Madison County Hazard Mitigation

Mitigating Risk: Protecting Madison County from All Hazards

2013-2018

Emergency Management
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EXECUTIVE SUMMARY

PURPOSE AND PROCESS OF DEVELOPMENT

This update document, "Mitigating Risk: Protecting Madison County from All Hazards, 2013 – 2018," was prepared by the jurisdictions within Madison County with the support of the Brazos Valley Council of Governments (BVCOG) and its contractor, the Texas Engineering Extension Service (TEEX).

This plan is a five-year blueprint for the future, aimed at making communities in Madison County disaster resistant by reducing or eliminating the long-term risk of loss of life and property from the full range of natural disasters. It meets the requirements of the Disaster Mitigation Act of 2000 (P.L. 106-390); Section 44 of the Code of Federal Regulations, Part 201.6 & 206; and State of Texas Division of Emergency Management standards. An open public process was established to provide multiple opportunities for all sectors in Madison County to become involved in the planning process and make input during its drafting stage.

HAZARDS FACING MADISON COUNTY

The plan identifies and assesses the potential impact of ten (10) natural hazards that threaten Madison County. These include: dam failures; drought; excessive heat; fires; floods; hail; hurricanes; severe winter storms; thunderstorms; and tornadoes. Hazards were identified based on a review of historical records, national data sources, existing plans and reports, and discussions with local, regional, and national experts. Each hazard was profiled based on its severity of impact, frequency of occurrence, seasonal patterns, warning time, cascading potential and existing warning systems. An inventory of populations, buildings, critical and special facilities, and commercial facilities at potential risk was conducted. The probability of occurrence and potential dollar losses from each hazard were estimated using the Federal Emergency Management Agency's Hazards U.S. ("HAZUS") multi-hazards model and other HAZUS-like modeling techniques. The hazards were then ranked based on potential damages in terms of lives lost, dollars lost, and other relevant community factors. In order of priority, they are:

- Floods
- Droughts
- Hurricanes
- Fires
- Severe Winter Storms
- Tornadoes
- Hail

- Thunderstorms
- Dam failures
- Excessive Heat

MITIGATION VISION

A vision statement, 6 goals, and 21 objectives were developed to guide the jurisdictions in Madison County in reducing or eliminating the long-term risk of loss of life and property from the full range of natural disasters. The mitigation vision for the Madison County region incorporates:

An informed citizenry aware of the risks they face and the measures that can be taken to protect their families, homes, workplaces, communities and livelihoods from the impact of disasters.

- Local governments and regional entities that are capable of high-level hazard-mitigation planning and project implementation, and of leveraging state, federal, and private resources for investments in mitigation;
- Intergovernmental coordination and cooperation on mutual issues of concern related to floodplain management and hazard mitigation.
- A commitment to locate buildings outside hazardous areas and to promote building methods that result in structures able to withstand the natural hazards that threaten them;
- The integration of mitigation into routine budgetary decisions and planning for future growth and development by Madison County communities, making disaster resistance an integral part of the livability and sustainability of the county.

GOALS, OBJECTIVES AND ACTIONS

The overall goal of this plan is to reduce or eliminate the long-term risk of loss of life and property damage in Madison County from the full range of disasters. Individual goals are:

GOAL 1. Develop new, and upgrade existing capabilities for identifying the need for and implementing hazard mitigation activities.

GOAL 2. Generate support for and increase public awareness of the need for hazard mitigation.

GOAL 3. Increase awareness of public officials, community and business leaders of the need for hazard mitigation, and support actions to protect public health and safety.

GOAL 4. Promote resource-sharing and increase coordination and cooperation among governmental entities in conducting hazard-mitigation activities.

GOAL 5. Mitigate damage to and losses of new and existing real property.

GOAL 6. Promote sustainable growth.

Twenty-one objectives in support of these goals are presented in Section 3.

Mitigation Actions

This plan sets forth mitigation actions to be carried out by the participating jurisdictions to reduce the risks to these hazards facing Madison County. Each action statement includes a description of the action, estimated costs, benefits, the responsible organization for implementing the action, an implementation schedule, objective(s) to which it is to achieve, priority, and potential funding sources. Some actions are directed at reducing the risk from a priority, and potential funding sources. Some actions are directed at reducing the risk from a single hazard, such as flooding. Others pertain to multiple hazards or all 10 hazards. The hazards differ in important ways, such as in their predictability, length of warning time, speed of onset, magnitude, scope, duration of impact, and the possibilities of secondary impacts. Many of the demands on the emergency management infrastructure they generate, however, arise not from their differences but from their commonalities.

ORGANIZATION OF THE PLAN

The executive summary is at the beginning of the plan. Sections 1 and 2 outline the purpose of the plan and the process of development. Section 3 contains the vision statement and mitigation goals and objectives. Section 4 describes profiles the geography, population, land use and development trends within Madison County.

The major natural hazards that Madison County faces and the property at risk are identified in Section 5. Background on each hazard, including why the hazard is a threat, a hazard profile, the location of hazardous areas, history of hazardous events, people and property at risk, and potential damages and losses, is presented in Sections 6 through 15.

Section 16 reports previously implemented mitigation actions, including those supported by federal and state agencies, and local programs relating to building and fire codes and floodplain management ordinances. Section 17 presents mitigation actions to be undertaken by each participating jurisdiction. Section 18 discusses plan maintenance procedures, including how the plan is to implemented, maintained and evaluated, and how the public will continue to be involved.

Appendix A defines acronyms used in this plan. Appendix B reports the results of a web-based hazard survey to elicit information from the public on issues of concern about hazard mitigation. Appendix C identifies members of the local hazard mitigation team who updated this plan. Appendix D identifies the critical facilities in Madison County. Appendix E contains the resolutions adopted by jurisdictional authorities to approve this plan.

TABLE OF CONTENTS

SECTION 1: PURPOSE AND ORGANIZATION OF THE PLAN

PURPOSE

The Brazos Valley Council of Governments (BVCOG) serves the seven-county Brazos Valley region that consists of Brazos, Burleson, Grimes, Leon, Madison, Robertson and Washington Counties, as well as incorporated cities and several unincorporated communities in those counties. Its boundaries are based on geographic features, economic market areas, labor markets, commuting patterns and media coverage areas. The COG was established in 1966 and is charged by the Texas legislature with addressing regional issues and opportunities.

BVCOG's goal is to create and enhance partnerships among local governments, private businesses and service organizations to collaboratively plan for and maintain the highest quality of life in Madison County. The organization provides, in consultation with and through the cooperation of the local elected officials, housing, health, workforce, and senior services programs throughout Madison County. The council also administers the regional 9-1-1 plan, community and economic development programs, criminal justice planning and grants, and solid waste planning and grants.

BVCOG took the lead in sponsoring the development of this comprehensive Hazard Mitigation Plan for Madison County.

Jurisdictions participating in this Hazard Mitigation Action Plan include Madison County, the cities of Madisonville, Midway, Normangee (which is partially in Leon County) and the North Zulch Municipal Utility District (MUD), and the BVCOG.

Role of this Plan

This Hazard Mitigation Action Plan was prepared by TEEX, on behalf of Madison County and participating jurisdictions. It is intended as a blueprint for future hazard mitigation, defined as "any sustained action taken to reduce or eliminate the long-term risk to human life and property from all hazards." The plan is designed to help build sustainable communities that, when confronted by natural or man-caused disasters, will sustain fewer losses and recover more quickly. It is also intended to:

- Minimize disruption to Madison County communities following a disaster;
- Streamline disaster recovery by articulating actions to be taken before a disaster strikes, to reduce or eliminate future damage;
- Serve as a basis for future funding that may become available through grant and technical assistance programs offered by state or federal governments. The plan will enable Madison County communities to take advantage of rapidly developing mitigation grant opportunities as they arise; and
- Ensure that Madison County maintains their eligibility for the full range of future federal disaster relief. Certain forms of federal mitigation assistance for projects will

be available only to cities and counties that have a FEMA-approved hazard mitigation plan in place.

ORGANIZATION

Section 2 of this plan address how it was prepared and who was involved in planning. Section 3 articulates the vision, mitigation goals, and objectives that guided the development of the plan. The goals are general guidelines that articulate a desired end state. They are expressed as policy statements of global visions. Objectives are specific, measurable, and define the strategies or implementation steps to attain the identified goals. Section 4 profiles Madison County's geography, population, land use and development trends. Section 5 identifies the major natural that have affected and may again affect the Madison County region and describes the people and property at risk from these hazards.

Sections 6 through 15 discuss each of the natural hazards that affect Madison County. The plan addresses why each hazard is a threat and profiles each hazard in terms of its severity of impact, frequency of occurrence, hours of warning time, and existing warning systems. If the hazard has a geographic boundary, it is identified and mapped if possible. Data on the property and number of people at risk from each hazard are presented, along with the history of hazard events in Madison County. Finally, potential dollar losses are presented.

Section 16 discusses previously implemented mitigation actions. These include federal projects such as the Federal Emergency Management Agency's Public Assistance projects, Hazard Mitigation Grant Program projects, and other federal mitigation projects; and the U.S. Army Corps of Engineers' (USACE) studies, plans, and projects. It also includes plans, studies and projects of the Texas Water Development Board, and local plans, ordinances, and inspection and permitting processes.

Section 17 contains actions to be undertaken by each participating city and the county to mitigate the hazards identified in Sections 6 to 15. Mitigation action plans describe each mitigation action, the hazard addressed, the estimated costs, benefits, organization responsible for overseeing implementation, implementation schedule, objectives the action is designed to achieve, priority, and potential funding sources. Section 18 discusses plan maintenance procedures, including how the plan is to implemented, maintained and evaluated, and how the public will continue to be involved.

Appendix A defines acronyms used in this plan. Appendix B reports the results of a web-based hazard survey to elicit information from the public on issues of concern about hazard mitigation. Appendix C identifies members of the local hazard mitigation team who updated this plan. Appendix D identifies the critical facilities in Madison County. Appendix E contains the resolutions adopted by jurisdictional authorities to approve this plan.

SECTION 2: THE PLANNING PROCESS

PREPARATION OF THE PLAN

This document was prepared by the BVCOG, in coordination with participating jurisdictions covered, with technical support of TEEX. It was developed in accordance with the provisions of the Disaster Mitigation Act of 2000 (Public Law 106-390), the Pre-Disaster Mitigation Grant Program, Federal Regulations (44 CFR 206), and the planning standards adopted by the Texas Division of Emergency Management. The hazard mitigation planning process for Madison County was started in April 2010 and a draft was completed for submission to the state in October 2011. After the state review in February 2012, the plan was revised and resubmitted back to the state in mid-2012. Following another review by the state, a revised plan was resubmitted back to the state in January 2013 and forwarded to FEMA for review. In April, FEMA finished their review and had some required revisions. The plan was revised and resubmitted back to FEMA for review in May 2013.

Development of this plan was funded by the Federal Emergency Management Agency (FEMA) under a mitigation grant awarded in November 2010, to the Brazos Valley Council of Governments.

Jurisdictions participating in this Hazard Mitigation Action Plan include Madison County, the cities of Madisonville, Midway, Normangee, the North Zulch Municipal Utility District (MUD), and the BVCOG.

Jurisdictional Participation

This Hazard Mitigation Action Plan was created in 2005 and updated in 2010-2013. Whereas the 2005 version contained multiple counties within the BVCOG region, this updated plan covers only the portion of Madison County.

The jurisdictions participating in this update remain the same as in 2005. They include Madison County, the cities of Madisonville, Midway, Normangee (located mostly in Leon County), the North Zulch MUD and the BVCOG.

The jurisdictions all participated equally during the update process. Each jurisdiction contributed during the update process by:

- Forming a new local Hazard Mitigation Team (HMT) with representatives from their jurisdiction.
- Attended kick-off meetings, a mitigation workshop and public meetings.
- Reviewed and analyzed the existing plan and updated each section, as necessary.
- Provided an updated risk assessment for their jurisdiction.
- Discussed the status of previous action items and provided new mitigation actions.
- Devised a way to keep the plan maintained from 2013-2018.

Open Public Process

An open public process was established to give Madison County and the participating jurisdictions an opportunity to become involved in the planning process and make their views known.

Madison County established a Hazard Mitigation Team composed of broad-based representatives of cities and the county. A list of team members is provided at Appendix C. The Hazard Mitigation Team members from each jurisdiction participated actively throughout the planning process. They attended a kick-off workshop and a mitigation workshop in the county, updated mitigation actions and developed new mitigation actions, and devised a way to keep the plan up to date from 2013-2018. Non-participating jurisdictions were notified about the planning effort and invited to participate. They were given the opportunity to attend a kick-off meeting, public meetings, a mitigation workshop and to fill out the Hazard Mitigation Survey Form.

A kick-off meeting was held in Madison County on May 6, 2010 in the City of Madisonville. The Madison County Judge, the Madison County Commissioners, mayors of the participating cities, the Madison County floodplain manager, the Madison County Emergency Management Coordinator, the fire and police chiefs of participating jurisdictions, the county sheriff, independent school districts officials and other interested local officials were invited to the kick-off meeting.

At the meeting, TEEX provided a briefing on the FEMA hazard mitigation planning requirements and the respective roles and responsibilities of the BVCOG, local jurisdictions and TEEX. An opportunity was provided for Madison County officials to discuss how they would like to approach the planning process in each county. The Madison County Kick-Off Meeting was conducted on May 6, 2010 and a second mitigation team meeting was held on October 13, 2011 in Madisonville. A Public meeting was held on May 6, 2010 and a second public meeting will occur following FEMA's review of the draft plan. The purpose of the meetings is to inform the public about the planning process and solicit their ideas and recommendations.

A Hazard Survey was developed to solicit opinions from the public about hazards of concern. The survey provided a mechanism to gain input from neighboring communities, agencies, businesses, academia, non-profit organizations, and other interested parties. A total of 12 responses were received. The responses are summarized in Appendix B. These responses provided a base of information to assist with participating jurisdictions in formulating mitigation actions.

Identify Hazards

Profiles of hazards were prepared to show their severity of impact, frequency of occurrence, seasonal patterns, warning time, cascading potential, and applicable warning systems.

Assess Risks

The characteristics and potential consequences of each hazard were assessed to determine how much of Madison County could be affected and the potential effects on local assets.

An inventory was taken of "at risk" populations, buildings, infrastructure and lifelines, and commercial facilities in Madison County classified as "critical" or "special" or housing hazardous materials. A list of critical facilities is provided in Appendix D.

Potential dollar losses from each hazard were estimated, using the Federal Emergency Management Agency's Hazards U.S. (HAZUS) Multi-Hazards (MH) Model (HAZUS-MH) and other HAZUS-like modeling techniques. The techniques were applied to examine the impact of various hazards on the built environment, including on the general building stock (e.g., residential, commercial, industrial), critical facilities, lifelines, and infrastructure.

Two distinct assessment methodologies were used. The HAZUS-MH risk-assessment methodology was used to model distinct hazard and inventory parameters (e.g., wind speed and building types) and determine potential damages and losses in the built environment. The second, "HAZUS-driven" methodology used a statistical approach to model risk by analyzing a hazard's frequency of occurrence and estimated effects based on recorded damage data. Both methodologies use a common, systematic framework developed to supply a factual basis for determining which actions will mitigate risks. The assessments also were used to set priorities for mitigation based on potential dollar losses, loss of lives, and other factors. The hazards in Sections 6 through 15 of this plan appear generally in priority order, based on risk to Madison County as a whole, with the greatest hazards appearing first.

The updated Hazard Identification and Risk Assessment was completed in July of 2012. Ten (10) hazards that have the potential or probability to affect Madison County were identified based on a review of historical records, national data sources, existing plans and reports, and discussions with local, regional, state, federal and national experts.

Develop Mitigation Strategies

A vision statement for mitigation in Madison County was formulated, along with mitigation goals and objectives to reduce or eliminate the long-term risk to life and property from hazards. The goals are general guidelines that articulate a desired end state. They are expressed as policy statements of global visions. Objectives are specific, measurable, and define the strategies or implementation steps necessary to attain the identified goals. The vision statement, goals, and objectives are presented in Section 3 of this plan.

Hazard Mitigation Team (HMT) members reviewed various documents, reports and plans as part of the update process. Some plans were local while others were state or federal documents. Examples of local documents reviewed include the Madison County Emergency Operation Plan, the City of Madisonville' s building codes, and Flood Insurance Rate Maps (FIRMs). The HMT utilized the FIRM maps to help them determine possible flood threat areas throughout the county and participating cities.

The HMT also reviewed local floodplain orders and ordinances from participating jurisdictions and discussed whether local floodplain management could be strengthened in an effort to improve mitigation. These plans were reviewed and taken into consideration when updating the mitigation plan, but no plans were incorporated into the Madison County mitigation plan.

Other sources of information included the Federal Emergency Management Agency, the National Oceanic and Atmospheric Administration, the Texas Water Development Board, the Texas Commission on Environmental Quality, the Texas State Data Center, and the Texas Division of Emergency Management. Section 16 and the hazard-specific sections of the plan summarize the findings from the studies, plans, reports and technical information.

An inclusive and structured process was used to develop and prioritize mitigation actions for this Hazard Mitigation Plan. It included the following steps:

- A vision statement, mitigation goals and objectives were formulated to reduce or eliminate the long-term risk to human life and property from each hazard.
- Mitigation team members considered the benefits that would result from the mitigation actions versus the cost of those projects. For those actions in which the benefits could be quantified, an economic evaluation was one factor that helped team member's select one mitigation action from among many competing ones. Cost-effectiveness of actions was considered as each team member developed their final list of mitigation actions. Economic considerations were part of the community's analysis of the comprehensive range of specific mitigation actions and projects being considered.
- Then, hazard mitigation team members selected mitigation actions and prioritized them. The prioritization method was based on the following criteria: 1) benefits in terms of effect on overall risk to life and property, including the effects on both new and existing buildings and infrastructure; 2) ease of implementation; 3) political and community support; and 4) cost and funding availability. The overall priority is reflected in each action in Section 17.
- Team members developed action plans identifying proposed actions, estimated costs and benefits, the responsible organization(s), implementation schedule, related objective(s) to which the actions relate, priority, and potential funding sources.

At the workshop, participants discussed responses to the public surveys and their implications for the plan. They received a briefing on the risk assessment results and identified any unique hazards for their jurisdiction that varied from those hazards affecting Madison County as a whole. Participants discussed potential mitigation actions to identify any that might be relevant to the risks they face in their jurisdiction and to solicit ideas.

Implement the Plan and Monitor Progress

A formal process was established at the workshops to ensure that the plan is implemented and remains an active and relevant document. Plan maintenance is addressed in Section 18.

PUBLIC INVOLVEMENT

Because public involvement is critical to the success of hazard-mitigation planning, public input was sought in several ways. Public input was solicited during the drafting stage, upon development of the draft, and prior to adoption of the plan. The public also was given the opportunity to provide comments, input into the planning process, and discuss other issues of concern to Madison County residents.

A public meeting was held in Madison County May 6, 2010 to inform the public about the planning process and solicit their ideas and recommendations. Announcements of the public meeting were distributed to the media and civic organizations and were displayed in public places. Members of the general public, residents, local businesses, community leaders, educators, representatives of neighboring jurisdictions and private and non-profit groups were invited to attend and participate. A second public meeting for Madison County will be held following FEMA's review of the draft plan.

The county-wide public meetings provided an opportunity for the public to make input to the planning process during the drafting stage. The public was also provided an opportunity to comment on the draft plan prior to its submission to the Texas Division of Emergency Management and FEMA. Each governing body in posted open meetings adopted the plan.

A Hazard Survey was made available to the public and was distributed at the public meetings. The survey sought information from citizens about hazards that have affected them and recommendations for action to reduce future risks. A total of 12 responses were received. The survey results provided an important source of information for use in formulating mitigation actions. Survey results appear in Appendix B.

A draft of this plan was made available on the BVCOG website for public review and comment. Each participating jurisdiction made a copy of the plan available for public inspection and review and formally solicited public review and comment prior to their governing bodies' adoption of the plan. A copy of each resolution adopting the plan is at Appendix E.

PARTNERS IN PLANNING

Hazard Mitigation Teams

The Hazard Mitigation Team (HMT) was lead by Linda McGuill, Public Safety Manager for the BVCOG, and their contractor, Suzannah Jones of TEEX. Adam Whitefield, Planner for the BVCOG, and David Larner, consultant for TEEX, also lead in the update of the plan. Linda McGuill formed the HMT by inviting representatives from participating jurisdictions to meet in a central location to discuss the mitigation plan and the update process. Suzannah Jones provided the talking points, slide shows and hand-out materials during the meetings. Adam Whitefield organized the meetings and took notes, while David Larner led the discussion on mitigation planning and the update process. The local meetings were lead by Shelly Butts, the Madison County Emergency Management Coordinator. The plan was reviewed by all members of the HMT, and each participant provided insight and information for the plan update. Topics of discussion

included previous occurrences of natural hazards and their locations throughout the county. The HMT discussed previous action items and provided new ones. TEEX added the inputs to the plan and the final review was provided by Shelly Butts.

Federal and state agencies were also involved in the planning process. Federal and state agencies provided input which assisted the team in developing the plan. These included the Federal Emergency Management Agency of the Department of Homeland Security, the U.S. Army Corps of Engineers, the Texas Division of Emergency Management, the Texas Water Development Board, the Texas Department of Transportation, and the Texas Forest Service. Weather event data were provided by the National Weather Service, NOAA.

Under the overall coordination of the council of government, hazard mitigation team members assessed their capabilities, examined previous mitigation efforts, and developed mitigation actions. Throughout the process, they reached out to police and fire departments, emergency medical services, code enforcement entities, floodplain managers, neighboring jurisdictions, local businesses, community leaders, educators and other private and non-profit organizations to inform them of the planning process and seek their views.

Updated Plan Participation

This Hazard Mitigation Action Plan was created in 2005 and updated in 2010-2013. The 2005 version contained multiple counties within the BVCOG region. This updated plan only covers the portion of Madison County, the cities of Madisonville, Midway, Normangee, the North Zulch MUD, and the BVCOG.

As part of the update process, a local Hazard Mitigation Team (HMT) was formed and tasked with reviewing and updating each section of the plan, as necessary.

The process by which the HMT undertook to determine if a section warranted an update began with the HMT reading the 2005 version of the plan. Local team members were then tasked to review and analyze the information that pertained to their local jurisdiction or to Madison County in general. The HMT would then determine if that data needed to be updated based on if it contained outdated information or, in the case of mitigation actions, had already been accomplished. Likewise, sections of the 2005 plan that did not warrant an update were not revised in this 2013 version.

The following is a summary of the sections that were updated by the Hazard Mitigation Team:

- The Executive Summary and Section 1: *Purpose and Organization of the Plan* were updated to reflect changes in the plans development. Whereas the original plan contained seven counties, this update reflects a focus on Madison County and participating jurisdictions.
- Section 2: *The Planning Process* was updated to reflect the local planning process undertook by Madison County, the BVCOG and the cities of Madisonville, Midway, Normangee, and the North Zulch MUD. This includes the formation of the local HMT workshops and public meetings were held in coordination with the BVCOG and TEEX.

