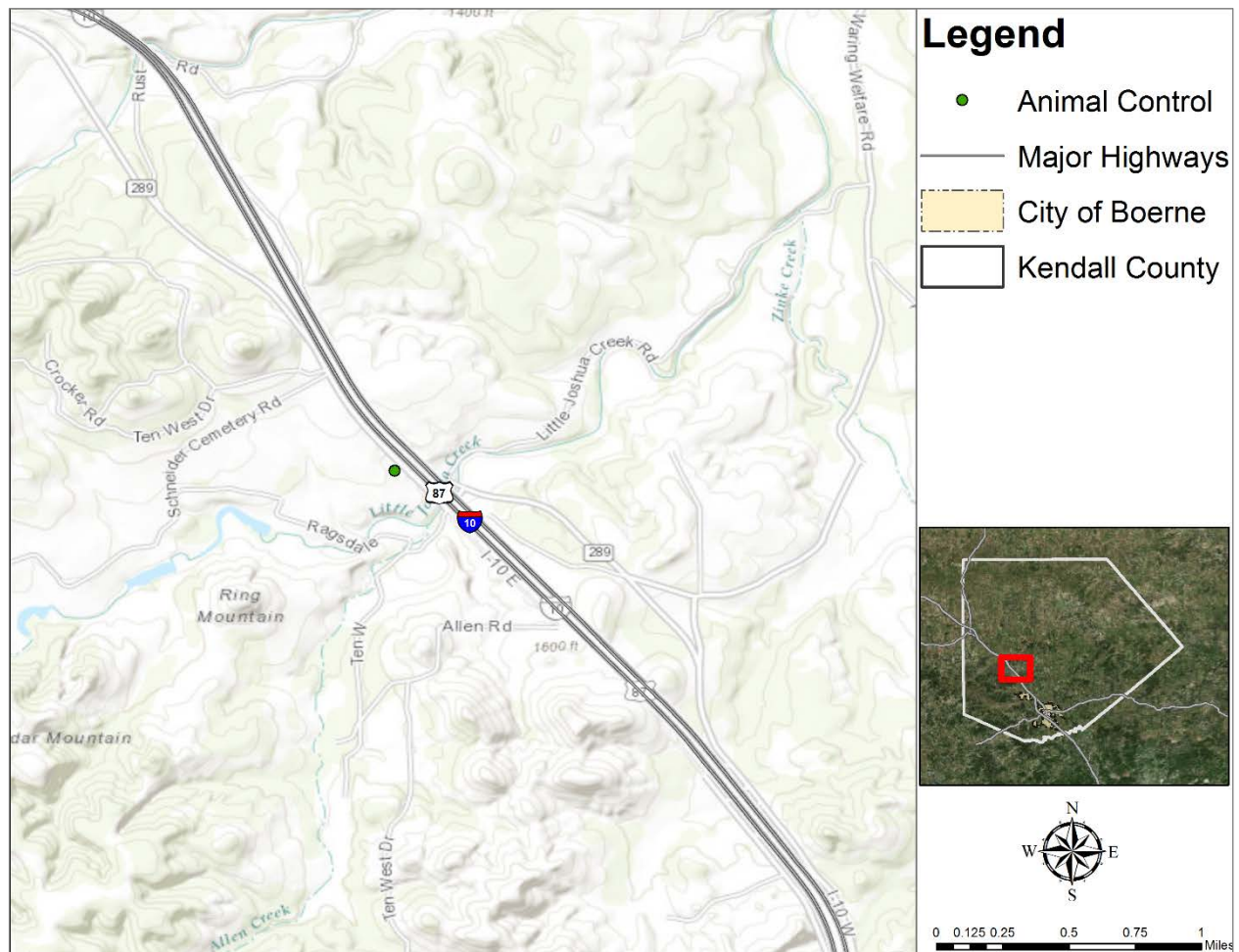
This Appendix is **For Official Use Only (FOUO)** and may be exempt from public release under FOIA. Figures C-1 through C-15 locates all critical facilities that were included in the risk assessment. Mapped facilities were provided by Kendall County and City of Boerne Planning Team members.

## Critical Facilities

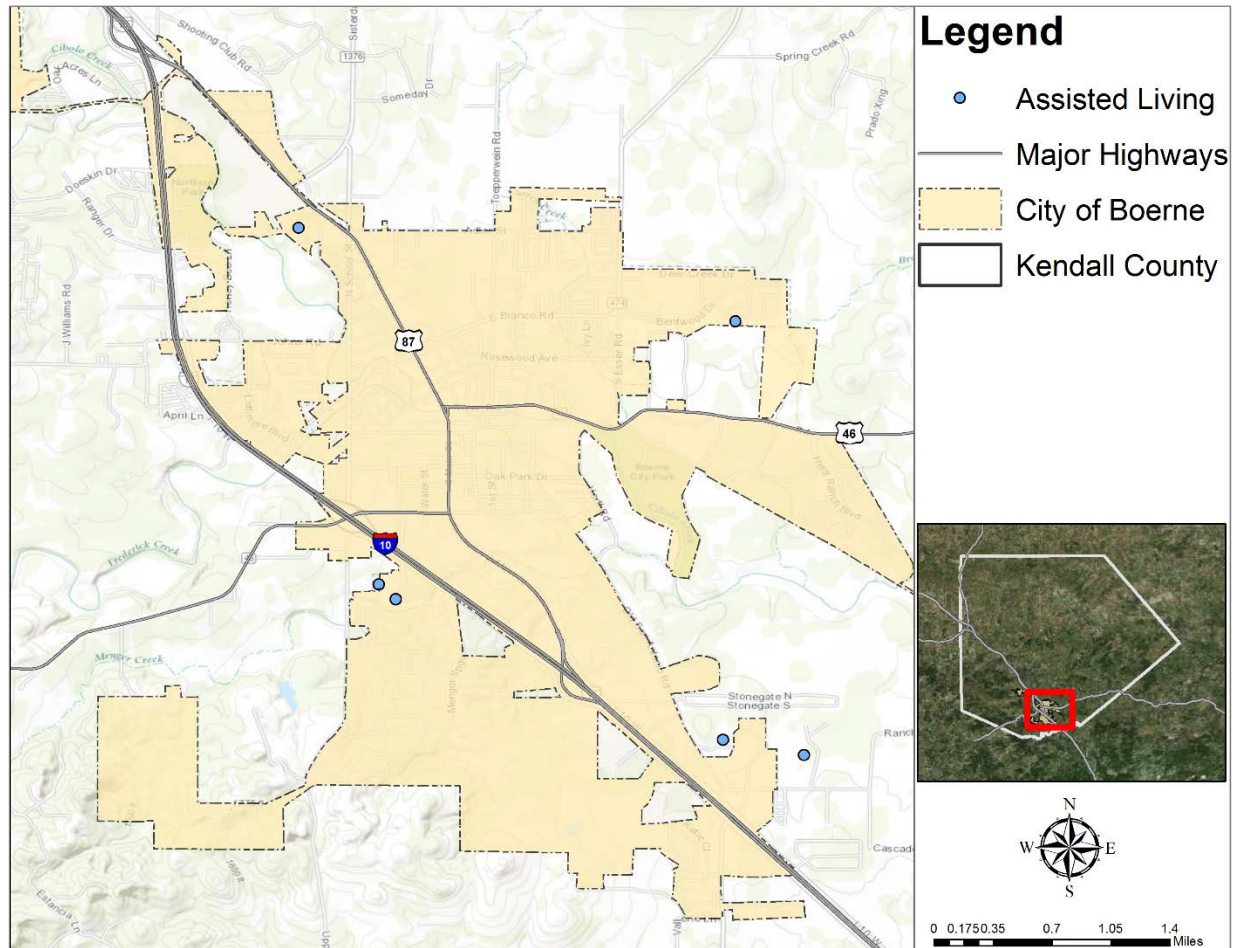
**Figure C-1. Critical Facilities (Ag & Equestrian Center) in Kendall County**