- Section 3: *Mitigation Vision, Goals, and Objectives* were not revised by the Hazard Mitigation Team (HMT). The HMT discussed the vision, goals, and objectives of the original version of the plan and felt they were still valid. The team voted to keep the vision, goals and objectives the same for this version of the plan.
- Section 4: *Madison County at a Glance* was updated to reflect a focus on Madison County, since the original plan contained multiple counties.
- Section 5: *Hazards the County Faces and What's at Risk* was revised to reflect a focus on Madison County rather than the multiple counties in the original plan.
- Sections 6-15 contain the risk assessment for each of the 10 hazards listed in the plan and was revised as necessary to reflect any changes to the risks that can affect the Madison County region. The HMT discussed the hazards listed in the original plan and decided to keep the same natural hazards. No previously unidentified natural hazards were determined by the HMT to pose a threat since the previous version of the plan. The team then discussed the manmade hazards listed in the plan and voted to eliminate the four manmade hazards of energy pipeline failures, hazardous materials incidents, nuclear power plant accidents and terrorism. These four manmade hazards were eliminated because they are not required by Section 44 of the Code of Federal Regulations, Part 201.6(c)(2)(i), which requires a risk assessment for all natural hazards that can affect the jurisdictions. The risk assessment was also revised to focus on Madison County rather than the BVCOG region, and previous occurrences of hazards since 2005 were updated.
- Section 16: *Previous Mitigation Actions* discusses mitigation actions supported by federal and state agencies, and local programs relating to building and fire codes and floodplain management ordinances. This section was revised to reflect any updated building and fire codes, and floodplain ordinances that were readopted since the original version of the plan.
- Section 17: *Mitigation Actions* contains actions to be undertaken by the county and each participating city to mitigate the hazards identified in Sections 6 through 15. This section was reviewed and analyzed by the HMT to identify and previous actions items to be deferred from the original plan and to include new action items to help achieve the vision, goals and objectives listed in Section 3.
- Section 18: *Plan Implementation and Maintenance Procedures* discusses the plan maintenance procedures and was revised to reflect how Madison County will maintain, update and evaluate the plan during the next five years.

SECTION 3: MITIGATION VISION, GOALS, AND OBJECTIVES

VISION

The mitigation vision for Madison County is:

- Intergovernmental coordination and cooperation on mutual issues of concern related to hazard mitigation and disaster preparedness;
- Local governments and regional entities with high levels of capability for hazard mitigation planning and project implementation, leveraging state, federal and private resources for investments in mitigation;
- An informed citizenry aware of the risks they face and the measures that can be taken to protect their families, homes, workplaces, communities and livelihoods from the impact of disasters; and
- Buildings located outside of hazardous areas and built to withstand the natural hazards that threaten them;
- Communities integrating hazard mitigation concerns into routine planning and budgetary decisions and plans for future growth and development; with disaster resistance an integral part of the livability and sustainability of the region.

GOALS AND OBJECTIVES

Overall Goal: Reduce or eliminate the long-term risk of loss of life and property damage in Madison County region from the full range of disasters.

The following mitigation goals and objectives, from the previous version of this plan, were re-evaluated by the Hazard Mitigation Team and determined to remain valid and effective.

GOAL 1. Build the capability for carrying out hazard mitigation activities.

Objective 1.1 Encourage education and training for personnel involved in hazard mitigation to develop high levels of expertise.

Objective 1.2 Ensure, to the extent feasible, adequate levels of staffing for hazard mitigation activities.

Objective 1.3 Create and foster partnerships to help communities reduce their exposure to hazards.

Objective 1.4 Focus on identifying and obtaining federal, state, and private-sector funds available for hazard mitigation.

Objective 1.5 Upgrade operational systems and facilities that support hazard mitigation.

GOAL 2. Heighten public awareness and support for hazard mitigation.

Objective 2.1 Ensure that communication between disaster personnel and the public in advance of and during hazard events is adequate in content and coverage.

Objective 2.2 Inform area citizens about the full range of natural hazards they face, and the need for guarding against injury and loss of life caused by those hazards.

Objective 2.3 Devise programs to educate the public about how to prevent or reduce the loss of life or property from all hazards, including specific actions that can be taken.

GOAL 3. Increase awareness of public officials, community and business leaders of the need for hazard mitigation, and support actions to protect public health and safety.

Objective 3.1 Encourage the adoption of appropriate hazard mitigation measures by local governments, businesses, institutions, and individuals, and communicate information about specific, effective actions they can take.

Objective 3.2 Ensure that communication among disaster personnel and public officials in advance of and during hazard events is adequate in content and coverage.

Objective 3.3 Focus on protecting particularly vulnerable areas during hazard events (e.g., hospitals, areas crossed by fuel transmission lines).

GOAL 4. Promote resource-sharing and increase coordination and cooperation among governmental entities in conducting hazard-mitigation activities.

Objective 4.1 Improve and expand communication and coordination within and among federal, state, and local governments and the BVCOG in mitigating hazards.

Objective 4.2 Identify and map critical facilities and take action to ensure that critical facilities and services can continue to operate in disaster situations.

Objective 4.3 Create hazard-specific and general hazard-mitigation partnerships among Valley counties, cities, the BVCOG and other stakeholders.

GOAL 5. Mitigate damage to and losses of new and existing real property.

Objective 5.1 Protect public infrastructure and private buildings from known hazards.

Objective 5.2 Support methods, codes, and ordinances that reduce threats to existing and new development and ensure that citizens are not unnecessarily exposed to potential hazards.

Objective 5.3 Reduce repetitive losses to the NFIP.

Objective 5.4 Protect against financial losses caused by hazard events through liberal application of insurance coverage.

GOAL 6. Promote sustainable growth.

Objective 6.1 Promote beneficial uses of hazardous areas while expanding open space and recreational opportunities.

Objective 6.2 Incorporate hazard mitigation into long-range planning, budgeting and development activities.

Objective 6.3 Prevent creation of future hazards to life and property.

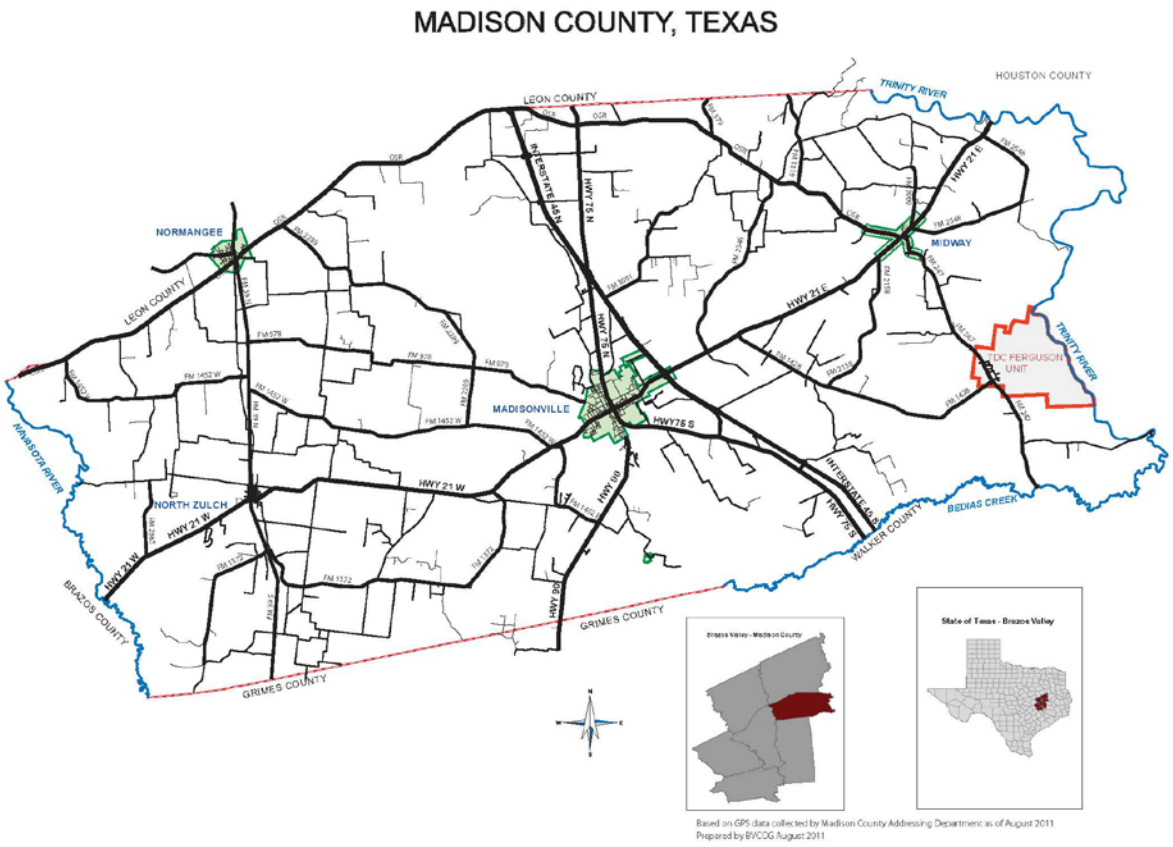
SECTION 4: MADISON COUNTY AT A GLANCE

GEOGRAPHY

Madison County comprises 473 square miles of undulating terrain, primarily in post-oak savannah with some post-oak woods and grasslands, in central East Texas. It was formed in 1853. Madisonville is the county seat and largest town, named for the nation's fourth president, James Madison.

Figure 4-1. Site of Madison County within Texas and the BVCOG region

Figure 4-2. Madison County



POPULATION

The population of Madison County in 2010 is 13,644 people. The largest city in Madison County is Madisonville with 4,280 people.

LAND USE

The U.S. Department of Agriculture conducts a census of agricultural uses of land. The 1,057 farms in Madison County in 2010, which averaged about 258 acres in size, contained almost 273,109 acres. Of this about 39,655 acres, or around 14 percent of the total farmland, were devoted to harvested crops.

Table 4-1. Agricultural Land Use Madison County, 2010

Number of Farms	Ave. Size of Farm (acres)	Harvested Cropland (acres)
1,057	258	39,655

Source: US Department of Agriculture, Census of Agriculture

Farms in the area covered by Madison County produce a wide variety of agricultural products with cattle being the most common.

Table 4-2. Agricultural Products of Madison County

Agricultural Products	Annual Value
Nursery crops, cattle, horses, poultry, forage	$83.3 million

Source: U.S. Department of Agriculture

In terms of minerals, oil is produced in Madison County. Table 4-3 lists the chief minerals found in Madison County.

Table 4-3. Minerals

County	Minerals
Madison	Sand, oil

Table 4-4. Madison County Economic Development Organizations

Organization Name	Telephone Number	E-Mail Address
Madison County Economic Development Corporation	936-349-0163	roger.johnson@ci.madisonville.tx.us

As part of the five-year plan update, depending upon resource availability, a review will be undertaken of development trends in each jurisdiction and vulnerability. Also as part of the five-year plan update, depending upon resource availability, a review will be undertaken for each hazard of the type and number of existing and future buildings, infrastructure and critical facilities within each hazard area, and an estimate will be undertaken of the vulnerability of critical facilities and infrastructure in terms of potential dollar losses from each hazard. Also

depending upon resource availability, land uses and development trends will also be re-examined, including the types of development occurring, location, expected intensity, and pace by land use for each jurisdiction. This will help complete and improve future vulnerability assessment efforts. Based on the analysis, a summary of vulnerability will be provided for participating jurisdictions below the county level.

COMMUNITIES DESIGNATED FOR SPECIAL CONSIDERATION

The state of Texas requires that hazard mitigation plans identify any Small and Impoverished Communities in the planning area. These communities may receive special consideration in some federal and state grant programs.

According to the established criteria, Small and Impoverished Communities 1) have a population less than 3,000 and are not a remote area within the corporate boundaries of a larger city and 2) are economically disadvantaged, with residents having an average per capita annual income not exceeding 80 percent of the national per capita income and a local unemployment rate that exceeds by one percentage point or more the most recently reported national unemployment rate.

At this time, there are no small and impoverished communities within Madison County.

SECTION 5: HAZARDS MADISON COUNTY FACES

RISK ASSESSMENT METHODOLOGIES

A risk assessment conducted in spring 2011 evaluated the probability of occurrence of a hazard event and the potential associated losses in Madison County. The resulting loss estimates are a starting point from which to evaluate mitigation measures if a real hazard event occurs. The loss estimates also are intended to support mitigation decision-making. It is important to note, however, that loss estimates calculated during the risk assessment used available data and methodologies and are approximate. The estimates should be used to understand relative risks from hazards and potential losses and are not intended to predict precise results. Uncertainties are inherent in any loss-estimation methodology and arise, in part, from incomplete scientific knowledge about natural hazards and their effects on the built environment. Uncertainties also result from approximations and simplifications (such as incomplete or outdated inventory, demographic, or economic parameter data) that are necessarily used during a comprehensive analysis. These data can result in a range of uncertainty in loss estimates, perhaps at a factor of two or more. In addition, a variety of previous studies and reports were reviewed for additional risk data.

Two distinct hazard risk-assessment methodologies were applied during the risk assessment: HAZUS-MH, FEMA's loss-estimation software, and a statistical risk-assessment methodology. Each provided estimates of potential effects using a common, systematic framework for evaluation.

The HAZUS-MH risk-assessment methodology is parametric; in that distinct hazard and inventory parameters (wind speed and building types) are modeled determine the effects (damages and losses) on the built environment. Its statistical approach and mathematical modeling of risk is based on recorded or historic damage information, and predicts a hazard's frequency of occurrence and estimated effects. The HAZUS-MH software was used to estimate losses from wind (hurricane and tornado) and flood hazards.

The statistical risk-assessment methodology was applied to analyze hazards outside the capability of the HAZUS-MH software. A brief description of each approach follows.

HAZUS-MH

HAZUS-MH is FEMA's standardized loss estimation software program built upon an integrated geographic information system (GIS) platform. This risk assessment applied HAZUS-MH to produce regional profiles and estimate losses for four hazards.

Statistical Risk Assessment Methodology

Risks associated with other natural hazards were analyzed using a statistical assessment methodology developed and used specifically for this project. Its approach is based on the same principles as HAZUS-MH but does not rely on readily available automated software.

Historical data for each hazard are used and statistics are evaluated using manual calculations. The general steps used in the statistical risk-assessment methodology are summarized below:

- Compile data from national and local sources
- Conduct statistical analysis of data to relate historical patterns within data to existing hazard models (minimum, maximum, average, and standard deviation)
- Categorize hazard parameters for each hazard to be modeled (e.g., tornado)
- Develop model parameters based on analysis of data, existing hazard models, and risk engineering judgment
- Apply hazard model including:
  - Analysis of frequency of hazard occurrence
  - Analysis of intensity and damage parameters of hazard occurrence
  - Development of intensity and frequency tables and curves based on observed data
  - Development of simple damage function to relate hazard intensity to a level of damage (for example, one flood = $ in estimated damages)
  - Development of exceedence and frequency curves relating a level of damage for each hazard to an annual probability of occurrence
  - Development of annualized loss estimates

The economic loss results are presented in this plan using two interrelated risk indicators:

- The Annualized Loss (AL), which is the estimated long-term value of losses to the general building stock in any single year in a specified geographic area (i.e., county)
- The Annualized Loss Ratio (ALR), which expresses estimated annualized loss as a fraction of the building inventory replacement value

The estimated Annualized Loss (AL) addresses the two key components of risk: the probability of the hazard occurring in the study area and the consequences of the hazard, largely a function of building construction type and quality, and of the intensity of the hazard event. By annualizing estimated losses, the AL factors in historic patterns of frequent smaller events with infrequent but larger events to provide a balanced presentation of the risk.

The Annualized Loss Ratio (ALR) represents the AL as a fraction of the replacement value of the local building inventory. This ratio is calculated using the following formula:

ALR = Annualized Losses / Total Exposure at Risk

The annualized loss ratio gauges the relationship between average annualized loss and building replacement value. This ratio can be used as a measure of relative risk between areas and, since it is normalized by replacement value, it can be directly compared across different geographic units such as metropolitan areas, jurisdictions or counties.

PEOPLE AND PROPERTY AT RISK

Hazard identification consists of defining the study area in terms of scale and coverage and collecting and compiling a list of prevalent hazards in the study area to help narrow the focus of the analysis.

Figure 5-1 below shows the extent of the study area, as well as the population density distribution at the county level (based on Census 2010) for the area forming Madison County. Table 5-1 provides a numeric breakdown of the population and total estimated dollar exposure by key occupancy, including statewide critical facilities, that was the basis of the risk assessment presented in this report. Table 5-2 provides the types of critical facilities. This information was derived from HAZUS-MH (October 2003). Figure 5-2 is a map of critical facilities in Madison County. Detailed lists of critical facilities can be found in Appendix D.

Figure 5-1. Population Density Distribution Map

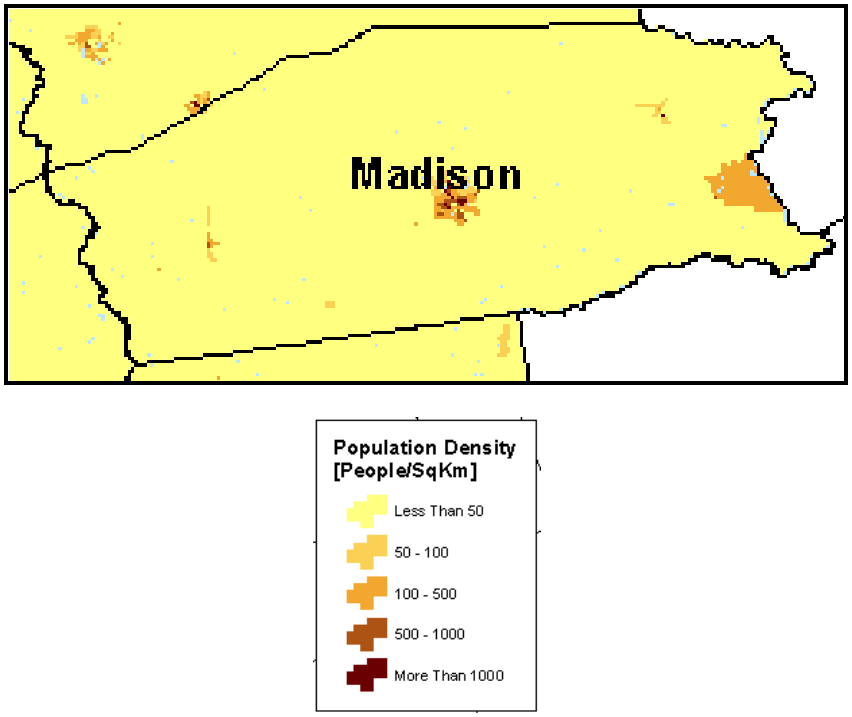


Table 5-1. Population and Building Distribution by Key Occupancy in Madison County

Population (2010)	Residential Buildings		Commercial Buildings		Critical Facilities
	Number	Value ($)	Number	Value ($)	Number
13,644	4,770	884,652	34	111,128	100

Table 5-2. Critical Facilities by Type in Madison County

Infrastructure and Lifelines				Hazardous Materials Facilities	
Oil Pipe (km)	Gas Pipe (km)	Highway (km)	Railroad (km)	Number of Sites	Number of Materials
86.6	465.5	132	28	0	0

Figure 5-2. Critical Facilities Distribution Map for Madison County

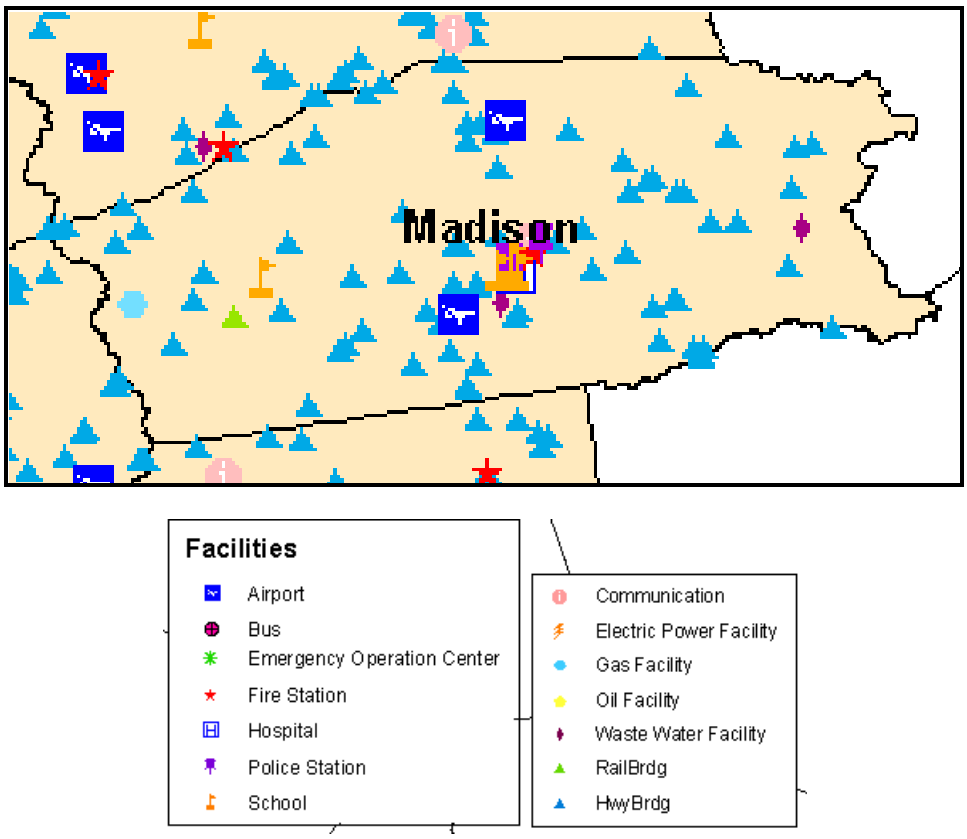
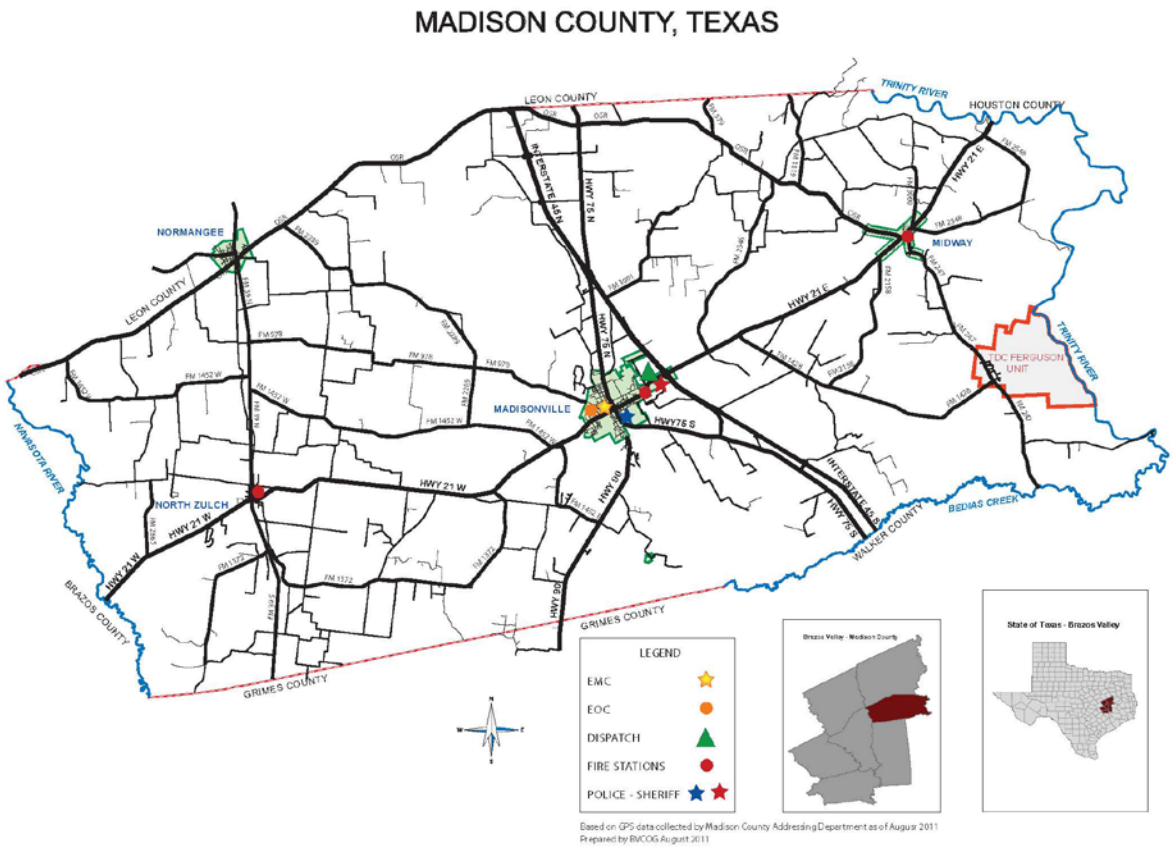


Figure 5-3. Emergency Critical Facilities Distribution Map for Madison County



HAZARDS OF CONCERN

Based on input such as historical data, public perception, and technical requirements, the following hazards (listed alphabetically) were considered for analysis:

- Dam failures
- Drought
- Excessive Heat
- Fires
- Floods

- Hail
- Hurricanes
- Severe Winter Storms
- Thunderstorms
- Tornadoes

DISASTER DECLARATIONS

A total of 6 Presidential and Small Business Administration Disaster Declarations have been issued since 1965 for Madison County. This area has experienced many additional disasters that were not severe enough to be declared by the president but nevertheless resulted in millions of dollars in direct and indirect costs to governments, businesses, and residents and caused significant human suffering, injuries, and deaths.

Table 5-3. Disaster Declarations in Madison County

Date	Event	Type of Declaration	Declaration Number
1987	Flood	Presidential, SBA	802 DR
1990	Flood	Presidential, SBA	863 DR
1991	Flood	Presidential, SBA	930 DR
1994	Flood	Presidential, SBA	1041 DR
2001	Tropical Storm	Presidential, SBA	1379 DR
2008	Hurricane	Presidential, SBA	1791 DR

ECONOMIC AND SOCIAL LOSSES

Risk (vulnerability) assessments are presented, whenever possible, in terms of annualized losses. The annualized data are useful for three reasons:

- Contribution of potential losses from all future disasters is accounted for with this approach.
- Results in this form from different hazards are readily comparable and, hence, easier to rank.
- For purposes of evaluating mitigation alternatives, use of annualized losses is the most objective approach.

Annualized losses for hazards where the parametric approach is used are computed in a three-step process:

- Compute / estimate losses for a number of scenario events with different return periods (e.g., 10-year, 100-year, 200-year, 500-year)
- Approximate the probability versus loss curve through curve fitting
- Calculate the area under the fitted curve to obtain annualized losses.

Computations of loss predictions from the other hazards that used a statistical approach are based primarily on observed historical losses.

Impact on Critical and Essential Facilities

Hazard mitigation plans often focus on critical facilities vulnerable to hazards simply because it is usually most cost-effective to mitigate the assets that are the most important to the community. These could be facilities critical to emergency operations, or ones that house important government functions or vulnerable populations, or ones simply deemed important to the community for their economic or cultural value. Consequently, these facilities are considered high-priority when evaluating structures for the purpose of increasing their disaster resistance.

Critical and essential facilities include:

- Facilities critical to normal and emergency response operations in the area (fire stations, police stations, and the EOC)
- Infrastructure and facilities critical to community survivability or continuity of community services (transportation facilities; post offices; radio station and other communication facilities; electrical transmission and distribution; water and wastewater treatment),
- Facilities needed to assist vulnerable populations during and after a disaster (schools, hospitals, residential care facilities), and
- Facilities in which key government functions take place (sheriff's office, county courthouse, town halls).

In general, for most of the hazards addressed in this study, the potential for significant damage exists primarily at critical facilities located in flood-prone areas. Critical facilities that happen to be in the tornado path or nearby energy pipelines where incidents could occur also may sustain considerable damage.

HAZARD RANKING

The ten hazards in Madison County are listed below.

- Flood
- Drought

- Hurricane
- Fire
- Winter Storm
- Tornado
- Hail
- Thunderstorm
- Dam Failure
- Excessive Heat

CONCLUSIONS

Tables 5-7, 5-8 and 5-9 on the following pages provides an overall summary of Madison County's vulnerability to hazards. Each hazard was given a rating of **substantial**, **major**, **minor** or **limited** based on a description of that particular jurisdiction's vulnerability to the hazard. Table 5-7 focuses on vulnerability in terms of property damage. Table 5-8 focuses on vulnerability in terms of loss of life or injury. Table 5-9 focuses on vulnerability of facilities to being shut down.

Section 201.6(c)(2)(iii) of FEMA regulations indicate that for multi-jurisdictional plans, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area. These rating were developed based on the best acceptable data and will be updated during the five-year plan review and update process.

Definitions of the classifications are as follows: "**Substantial**" severity of impact may result in multiple deaths, complete shutdown of facilities for 30 or more days, or more than 50 percent of property destroyed or with major damage. "**Major**" severity of impact may result in injuries or illnesses that result in permanent disability, complete shutdown of critical facilities for at least 2 weeks, or more than 25 percent of property destroyed or with major damage. "**Minor**" severity of impact may result in injuries or illnesses that do not result in permanent disability, a complete shutdown of critical facilities for more than 1 week, or more than 10 percent of property destroyed or with major damage. "**Limited**" severity of impact may result in injuries or illnesses that are treatable with first aid, minor quality of life lost, shutdown of critical facilities and services for 24 hours or less, or less than 10 percent of property destroyed or with major damage.

Dam failure ratings are based on the U.S. Army Corps of Engineers' definitions. The existence of a high hazard dam resulted in a "substantial" ranking; of a significant hazard dam in a "major" ranking; and a low hazard dam in a "minor" ranking. The USACE rankings only focus on the potential consequences of a dam failure; not the probability that a dam will fail. Just because a dam is considered "high hazard," does not mean that it is at high risk for failure. BVCOG and the participating jurisdictions chose to use the official USACE ratings in these tables, even though

the likelihood of a dam failure is low. The flooding risk is based on FEMA flood maps and on claims under the National Flood Insurance Program (NFIP).

S=Substantial define

Maj=Major

Min=Minor

L=Limited

Table 5-7. Overall Summary Descriptions of Jurisdictions' Vulnerability to Hazards in Madison County in Terms of Property Damage

Jurisdiction	Dam Failure	Drought (Including agriculture)	Excessive Heat	Flooding (riverine)	Hail Storm	Hurricane Wind	Severe Winter Storm	Thunderstorm	Tornado	Wildfire
Madison	L	MIN	L	S	L	L	MIN	L	MAJ	MIN
Madisonville	L	L	L	S	L	L	MIN	L	MAJ	L
Midway	L	L	L	MIN	L	L	MIN	L	MAJ	L
BVCOG	L	L	L	L	L	L	L	L	MIN	L

Table 5-8. Overall Summary Descriptions of Jurisdictions' Vulnerability to Hazards in Madison County in Terms of Loss of Life or Injury

Jurisdiction	Dam Failure	Drought (Including agriculture)	Excessive Heat	Flooding (riverine)	Hail Storm	Hurricane Wind	Severe Winter Storm	Thunderstorm	Tornado	Wildfire
Madison	L	L	S	S	L	L	L	L	MAJ	L

Madisonville	L	L	S	S	L	L	L	L	MAJ	L
Midway	L	L	S	MIN	L	L	L	L	MAJ	L
BVCOG	L	L	L	L	L	L	L	L	MIN	L

Table 5-9. Overall Summary Descriptions of Jurisdictions' Vulnerability to Hazards in Madison County in Terms of Vulnerability of Facilities to Being Shut Down

Jurisdiction	Dam Failure	Drought (Including	Excessive Heat	Flooding (riverine)	Hail Storm	Hurricane Wind	Severe Winter Storm	Thunderstorm	Tornado	Wildfire
Madison	L	L	L	S	L	L	L	L	MAJ	L
Madisonville	L	L	L	S	L	L	L	L	MAJ	L
Midway	L	L	L	MIN	L	L	L	L	MAJ	L
BVCOG	L	L	L	L	L	L	L	L	MIN	L

The hazard-event profiles relevant to Madison County reveal historic hazard trends and provide a reference point for understanding the potential effects of future hazard events. A review of historic data helps to evaluate hazard-event profiles and answer questions: How often may a particular disaster occur? Who and where are most likely to be affected? How bad can it get?

Sections 6 through 15 of this plan contain reviews of the historical frequency of occurrence and/or loss and damage estimates, by hazard, in Madison County.

Frequency of occurrence in Sections 6 through 15 will be defined as follows:

- **Highly Likely** means that the event is possible in the next 3 years.
- **Likely** means that the event is possible in the next 5 years.
- **Unlikely** means that the event is possible in the next 10 years.
- **Highly Unlikely** means that the event is possible in the next 20 years.

Sections 6 through 15 of this plan contain reviews of the historical frequency of occurrence and/or loss and damage estimates, by hazard, in Madison County. Each section discusses why the hazard is a threat, profiles the hazard, identifies areas at risk to hazards that have distinct geographic boundaries, identifies the people and property at risk, and summarizes the history of hazard events and potential damages and losses.

The results of this study are useful in at least three ways:

- Improving our understanding of the risk associated with the natural hazards in Madison County through better understanding of the complexities and dynamics of risk, how levels of risk can be measured and compared, and the myriad factors that influence risk. An understanding of these relationships is critical in making balanced and informed decisions on managing the risk.
- Providing a baseline for policy development and comparison of mitigation alternatives. The data used for this analysis present a current picture of risk in Madison County. Updating this risk "snapshot" with future data will enable comparison of the changes in risk with time. Baselines of this type can support the objective analysis of policy and program options for risk reduction in the region.
- Comparing the risk among the natural hazards addressed. The ability to quantify the risk to all these hazards relative to one another helps in a balanced, multi-hazard approach to risk management at each level of governing authority. This ranking provides a systematic framework to compare and prioritize the very disparate natural hazards that are present in Madison County. This final step in the risk assessment provides the necessary information for the Mitigation Planning Committee to craft a mitigation strategy to focus resources on only those hazards that pose the most threat to the region.

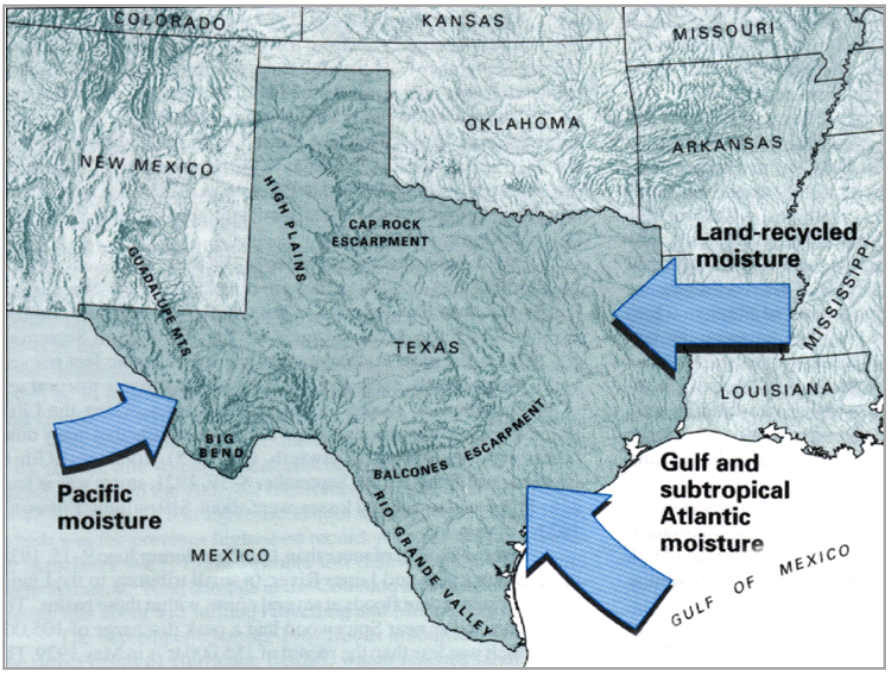
WHY FLOODS ARE A THREAT

Unique Geographic and Atmospheric Conditions

According to American Hazardscapes: The Regionalization of Hazards and Disasters published by the National Academy Press, Texas, because of its size and location, consistently outranks other states in deaths and damage from floods. Texas is second in casualties and damage from hurricanes and tropical storms.

The state's vulnerability is the result of several factors: its miles of Gulf of Mexico coastline; its proximity to the Pacific Ocean off the west coast of Mexico; its geographical location near the Rocky Mountains of Colorado and Arizona and the high-altitude jet stream; and its nearness to the unique West Texas "dry line," a shifting, invisible atmospheric separation of dry desert air from the moist Gulf air. These factors create a breeding ground for the big storms of spring and fall that spawn tornadoes and suck up Gulf or Pacific moisture that feed the heavy rains that cause flash flooding. All these geographic factors cause Texas to experience extensive, annual storms. Figure 6 1 shows the state's vulnerability to damaging storms. Flooding takes many forms in Madison County.

Figure 6-1. Texas Sources of Moisture



Flash Flooding

Most flash flooding is caused by slow-moving thunderstorms, by thunderstorms repeatedly moving over the same area, or by heavy rains from hurricanes and tropical storms. Flash floods can occur within a few minutes or after hours of excessive rainfall. Often there is no warning that flash floods are coming.

Flash flooding can pose a deadly danger to residents of Madison County. A number of roads run through low-lying areas that are prone to sudden and frequent flooding during heavy rains. Motorists often attempt to drive through barricaded or flooded roadways. It takes only 18-to-24-inches of water moving across a roadway to carry away most vehicles. Floating cars easily get swept downstream, making rescues difficult and dangerous.

Riverine Flooding

Riverine flooding is natural and inevitable. It is the overbank flooding of rivers and streams, typically resulting from large-scale weather systems that generate prolonged rainfall over a wide geographic area. 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.

Urban Flooding

Urban flooding occurs as land is converted from fields or woodlands to roads, buildings and parking lots and when the natural land loses its ability to absorb rainfall. Urbanization changes the natural hydrologic systems of a basin, increasing runoff two to six times over what would occur on natural terrain. During periods of urban flooding, streets can become swift moving rivers, while highway underpasses and underground parking garages can become death traps as they fill with water.

El Niño Phenomenon

Flooding can occur in cycles. The El Niño phenomenon – the cyclical disruption of the ocean-atmosphere system in the tropical Pacific Ocean – has important consequences around the globe and here in Texas. The presence of El Niño is indicated by unusually warm water in the eastern Pacific Ocean, altering wind and ocean currents. El Niño generally brings cooler winters and wetter than normal conditions to Texas. In 1997-1998, El Niño increased surface temperatures in the Eastern equatorial Pacific Ocean by five-to-seven-degrees Fahrenheit warmer than normal, thus contributing to the 1998 flooding.

Tropical Flooding

Hurricanes and tropical storms also bring floods. Between 1900 and 2010, forty-seven hurricanes made landfall in Texas. Eight were a Category 4 on the Saffir-Simpson scale, 10 were Category 3, 11 were Category 2 and 18 were Category 1.

Madison County is not immune to the death and destruction that tropical systems can bring. Indeed, almost 60 percent of deaths in the U.S. from tropical cyclones have been from inland, freshwater flooding.

HAZARD PROFILE

Major flooding and flash flooding events in Madison County can have a substantial severity of impact. They can cause multiple deaths, completely shut down facilities for thirty days or more, and cause more than fifty percent of affected properties to be destroyed or suffer major damage.

The frequency of occurrence of flooding is highly likely, with an event probable in the next year.

The annual probability of observing a 100-year flood is one-percent. The annual probability of observing a 500-year flood event is 0.2 percent.

The extent of flooding in Madison County, including all participating jurisdictions, can be water depths from between one and five feet deep in structures located in the identified flood hazard area.

HISTORY OF FLOODING

Flood events in Madison County reported to the National Weather Service are listed in Table 6-1.

Table 6-1. Reported Flood Events, 1994 to July 2012

Type	Location	Date	Deaths	Injuries	Property Damage ($)	Crop Damage ($)
Flash flood	Madison	10/16/1994	0	0	500K	50K
Flash flood/flood	Madison	12/15/1994	2	0	500K	50K
Flash flood	Countywide	09/26/1996	0	0	5K	0
Flash flood	Countywide	02/20/1997	0	0	5K	0
Flooding, riverine	County	10/17/1998	1	0	0	0
Flash flood	Madisonville	10/17/1998	0	0	5K	0
Flash flood	Countywide	10/18/1998	0	0	10K	0
Flooding,	County	11/12/1998	0	0	0	0

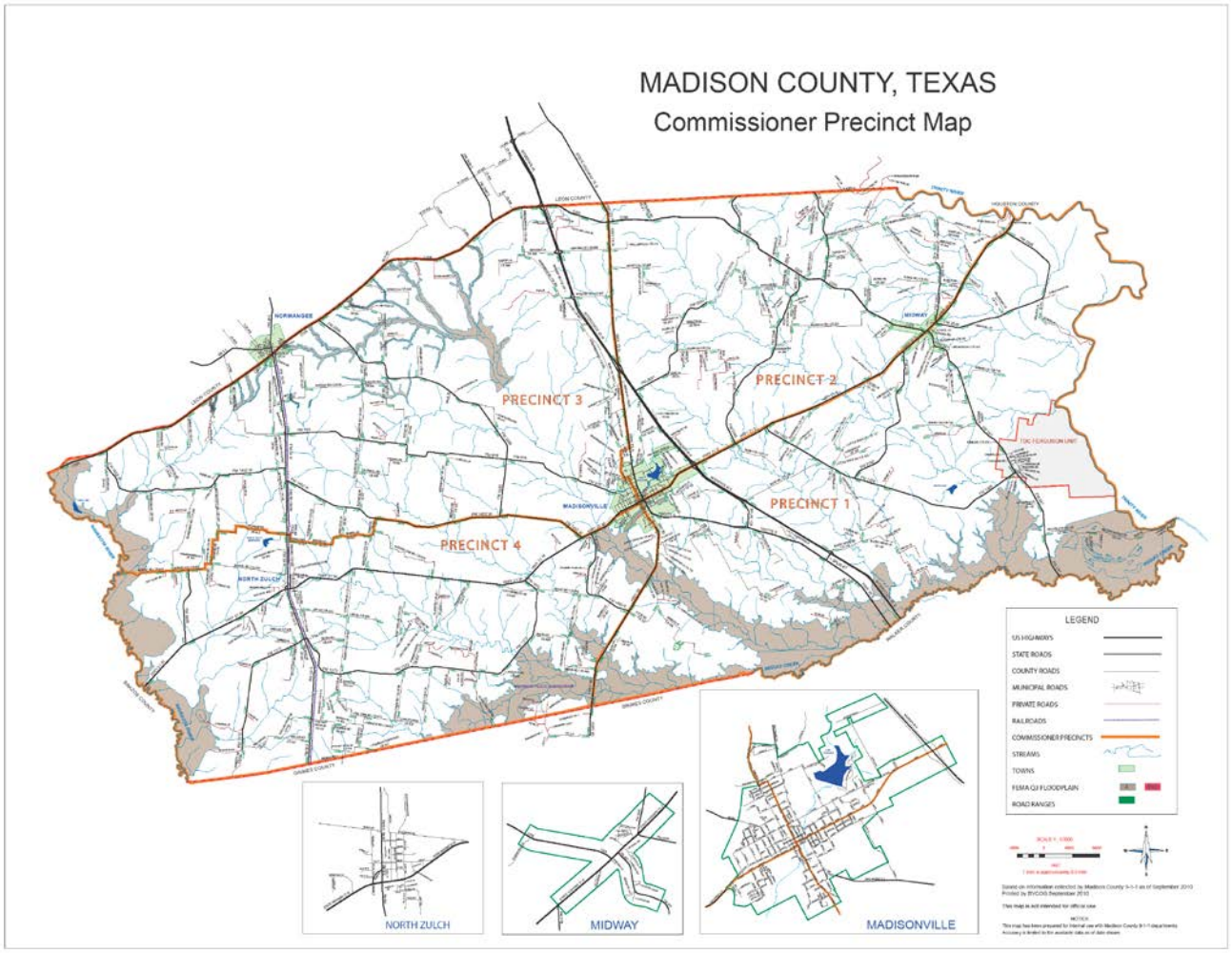
riverine						
Flash flood	Southwest Portion	07/11/1999	0	0	25K	0
Flash flood	Countywide	11/02/2000	0	0	50K	0
Flash flood	Countywide	11/03/2000	0	0	25K	0
Flash flood	Countywide	11/04/2000	0	0	25K	0
Flash flood	Countywide	11/06/2000	0	0	25K	0
Flash flood	Countywide	11/04/2002	0	0	20K	0
Flash flood	Countywide	02/20/2003	0	0	8K	0
Flash flood	Countywide	05/13/2004	0	0	30k	0
Flash flood	Madisonville	06/27/2004	0	0	10k	0
Flash flood	North Zulch	6/30/2004	0	0	5k	0
Flash flood	Madisonville	05/01/2007	0	0	30k	0
Flash flood	Normangee	04/28/2009	0	0	10k	0

LOCATION OF HAZARDOUS AREAS

Flood-hazard areas are determined using statistical analyses of records of riverflow, storm tides, and rainfall; information obtained through consultation with communities; floodplain topographic surveys; and hydrological and hydraulic analyses. FEMA's Flood Insurance Rate Maps (FIRMs) identify areas subject to flood hazard. These include Special Flood Hazard Areas, which are defined as areas that will be inundated by a flood event having a one-percent chance of being equaled or exceeded in any given year. The one-percent-annual-chance flood is also referred to as the base flood or 100-year flood. Moderate flood-hazard areas are also shown on the FIRM, and are the areas between the limits of the base flood and the two-tenths of a percent-annual-chance (or 500-year) flood. Figure 6-2 on the following page is a map of the flood plains in Madison County. Minor flooding has occurred on low level streets within the City of Madisonville as well as minor flooding along the Trinity River, which makes the east border of the county. Maps on pages 40-45 show more detailed flood hazard areas in relation to nearby structures, if any.

Figure 6-2 depicts the flood zones where there is potential for damage to property and loss of life.

Figure 6-2. Riverine Flooding Potential, Madison County

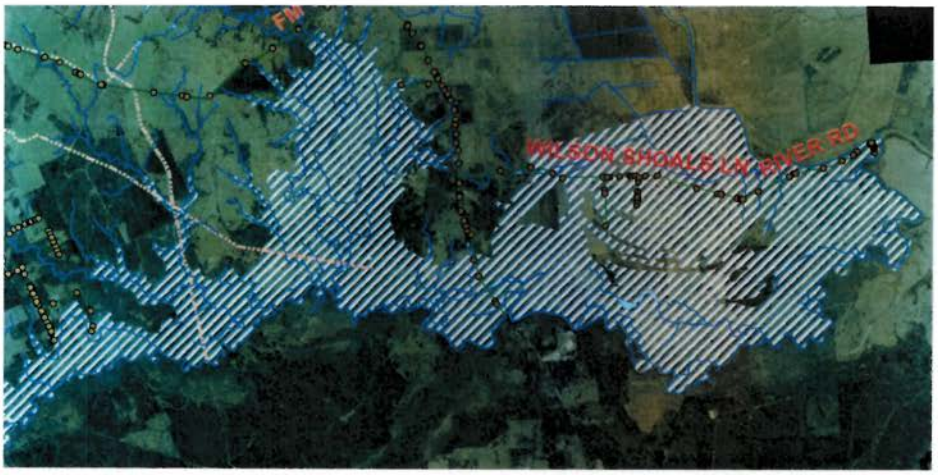


MADISON COUNTY

SouthEast corner of County

(Each dot indicates a driveway. Hatched area indicates floodplain.)