**Figure C-2. Critical Facilities (Animal Control) in Kendall County**

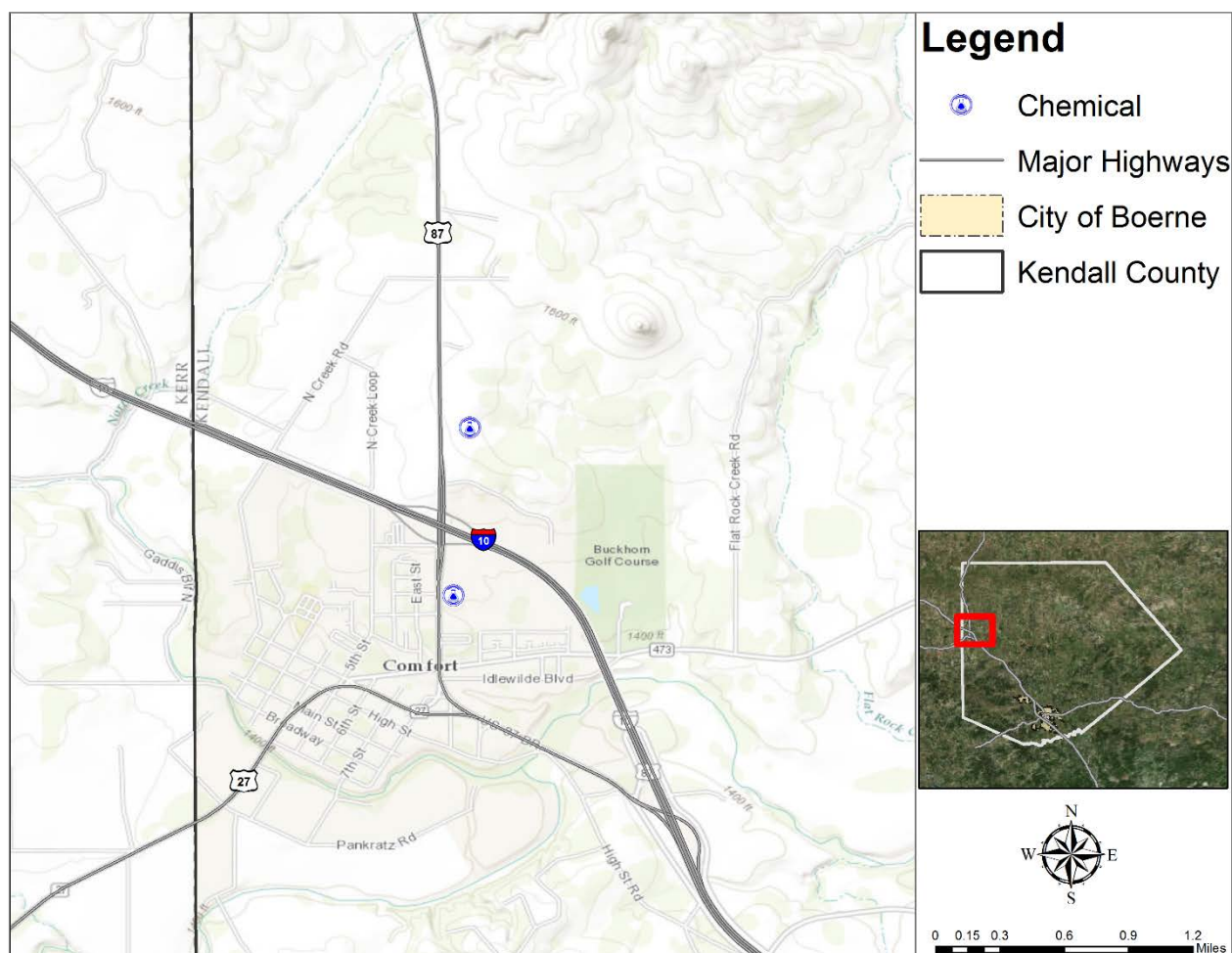


**Figure C-3. Critical Facilities (Assisted Living Centers) in Kendall County and the City of Boerne**

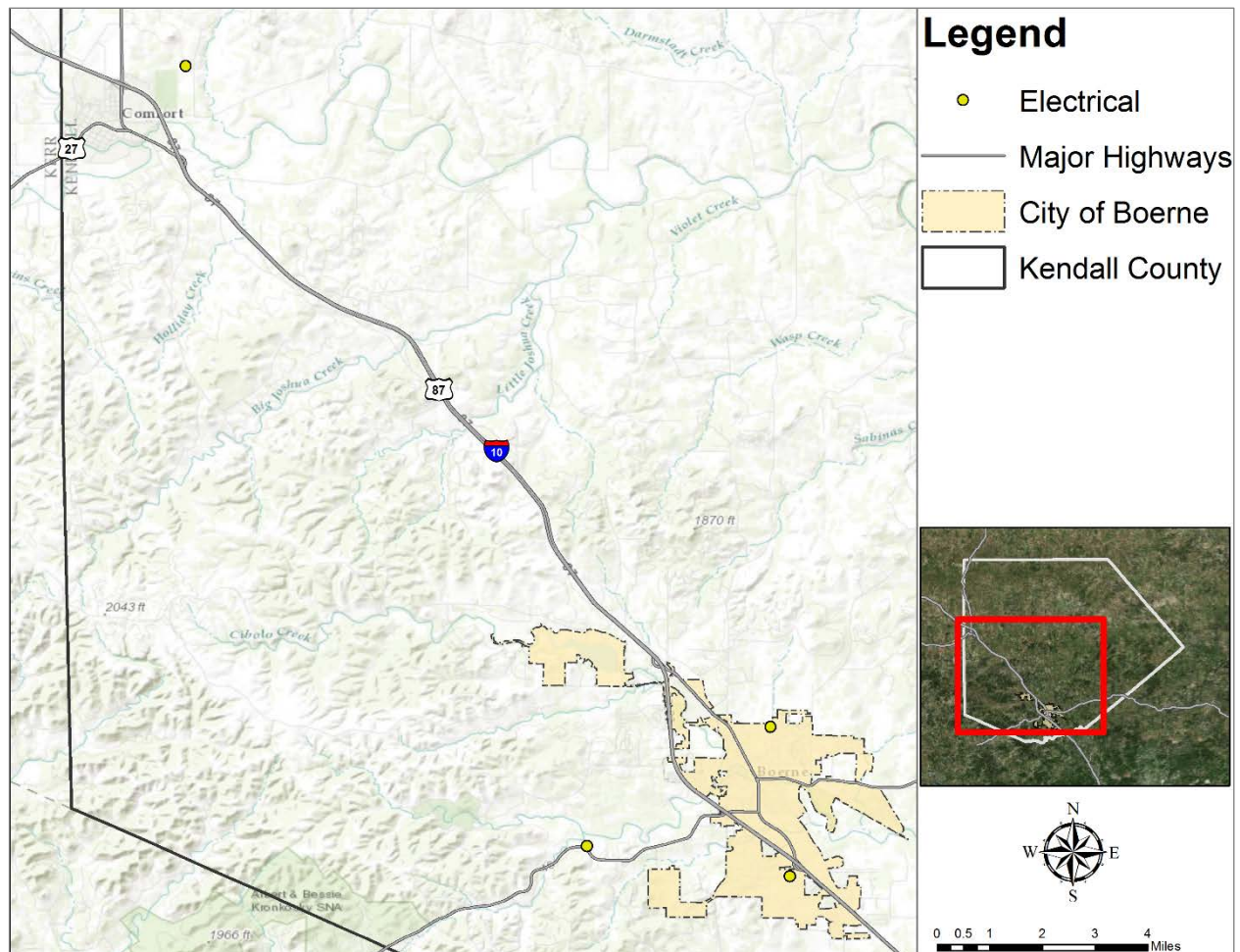




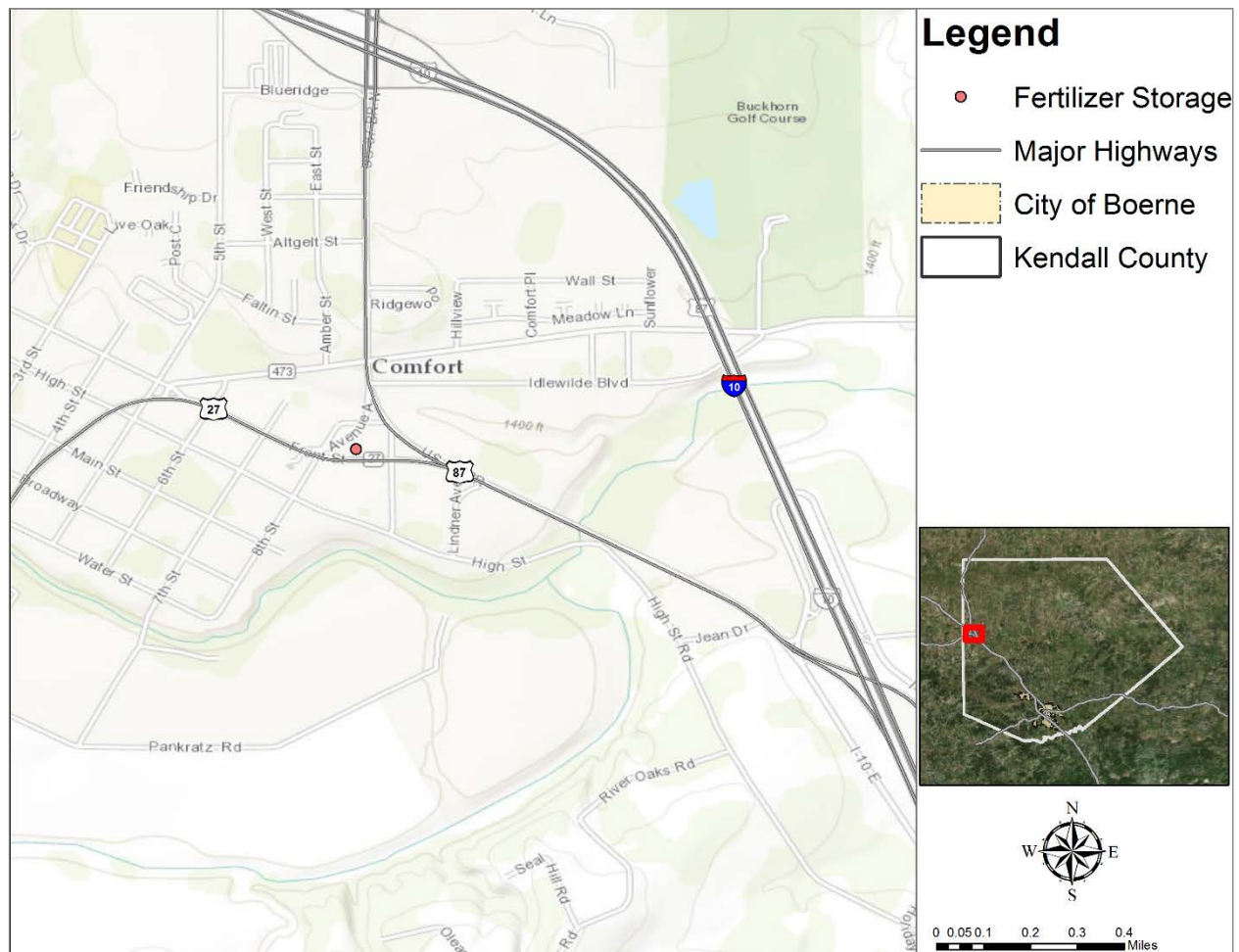
**Figure C-4. Critical Facilities (Chemical Facilities) in Kendall County**