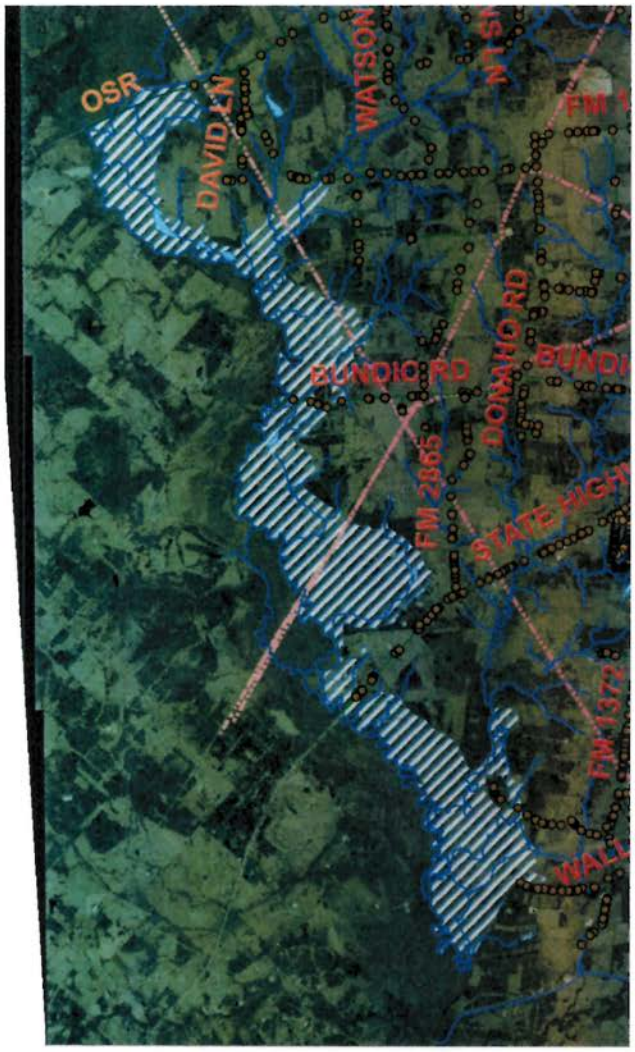
Affects Wilson Shoals subdivision, Leaning Oaks subdivision area off Highway 90 South, and Shannon Place subdivision, accessible through Grimes County.



Western edge of County

(Each dot indicates a driveway. Hatched area indicates floodplain.)

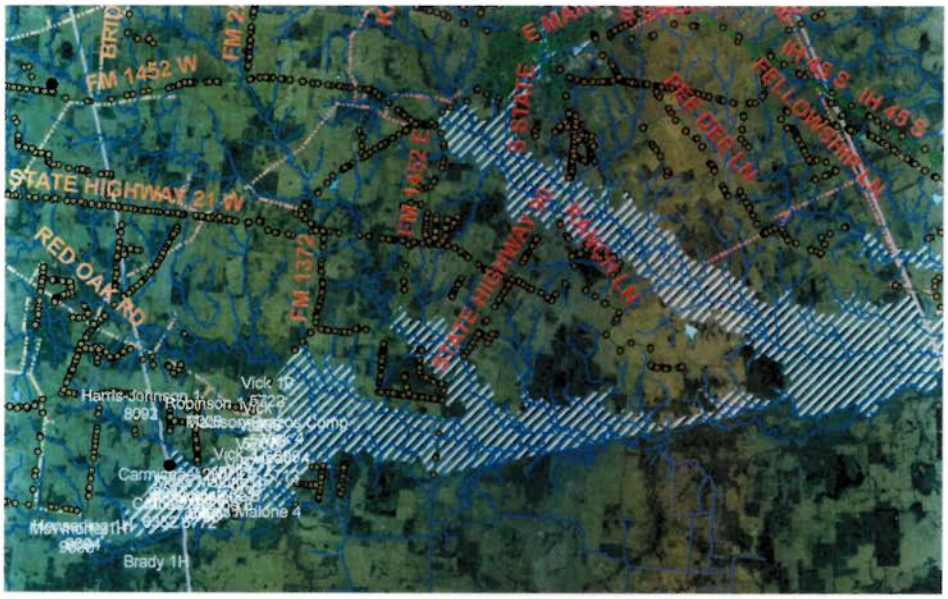
Affects First Texas Equities, Inc. subdivision and mostly grazing land.



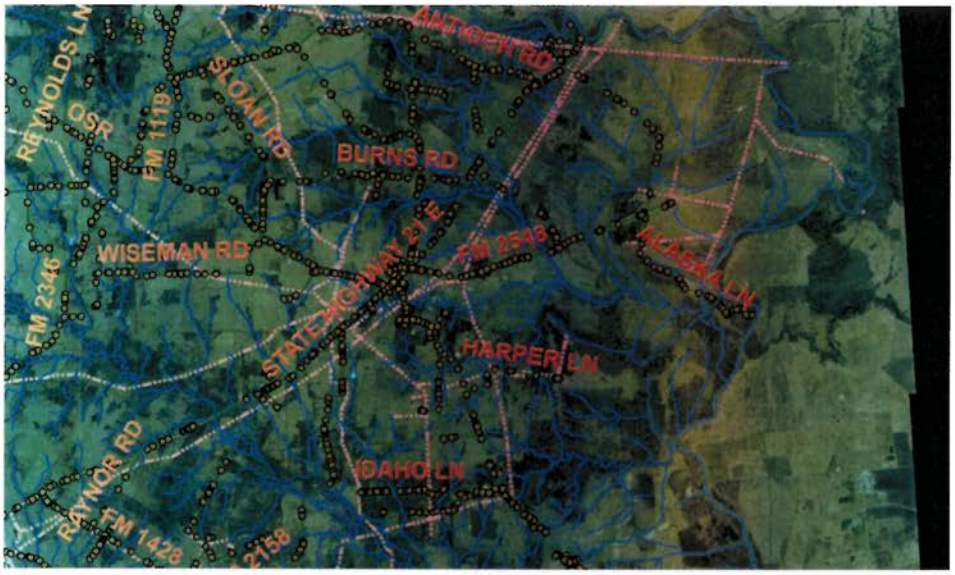
SouthEast corner of County

(Each dot indicates a driveway. Hatched area indicates floodplain. White lettering is one of many oillfields in the county)

Affects Town and Country subidivision, Leaning Oaks subdivision, Shannon Place Estates, and oilfields.



Northeast and Central section of Madison County were not studied.



Central Section of Madison County Map

(Each dot indicates a driveway. Hatched area indicates floodplain. Notice the "Limit of Study" at the center of the floodplain area shown.)

Affects some residences, but mostly grazing land.

Northwestern area of County

(Each dot indicates a driveway. Hatched area indicates floodplain.)

Affects Ten Mile Estates, other residences, and grazing land.

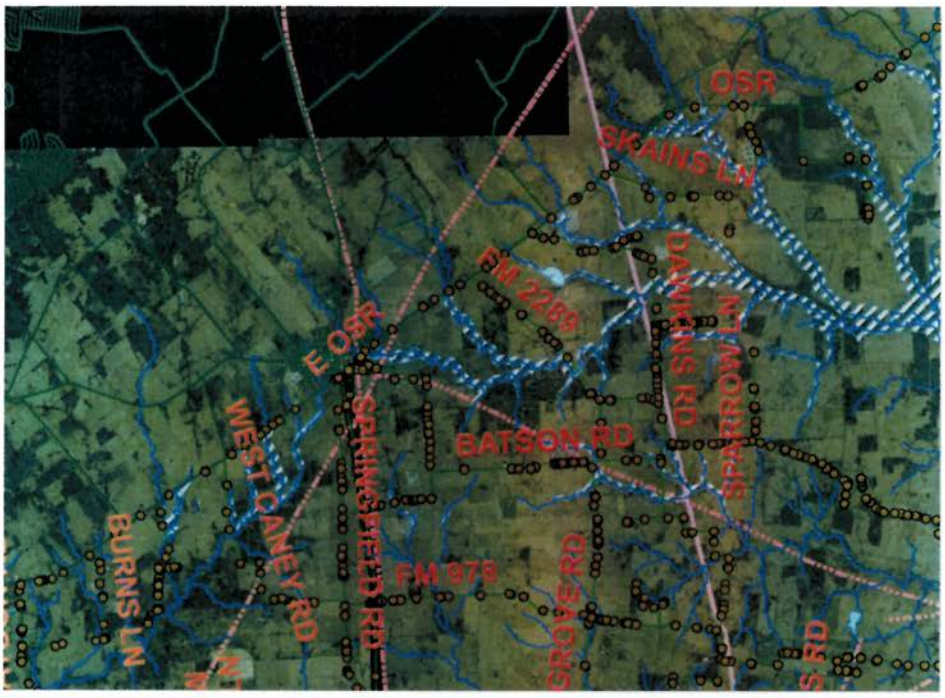
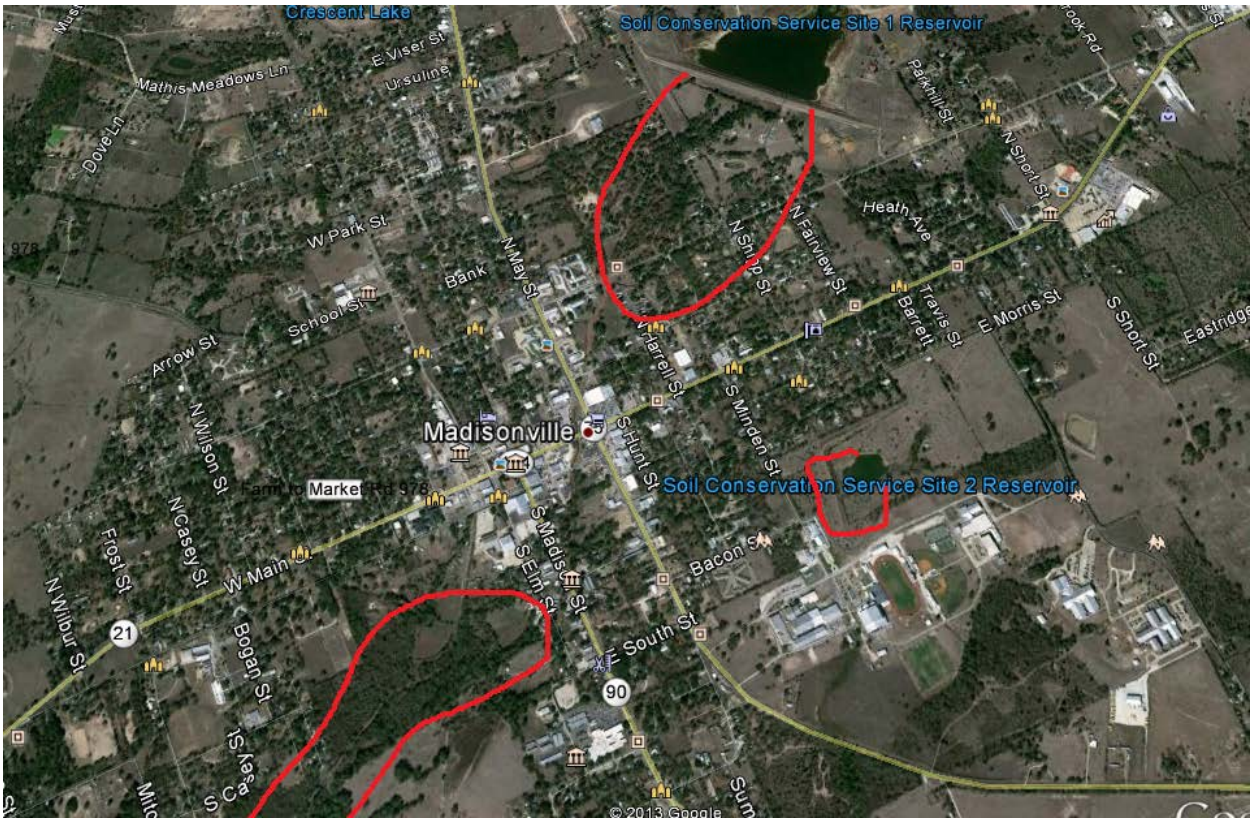


Figure 6-3. Riverine Flooding Potential in the City of Madisonville (shown in red lines)



The cities of Midway, Normangee and the North Zulch Municipal Utility District do not have any mapped special flood hazard areas within their jurisdictions, therefore, no flood maps will be presented for those communities in this plan.

NFIP PROGRAM PARTICIPATION

Flood insurance offered through the National Flood Insurance Program (NFIP) is the best way for home and business owners to protect themselves financially against the ravages of flooding.

According to FEMA, jurisdictions participate in the NFIP by adopting and enforcing floodplain management ordinances to reduce future flood damage. In exchange, the NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in these communities. Community participation in the NFIP is voluntary.

Madison County and the cities of Madisonville and Midway are currently the only jurisdictions within the county that participate in the NFIP.

These jurisdictions maintain their continued NFIP compliance in several ways, including:

- Requiring all new development in the identified flood hazard area to be permitted
- Requiring revisions to existing structures in the identified flood hazard area to be permitted
- Requiring Elevation Certificates to be submitted as part of the permitting process
- Persons looking to purchase flood prone property are being advised of the flood hazard area through credited hazard disclosure measures
- Continued preservation of open space in the floodplain
- Acquisition of existing structures from the floodplain
- Keeping track of building improvements and repairs to structures located in the identified flood hazard area
- Continued enforcement of stream dumping regulations
- Perform periodic reviews of local dams, rivers and stream to ensure that no obstructions prevent the flood water from flowing downstream

There are currently approximately 25 flood insurance policies in the force in participating Madison County jurisdictions. There have been 10 losses to date with $91,452 in claims payments. Table 6-2 shows a summary of the NFIP policies for Madison County.

Table 6-2. National Flood Insurance Program, Policies and Losses for Madison County

Community	Policies in Effect	Total Coverage in Thousands	Total Losses	Dollars Paid, Historical
Madison County	11	$989	9	$88,819
Madisonville	14	$2,972	1	$2,633

PEOPLE AND PROPERTY AT RISK

Minor flooding has occurred on low level streets within the City of Madisonville as well as minor flooding along the Trinity River, which makes the east border of the county. To assess flood risk for the entire county, flood areas were modeled for 100-year and 500-year events. Flood depth was estimated at the pixel level for affected areas, along with proportion of the area affected within the census block. HAZUS-MH inventory and damage functions were then utilized to estimate exposure. Table 6-3 shows the estimated buildings and people at risk to flooding in Madison County.

Because detailed information was not available to calculate potential losses due to flood, it is assumed that in a worst-case-scenario event, all exposed areas would be impacted and the exposed values would equal the potential losses.

Table 6-3. Potential Wet Exposure for 100-Year Flood in Madison County (Riverine Flooding)

Potential Residential Building Exposure at Risk		Potential Commercial Building Exposure at Risk		People at Risk
Number	Value ($1,000)	Number	Value ($1,000)	
332	57,160	1	12,078	637

POTENTIAL DAMAGES AND LOSSES

To estimate annualized losses due to flood, the exposed values were multiplied by the probability of the occurrence of a 100-year flood event (1 percent) to calculate the estimated annualized losses. Annualized losses by county are shown in Table 6-4. Potential impacts to critical facilities and infrastructure are provided in Table 6-5. Repetitive losses are provided in Table 6-6.

Table 6-4. Potential Annualized Losses in Madison County (Riverine Flooding)

Total Exposure of Residential and Commercial Buildings ($1000)	Annualized Losses for Residential Buildings at Risk ($1000)	Annualized Losses for Commercial Buildings at Risk ($1000)	Total Annualized Expected Property Losses	Annualized Percent Loss Ratio
290,598	2,761	144	2905	0.01000

Table 6-5. Critical Facilities and Infrastructure Potentially Damaged for Madison County

Critical Facilities and Infrastructure		
Total Number	**Number Inside the 100-year Floodplain**	**Percentage Susceptible to Flooding**
10	2	5.0

REPETITIVE LOSSES FOR MADISON COUNTY

Madison County has two (2) structures on FEMA's Repetitive Loss (RL) list and no structures on FEMA's Severe Repetitive Loss (SRL) list.

Madison County RL properties have been paid $44,226 in insurance claims from FEMA's NFIP program since 1977.

These two RL structures are residential homes in the rural county.

The cities of Madisonville and Midway have no structures listed on FEMA's RL or SRL lists.

WHY DROUGHT IS A THREAT

According to the Texas Parks and Wildlife Department, "Drought is one of the most complex, and least understood, of all natural hazards, affecting more people than do other natural hazards, but differing from them in important ways. Unlike earthquakes, hurricanes and tornadoes, drought unfolds at an almost imperceptible pace with beginning and ending times that are difficult to determine, and with effects that often are spread over vast regions. Drought is the most costly of all natural disasters, and because of the famines it causes, it is the most deadly."

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 regimes, including areas with high and low average rainfall. Drought is the consequence of a natural reduction in the amount of precipitation expected 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. Drought Classification Definitions

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

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

Over time, droughts can have very damaging effects on crops, municipal water supplies, recreational uses, and wildlife. If droughts extend over a number of years, the direct and indirect economic impact can be significant.

Droughts can affect a large area and range in size from a couple of counties to several states. Their impact on wildlife and area farming is enormous. Droughts can kill crops, grazing land, edible plants and even in severe cases, trees. Agricultural losses in Texas from the 1996 drought

are estimated at $2 billion, and losses from the 1998 drought estimated at $2.1 billion, with some estimates much higher. Estimates of overall state losses from both droughts exceed $11 billion. Dying vegetation also serves as a prime ignition source for wildland fires.

A heat wave combined with a drought is a very dangerous situation. Although drought can occur in any season, when extreme heat combines with drought conditions, the result can be a community disaster.

Droughts occur regularly in Texas and are a normal condition. They can vary greatly, however, in their intensity and duration. On average, a yearlong drought takes place somewhere in Texas once every 3 years and a major drought every 20 years. Major droughts can last for years.

HAZARD PROFILE

The potential severity of impact of droughts in Madison County is major; droughts may result in injuries or illnesses that result in permanent disability, complete shutdown of critical facilities for at least 2 weeks, or more than 25% of property destroyed or with major damage, especially taking into consideration the economic losses that may result.

The location of drought can affect the entire planning area. All areas of Madison County, including Madisonville, Midway, Normangee and North Zulch MUD can be affected by drought when the conditions are present.

The frequency of occurrence of drought in Madison County is likely, with an event possible in the next three years.

Droughts are slow onset hazards. Warning time for drought is long, since drought events take place over long periods of time. Drought warnings are issued by the State Drought Preparedness Council, as directed by House Bill 2660, based upon input from NOAA, the Office of the State Climatologist, the U.S. Geological Service, the Texas Water Development Board, Texas Commission on Environmental Quality, and the Texas Agricultural Statistics Service. Warnings utilize five "levels of concern" and take into account assessments of climatology, agriculture, and water availability for each of 10 climatic regions of the state.

According to the Palmer Drought Index, shown in Table 7.2 on the next page, the extent of droughts can range from minor or moderate to extreme or exceptional. The maximum extent of drought that can affect Madison County would be exceptional, as shown in Figure 7.1. This occurred during the summer of 2011. The minimum extent of drought that can affect Madison County would be moderate, as shown in Figure 7.2. This occurred during the spring of 2012 after some much needed rain.

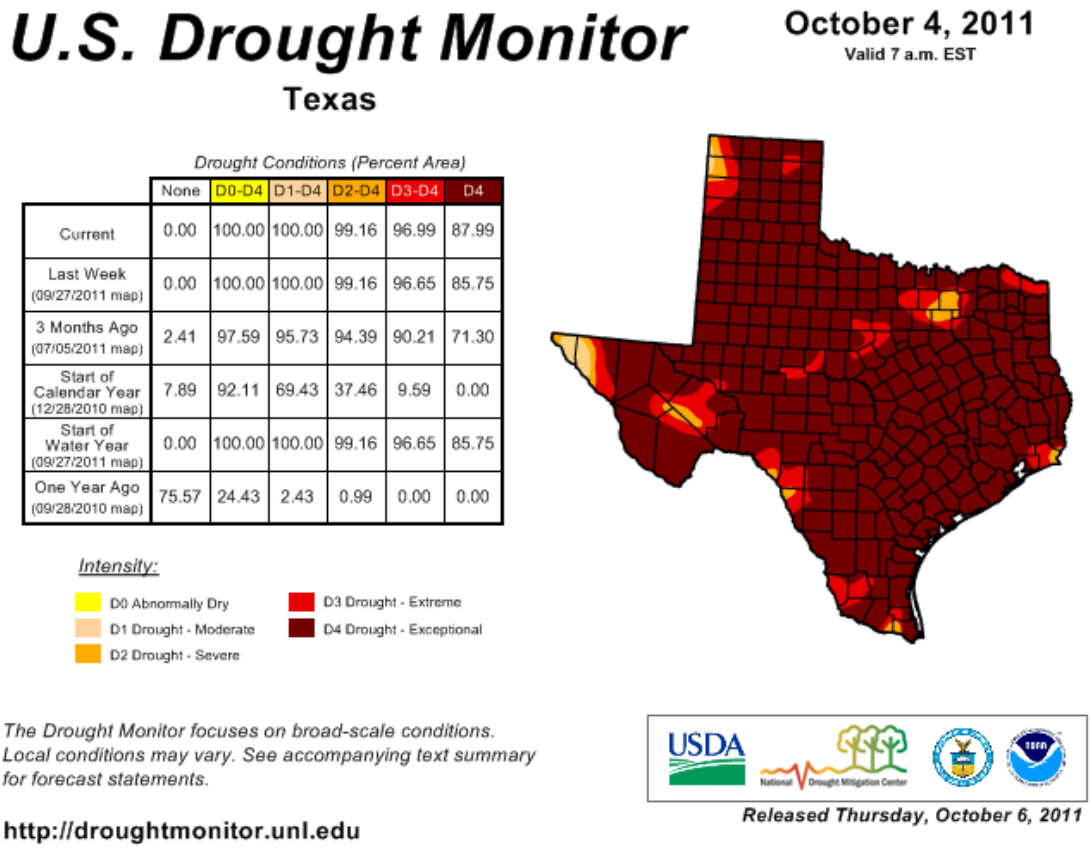
Table 7-2. Palmer Drought Index

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

*NDMC - National Drought Mitigation Center

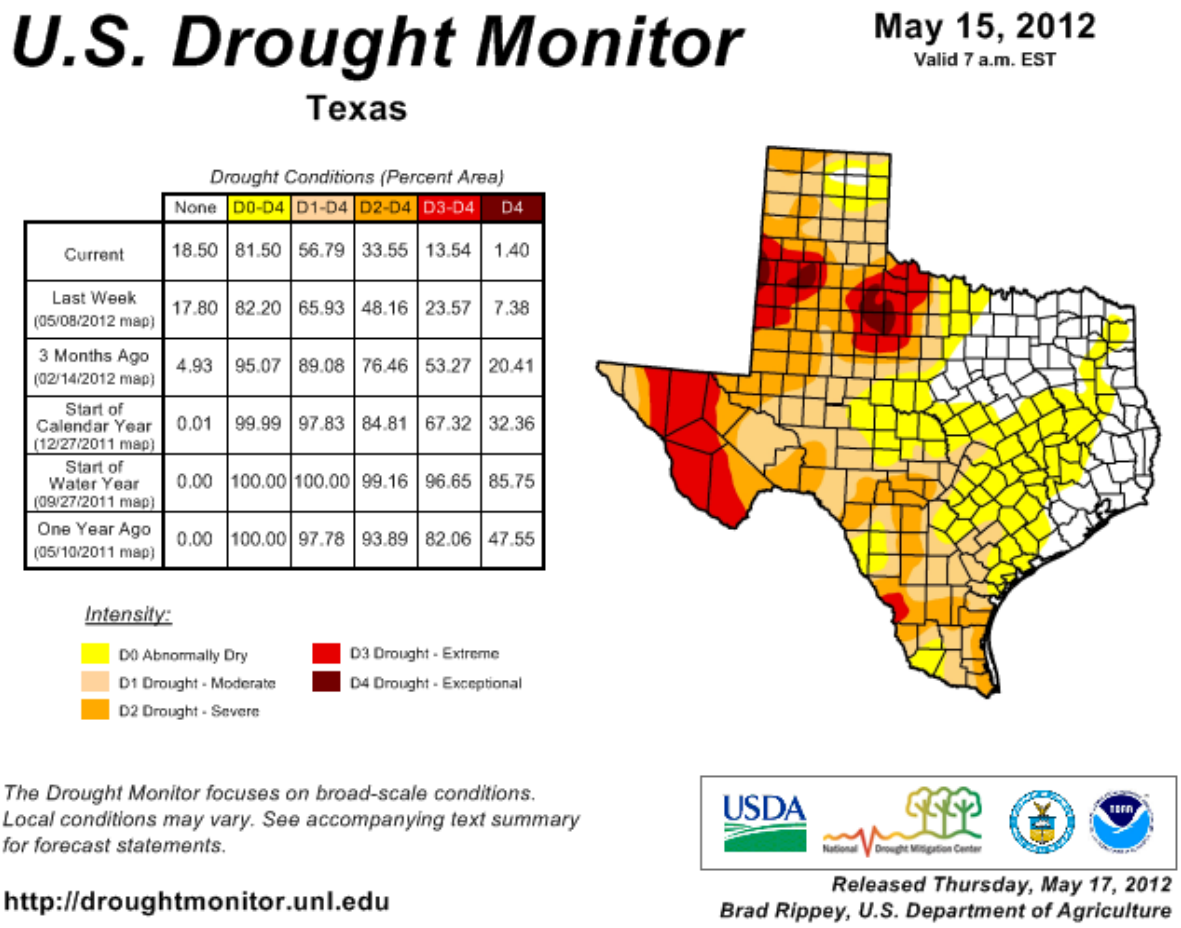
The maximum extent of drought that can affect Madison County could be exceptional, as shown in Figure 7.1

Figure 7-1. Extent of Drought



The minimum extent of drought that can affect Madison County could be moderate, as shown in Figure 7.2.