**Figure C-5. Critical Facilities (Electrical Facilities) in Kendall County and the City of Boerne**

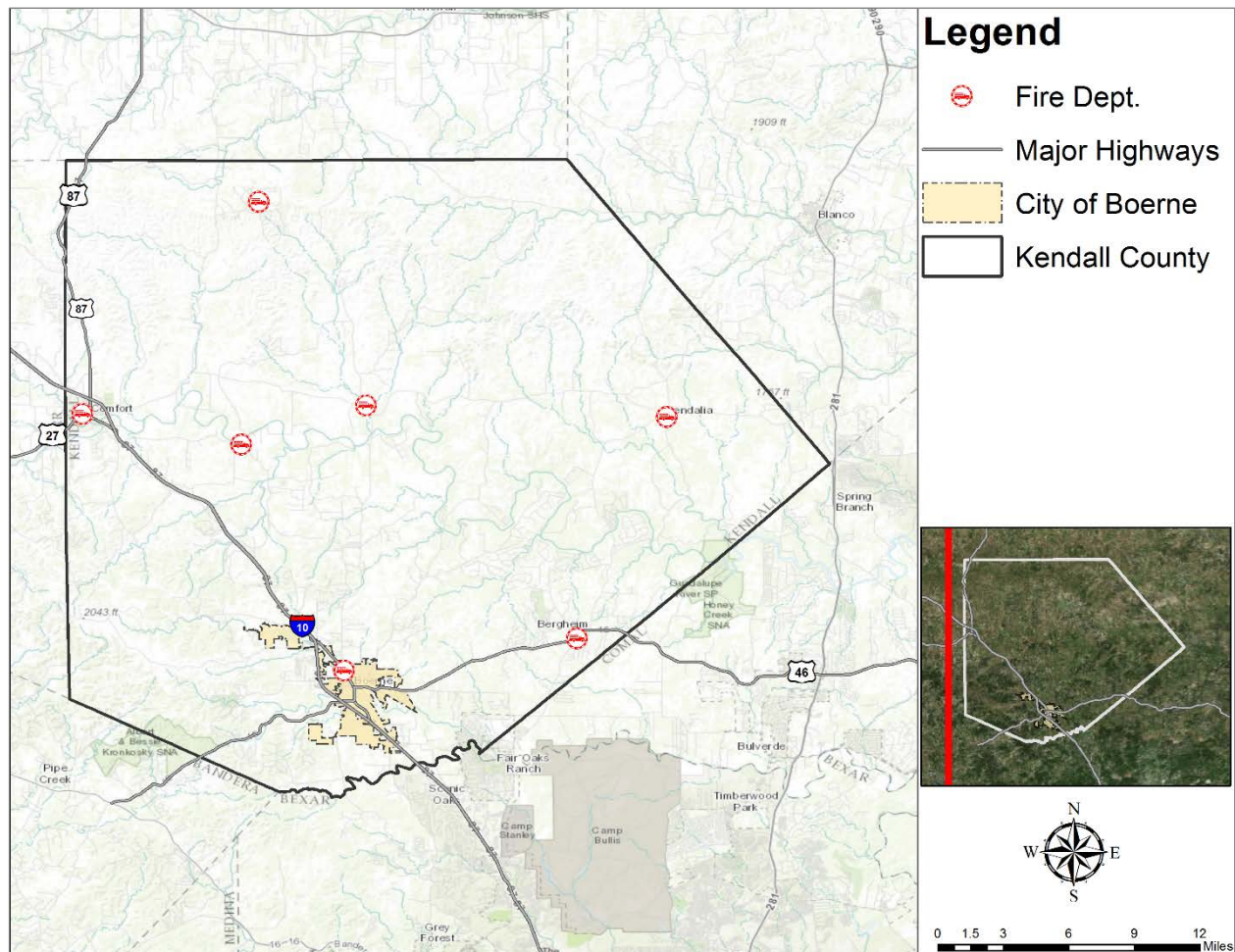


**Figure C-6. Critical Facilities (Fertilizer Storage) in Kendall County**

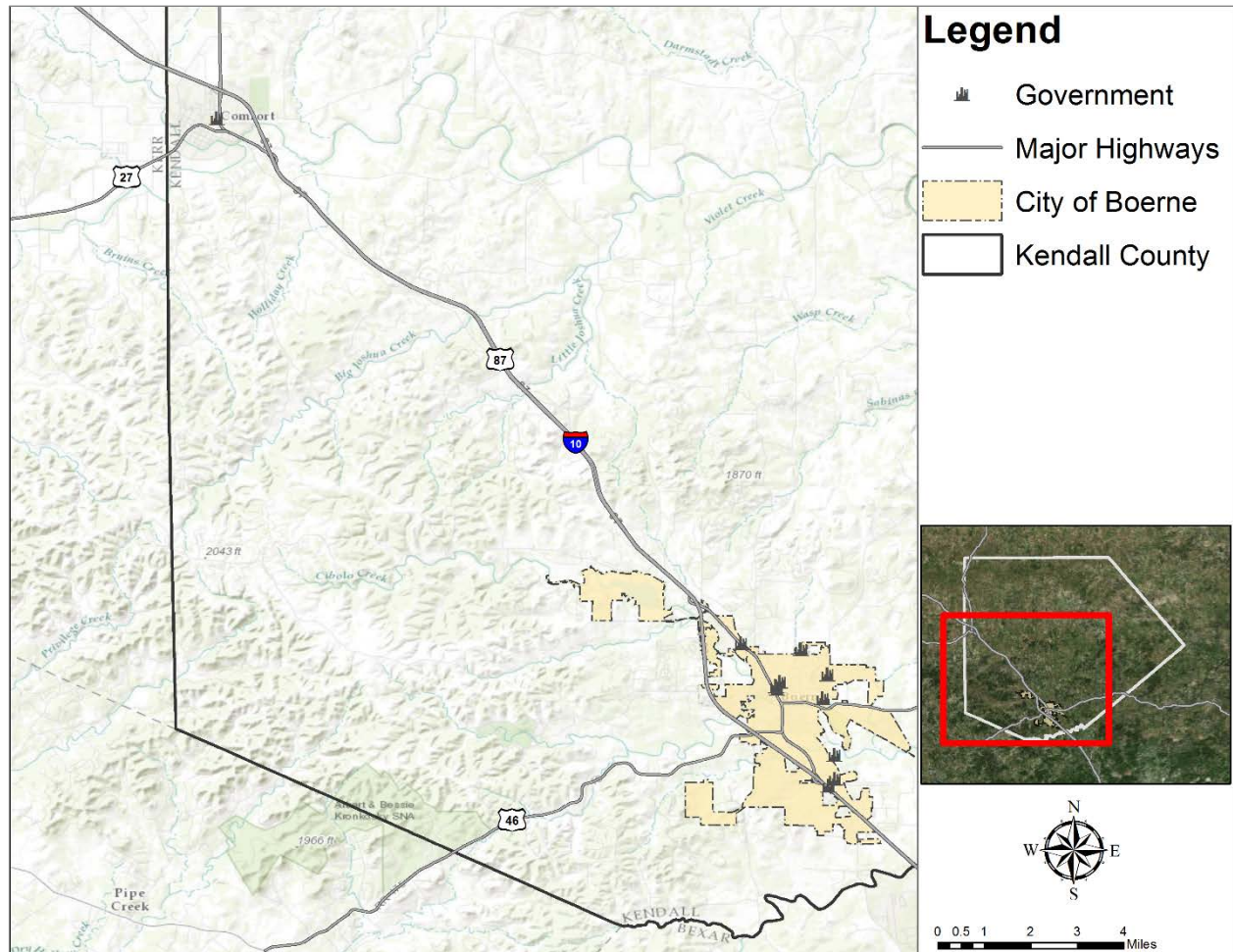




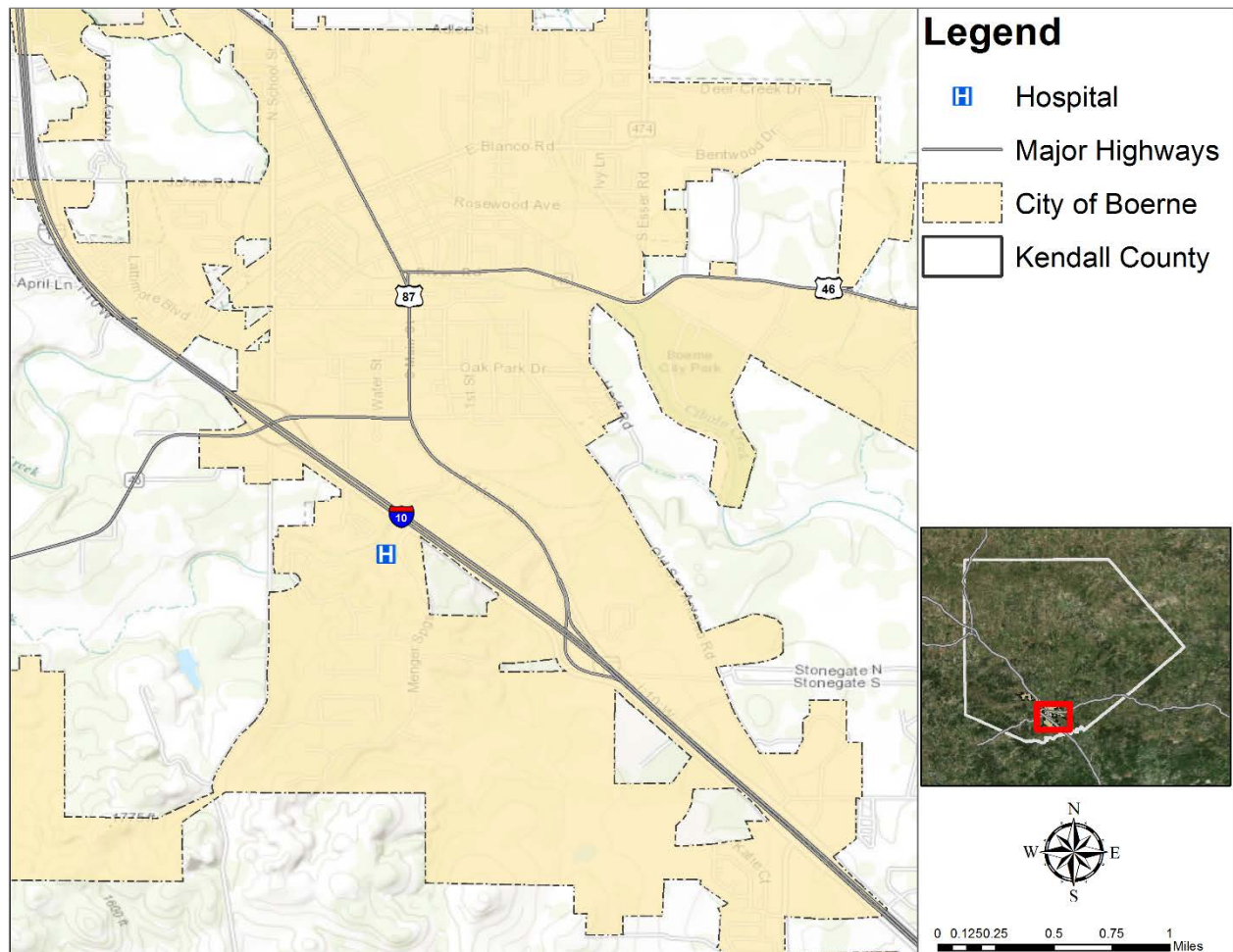
**Figure C-7. Critical Facilities (Fire Departments) in Kendall County and the City of Boerne**