Figure 7-2. Extent of Drought



HISTORY OF DROUGHT

Table 7-3. Exposure to Droughts in Madison County as Reported to the National Weather Service, 01/01/1950 to 08/01/2012

Date	Death	Injury	Property Damage	Crop Damage	Notes
4/1/1996	0	0	0	0	Entire County affected

5/1/1996	0	0	0	0	Entire County affected
6/1/1996	0	0	0	0	Entire County affected
5/1/1998	0	0	0	0	Entire County affected
6/1/1998	0	0	0	0	Entire County affected
7/1/1998	0	0	0	0	Entire County affected
8/1/1998	0	0	23.0M	167.9M	Entire County affected No data to separate damages within area
8/1/2000	0	0	0	0	Entire County affected
9/1/2000	0	0	0	102.3M	Entire County affected No data to separate damages within area
7/1/2011	0	0	TBD	TBD	Entire County effected
8/1/2011	0	0	TBD	TBD	Entire County affected

PEOPLE AND PROPERTY AT RISK

Droughts impact large geographical areas, thus all the population, buildings, critical facilities, infrastructure and lifelines, and hazardous materials facilities are considered exposed to the hazard and could potentially be impacted. In Madison County, drought does not have a specific location. However, all jurisdictions are at risk and could be affected by drought.

POTENTIAL DAMAGES AND LOSSES

In order to analyze the risk of Madison County to drought and estimate potential losses, 100 years of statistical data from the University of Nebraska was used (this data was developed by the university based on Palmer Drought and Crop Severity Indices) as well as 1997 USDA agriculture data. A drought event frequency-impact was then developed to determine a drought impact profile on non-irrigated agriculture products and estimate potential losses due to drought in the area. Table 7-3 shows annualized expected exposure by county.

Table 7-4. Annualized Expected Agricultural Product Market Value Exposed to Drought in Madison County

County	Annualized Expected Exposure ($)
Madison	293,903

SECTION 8: HURRICANES

WHY HURRICANES ARE A THREAT

According to the National Oceanic and Atmospheric Administration, 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. A hurricane is a type of tropical cyclone, a low pressure system that generally forms in the tropics. A hurricane is accompanied by thunderstorms and, in the Northern Hemisphere, a counterclockwise circulation of winds near the earth's surface.

Hurricanes are categorized according to the strength of their winds using the Saffir-Simpson Hurricane Scale. A Category 1 storm has the lowest wind speeds, while a Category 5 hurricane has the strongest. These are relative terms, because lower category storms can sometimes inflict greater damage than higher category storms, depending on where they strike and the particular hazards they bring. In fact, tropical storms can also produce significant damage and loss of life, mainly due to flooding.

The ingredients for a hurricane include a pre-existing weather disturbance, warm tropical oceans, moisture, and relatively light winds aloft. If the right conditions persist long enough, they can combine to produce the violent winds, incredible waves, torrential rains, and floods we associate with this phenomenon.

Each year, an average of ten tropical storms develops over the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico. Many of these remain over the ocean and never impact the U.S. coastline. Six of these storms become hurricanes each year. In an average 3-year period, roughly 5 hurricanes strike the U.S. coastline, killing approximately 50 to 100 people anywhere from Texas to Maine. Of these, two are typically "major" or "intense" hurricanes (a category 3 or higher storm on the Saffir-Simpson Hurricane Scale).

When the winds from these storms reach 39 mph, the cyclones are given names. Years ago, an international committee developed names for Atlantic cyclones. In 1979, a six-year rotating list of Atlantic storm names was adopted — alternating between male and female hurricane names. Storm names are used to facilitate geographic referencing, for warning services, for legal issues, and to reduce confusion when two or more tropical cyclones occur at the same time. Through a vote of the World Meteorological Organization Region IV Subcommittee, Atlantic cyclone names are retired usually when hurricanes result in substantial damage or death or for other special circumstances.

The Saffir-Simpson Wind Scale classifies hurricanes according to the following:

- Tropical Storm—Winds 39-73 mph
- Category 1 Hurricane—winds 74-95 mph (64-82 kts.).
  No real damage to buildings. Damage to unanchored mobile homes. Some damage to

poorly constructed signs. Also, some coastal flooding and minor pier damage.
Examples: Dolly (TX) 2008, Irene 1999 and Allison 1995

- Category 2 Hurricane—winds 96-110 mph (83-95 kts.).
  Some damage to building roofs, doors and windows. Considerable damage to mobile homes. Flooding damages piers and small craft in unprotected moorings may break their moorings. Some trees blown down.
  Examples: Ike (TX) 2008, Gustav (LA) 2008, Bonnie 1998, Georges (FL & LA) 1998, and Gloria 1985
- Category 3 Hurricane—winds 111-130 mph (96-113 kts.)
  Some structural damage to small residences and utility buildings. Large trees blown down. Mobile homes and poorly built signs destroyed. Flooding near the coast destroys smaller structures with larger structures damaged by floating debris. Terrain may be flooded well inland.
  Examples: Katrina (LA) 2005, Rita (TX) 2005, Keith 2000, Fran 1996, Opal 1995, Alicia 1983 and Betsy 1965
- Category 4 Hurricane—winds 131-155 mph (114-135 kts.)
  More extensive curtain wall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain may be flooded well inland.
  Examples: Hugo 1989 and Donna 1960
- Category 5 Hurricane—winds 156 mph and up (135+ kts.)
  Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas may be required.
  Examples: Andrew (FL) 1992, Camille 1969 and Labor Day 1935

Hurricane hazards come in many forms: storm surge, high winds, tornadoes, and flooding.

Storm Surge

Although Madison County is not at risk from it, the greatest potential for loss of life related to a hurricane is from the storm surge, according to the National Hurricane Center.

Storm surge is water that is pushed toward the shore by the force of the winds swirling around the storm. This advancing surge combines with the normal tides to create the hurricane storm tide, which can increase the mean water level 15 feet or more. In addition, wind driven waves are superimposed on the storm tide. This rise in water level can cause severe flooding in coastal areas, particularly when the storm tide coincides with the normal high tides. Because much of the United States' densely populated Atlantic and Gulf Coast coastlines lie less than 10 feet above mean sea level, the danger from storm tides is tremendous.

High Winds

Madison County can experience high winds from hurricanes. The intensity of a landfalling hurricane is expressed in terms of categories that relate wind speeds and potential damage. According to the Saffir-Simpson Hurricane Scale, a Category 1 hurricane has lighter winds compared to storms in higher categories. A Category 4 hurricane would have winds between 131 and 155 mph and, on the average, would usually be expected to cause 100 times the damage of the Category 1 storm. Depending on circumstances, less intense storms may still be strong enough to produce damage, particularly in areas that have not prepared in advance.

Tropical storm-force winds are strong enough to be dangerous to those caught in them. For this reason, emergency managers plan on having their evacuations complete and their personnel sheltered before the onset of tropical storm-force winds, not hurricane-force winds.

Hurricane-force winds can easily destroy poorly constructed buildings and mobile homes. Debris such as signs, roofing material, and small items left outside become flying missiles in hurricanes. Extensive damage to trees, towers, water and underground utility lines (from uprooted trees), and fallen poles cause considerable disruption.

Tornadoes

Hurricanes can also produce tornadoes that add to the storm's destructive power. Tornadoes are most likely to occur in the right-front quadrant of the hurricane. However, they are also often found elsewhere embedded in the rain bands, well away from the center of the hurricane.

Some hurricanes seem to produce no tornadoes, while others develop multiple ones. Studies have shown that more than half of the land falling hurricanes produce at least one tornado; Hurricane Beulah (1967) spawned 141 according to one study. In general, tornadoes associated with hurricanes are less intense than those that occur independently. Nonetheless, the effects of tornadoes, added to the larger area of hurricane-force winds, can produce substantial damage.

Inland Flooding

In the last 30 years, inland flooding has been responsible for more than half the deaths associated with tropical cyclones in the United States. Inland flooding from hurricanes is a potential threat to Madison County.

When it comes to hurricanes, wind speeds do not tell the whole story. Hurricanes produce storm surges, tornadoes, and often the most deadly of all - inland flooding.

While storm surge is always a potential threat, more people have died from inland flooding in the last 30 years. Intense rainfall is not directly related to the wind speed of tropical cyclones. In fact, some of the greatest rainfall amounts occur from weaker storms that drift slowly or stall over an area.

Inland flooding can be a major threat to communities hundreds of miles from the coast as intense rain falls from these huge tropical air masses.

- Freshwater floods accounted for more than half (59 percent) of U.S. tropical cyclone deaths over the past 30 years. These floods are why 63 percent of U.S. tropical cyclone deaths during that period occurred in inland counties.
- At least 23 percent of U.S. tropical cyclone deaths occur to people who drown in, or attempting to abandon, their cars.
- 78 percent of children killed by tropical cyclones drowned in freshwater floods.

HAZARD PROFILE

Due to the location of Madison County away from the coast, the severity of impact to Madison County is minor; a hurricane may result in injuries or illnesses that do not result in permanent disability, a complete shutdown of critical facilities for more than one week, or more than 10 percent of property destroyed or with major damage.

The location of hurricanes can affect the entire planning area. All areas of Madison County, including Madisonville, Midway, Normangee and North Zulch MUD can be affected by a hurricane .

The last previous occurrence of a hurricane to affect the county was in 2008, when Hurricane Ike hit Madison County and the cities of Madisonville, Midway, Normangee and North Zulch MUD. Parts of rural Madison County were without electrical power for up to 10 days.

The extent of hurricanes in Madison County can be Category 2 Hurricane, based on the Saffir-Simpson Wind Scale located on pages 56-57.

The frequency of occurrence of hurricanes in Madison County is unlikely, with an event possible in the next ten years.

Hurricanes occur in seasonal patterns, with hurricane season occurring between June 1 and November 30.

Warning time for hurricanes is long, thanks to modern warning technology.

HISTORY OF HURRICANES

Between 1900 and 2010, 47 hurricanes made landfall in Texas.

Hurricane Winds

Table 8-1 profiles the potential winds speeds (in miles per hour) that could be expected in Brazos Valley Region counties in a hurricane event.

Table 8-1. Average Hurricane Wind Speeds in Madison County

County	Wind Speed [MPH] vs. Return Period [Year]						
	10	20	50	100	200	500	1000
Madison	39	55	72	84	95	107	116

PEOPLE AND PROPERTY AT RISK

The entire building stock in Madison County is exposed to the threat of hurricane winds. Table 8-2 shows the potential impact on the 100 critical facilities in Madison County from 100- and 500-year winds.

It is impossible to predict the exact location of hurricanes. However, the effects of hurricanes are generally two-fold. They are expected to have the most impact on floodplains. The location of floodplains is identified in Figure 6-3. Hurricane winds may impact the entire region depending on the path of the hurricanes.

Table 8-2. Critical Facilities at Risk from Hurricane Winds in Madison County

Critical Facilities	100-Year Hurricane Wind			500-Year Hurricane Wind		
Total Number	Loss of Function	Partially Functional	Fully Functional	Loss of Function	Partially Functional	Fully Functional
100	0	100	0	76	24	0

POTENTIAL DAMAGES AND LOSSES

Table 8-4 displays the risks from hurricanes faced by Madison County. Annualized expected property losses from hurricane winds total almost $600,000 per year. Annualized loss ratios are presented to show the relative risk among counties.

Table 8-4. Potential Annualized Losses from Hurricanes in Madison County

Total Exposure ($)	Annualized Losses for Residential Buildings at Risk ($)	Annualized Losses for Commercial Buildings at Risk ($)	Total Annualized Expected Property Losses ($)	Annualized Percent Loss Ratio
1,032,976,000	516,591	57,520	594,647	0.0576%

SECTION 9: URBAN AND WILDLAND FIRES

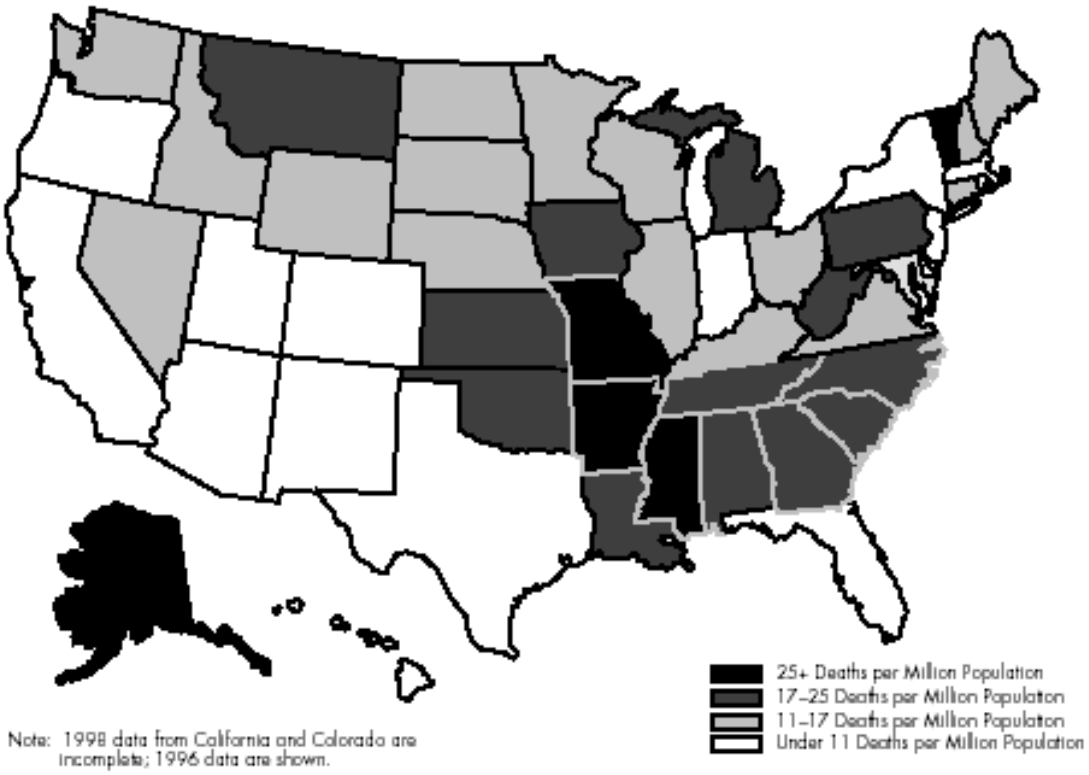
WHY URBAN AND WILDLAND FIRES ARE A THREAT

The fire problem in the United States on a per capita basis is one of the worst in the industrial world. Thousands of Americans die each year from fire, tens of thousands of people are injured, and property losses reach billions of dollars. To put these figures in context, the annual losses from floods, hurricanes, tornadoes, earthquakes and other natural disasters combined in the United States average just a fraction of the losses from fire.

According to the National Fire Data Center of the U.S. Fire Administration, recent trends show a decline in the numbers of fires, deaths, injuries, and dollar loss to property. However, despite these encouraging trends, an average of over 5,000 deaths and 28,000 injuries to civilians, and over 100 firefighter deaths occurred annually over the 10–year period from 1987 to 1996. The fire death rate, by state, is shown in Figure 9-1.

This plan addresses both wildland fires and major urban fires. For purposes of this plan, major wildland fire events are those that were greater than or equal to two-alarm fires. Major urban fires are defined as those structure fires that were greater than or equal to three-alarm fires.

Figure 9-1. Fire Death Rate by State



Major Urban Fires

The leading causes of fires nationally are arson, open flames, and cooking. Urban fires cause most fire deaths and injuries. The leading causes of fire deaths are smoking, arson, and heating. Between 70 and 80 percent of deaths result from residential fires. People under age 5 and over age 55 have a much higher death rate than the average population. These two age groups account for more than one-third of all deaths nationally.

Wildland Fires

A wildland fire is any fire occurring on grassland, forest, or prairie, regardless of ignition source, damages, or benefits. According to the National Fire Plan, 2000, the wildland fire risk is now considered by authorities as "the most significant fire service problem of the century."

The National Fire Plan was issued by the U.S. Departments of Agriculture and Interior. It defines the urban/wildland interface as "the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels." The interface problem has grown dramatically over the last twenty years, spawned by increases in population, urban expansion, land-management decisions that place neighborhoods adjacent to wildland preserves, parks, and greenbelts, and the ever-present desire to intermingle with nature. The marriage between humans and their property and wildland areas has significantly increased human exposure to wildfires.

More and more people are building their homes in woodland settings in or near forests, rural areas, or remote mountain sites. Many of these homes are nestled along ridgelines, cliff-edges, and other classic fire-interface hazard zones. There, homeowners enjoy the beauty of the environment but they also face the very real danger of wildfire.

Years of fire suppression have significantly disturbed natural fire occurrences—nature's renewal process. The result has been the gradual accumulation of understory and canopy fuels to levels of density that can feed high-energy, intense wildfires and further increase the hazards from and exposure to interface problems.

Multiple devastating interface-area fires over the past several years have demonstrated the disastrous potential inherent in the interface. This danger is perhaps best epitomized by the Cerro Grande fire of 2000 in New Mexico or the Oakland, California, fire of 1991 in which 25 lives were lost and more than 2,900 homes destroyed.

In a letter to the president after the devastating 1999-2000 fire season, the secretaries of the Departments of Agriculture and Interior wrote, "explosive growth in the wildland urban interface now puts entire communities and associated infrastructure, and the socioeconomic fabric that holds communities together, at risk from wildland fire."

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

Three different classes of wildfires exist. A "surface fire" is the most common type and burns along the floor of a forest, moving slowly and killing or damaging trees. A "ground fire" is usually started by lightning and burns on or below the forest floor in the humus layer down to the mineral soil. "Crown fires" spread rapidly by wind and move quickly by jumping along the tops of trees.

Humans start about 90 percent of wildfires (cigarettes thrown from cars, burning of refuse, etc.); lightning starts the other 10 percent.

HAZARD PROFILE

The extent of both urban and wildland fires in Madison County is major; fires can completely shut down facilities for at least two weeks and cause more than 25 percent of affected properties to be destroyed or incur major damage.

The frequency of occurrence of urban and wildland fire events in Madison County is likely, with an event probable in the next three years.

Winter is the peak period for major urban fires and fire deaths. The wildland fire risk varies considerably by month.

Warning time for urban and wildland fire events is minimal or none.

HISTORY OF FIRE

Table 9-1 shows the number of voluntarily reported incidents and the total dollar losses by county in Madison County during 2006 through 2009. It is likely that more fire incidents occurred during this timeframe that were not reported. Reporting is voluntary and thus not consistent.

Table 9-1. Urban Fire Incidents and Losses in Madison County, 2006-2012

FD Name	Date	Type	Acres	Cause	# Dept Response
Madisonville VFD	1/7/2006	Wildfire	200	Miscellaneous	3
Madisonville VFD	1/8/2006	Wildfire	200	Miscellaneous	2
Madisonville VFD	1/17/2006	Wildfire	25	Miscellaneous	4
Madisonville VFD	1/17/2006	Wildfire	25	Miscellaneous	1
Madisonville VFD	1/17/2006	Wildfire	25	Miscellaneous	1
Madisonville VFD	2/10/2008	Wildfire	30	Debris burning	4
Madisonville VFD	2/10/2008	Wildfire	30	Debris burning	4

Madisonville VFD	7/29/2008	Wildfire	40	Debris burning	3
HILLTOP LAKES VFD, INC.	1/19/2009	Wildfire	200	Debris burning	5
Normangee VFD	1/19/2009	Wildfire	200	Debris burning	5
Normangee VFD	1/19/2009	Wildfire	200	Debris burning	5

LOCATION OF HAZARDOUS AREAS

There is no defined geographic hazard boundary for urban and wildland fires in Madison County. Due to the recent droughts of 2009 and 2011, along with the excessive heat of the summer months during those years, all people, buildings, critical facilities, infrastructure and lifelines are considered exposed to the urban and wildland fire hazard and could potentially affect Madison County.

Figure 9-2 on the following pages show wildfire risk across Madison County, as determined by the Texas Forest Service. The map represents the cumulative weights of (1) the risks associated with fuel complexes, (2) the risks associated with population, and (3) the weighted factors of population growth. These combined variables determine the following risk categories:

- Low risk: Low risk areas are primarily those that have little population or population densities that are not located near or in a hazardous fuel complex.
- Moderate risk: Areas that may have a high population but are located near or in a moderate- or low-hazard fuel complex. Also, counties that have a low population but have significant growth located near or in a high-hazard fuel complex are included in this category.
- Substantial risk: Areas that have a moderate population and a high growth rate and are located near or in a high- or moderate-hazard fuel complex.
- High risk: Areas that have high population numbers and moderate-to-high growth rates and are located near or in a high-hazard fuel complex area.

Figure 9-2. Areas of risk to wildfire in Madison County and participating jurisdictions

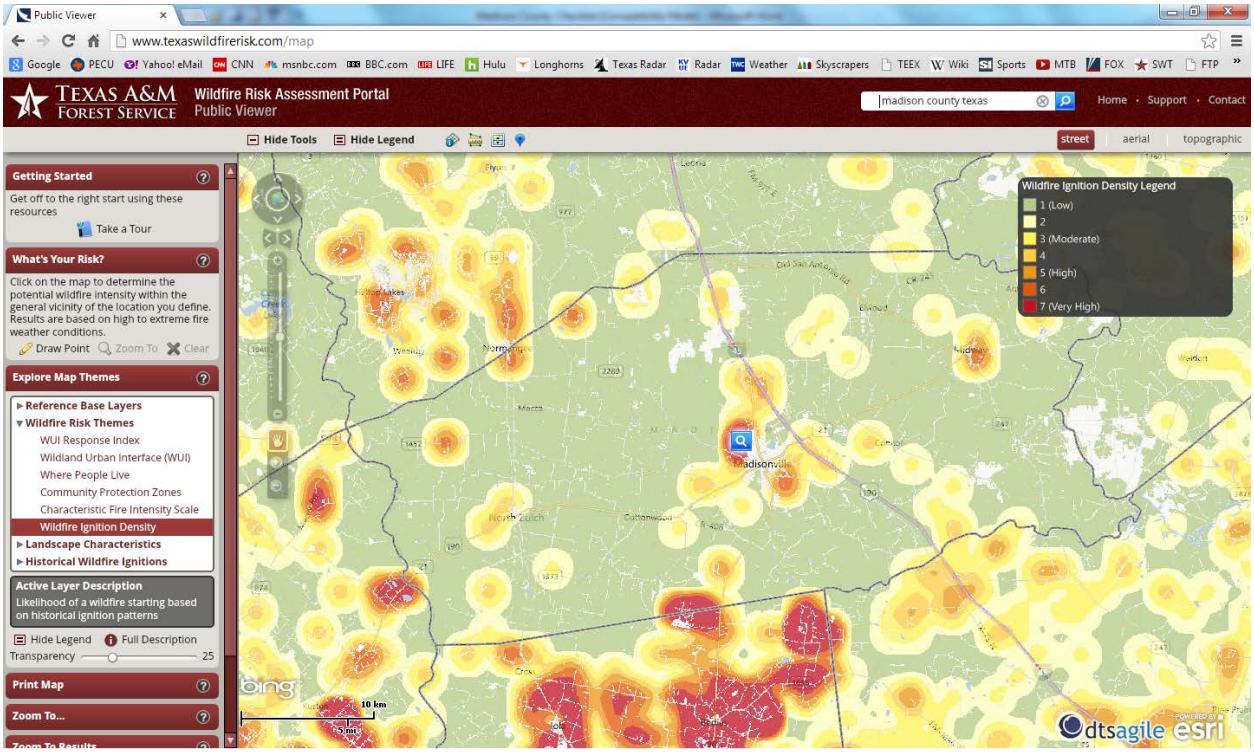


Figure 9-2. Areas of risk to wildfire in Madisonville

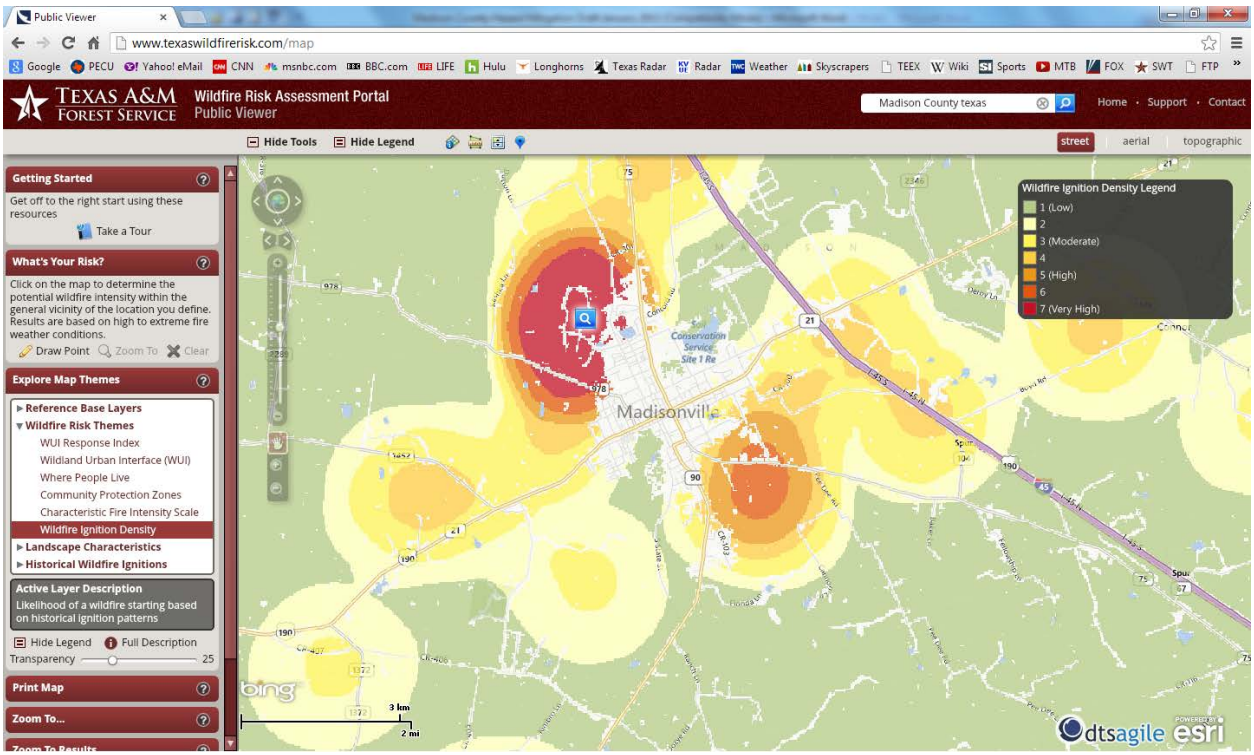


Figure 9-2. Areas of risk to wildfire in Midway

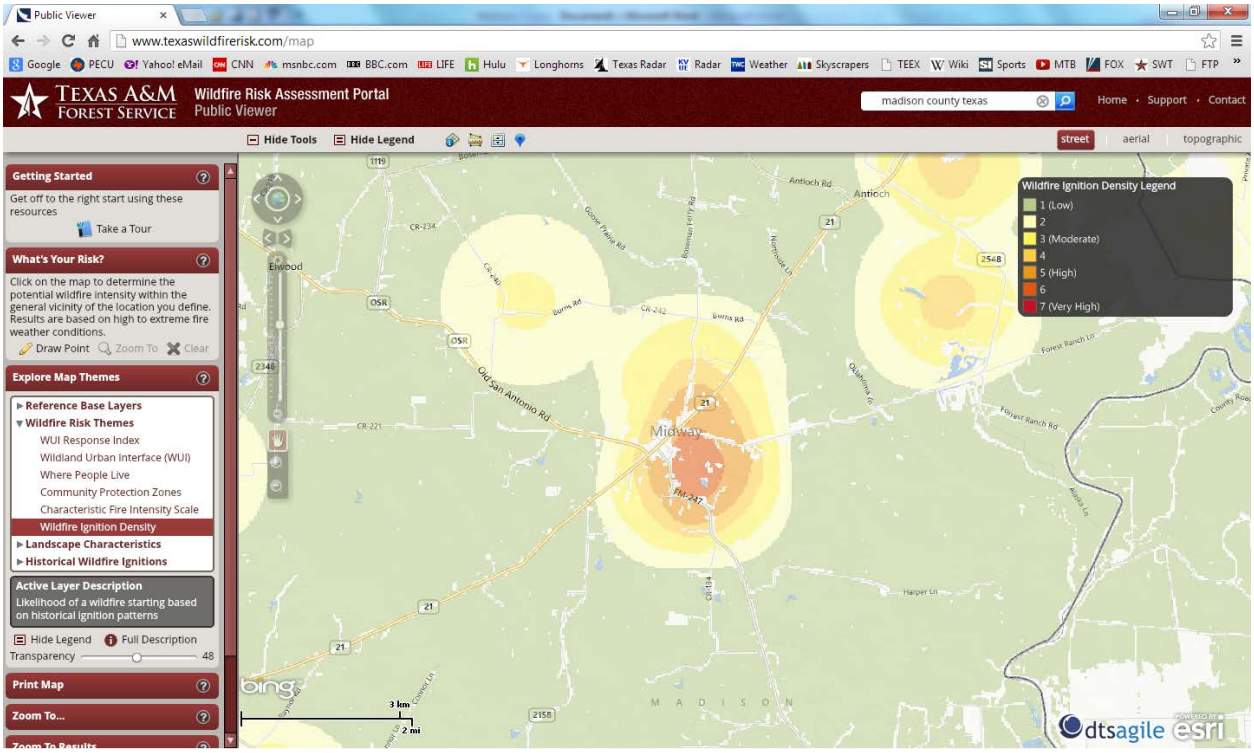


Figure 9-2. Areas of risk to wildfire in Normangee

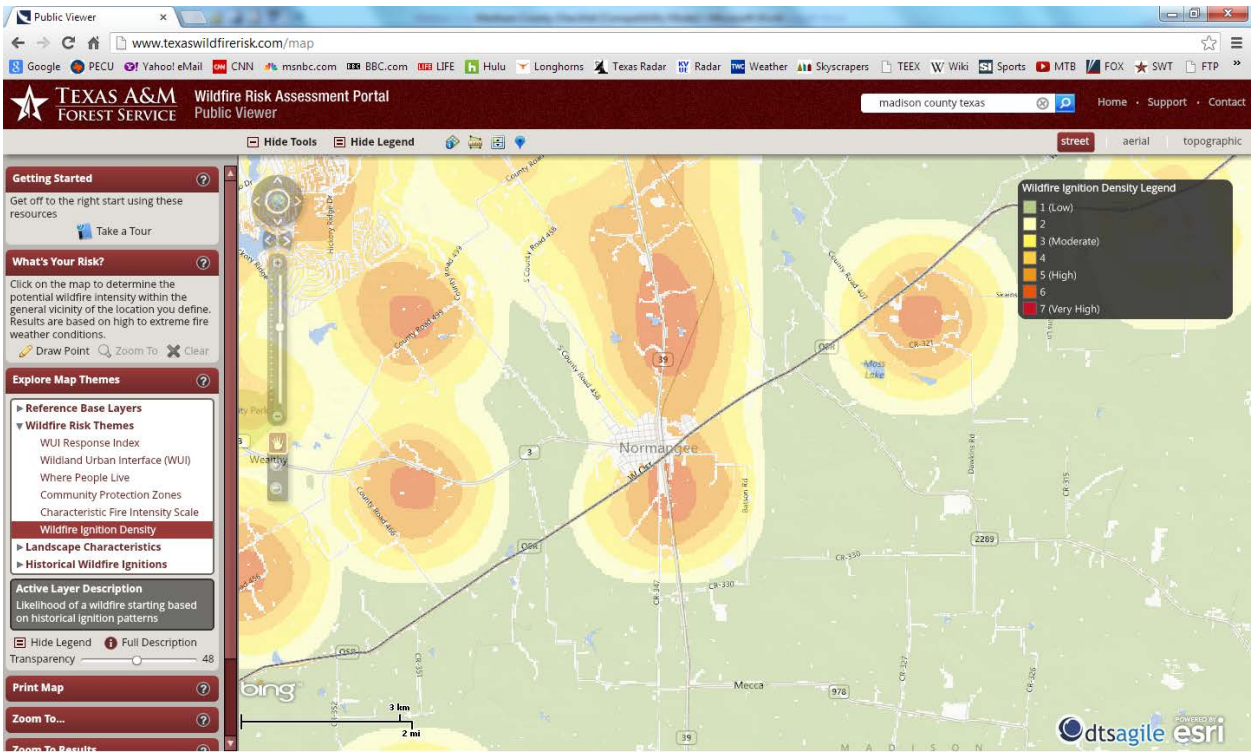
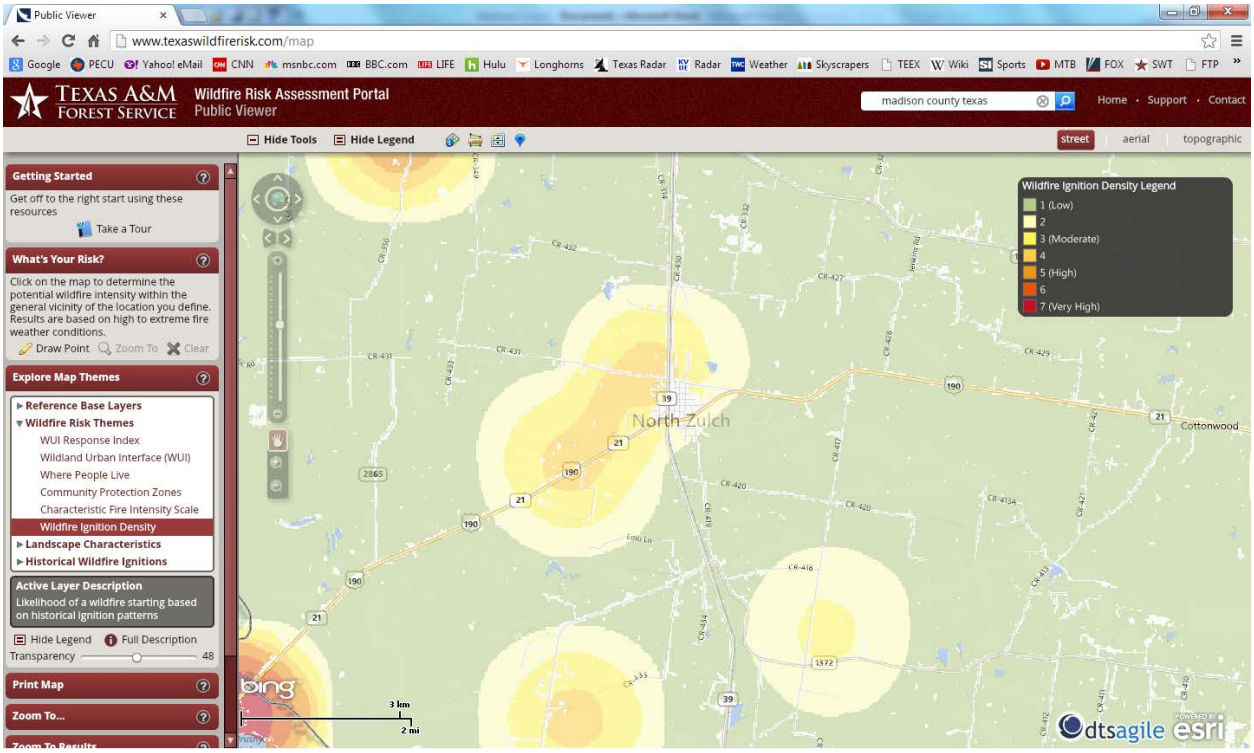


Figure 9-2. Areas of risk to wildfire in North Zulch



This overall hazard rating by the Texas Forest Service is descriptive and not predictive, based on wide-ranging parameters. In most cases, the interface risk in a county will change based on the distribution of hazardous wildland fuels and population and growth within the county. Keeping this in mind, counties that have an overall low-hazard rating may have isolated areas within the county that are at high risk, just as counties identified as high risk may have isolated areas within the county that are at low risk.

A major component of the risk assessment was the relation of population and urban development to hazardous wildland fuels. To achieve a rating, the fuels model map for Texas was categorized in to fuel complexes that represented low, moderate and high hazard fuels. This correlation was developed under the direction of Karen Allender and the Urban Wildland Interface Division of the Texas Forest Service. Fuels were grouped by National Fire Danger Rating System (NFDRS) and Anderson Fuel Model ratings and the resulting descriptors of low to high hazard were assigned. These descriptors were based on the fuel complexes potential for spread rates, heat output (BTUs) and duration of output, difficulty of control and potential for fire movement in the canopy of the vegetation. Fuels that had the highest potential for crowning, difficulty in control and heat output for duration posed the most hazards.

Any structure is exposed to the urban fire risk. The wildland fire risk is a function of the following:

- the climate (patterns over time);
- fuel complexes (vegetation);
- topography (slope, aspect and elevation);
- human factors (structures and infrastructure).

History of Fire

Table 9-2 shows the number of voluntarily reported incidents and the total dollar losses in Madison County during a ten year period. It is likely that more fire incidents occurred during this timeframe that were not reported. Reporting is voluntary and thus not consistent.

Table 9-2. Urban Fire Incidents and Losses in Madison County

Incidents	Total Dollar Loss ($)
4,272	14,570,651

People and Property at Risk

There is no defined geographic hazard boundary for urban and wildland fires. All people, buildings, critical facilities, infrastructure and lifelines, and hazardous materials facilities are considered exposed to the urban and wildland fire hazard and could potentially be impacted. However, it is not expected that a fire event would impact a large area.

Potential Damages and Losses

Table 9-3 shows potential annualized losses by county due to urban fire, which were calculated using the statistical risk assessment methodology.

Table 9-3. Potential Annualized Losses to Urban Fire in Madison County

County	Annualized Expected Property Losses ($)
Madison	293,903

SECTION 10: WINTER STORMS

WHY WINTER STORMS ARE A THREAT

A severe winter storm event includes a storm with snow, ice or freezing rain—all of which can cause significant problems for area residents. Winter storms that threaten Texas usually start out as powerful cold fronts that push south from central Canada.

Most of the precipitation seen in the Brazos Valley from severe winter storms takes the form of ice or sleet. Freezing rain occurs when rain developing in a relatively warm (above freezing) layer of air falls through a layer of air that is below freezing (25-32° F). The rain is "supercooled" as it falls through the cold layer near the surface of the earth. When the supercooled but still liquid raindrops strike the ground or an object already below freezing, they freeze on contact. The resulting coating of ice is commonly known as glaze.

A heavy accumulation of ice can topple power and telephone lines, television towers, and trees. Highways become impossible to travel on, and even stepping outdoors can be extremely risky. The severity of an ice storm and the amount of damage caused by the storm depends on the amount of rain and thus the amount of icing taking place, the strength of the wind, and whether or not the storm strikes an urban or rural area. Urban areas tend to suffer more damage than rural areas because of the concentration of utilities and transportation systems (aircraft, trains, buses, trucks, and cars), all of which may be affected to a great degree by the icing.

HAZARD PROFILE

The extent of winter storms on Madison County can extend from something as minor as winter weather advisory's or as major as freezing temperatures with sleet, snow and wind chill. The maximum extent of winter storms for Madison County include low temperatures below 32 degrees, freezing rain and sleet, and/or snow amounts up to 3-8 inches.

The frequency of occurrence of winter storms in Madison County is unlikely, with an event probable in the next ten years.

A heavy accumulation of ice can topple power and telephone lines, television towers, and trees. Highways become impossible to travel on, and even stepping outdoors can be an extremely risky undertaking. Utility disruptions from winter storms can severely impact the delivery of services. Water pipes can freeze and crack in sub-freezing temperatures. Ice can build up on power lines and cause them to break under the weight, or ice on trees can cause tree limbs to fall on the lines. These events can disrupt electric service for long periods.

Warning time for winter storms is generally six to twelve hours. Table 10-1 provides definitions of winter weather alerts.

Table 10-1. Winter Weather Alerts

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

HISTORY OF SEVERE WINTER STORMS

Winter storm events that have occurred in Madison County 1993 to 2012 are presented in Table 10-2, along with reported injuries, deaths and damages.

Table 10-2. Severe Winter Storms, Madison County, 1993–2012

Date	Time	Type	Magnitude	Death	Injury	Property Damage	Crop Damage	Notes
1/12/1997	0600	Ice Storm	N/A	3	0	0	0	23 counties affected, no data on location of Dth
12/22/1998	1614	Winter Storm	N/A	0	0	75K	0	5 counties affected, no data on location of PrD
12/13/2000	0001	Ice Storm	N/A	0	0	1.0M	0	9 counties affected, no data on location of PrD
1/16/2007	2000	Ice Storm	N/A	0	0	1K	0K	16 counties affected, no data on location of PrD
12/10/2008	1100	Heavy Snow	N/A	0	0	0K	0K	2 counties affected.
2/11/2010	2200	Heavy Snow	N/A	0	0	0K	0K	8 counties affected, no data on location of PrD
2/23/2010	1200	Heavy Snow	N/A	0	0	0K	0K	3 counties affected, no data on location of PrD
2/4/2011	0000	Ice Storm/ Winter Storm	N/A	0	0	0K	0K	7 counties affected, no data on location of PrD

PEOPLE AND PROPERTY AT RISK

Winter storms usually impact large geographical areas; thus, all the population, buildings, critical facilities, infrastructure and lifelines, and hazardous materials facilities are considered exposed to the hazard and could potentially be impacted.

POTENTIAL DAMAGES AND LOSSES

Table 10-3 presents annualized expected property losses due to winter storms in Madison County.

Table 10-3. Potential Annualized Losses due to Winter Storms in Madison County

County	Annualized Expected Property Losses ($)
Madison	71,706

WHY TORNADOES ARE A THREAT

Tornadoes are unquestionably the most violent storms on the planet. A tornado is a violently 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 spawned by "super-cell thunderstorms." These storms are affected by horizontal wind shears (winds moving in different directions at different altitudes) that 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 11-1. Enhanced Fujita Tornado Scale implemented February 1, 2007

EF-Scale Number	Intensity	Wind Speed (mph)	Type of Damage Done
EF0	Gale tornado	65-85	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.
EF1	Moderate tornado	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	Significant tornado	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 tornado	136-165	Roof and some walls torn off well constructed houses; trains overturned; most trees in forest uprooted.
EF4	Devastating tornado	166-200	Well-constructed homes leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
EF5	Incredible tornado	Over 200	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles flying through the air in excess of 100 meters; trees debarked; steel

			reinforced concrete badly damaged.

Madison County is known for frequent severe weather and thunderstorms. Thunderstorms form when warm, moist air collides with cooler, drier air. Since these masses tend to come together during the transition from summer to winter, most thunderstorms occur during the spring and fall months. Severe thunderstorms can produce tornadoes, high winds, and hail—any of which can cause extensive property damage and loss of life.

Tornadoes occasionally accompany tropical storms and hurricanes that move over land. Tornadoes are the most common to the right and ahead of the path of the storm center as it comes ashore.

Tornadoes vary in terms of duration, wind speed and the toll that they take, as shown in Table 11-2.

Table 11-2. Variations Among Tornadoes

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

HAZARD PROFILE

The impact of tornadoes in Madison County can be substantial. They can cause multiple deaths, completely shut down facilities for thirty days or more, and cause more than fifty percent of affected properties to be destroyed or suffer major damage.

The location of tornadoes in Madison County can affect the entire planning area, since tornadoes do not follow a defined geographic border. The entire county and the cities of Madisonville, Midway, Normangee and North Zulch MUD may be impacted by a tornado.