**Figure C-8. Critical Facilities (Government Facilities) in Kendall County and the City of Boerne**

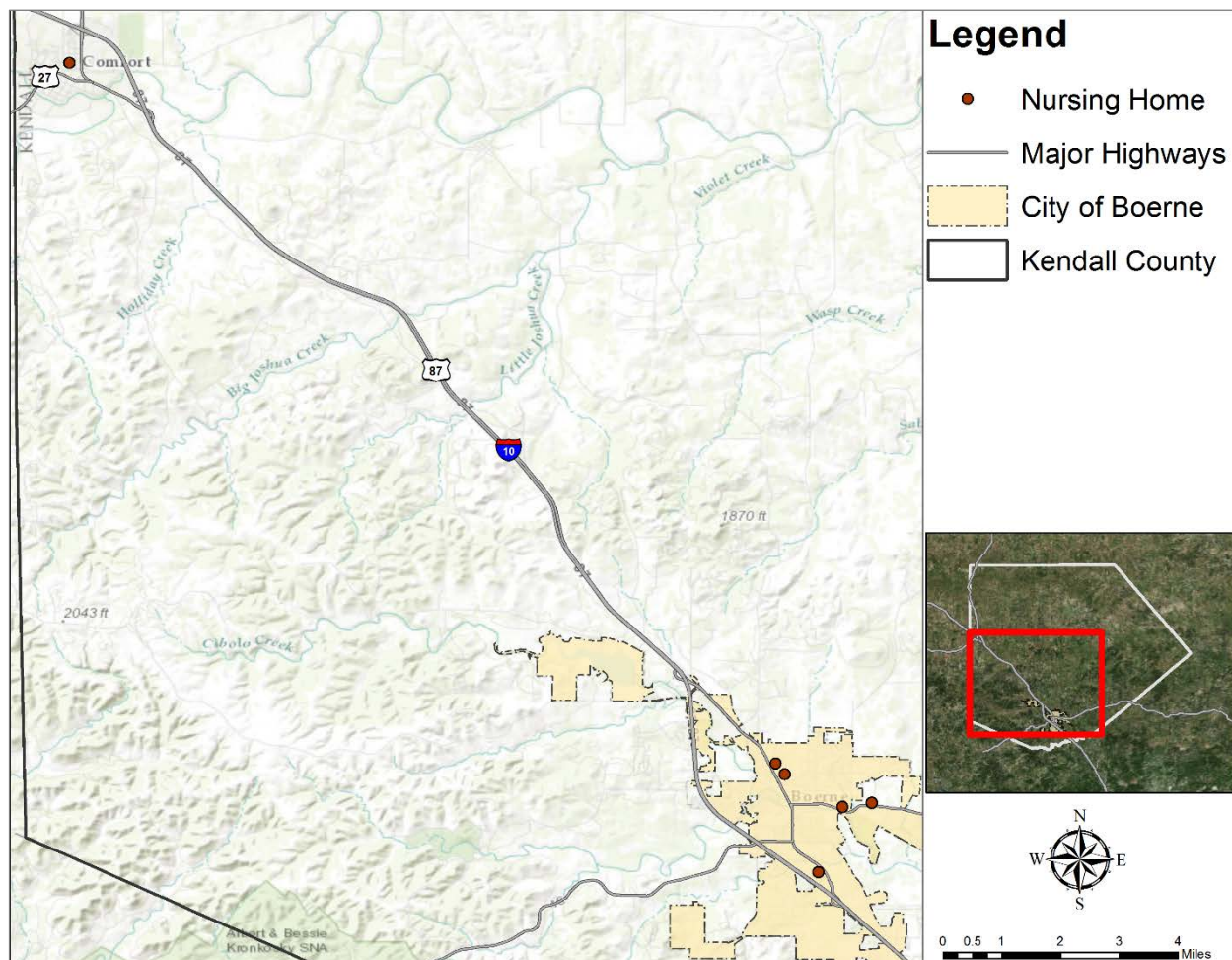


**Figure C-9. Critical Facilities (Hospitals) in Kendall County and the City of Boerne**

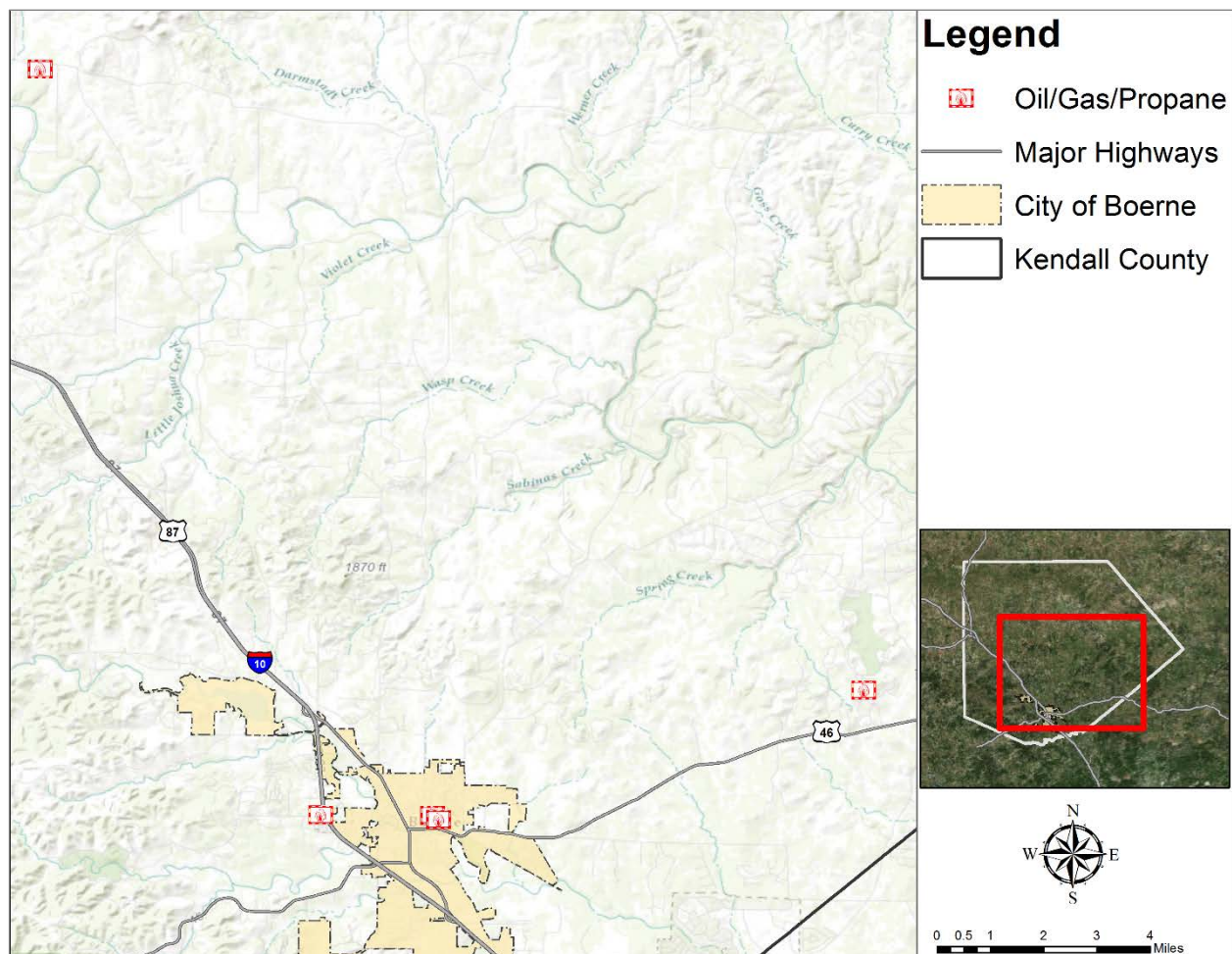




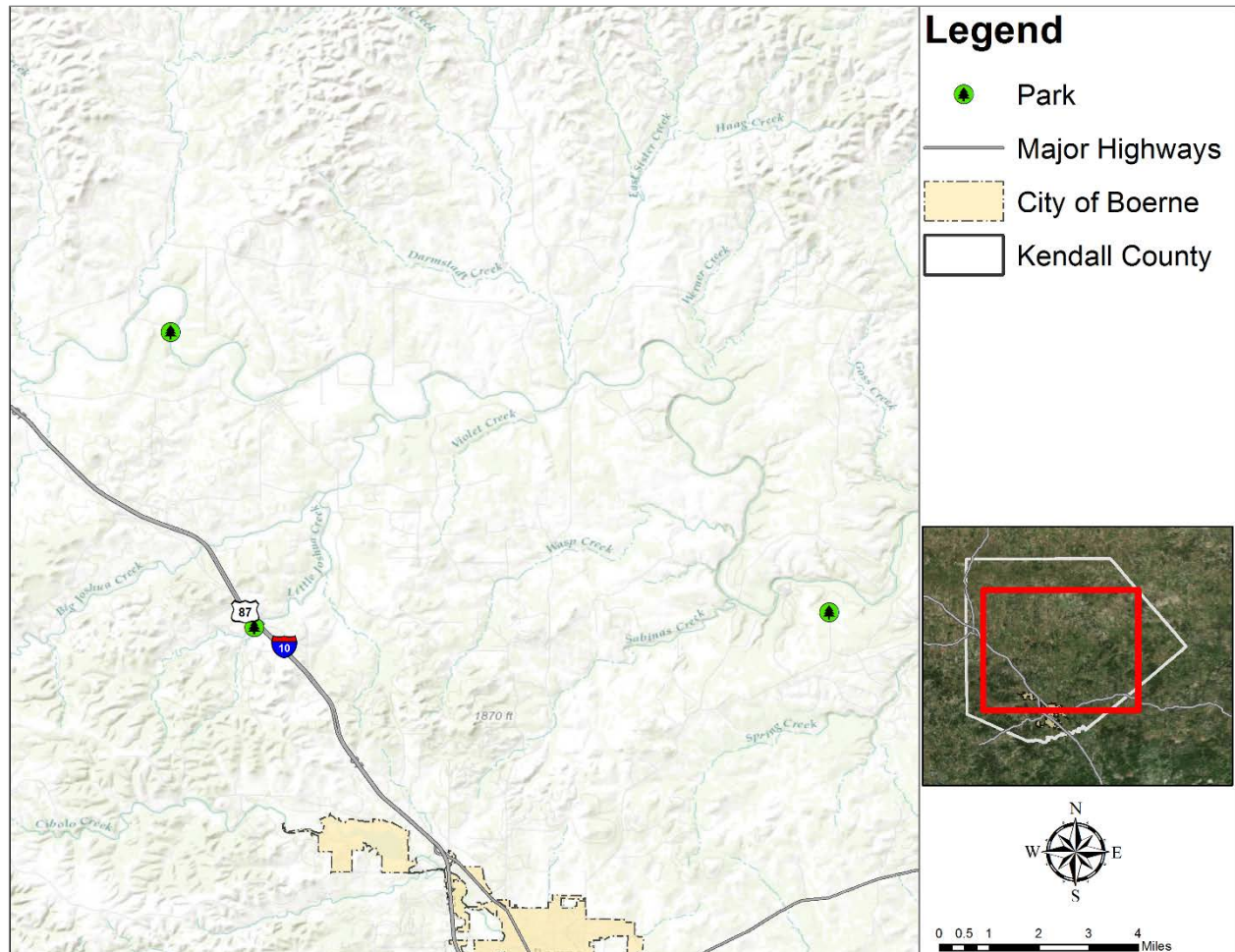
**Figure C-10. Critical Facilities (Nursing Homes) in Kendall County and the City of Boerne**