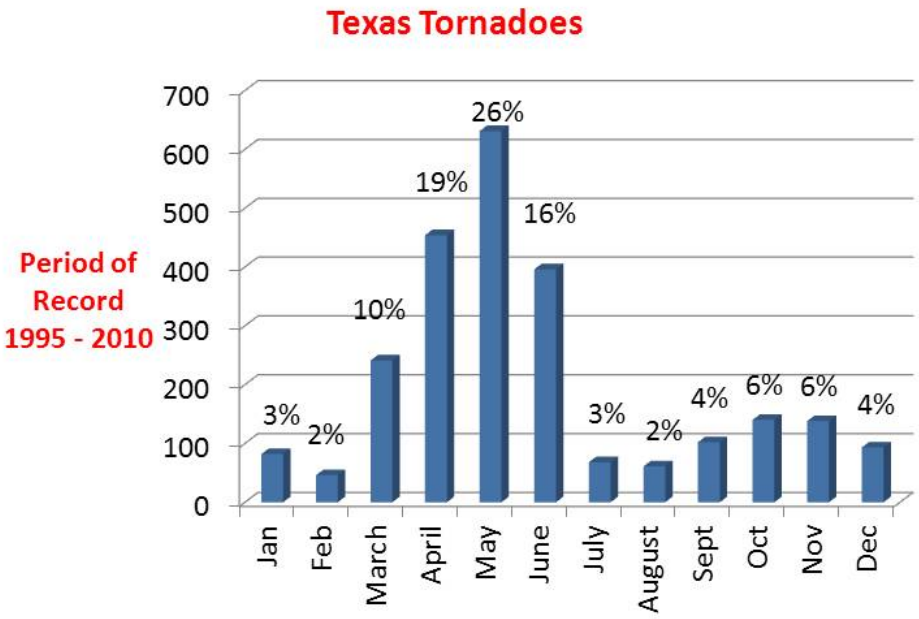
The maximum extent of tornadoes that can affect Madison County is an EF5, which according to the Enhanced Fujita Scale, would be an incredibly strong tornado with winds speeds over 200 miles per hour.

The frequency of occurrence of tornadoes in Madison County is likely, with an event probable in the next three years.

Seasonal patterns are relevant to tornadoes. Thunderstorms form when warm, moist air collides with cooler, drier air. Since these masses tend to come together during the transition from

summer to winter, most thunderstorms and resulting tornadoes occur during the spring (March, April, May and June) and, at a lesser intensity, during the fall (September, October, and November). Warning time for tornadoes is minimal.

Figure 11-1. Occurrence of Texas Tornadoes, by Month



HISTORY OF TORNADOES

Since the Enhanced Fujita Scale was not implemented until 2007, the original Fujita Scale is included here to help understand the History of Tornado Events scale in Table 11-3.

ORIGINAL FUJITA SCALE		ENHANCED FUJITA SCALE	
F5	261-318 mph	EF5	+200 mph
F4	207-260 mph	EF4	166-200 mph
F3	158-206 mph	EF3	136-165 mph
F2	113-157 mph	EF2	111-135 mph
F1	73-112 mph	EF1	86-110 mph
F0	<73 mph	EF0	65-85 mph

Table 11-3 identifies reported tornado events in Madison County, and Table 11-4 gives the number of tornadoes in the county.

Table 11-3. History of Tornado Events in the Madison County as Reported to the National Weather Service

Type	Date	Mag	Dth	Inj	PrD	CrD
Tornado	10/22/1954	F2	0	0	25K	0
Tornado	4/11/1961	F1	0	0	0K	0
Tornado	5/1/1967	F2	0	0	3K	0
Tornado	11/15/1987	F2	3	2	2.5M	0
Tornado	4/15/1994	F0	0	0	0	50K
Tornado	4/15/1994	F0	0	0	50K	0
Tornado	1/21/1998	F0	0	0	250K	0
Tornado	12/23/2002	F1	0	2	55K	0
Tornado	5/16/2003	F0	0	0	5K	0
Tornado	5/28/2005	F0	0	0	0	0
Tornado	12/29/2006	F1	0	3	750K	0K
Tornado	4/28/2009	F0	0	0	0K	0K
Tornado	4/28/2009	F0	0	0	0K	0K

Table 11-4. Overall Historical Impact of Tornadoes in Madison County

Number of events	Maximum F-Scale
13	F2

PEOPLE AND PROPERTY AT RISK

Because it cannot be predicted where a tornado will touch down, all buildings and facilities are considered to be exposed to the tornado hazard and could potentially be impacted. All the population, buildings, critical facilities, infrastructure and lifelines, and hazardous materials facilities are considered exposed to the hazard and could potentially be impacted.

POTENTIAL DAMAGES AND LOSSES

Table 11-5 shows potential annualized expected property losses in Madison County.

Table 11-5. Potential Annualized Losses from Tornadoes in Madison County

County	Annualized Expected Property Losses ($)
Madison	29,773

WHY HAILSTORMS ARE A THREAT

Large hail results in nearly $1 billion in damage annually to property and crops in the United States. Hail is made up of spherical balls of ice. It is a product of thunderstorms or intense showers. It is generally white and translucent, consisting of liquid or snow particles encased with layers of ice. Hail is formed within the high tops of a well-organized thunderstorm. An updraft will sometimes throw rain droplets high up into the tops of a cloud, where the temperature is well below freezing. The droplet freezes, then falls and can become caught in another updraft. This time, a second coating of ice is added, making the hail stone larger. This cycle continues until the hailstone is too heavy to be lifted again and falls to the ground as hail. The stronger the updraft, the longer the hail develops and the bigger the hailstone is when it falls.

Hail is not to be confused with sleet, which consists of frozen raindrops that fall during winter storms. Hail can be smaller than a pea or as large as a softball and can be very destructive to plants, cars, homes, buildings and crops.

The development and maturation of hailstones are very complex processes. Numerous factors impact the resultant size of the hailstone including updraft strength, storm scale wind profile, height of the freezing level, and the mean temperature and relative humidity of downdraft air. The complexities of hail formation and sub-cloud processes make utilizing Doppler radar data to forecast the occurrence of large hail difficult. Verification of hail events is also important, but is a cumbersome process due to the limited temporal and spatial distribution of the event.

Large hailstones fall at speeds faster than 100 mph. Large falling balls of ice can be very dangerous. Large hail can do significant damage to automobiles, windows, roofs, crops and animals. When caught in a hailstorm, it is important to seek shelter immediately. Pets and livestock are particularly vulnerable to hail, and should be brought into a shelter.

HAZARD PROFILE

Hailstorms are generally localized and their impact is considered limited in Madison County since the injuries they cause are generally treatable with first aid, they shut down critical facilities and services for 24 hours or less, and less than ten percent of affected properties are destroyed or suffer major damage.

The location of hailstorms in Madison County can affect the entire planning area, since hailstorms do not follow a defined geographic border. The entire county and the cities of Madisonville, Midway, Normangee and North Zulch MUD may be impacted by a hailstorm.

The frequency of occurrence of hail in Madison County is highly likely, with an event probable in the next three years.

Most hailstorms occur during the spring (March, April and May) and the fall, during the month of September.

Warning time for hailstorms is generally minimal or no warning. The National Weather Service classifies a storm as severe if hail of ¾ of an inch in diameter (approximately the size of a penny) or greater is imminent based on radar intensities or observed by a spotter or other people.

The extent of hail in Madison County can range from ¾ of an inch up to 3.50 inches, which, according to the Tornado and Storm Research Organization (TORRO) Hailstorm Intensity Scale shown below, is classified as an H8 with softball size hailstorms. These hail storms can lead to severe damage to fruit and crops, the wholesale destruction of glass, damage to tiled roofs, and creates a risk of injuries to people not protected by shelter.

HAIL CHARACTERISTICS			
Size	**Equiv**	**Terminal velocity (mph)**	**Energy (ft-lbs)**
1/2"	-	35	.09
3/4"	dime	43	.44
1"	quarter	50	1.4
1.25"	halfdollar	56	4
1.5"	walnut	61	7
1.75"	golfball	66	14
2"	hen egg	72	24
2.25"	-	76	38
2.5"	tennis ball	80	57
2.75"	baseball	85	86
3"	tea cup	89	122
3.25"	-	93	173
3.5"	-	98	235
3.75"	-	102	314
4"	grapefruit	106	413
4.5"	softball	OUCH	OWIE

THE TORRO HAIL-SCALE		
CAT	**Equiv**	**Size**
H1	Green pea	.2-.4 inch
H2	Mothball	.4-.6 inch
H3	Marble	.6-.8 inch
H4	Walnut	.8-1.2 inch
H5	Golfball	1.3-1.8 inch
H6	Hen's Egg	1.9-2.4 inch
H7	Baseball	2.4-3.2 inch
H8	Softball	3.3-4.0 inch
H9	Melon	4.0-5.0 inch
H10	Coconut	>5 inch

HISTORY OF HAILSTORMS

Historical hail events with hailstone size one inch or greater are listed in Table 12-1 below. Table 12-2 aggregates historical hail events by county.

Table 12-1. Overall Historical Hail Impact by County (National Climatic Data Center), 1956-2012

Location or County	Date	Time	Type	Magnitude	Death	Injury	Property Damage	Crop Damage
Madison	5/25/1976	2020	Hail	3.50 in.	0	0	0	0
Madison	2/10/1981	0300	Hail	2.50 in.	0	0	0	0
Madison	5/9/1981	1445	Hail	1.00 in.	0	0	0	0
Madison	12/10/1983	1550	Hail	1.75 in.	0	0	0	0
Madison	1/24/1987	1915	Hail	0.87 in.	0	0	0	0
Madison	4/28/1989	1435	Hail	0.75 in.	0	0	0	0
North Zulch	5/18/1995	0226	Hail	1.75 in.	0	0	1K	0
North Zulch	5/18/1995	0226	Hail	1.75 in.	0	0	1K	0
North Zulch	5/27/1997	1854	Hail	1.25 in.	0	0	5K	0
Madisonville	5/27/1997	1855	Hail	0.75 in.	0	0	5K	0
Midway	10/25/1997	1647	Hail	1.75 in.	0	0	10K	0
Midway	2/27/1999	1610	Hail	1.75 in.	0	0	15K	0
Normangee	3/10/2000	1945	Hail	1.00 in.	0	0	10K	0
Madisonville	4/7/2000	2115	Hail	1.75 in.	0	0	50K	0
North Zulch	5/5/2000	1700	Hail	0.75 in.	0	0	10K	0
North Zulch	5/31/2001	1630	Hail	1.75 in.	0	0	5K	0
North Zulch	5/31/2001	1638	Hail	0.75 in.	0	0	2K	0
Normangee	2/19/2002	1230	Hail	0.75 in.	0	0	1K	0
Madisonville	12/23/2002	1705	Hail	1.75 in.	0	0	10K	0
Madisonville	12/23/2002	2010	Hail	1.75 in.	0	0	15K	0
Madisonville	12/23/2002	2020	Hail	1.75 in.	0	0	10K	0
North Zulch	3/25/2003	2230	Hail	0.75 in.	0	0	3K	0
Madisonville	5/16/2003	2040	Hail	0.75 in.	0	0	3K	0

Madisonville	5/16/2003	8:43 PM	Hail	1.75 in.	0	0	10K	0
Madisonville	5/16/2003	2047	Hail	2.75 in.	0	0	13K	0
Midway	5/16/2003	2047	Hail	2.75 in.	0	0	14K	0
Normangee	1/17/2004	1832	Hail	0.75 in.	0	0	1K	0
Madisonville	4/7/2004	1636	Hail	1.00 in.	0	0	2K	0
Madisonville	5/31/2004	2127	Hail	1.00 in.	0	0	7K	0
Midway	11/23/2004	1315	Hail	1.75 in.	0	0	10K	0
Madisonville	11/23/2004	2038	Hail	1.75 in.	0	0	10K	0
Midway	2/15/2008	2157	Hail	1.75 in.	0	0	0K	0K
Madisonville	3/27/2009	1243	Hail	0.88 in.	0	0	0K	0K
Madisonville	7/26/2009	1610	Hail	1.00 in.	0	0	2K	0K
Madisonville	8/25/2009	1701	Hail	0.88 in.	0	0	0K	0K
Midway	9/3/2009	1500	Hail	1.25 in.	0	0	8K	0K

Table 12-2. Overall Historical Hail Impact in Madison County (National Climatic Data Center)

Number of Events	Maximum Diameter (inches)
37	3.50

PEOPLE AND PROPERTY AT RISK

Because it cannot be predicted where hail may fall, all buildings and facilities are considered to be exposed to this hazard and could potentially be impacted, so estimated annualized losses cannot be broken down into further categories (residential, commercial, etc.). It is important to note that only hail that has been reported has been factored into this risk assessment. However, in the past 53 years it is likely that a higher number of occurrences have not been reported.

POTENTIAL DAMAGES AND LOSSES

To estimate losses due to hail, Madison County used NOAA historical hail loss data to develop a hail stochastic model. In this model:

- Losses were scaled to account for inflation;
- Average historic hail damageability was used to generate losses for historical hail events where losses were not reported;
- Expected annualized losses were calculated through a non-linear regression of historical data; and
- Probabilistic losses were scaled to account for would-be losses where no exposure/instrument was present at the time of the event.

Table 12-3 shows potential annualized losses in Madison County.

Table 12-3. Overall Historical Hail Impact in Madison County (National Climatic Data Center)

County	Annualized Expected Property Damage ($)
Madison	10,272

SECTION 13: THUNDERSTORMS

WHY THUNDERSTORMS ARE A THREAT

According to the National Weather Service (NWS), a thunderstorm occurs when an observer hears thunder, radar observers use the intensity of the radar echo to distinguish between rain showers and thunderstorms. Lightning detection networks routinely track cloud-to-ground flashes, and therefore thunderstorms. Thunderstorms form when clouds develop sufficient upward motion and are cold enough to provide the ingredients (ice and super-cooled water) to generate and separate electrical charges within the cloud. The cumulonimbus cloud is the perfect lightning and thunder factory, earning its nickname, "thunderhead."

Thunderstorms are like nature's heat pumps. At the very top of giant thunderstorms, air temperatures can sometimes drop to below -100 degrees Fahrenheit. Sometimes, on a hot summer day, this air originates near the ground at 100 degrees Fahrenheit. Thunderstorms carry the sun's energy from the surface into the cooler reaches of the atmosphere. Without this convective heat transport it is estimated that the mean temperature of the planet would increase by over 20 degrees Fahrenheit, making many areas uninhabitable.

By definition, the National Weather Service classifies a thunderstorm as severe if it contains hail of three-quarter inches or larger, and/or wind gusts of 58 mph or higher, and/or a tornado. Severe thunderstorm watches, meaning conditions are suitable for severe thunderstorm development during the next several hours, are issued for areas several hundred miles on a side by the National Weather Service Storm Prediction Center in Norman, Oklahoma. A severe thunderstorm warning is issued by the local NWS office, usually for a county or several counties over an hour or so, based on spotter reports or radar indications of conditions exceeding severe levels. If there is a distinct threat or actual observation of a tornado, a tornado warning is issued. Tornadic storms also produce hail, downbursts, and lightning.

HAZARD PROFILE

The severity of impact of thunderstorms in Madison County is considered to be limited since they generally result in injuries treatable with first aid, shut down critical facilities and services for 24 hours or less, and less than ten percent of affected properties are destroyed or suffer major damage.

The frequency of occurrence of thunderstorms in Madison County is highly likely, with an event probable in the next year.

Warning time for thunderstorms is generally minimal or no warning.

The extent of thunderstorm types in Madison County can be classified as a T-3 Heavy Thunderstorm, as described in the Thunderstorm Criteria Scale below.

Extreme Weather Madness
Thunderstorm Criteria

THUNDERSTORM TYPES	Rainfall Rate/hr	MAX WIND GUST	HAIL SIZE	PEAK TORNADO Possibility	LIGHTNING FREQUENCY (5 min Intervals)	Darkness Factor	STORM IMPACT
T-1 – Weak thunderstorms or Thundershowers	.03-.10	< 25 MPH	None	None	Only a few strikes during the storm.	Slightly Dark. Sunlight may be seen under the storm.	1. No damage. 2. Gusty winds at times.
T-2 – Moderate Thunderstorms.	.10"-.25"	25-40 MPH	None	None	Occasional 1-10	Moderately Dark. Heavy downpours may cause the need for car lights.	1. Heavy downpours. 2. Occasional lightning. 3. Gusty winds. 4. Very little damage. 5. Small tree branches may break 6. Lawn furniture moved around
T-3 – Heavy Thunderstorms 1. Singular or lines of storms.	.25"-.55"	40-57 MPH	1/4 " to ¾"	EF0	Occasional to Frequent 10-20	Dark. Car lights used. Visibility low in heavy rains. Cars may pull off the road.	1. Minor Damage. 2. Downpours that produce some flooding on streets. 3. Frequent lightning could cause house fires. 4. Hail occurs within the downpours. 5. Small branches are broken. 6. Shingles are blown off roofs.
T-4 – Intense Thunderstorms 1. Weaker supercells 2. Bow Echos or lines of Storms	.55" – 1.25"	58 to 70 MPH	1" to 1.5"	EF0 to EF2	Frequent 20-30	Very Dark. Car lights used. Some street lights come on..	1. Moderate Damage. 2. Heavy rains can cause flooding to streams and creeks. Roadway flooding. 3. Hail can cause dents on cars and cause crop damage. 3. Wind damage to trees and buildings. 4. Tornado damage. 5. Power outages
T-5 – Extreme Thunderstorms 1. Supercells with familty of tornadoes. 2. Derecho Windstorms	1.25" – 4"	Over 70 Mph	Over 1.5" to 4"	EF3 to EF5	Frequent to Continuous. > 30	Pitch Black, Street Lights come on. House lights maybe used	1. Severe Damage to Trees and Property. Damage is widespread. 2. Flooding rains. 3. Damaging hail. 4. Damaging wind gusts to trees and buildings. 5. Tornadoes F3-F5 or family of tornadoes can occur. Tornadoes can cause total devastation. 6. Widespread power outages.

The extent of thunderstorm high winds in Madison County can be classified as a Beaufort Number 6, based on the Beaufort Scale below.

Beaufort Scale

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

HISTORY OF THUNDERSTORMS

Historical thunderstorm events are detailed in Table 13-1. It is important to note that only thunderstorms that have been reported are recorded in these tables. It is likely that a higher number of occurrences have not been reported.

The frequency of thunderstorms (or probability of occurrence) is highly likely as indicated in Figure 13-1.

Table 13-1. Thunderstorms in Madison County

Type	Location	Date	Magnitude	Death	Injury	Property Damage	Crop Damage
Thunderstorm Winds	Madison	5/13/1980	52 kts.	0	0	0	0
Thunderstorm Winds	Madison	2/10/1981	0 kts.	0	0	0	0
Thunderstorm Winds	Madison	5/17/1982	0 kts.	0	0	0	0
Thunderstorm Winds	Madison	10/12/1984	0 kts.	0	0	0	0
Thunderstorm Winds	Madison	12/13/1984	0 kts.	0	0	0	0
Thunderstorm Winds	Madison	12/13/1984	0 kts.	0	0	0	0
Thunderstorm Winds	Madison	8/13/1985	0 kts.	0	0	0	0
Thunderstorm Winds	Madison	8/2/1988	0 kts.	0	0	0	0
Thunderstorm Winds	Madison	5/5/1989	0 kts.	0	0	0	0
Thunderstorm Winds	Madison	6/7/1989	0 kts.	0	0	0	0
Thunderstorm Winds	Madison	8/2/1992	0 kts.	0	0	0	0
Thunderstorm Winds	Madison	3/7/1995	0 kts.	0	0	0	0
Thunderstorm Winds	Madison	3/7/1995	0 kts.	0	0	3K	0
Thunderstorm Winds	Madison	5/18/1995	0 kts.	0	0	2K	0
Thunderstorm Winds	Madison	5/18/1995	0 kts.	0	0	2K	0
Thunderstorm Winds	Madison	9/12/1995	0 kts.	0	0	50K	0

Type	Location	Date	Magnitude	Death	Injury	Property Damage	Crop Damage
Thunderstorm Winds	Madisonville	11/10/1995	0 kts.	0	0	3K	0
Thunderstorm Winds	Central Portion	9/3/1996	0 kts.	0	0	5K	0
Thunderstorm Winds	North Zulch	9/18/1996	0 kts.	0	0	5K	0
Thunderstorm Winds	Midway	11/7/1996	0 kts.	0	0	30K	0
Thunderstorm Winds	Midway	5/30/1997	0 kts.	0	0	5K	0
Thunderstorm Winds	Madisonville	6/22/1997	0 kts.	0	0	5K	0
Thunderstorm Winds	Normangee	2/26/1998	0 kts.	0	0	5K	0
Thunderstorm Winds / Hail	Madisonville	7/17/1998	0 kts.	0	0	5K	0
Thunderstorm Winds	Midway	8/5/1998	0 kts.	0	0	15K	0
Thunderstorm Winds	Madisonville	8/12/1998	0 kts.	0	0	3K	0
Thunderstorm Winds	Madisonville	3/26/2000	0 kts.	0	0	25K	0
Thunderstorm Winds	Madisonville	5/5/2000	0 kts.	0	0	15K	0
Thunderstorm Winds	Madisonville	11/5/2000	0 kts.	0	0	25K	0
Thunderstorm Winds	Madisonville	5/6/2001	0 kts.	0	0	5K	0
Thunderstorm Winds	Madisonville	5/28/2001	0 kts.	0	0	3K	0
Thunderstorm Winds	Countywide	10/13/2001	0 kts.	0	0	10K	0

Type	Location	Date	Magnitude	Death	Injury	Property Damage	Crop Damage
Thunderstorm Winds	North Zulch	3/19/2002	0 kts.	0	0	10K	0
Thunderstorm Winds	Madisonville	6/29/2002	0 kts.	0	0	3K	0
Thunderstorm Winds	Normangee	7/7/2002	0 kts.	0	0	3K	0
Thunderstorm Winds	Madisonville	7/8/2002	0 kts.	0	0	5K	0
Thunderstorm Winds	Madisonville	7/8/2002	0 kts.	0	0	15K	0
Thunderstorm Winds	Madisonville	5/1/2003	52 kts.	0	0	10K	0
Thunderstorm Winds	Madisonville	5/16/2003	55 kts.	0	0	5K	0
Thunderstorm Winds	Madisonville	6/12/2003	53 kts.	0	0	3K	0
Thunderstorm Winds	Madiosnville	5/11/2004	60 kts.	0	0	10K	0
Thunderstorm Winds	North Zulch	5/13/2004	55 kts.	0	0	15K	0
Thunderstorm Winds	Midway	5/13/2004	55 kts.	0	0	5K	0
Thunderstorm Winds	Madisonville	5/31/2004	55 kts.	0	0	20K	0
Thunderstorm Winds	North Zulch	6/2/2004	50 kts.	0	0	10K	0
Thunderstorm Winds	North Zulch	7/1/2005	51 kts.	0	0	4K	0
Thunderstorm Winds	Madisonville	8/17/2006	52 kts.	0	0	2K	0
Thunderstorm Winds	Madisonville	4/13/2007	50 kts.	0	0	1K	0K

Type	Location	Date	Magnitude	Death	Injury	Property Damage	Crop Damage
Thunderstorm Winds	Madisonville	5/1/2007	50 kts.	0	0	0K	0K
Thunderstorm Winds	Normangee	5/2/2007	55 kts.	0	0	0K	0K
Thunderstorm Winds	North Zulch	12/15/2007	52 kts.	0	0	0K	2K
Thunderstorm Winds	North Zulch	5/14/2008	56 kts.	0	0	0K	0K
Thunderstorm Winds	Madisonville	5/14/2008	56 kts.	0	0	6K	0K
Thunderstorm Winds	Connor	5/27/2008	53 kts.	0	0	3K	0K
Thunderstorm Winds	Connor	5/3/2009	55 kts.	0	0	2K	0K
Thunderstorm Winds	Midway	5/3/2009	55 kts.	0	0	3K	0K
Thunderstorm Winds	Madisonville	7/26/2009	61 kts.	0	0	5K	0K
Thunderstorm Winds	Madisonville	7/26/2009	70 kts.	0	3	500K	0K
Thunderstorm Winds	Madisonville	7/26/2009	70 kts.	0	0	25K	0K
Thunderstorm Winds	Madisonville	7/26/2009	70 kts.	0	0	0K	0K
Thunderstorm Winds	Madisonville	8/25/2009	53 kts.	0	0	5K	0K
Thunderstorm Winds	Midway	9/3/2009	50 kts.	0	0	4K	0K

People and Property at Risk

There is no defined geographic boundary for thunderstorm events. Thunderstorms usually impact large geographical areas; thus, all the population, buildings, critical facilities, infrastructure and lifelines, and hazardous materials facilities are considered exposed to the hazard and could potentially be impacted.