**Figure C-11. Critical Facilities (Oil/Gas/Propane Facilities) in Kendall County and the City of Boerne**

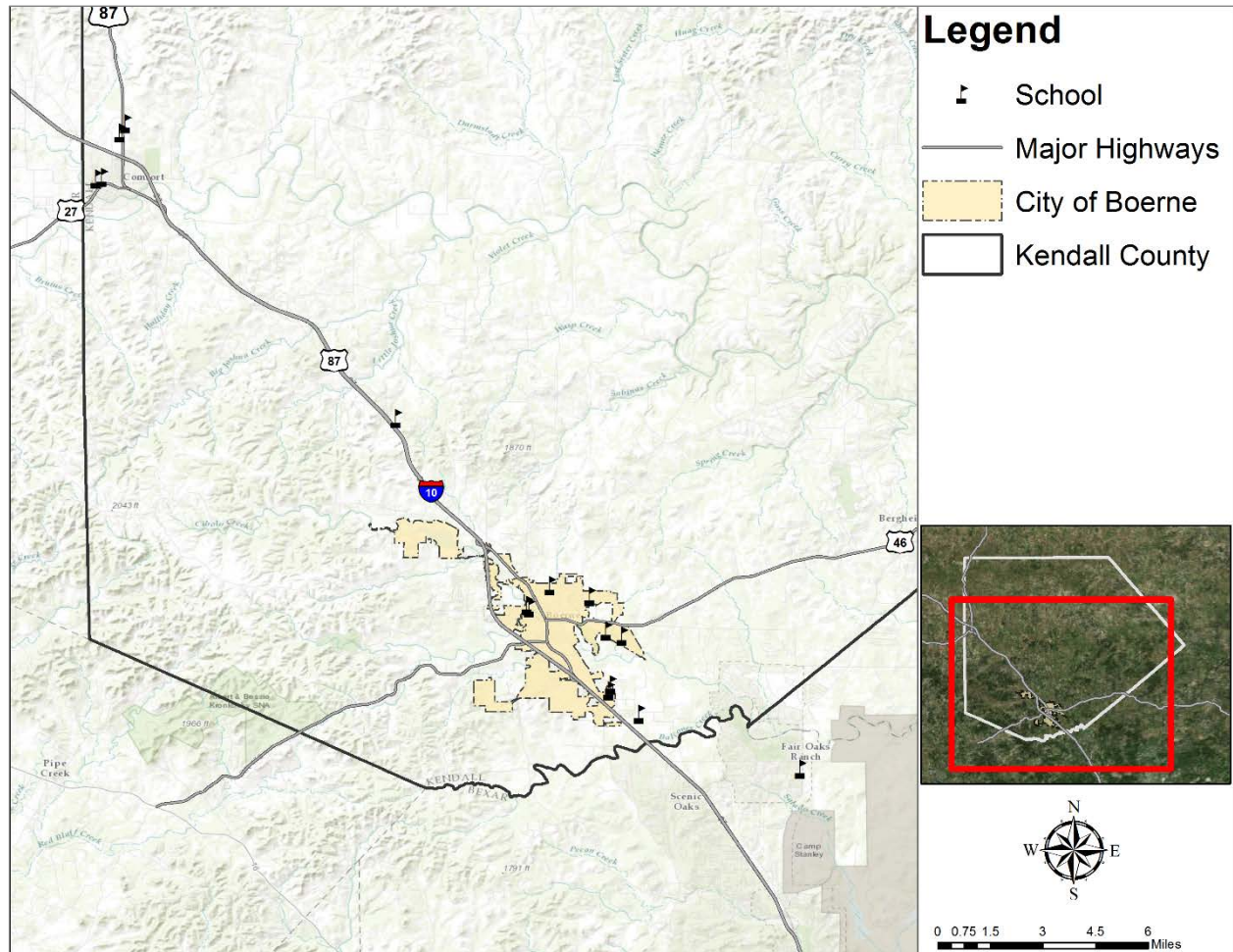


**Figure C-12. Critical Facilities (Parks) in Kendall County and the City of Boerne**

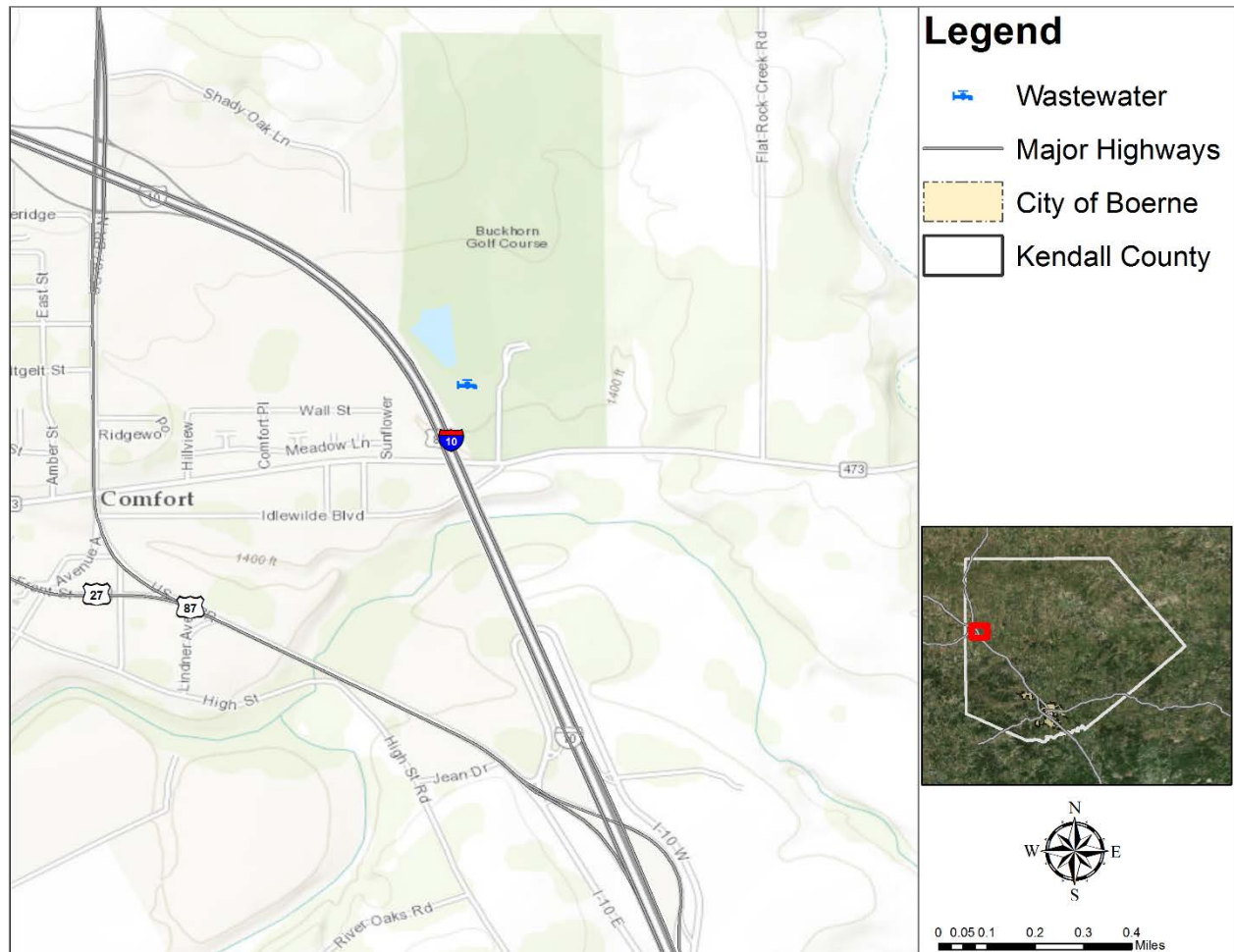




**Figure C-13. Critical Facilities (Schools) in Kendall County and the City of Boerne**



**Figure C-14. Critical Facilities (Wastewater Facilities) in Kendall County**



## Appendix C: Critical Facilities

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**Table C-1. Critical Facilities by Type in Kendall County and the City of Boerne**

TYPE	COUNTY NUMBER	CITY NUMBER
Ag & Equestrian Center	1	0
Animal Control Facilities	1	0
Assisted Living Facilities	2	4
Chemical Facilities	2	0
Electrical Facilities	2	2
Emergency Medical Services Facilities	1	1
Fertilizer Storage Facilities	1	0
Fire Departments	6	1
Government Facilities	2	8
Hospitals	0	1
Nursing Homes	1	5
Oil/gas/propane Facilities	3	2
Parks	3	0
Schools	6	8
Wastewater Facilities	1	2

# Appendix D: Dam Locations

Overview .....	1
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## Overview

Appendix D is **For Official Use Only (FOUO)** and may be exempt from public release under the Freedom of Information Act (FOIA).

Table D-1 below reflects all dams that are located in Kendall County. This list includes High, Significant, and Low Hazard Dams. Section 13 of the Plan, profiles only “high” hazard type dams, as required by FEMA.

## Dam Locations

**Table D-1. Listing of Kendall County Dam Locations and Storage Capacities**

JURISDICTION	LATITUDE	LONGITUDE	HEIGHT (Ft.)	STORAGE (Acre Feet)
Kendall County	29.77981	-98.81163	17	120
Kendall County	29.77812	-98.78782	12	50
Kendall County	29.80198	-98.80507	28	212
Kendall County	29.77858	-98.8064	18	55
Kendall County	29.87709	-98.51546	39	1,170
Kendall County	29.77685	-98.80218	24	83
Kendall County	29.80724	-98.79016	54	1,060
Boerne	29.82172	-98.76768	87	19,022
Boerne	29.78905	-98.72404	12	55
Kendall County	29.76055	-98.78813	56	1,278
Kendall County	29.93387	-98.89997	36	92
Kendall County	-98.80846	29.88389	36	39
Kendall County	-98.60831	29.88995	12	50
Kendall County	-98.81881	29.88399	20.1	49
Kendall County	-98.81662	29.88383	16.2	13
Kendall County	-98.78316	29.77934	76	4,750

# Appendix E: Meeting Documentation

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## Overview

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Appendix E is **For Official Use Only (FOUO)** and may be exempt from public release under the Freedom of Information Act (FOIA).

Kendall County and the City of Boerne held a series of Planning Team workshops: a Kickoff Workshop on February 8, 2016, a Risk Assessment Workshop on May 5, 2016, and a Mitigation Workshop on July 26, 2016. At each of these workshops members of the Planning Team were informed of the planning process, expressed opinions, and volunteered information. The sign-in sheets for each workshop are included below. Public meetings followed each of the workshops and sign-in documentation is included in Appendix E as well. For more details on the workshops and planning process, see Section 2.

## Workshop Documentation

Figure E-1. Kickoff Workshop, 02.08.16 (3 pages)



KENDALL COUNTY HAZARD MITIGATION PLAN KICKOFF  
Planning / Stakeholder Workshop  
Kendall County Courthouse, 3<sup>rd</sup> Floor Commissioners Count Room, Boerne, TX  
February 8, 2016

Name/Title	Department	Phone	Email
Rachel Andrews	H2O Partners (Mitigation)	512-983-0092	rachel@h2opartners.usa.co
JEFF FENNER	Kendall County HMC	830-249-3721	JFENNER@CO.KENDALL.TX.US
DEMO LILLY, Chief	Waring VFD	86-3779580	jog@svtc.com
ROBERT KINSEY	FACILITIES		ROBERT.KINSEY@CO.KENDALL.TX.US
H. Gideon	Boerne ISD	830-457-2000	Honey.Gideon@Boerne-isd.net
MARK MATTIOLI	City of Boerne	210-218-8813	mmattioli@ci.boerne.tx.us
Jim Kowler	CCB	210-286-4361	j.kowler@ci.boerne.tx.us
Don Durso	Compass A.F.	210-414-9099	ddurden@Cetexas.com
Patrick Cohen	Boerne Chamber of Commerce	210-561-4401	jpatrickcohen@chamber.com
LARRY RIPLEY	KCSO	830-249-9721	Larry.Ripley@Kendall.TX.US
BRIAN REILLY	Sisterdale VFD	(817) 968-1430	Brian.E.Reilly@graceville.com
Billy Shussler	KCRB	830-995-3995	billy.shussler@co.kendall.tx.us
N. Taylor	BEMU		

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## Appendix E: Meeting Documentation



### KENDALL COUNTY HAZARD MITIGATION PLAN KICKOFF

#### Planning / Stakeholder Workshop

Kendall County Courthouse, 3<sup>rd</sup> Floor Commissioners Count Room, Boerne, TX

February 8, 2016

Name/Title	Department	Phone	Email
Doug Macke - Fire Chief	Boerne Fire	(830) 249-3644	dmacke@ci.boerne.tx.us
Ray Andler - Asst. Fire Chief	Boerne FD	830-249-3644	r.andler@ci.boerne.tx.us
Misty Mayo - CEO/Pres.	BKC EDC	830-331-9070	misty.mayo@kenda11
Mark Montgomery - Division Director	STRAC	210 233 5890	mark.montgomery@countysdc
Don Evans - Coordinator R+B	Road Bridge	(210) 563-2726	DONEVANS6347@gmail.com
TAMER S. MORANES	KCCDEM	210/218/1417	DMORANES@KCCDEM.ORG
Hume Balderamas - H&H Specialist	Reflexologist Health	210 771 7558	hume.balderamas@kccdem.org
Mike Mern	Boerne Public Works	830 249 9511	mmern@ci.boerne.tx.us
TERRY TOLAN	City of Boerne	830-249-9511	TTOLAN@CI.BOERNE.TX.US
AL AUXIER	KENDALL COUNTY SHERIFF'S OFFICE	(830) 249 9721	AL.AUXIER@CO.KENDALL.TX.US
Reshaun	Comcast ISD Superintendent	806-470-1160	1ez1ezvzum62@gmail.com
Juanita Espino - HR Director	Kendall Co.	(830) 249-9343	juanita.espino@co.kendall.tx.us

H<sub>2</sub>O PARTNERS

## Appendix E: Meeting Documentation

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**KENDALL COUNTY HAZARD MITIGATION PLAN KICKOFF**  
**Planning / Stakeholder Workshop**  
**Kendall County Courthouse, 3<sup>rd</sup> Floor Commissioners Count Room, Boerne, TX**  
**February 8, 2016**

Name/Title	Department	Phone	Email
Eileen Huss	Boerne IER	830-331-3031	eileen.huss@mhsbreath.com
CORINNA SPEER	COUNTY AUDITOR	830-331-8214	corinna.speer@co.kendall.tx.us

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Figure E-2. Risk Assessment Workshop, 05.05.16 (2 pages)



KENDALL COUNTY HAZARD MITIGATION PLAN  
Risk Assessment Workshop  
Boerne Fire Station – Training Room, Boerne, TX  
May 5, 2016

Name/Title	Department	Phone	Email
Rachel Andrews/Mitigation Specialist	H2O Partners	512-983-0712	rad@h2opartnersusa.com
Heidi Watson	H2O Partners	512-568-2259	heidi@h2opartnersusa.com
MIKE HOWLE	GIS	830-331-8245	mhowle@co.kendall.tx.us
JEFF MAXWELL	Operations/Roads	830-995-2995	JMAXWELL@CO.KENDALL.TX.US
JEFF FINCH	EMS	830-249-3721	JFINCH@CO.KENDALL.TX.US
Richard W. Smith	RHB	830-995-2995	Richard.W.Smith@co.kendall.tx.us
MARK MATTHEW	COP	830-249-9591	mmatthew@co.kendall.tx.us
Wesley Spear	Kendall County Inspector	210-827-4483	Wesley.Spear@co.kendall.tx.us
KURT SOLIS	Comfort Chamber of C.	832-484-6236	kurt.solis@hdc.net
Don Duran	CAF	641-9999	dduran@cedex.com
DANIEL J. MORALES	CEM	210-218-1417	danny.morales@co.kendall.tx.us
Joe Pavoliti	Wash, VFD	803-779-530	joe@svr.com TX, U

H<sub>2</sub>O PARTNERS

## Appendix E: Meeting Documentation



**KENDALL COUNTY HAZARD MITIGATION PLAN**  
**Risk Assessment Workshop**  
**Boerne Fire Station – Training Room, Boerne, TX**  
**May 5, 2016**

Name/Title	Department	Phone	Email
Doug Mackie	Fire Dept	(830) 249-3644	dmackie@ci.boerne.tx.us
Ray Haskin	Boerne Fire	830-249-3644	rhas@ci.boerne.tx.us
TERRY NOLAN	CITY OF BOERNE	830-249-9511	TNOLAN@ci.boerne.tx.us
MIKE MAYER	CITY OF BOERNE	830-249-9511	MMAYER@ci.boerne.tx.us
Jim Kohler	COB	249-8645	j.kohler@ci.boerne.tx.us
Dorel Lux	KC	830-249-9343	Dorel@co.kendall.tx.us
Rich Tobolski	Kendall County	830-331-8250	Richard.tobolski@co.kendall.tx.us

**Figure E-3. Mitigation Strategy Workshop, 07.26.16 (2 pages)**

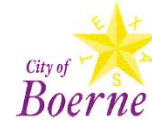


**KENDALL COUNTY HAZARD MITIGATION PLAN UPDATE**  
**Mitigation Actions Workshop**  
**Kendall County Commissioners Court Chambers, Boerne, TX**  
**July 26, 2016**

Name/Title	Department	Phone	Email
Rachel Andrews	H2O Partners	512-983-0092	rachel@h2opartners.com
Heidi Watson	H2O Partners	512-568-2259	heidi@h2opartners.usa.com
Jeff Guille	KCCMC	830-249-3721	JGuille@co.kendall.tx.us
Neil Guille	Kendall SO	830-249-9721	Neil.Guille@co.kendall.tx.us
Joe Paolilli	Wing VFD	830-377-9530	joe@grtc.com
Milburn Deering	Kendall Co. Constable Patz	830-249-2171	deering@gate.com
Roger Baker - Sgt.	Kendall County Sheriff	830-244-4721	roger.baker@co.kendall.tx.us
Jean Maxwell	Road & Bridge	830-995-2995	JMAXWELL@co.kendall.tx.us
Wesley Speer	Dev. Management	210-827-4483	wesley.speer@co.kendall.tx.us
Mike Howle	Dev. Mgt./GIS	830-331-8245	mhowle@co.kendall.tx.us
Terry Nolan	CITY OF BOERNE	830-249-9511	TNOLAN@CIBOERNE.TX.US
Tommy Pfeiffer	PET 3 a.m.m	210-325-7229	

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## Appendix E: Meeting Documentation



**KENDALL COUNTY HAZARD MITIGATION PLAN UPDATE**  
**Mitigation Actions Workshop**  
**Kendall County Commissioners Court Chambers, Boerne, TX**  
**July 26, 2016**

Name/Title	Department	Phone	Email
Richard R. Rife	Kendall Co. R&B	830-995-2995	Richard.Rife@co.kendall.tx.us
Rick Tobalka	Kendall County	830-331-8252	rickmeh.tobalka@co.kendall.tx.us
Mark Mattick	COB	210-218-8813	mmattick@ci.boerne.tx.us
Ray Harker	Boerne Fire	210-433-7635	rharker@ci.boerne.tx.us
Darrel Lux	Kendall County	830-249-9343	judge@co.kendall.tx.us



### Public Meeting Documentation

As discussed in Section 2, a series of three public meetings were held in conjunction with each of the workshops. Documentation in the form of sign-in sheets for each of the meetings follows.

**Figure E-4. Public Kickoff Meeting, 02.08.16**



**KENDALL COUNTY HAZARD MITIGATION PLAN KICKOFF**

**Public Meeting**

Kendall County Courthouse, 3<sup>rd</sup> Floor Commissioners Count Room, Boerne, TX

February 8, 2016

Name/Title	Department	Phone	Email
Rachel Andrews	H2O partners Mitigation Specialist	512-983-0092	rachel@h2opartnersusa.com
Mark Mattioli	City of Boerne	210-218-8813	mmattioli@ci.boerne.tx.us
CAROL WESTERMEIER		830-249-7084	jimcaro1@gvtr.com
JIM WESTERMEIER		"	"
JEFF FINCKS	Kendall CO. EMC	830-249-3721	"
DARRYL LUX	Kendall CO Judge		

Figure E-5. Public Risk Assessment Meeting, 05.05.16 (2 pages)



KENDALL COUNTY HAZARD MITIGATION PLAN  
Public Meeting  
Boerne Fire Station – Training Room, Boerne, TX  
May 5, 2016

Name/Title	Department	Phone	Email
Rachel Andrews/Mitigation Specialist	H2OPartners	512-983-0090	rachel@h2opartnersusa.com
Hendi Watson	H2O Partners	912 968 2259	hendi@h2opartnersusa.com
JEFF FENDERS	Kendall Co. EMC	430 249-3721	JFENDERS@CO-KENDALLTX.US
William H. Gosdin	Visitor	830-336-3988	gggOSDIN@Yahoo.com
Gabeir Gosdin	Visitor/City of Boerne	830-336-3988	gggOSDIN@Yahoo.com
Gene Berube	Constable Prec 3	830-249-8082	gene.berube@kendall.tx.us
Mark Seaman	Visitor	210-317-7891	mark@seamans.cc
Ken Nichols	Visitor	301-717-4571	Ken@Nichols.cc
Rudy England	Rep. Doug Miller	512-463-8225	rudy.england@house.texas.gov
Bob Eason	County Attorney	249-9345-x298	eason.robert@kahd.com
Marie Gansel	All TX	211	marie.gansel@satx.org
Bob Webster	CLGCD	210 452-8876	ORLANIC 808 258C GLOBE.NET

## Appendix E: Meeting Documentation



**KENDALL COUNTY HAZARD MITIGATION PLAN**  
**Public Meeting**  
**Boerne Fire Station – Training Room, Boerne, TX**  
**May 5, 2016**

Name/Title	Department	Phone	Email
RICHARD ELKINS	Commissioner Pct 2	830-428-8017	ELKINSUSA@YAHOO.CO
B. David Moore	Union	(210) 846-9745	dmboerne@gvdc.com
Debbi S. Hudson	VP	830-249-2820	judge3@gvdc.com
Darrell Lux	County Judge	830-249-9343	judge@co.kendall.tx.us

**Figure E-6. Public Mitigation Actions Meeting, 07.26.16**



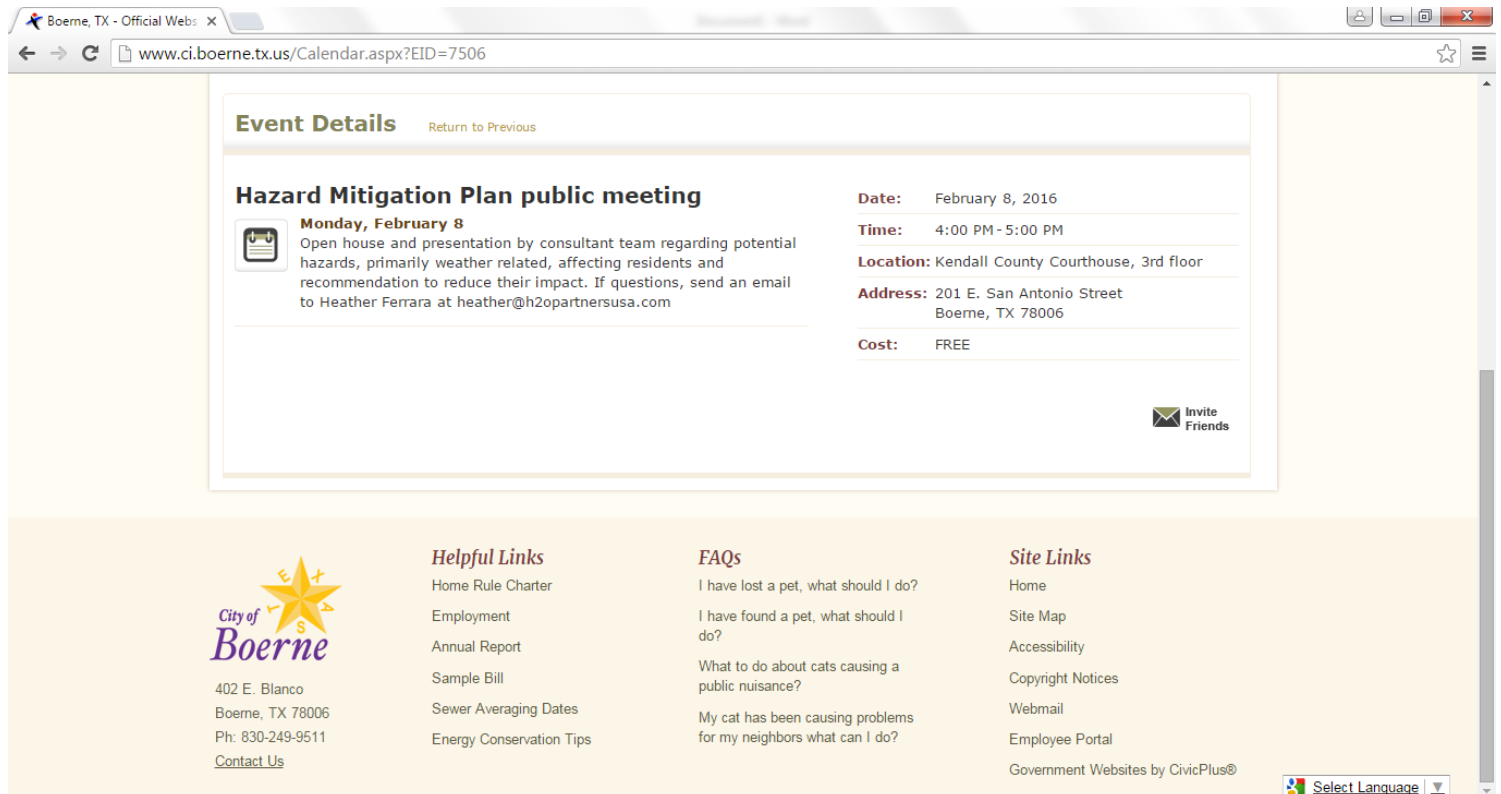
**KENDALL COUNTY HAZARD MITIGATION PLAN UPDATE**  
**Public Meeting**  
**Kendall County Commissioners Court Chambers, Boerne, TX**  
**July 26, 2016**

Name/Title	Department	Phone	Email
Rachel Andrews	Mitigation Specialist H2O Partners	512-983-0092	rachel@h2opartnersusa.com
Heidi Watson	H2O Partners Mitigation Specialist	925-568-2259	heidi@h2opartnersusa.com
Rodney Vondam	MA All Hazards Comm, Comm, County, Radio	830-391-6348	rodney@vondam.org
John Buckelew	IT	210-863-7323	john.buckelew@co.kendall.tx.us
Jeff Fencer	Emergency Management Co.	830-248-3121	JFencer@co.kendall.tx.us
Gene Sereno	At 3 Constable	830-244-2820	gene.sereno@co.kendall.tx.us

### Public Notices

Public notices to announce Kendall County and the City of Boerne's participation in the Plan development process were posted on City and County webpages, County Facebook page and via email in conjunction with the public meetings as shown in Figures E-7 and E-12.

**Figure E-7. Public Notice for 02.08.16 Meeting, City of Boerne Webpage**



**Figure E-8. Public Notice for 02.08.16 Meeting, City of Boerne Newspaper**

TUESDAY, FEBRUARY 2, 2016

THE BOERNE STAR

PAGE 3

## COMMUNITY

### Public meeting set for county, city hazard mitigation plan

Kendall County and the City of Boerne will hold a public meeting on Monday, Feb. 8, to gather public input for a countywide Hazard Mitigation Plan.

The meeting will be held from 4 to 5 p.m. at the Kendall County Courthouse, third floor Commissioners Courtroom, 201 E. San Antonio in Boerne. The public is invited and encouraged to attend the meeting.

The meeting will provide a project overview from H2O Partners, Inc., consultant to the project, and solicit information from citizens. Public input will help the project team to identify and analyze potential hazards affecting residents and recommend possible actions to reduce their impact.

Hazards can include floods, tornadoes, wildfires, winter storms and other major disasters.

For anyone who cannot attend, information about the planning process and a public participation survey can be obtained by contacting Heather Ferrara, H2O Partners, Inc. at [heather@h2opartnersusa.com](mailto:heather@h2opartnersusa.com).

The goal of the plan is to minimize or eliminate the long-term risk to human life and property from known hazards by identifying and implementing cost-effective mitigation actions.

Mitigation is defined by the Federal Emergency Management Agency as sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects.

Questions about the Hazard Mitigation Plan should be addressed to H2O Partners, Inc., Attn: Heather Ferrara, project manager, by email at [heather@h2opartnersusa.com](mailto:heather@h2opartnersusa.com).

### KC Republicans host meet-the-candidates tonight at BHS

The Kendall County Republican Women, Kendall County Republican Club and the Kendall County Republican Party will join to host a Meet the Republican Candidates forum on Tuesday, Feb. 2. The event will be held at the Boerne High School Auditorium, 1 Greyhound Lane in Boerne. Doors will open at 6 p.m. and the forum will begin at 6:30 p.m.

Invitees include all Republican presidential candidates, Texas Supreme Court Justices, and many other Republican nominees up for election.

Similar to past years we expect high turnout, as all area media outlets are expected to cover this event.

Additionally, many of the candidates will stay after the event for an informal meet-and-greet session to visit and answer questions. Voter registration will also be available for those who would like to register to vote.

Contact Halie Daniels, Kendall County Republican Women campaign activities chairman, at [haliedaniels26@gmail.com](mailto:haliedaniels26@gmail.com) for additional information.

### Family History Place and LDS History Center partner for easier access to research materials

The Genealogical Society of Kendall County has formed a new partnership with the Family History Center of the Church of Jesus Christ of Latter Day Saints, which has relocated their research computers with genealogical databases and websites to the History Place, 114 E. Blanco Rd.

These databases and websites greatly expand access to genealogical resources. FHP and FHC volunteers are working together to provide expanded hours and resources for free genealogical research for the public.

The Family History Place has changed also. There is now additional space for more people to research and receive help from volunteers. More books are on the shelves from many donations and memorials.

We also sell books on history and genealogy by local authors. The informative monthly meetings with great speakers and refreshments will continue to be open to everyone on the third Saturday at 10:30 a.m. at the Patrick Heath Public Library.

"We are adjusting the Family History Place hours as we expand, so call FHP at 830-

## OBITUARY

CONT'D FROM PAGE 2

### Gary S. Marcell Sept. 27, 1957 - Jan. 28, 2016

Gary S. Marcell, age 58, a 42-year resident of Boerne, passed away on Jan. 28, 2016, after a courageous battle with prostate cancer. Gary was born in San Antonio on Sept. 27, 1957. He graduated from Boerne High School in 1976. Gary was a life-long athlete and passed on this love of sports to his three



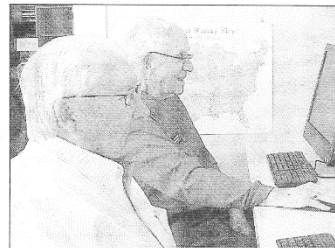
Marcell

daughters.

He is survived by his children, Jordan Ashley Marcell, Haley Shea Marcell and Paige Elisabeth Marcell; his mother and stepfather, Joann and Les Steubing; his grandmother, Pauline Gordon; his sister and nephew, Cheryl and Stephen Graves; and half siblings, Jennifer, Alicia, Kathleen, Kristin, Brittani, Rachael and Jonathan Marcell.

He was preceded in death by his father, Frank G. Marcell and grandmother Beatrice Rupert.

Memorial services will be on Thursday, Feb. 4, at 5 p.m. at First United Methodist Church at 205 James Street, Boerne.



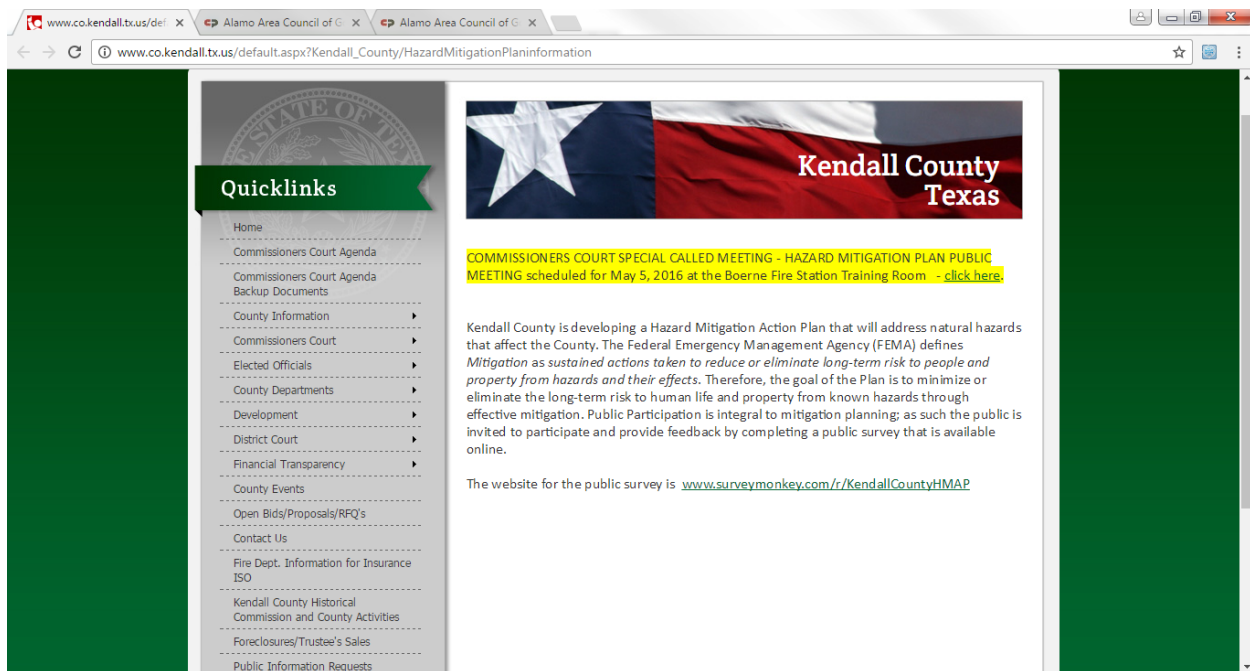


## Appendix E: Meeting Documentation

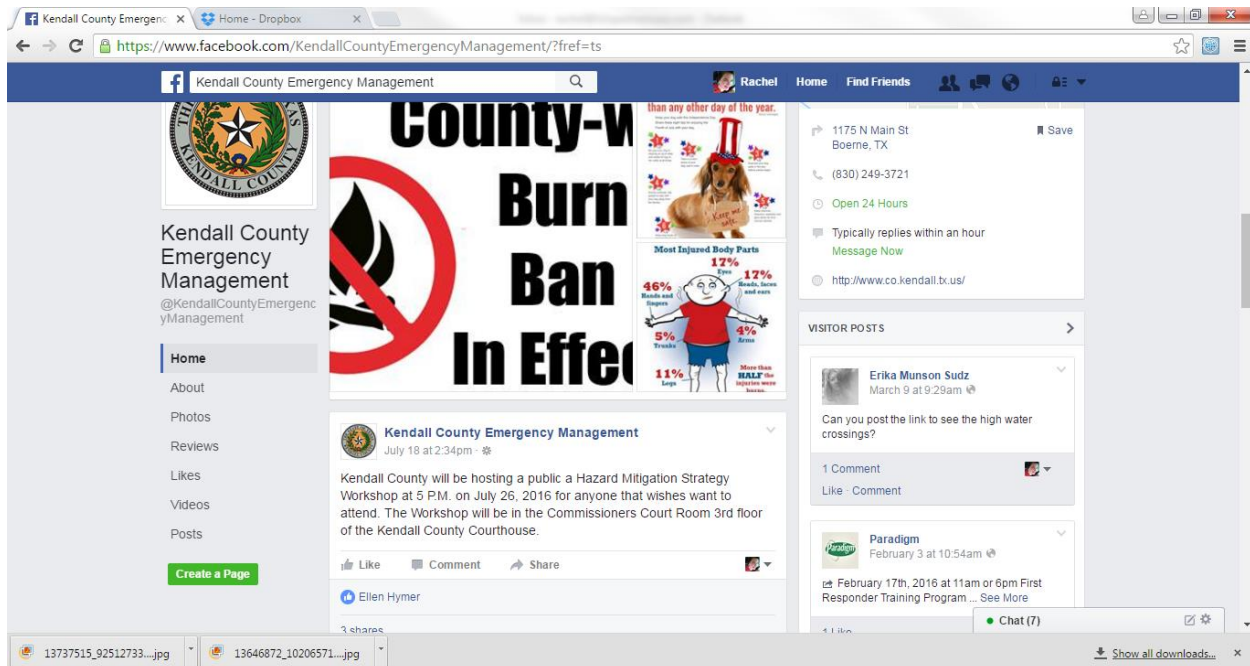
Figure E-9. Public Notice for 05.05.16 Meeting, Kendall County Facebook Page



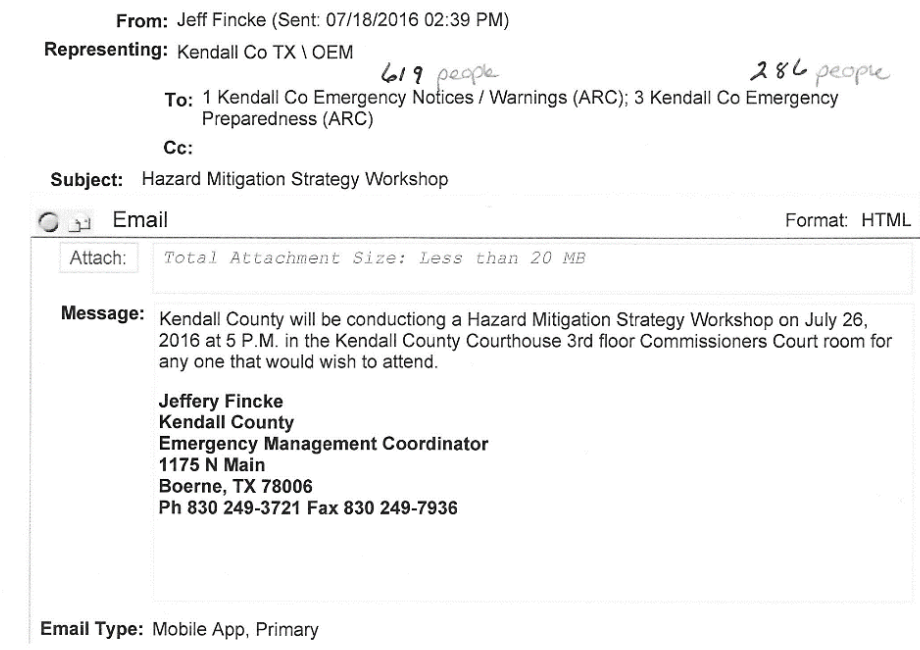
Figure E-10. Public Survey and 05.05.16 Public Meeting Invitations, Kendall County Website



**Figure E-11. Public Notice for 07.26.16 Meeting, Kendall County Facebook Page**



**Figure E-12. Public Notice for 07.26.16 Meeting, Email to 905 Addresses**



# Appendix F: Capability Assessment

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Overview .....	1
Kendall County Capability Assessment.....	2
City of Boerne Capability Assessment.....	4

## Overview

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The Planning Team completed a Capability Assessment Survey at the beginning of the planning process. The completed Capability Assessment Checklist, included in Appendix F, provides information on existing policies, plans, and regulations for Kendall County. The City of Boerne's completed Capability Assessment Checklist is also included in Appendix F.

A Capability Assessment is an integral component of the Plan development process. The Capability Assessment serves to evaluate a community's existing planning and regulatory capabilities to support implementation of the Plan's Mitigation Strategy Objectives.

Each community has a unique set of capabilities including policies, programs, staff, funding, and other resources available to accomplish hazard mitigation objectives and reduce long-term vulnerability. The Planning Team identified existing capabilities in each jurisdiction that currently reduce disaster losses or could be used to reduce losses in the future, and capabilities that inadvertently increase risks in the community.

## Kendall County Capability Assessment

COMMUNITY CAPABILITY CHECKLIST		
Planning/Regulatory Tool	In Place	Under Development
Hazard Mitigation Plan	X	
Comprehensive Land Use Plan		X
Stormwater Management Plan/Ordinance	X	
Emergency Operations Plan	X	
Capital Improvements Plan		X
Floodplain Management Plan	X	
Flood Response Plan	X	
Historic Preservation Plan		
Continuity of Operations Plan	X	
Evacuation Plan	X	
National Flood Insurance Program (NFIP)	X	
NFIP Community Rating System		
NFIP Floodplain Ordinance	X	
Building Code		
Fire Code	X	
Other Plans - Post-Disaster Recovery Plan (Roadway Repair and Debris Removal)	X	
Other Plans -		
Administrative and Technical Capability	Yes	No
Planners	X	
Engineers	X	

## Appendix F: Capability Assessment

COMMUNITY CAPABILITY CHECKLIST		
Emergency Manager	X	
Floodplain Manager	X	
Personnel skilled in Geographic Information Systems (GIS)	X	
Resource development staff or grant writers		
Financial Resources	Yes	No
Capital Improvement Programming		
Community Development Block Grants (CDBG)		
Stormwater Utility Fees		
Development Impact Fees		
Partnering Agreements or Intergovernmental Agreements	X	
Other: Regional Stormwater Management Program		
Other		

## City of Boerne Capability Assessment

COMMUNITY CAPABILITY CHECKLIST		
Planning/Regulatory Tool	In Place	Under Development
Hazard Mitigation Plan	X	
Comprehensive Land Use Plan	X	
Stormwater Management Plan/Ordinance		
Emergency Operations Plan	X	
Capital Improvements Plan		
Floodplain Management Plan		
Flood Response Plan	X	
Historic Preservation Plan	X	
Continuity of Operations Plan		
Evacuation Plan	X	
National Flood Insurance Program (NFIP)	X	
NFIP Community Rating System		
NFIP Floodplain Ordinance		
Building Code	X	
Fire Code	X	
Other Plans/Codes – ADA Compliance, National Electrical Code, Plumbing Codes, International Energy Conservation Code		
Administrative and Technical Capability	Yes	No
Planners	X	
Engineers	X	



## Appendix F: Capability Assessment

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COMMUNITY CAPABILITY CHECKLIST		
Emergency Manager	X	
Floodplain Manager	X	
Personnel skilled in Geographic Information Systems (GIS)		
Resource development staff or grant writers		
Financial Resources	Yes	No
Capital Improvement Programming		
Community Development Block Grants (CDBG)		
Partnering Agreements or Intergovernmental Agreements		