Potential Damages and Losses

Table 13-2 presents annualized expected property losses by county. To estimate thunderstorm losses, National Oceanic and Atmospheric Administration historical thunderstorm loss data was used to develop a thunderstorm stochastic model. In this model:

- Losses were scaled to account for inflation;
- Average historic thunderstorm damageability was used to generate losses for historical thunderstorm events where losses were not reported;
- Expected annualized losses were calculated through a non-linear regression of historical data; and
- Probabilistic losses were scaled to account for would-be losses where no exposure/instrument was present at the time of the event.

Table 13-2. Potential Annualized Losses to Thunderstorms in Madison County

County	Annualized Expected Property Losses ($)
Madison	78,873

SECTION 14: DAM FAILURE

WHY DAM FAILURE IS A THREAT

Dams are water storage, control, or diversion barriers that impound water upstream in reservoirs. Dams provide many benefits and are an important part of our public works infrastructure. They are built for a variety of reasons, including maintenance of lake levels, flood control, power production, and water supply.

Although dams have many benefits, the risk that a dam could fail still exists. Dams can pose a risk to communities if not designed, operated and maintained properly. Dam failure is a collapse or breach in the structure. While most dams have storage volumes small enough that failures have little or no repercussions, dams with large storage 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 flows;
- Internal erosion caused by embankment or foundation leakage or piping;
- Improper maintenance, including failure to remove trees, repair internal problems, or maintain gates, valves, and other operational components;
- Improper design, such as 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;
- Earthquakes, which typically cause longitudinal cracks at the tops of the embankments, leading to structural failure.

The nation's infrastructure of dams is aging. Old age and neglect can intensify vulnerability to these same influences. Furthermore, the terrorist attacks of September 11, 2001, have brought an increased focus on infrastructure protection nationwide, including the safety of dams.

Dam failures may result in the quick release of all the water in the lake. 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 great property damage downstream of the dam.

HAZARD PROFILE

The frequency of occurrence of a major dam failure in Madison County is an unlikely event, with an event possible in the next ten years. If a major dam should fail, however, the severity of

impact could be major; it may result in injuries or illnesses that result in permanent disability, complete shutdown of critical facilities for at least two weeks, or more than 25 percent of property destroyed or with major damage.

The extent of a major dam failure in Madison County is that several thousand gallons of water could be released at a sudden and unexpected rate. Over 100 people could be affected, 150 buildings could be flooded and several million dollars in damages could occur.

Flooding-related dam failure would most likely occur in months when floods are most likely -- during the spring (April, May and June) and fall (October, November, and December). Warning time for dam failure, or the potential speed of onset, varies with the causes but is estimated to be three to six hours.

There are about 80,000 dams in the United States today. Catastrophic dam failures have occurred frequently throughout the past century. Between 1918 and 1958, 33 major dam failures in the United States caused 1,680 deaths—an average of 42 deaths a year. From 1959 to 1965, nine major dams failed worldwide.

LOCATION OF HAZARDOUS AREAS

It is assumed that dam breaks happens most likely at the time of maximum capacity of the lake and that the location of the released water would inundate a downstream quarter-circle buffer proportional to the maximum capacity of the dam to represent the maximum impact area.

As part of an extensive Town Branch Dam Breach Study, the two dams at Town Branch near the City of Madisonville have prepared detailed inundation maps. The information from the study is kept at the offices of the local Emergency Operations Center (EOC). Spreadsheets containing locations and coordinates, as well as contact information for dam operators is also maintained in the EOC.

Figure 14-1 on the following pages shows the possible inundation areas for Town Branch Dam.

A map for Crescent Lake Dam is also shown in Figure 14-1. The lake is located between West Crescent Street and East Crescent Street in the northwest portion of Madisonville. If the dam were to fail, water would flow northwest from the lake into rural areas and is not expected to impact many structures.

The cities of Midway, Normangee and North Zulch MUD are not located near any lake or dam, and therefore, do not have any vulnerabilities to dam failures. Therefore, these communities will not present mitigation actions for dam failure in Section 17 of this plan.

Figure 14-1. Possible Inundation Areas for Town Branch Dam

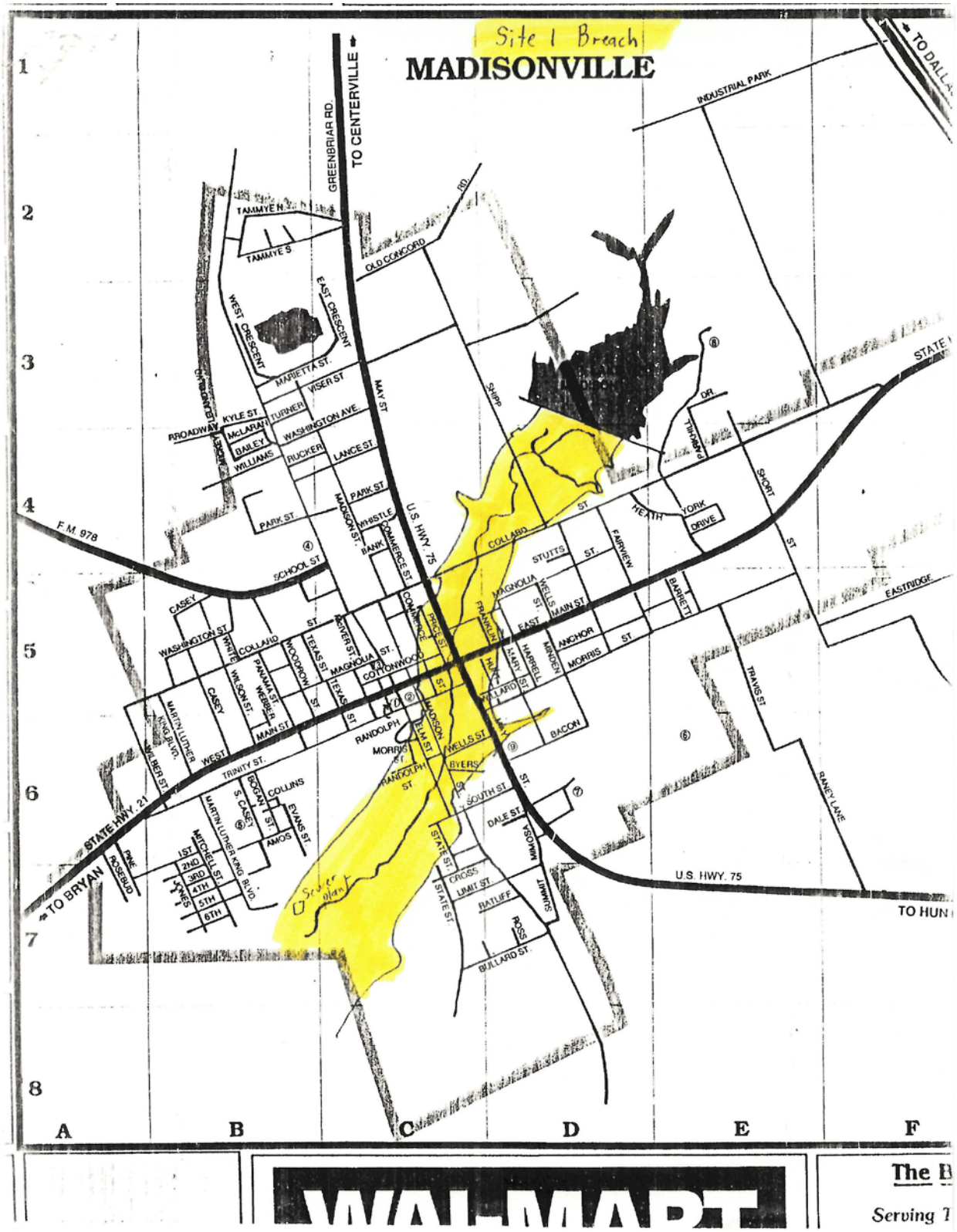


Figure 14-1. Possible Inundation Areas for Town Branch Dam

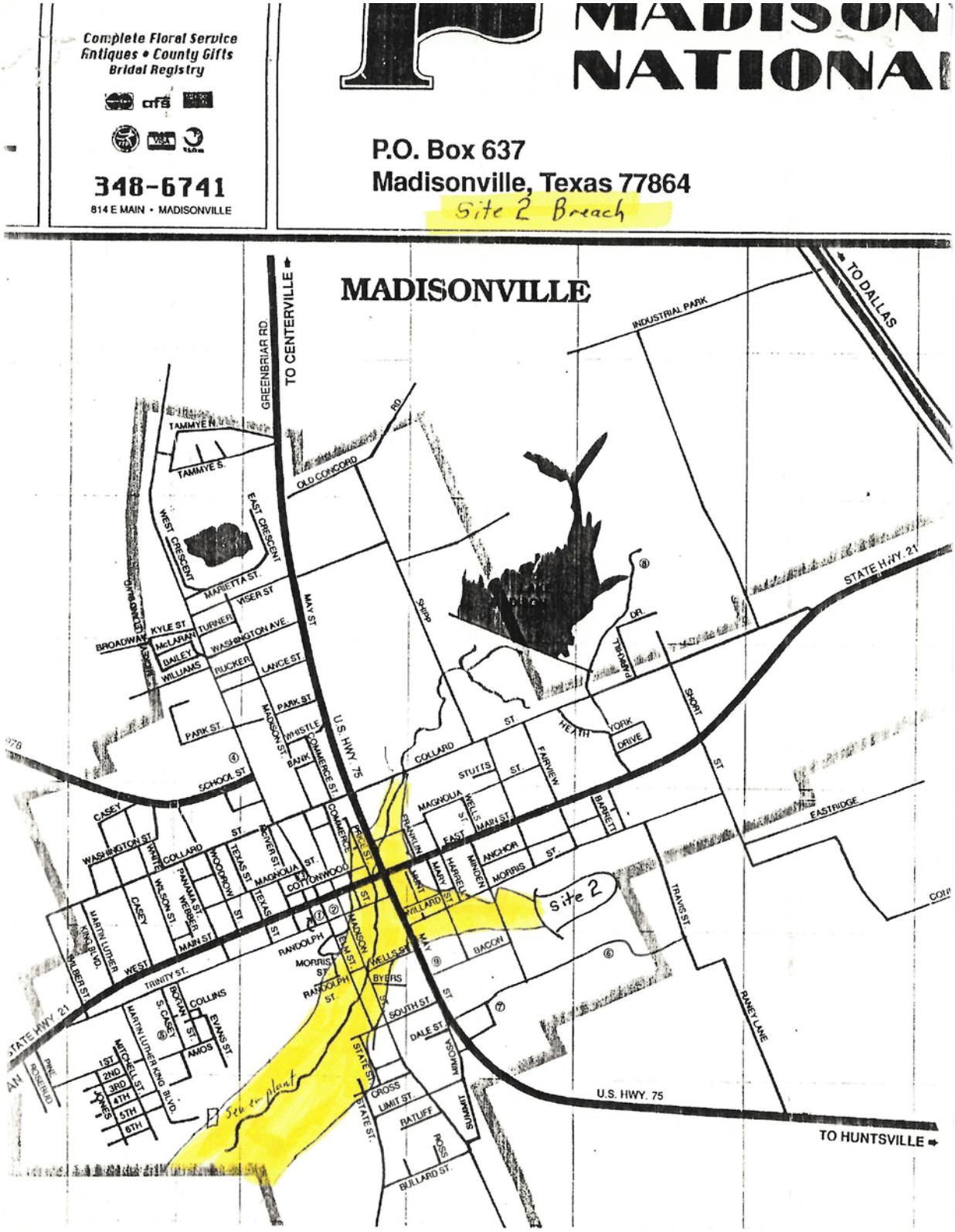


Figure 14-1. Possible Inundation Areas for Town Branch Dams and Crescent Lake Dam

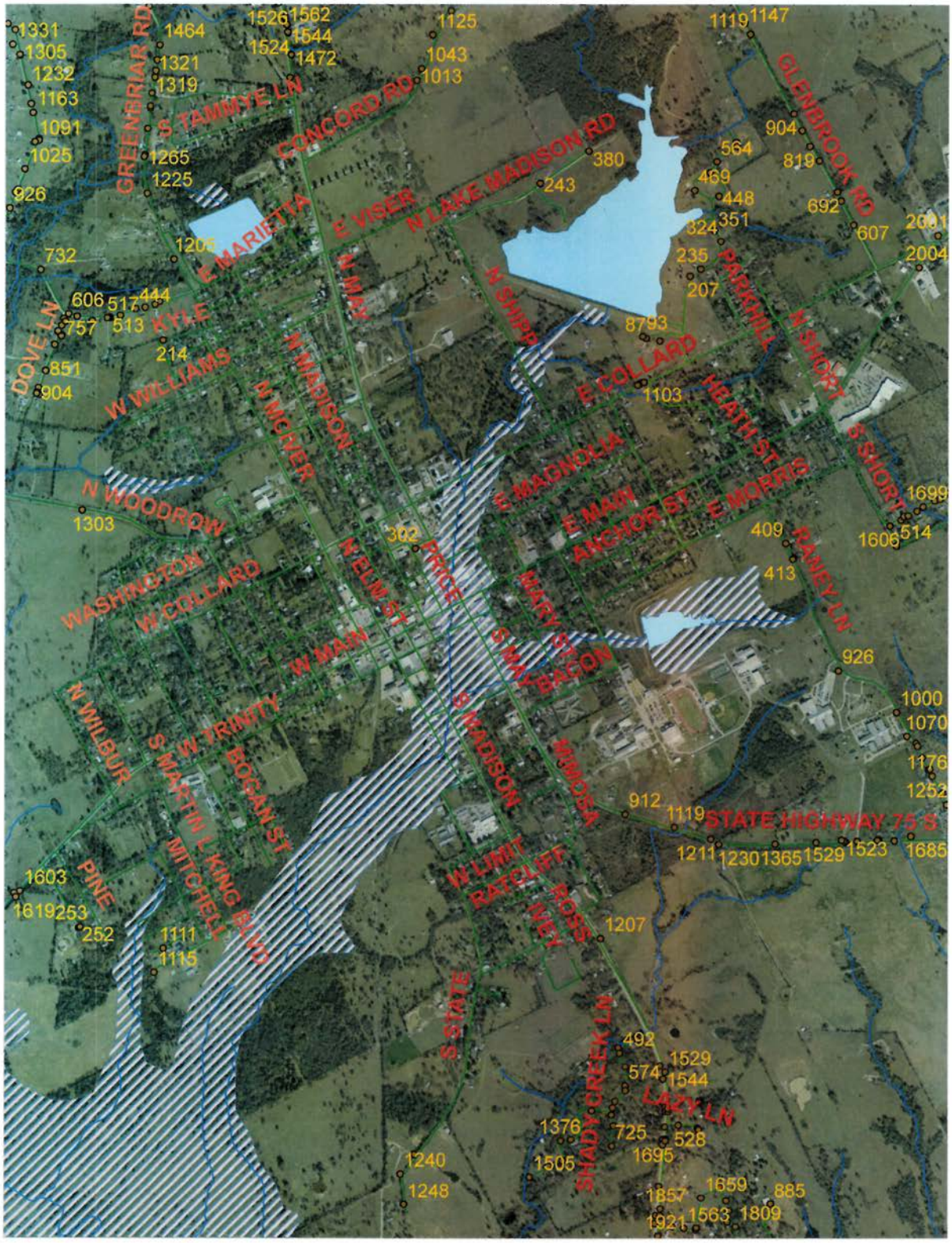


Figure 14-1. Possible Inundation Areas for Town Branch Dam Site 1

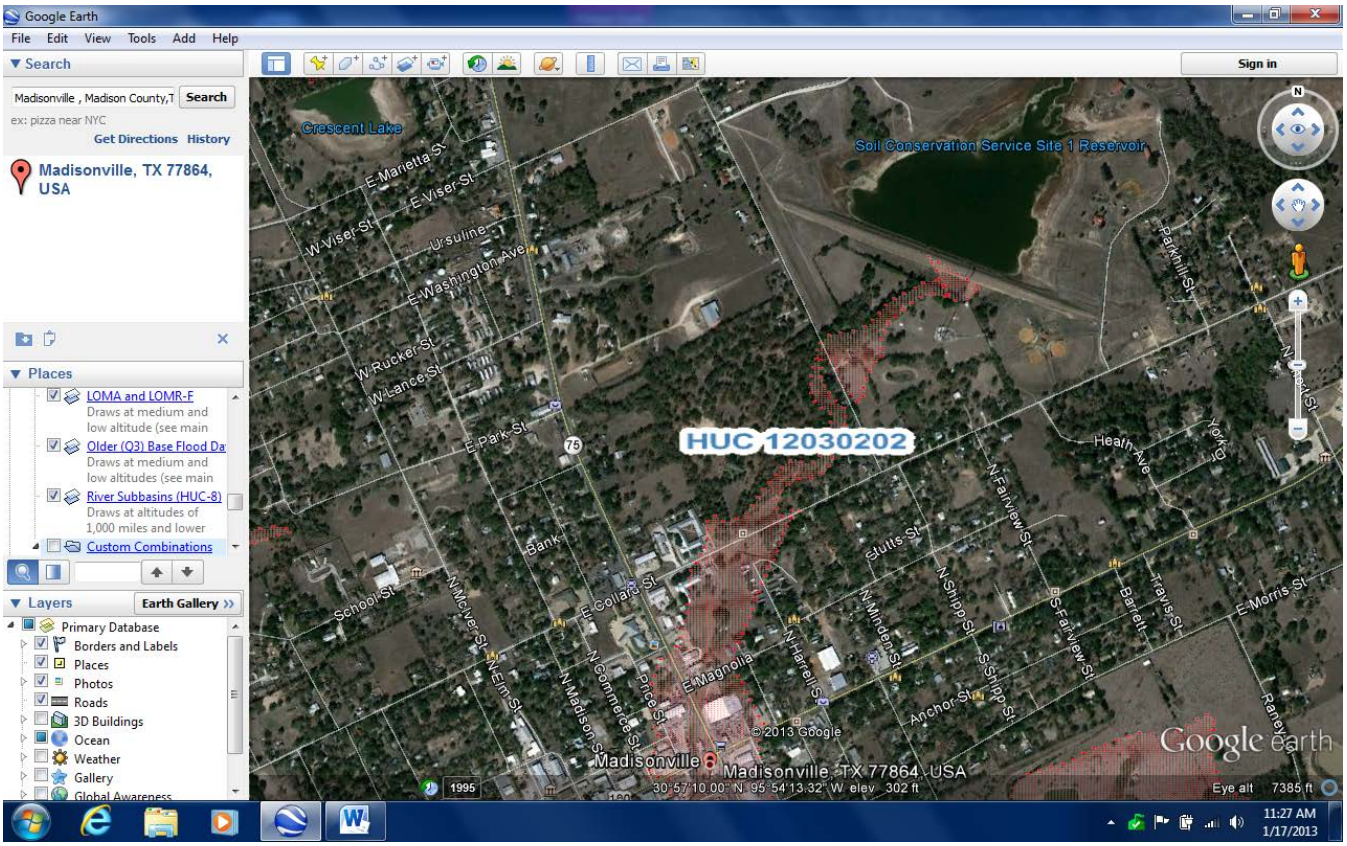


Figure 14-1. Possible Inundation Areas for Town Branch Dam Site 2

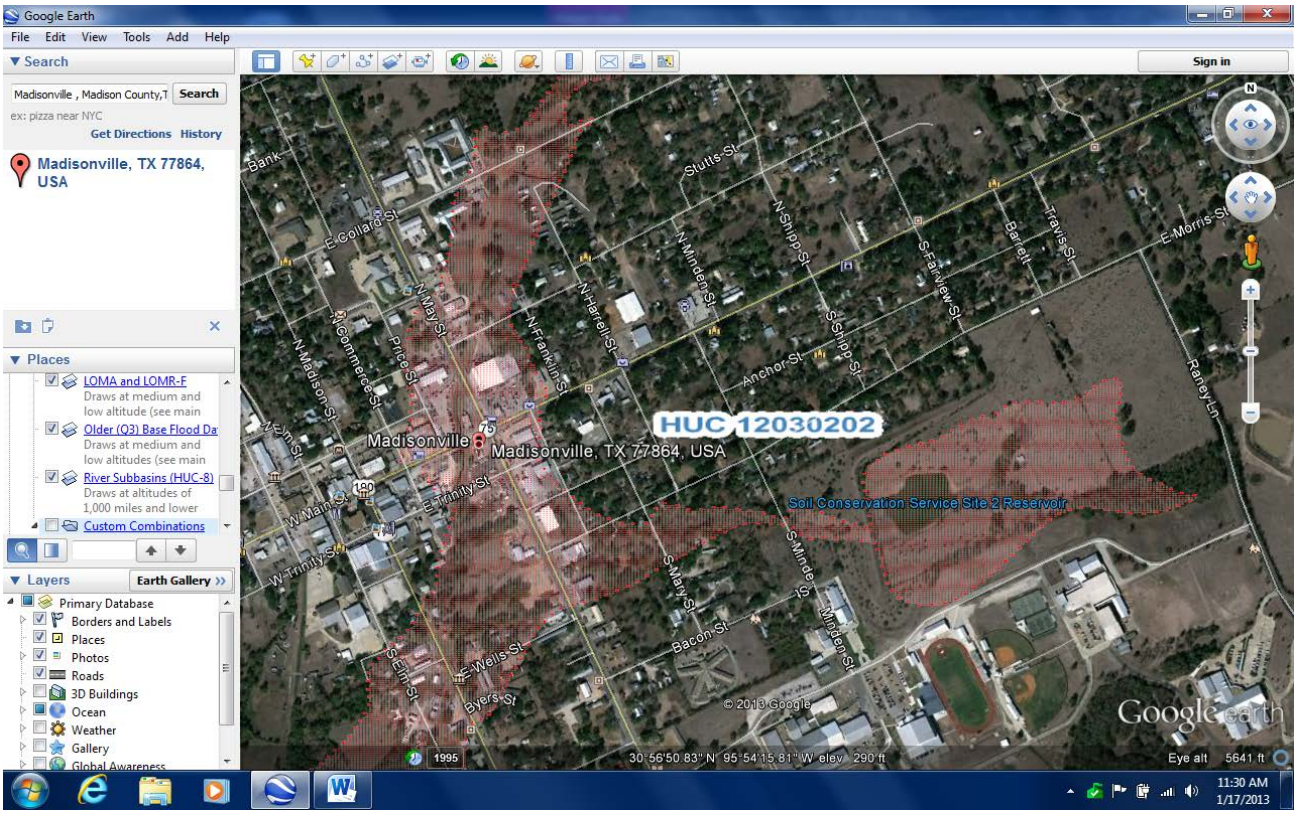
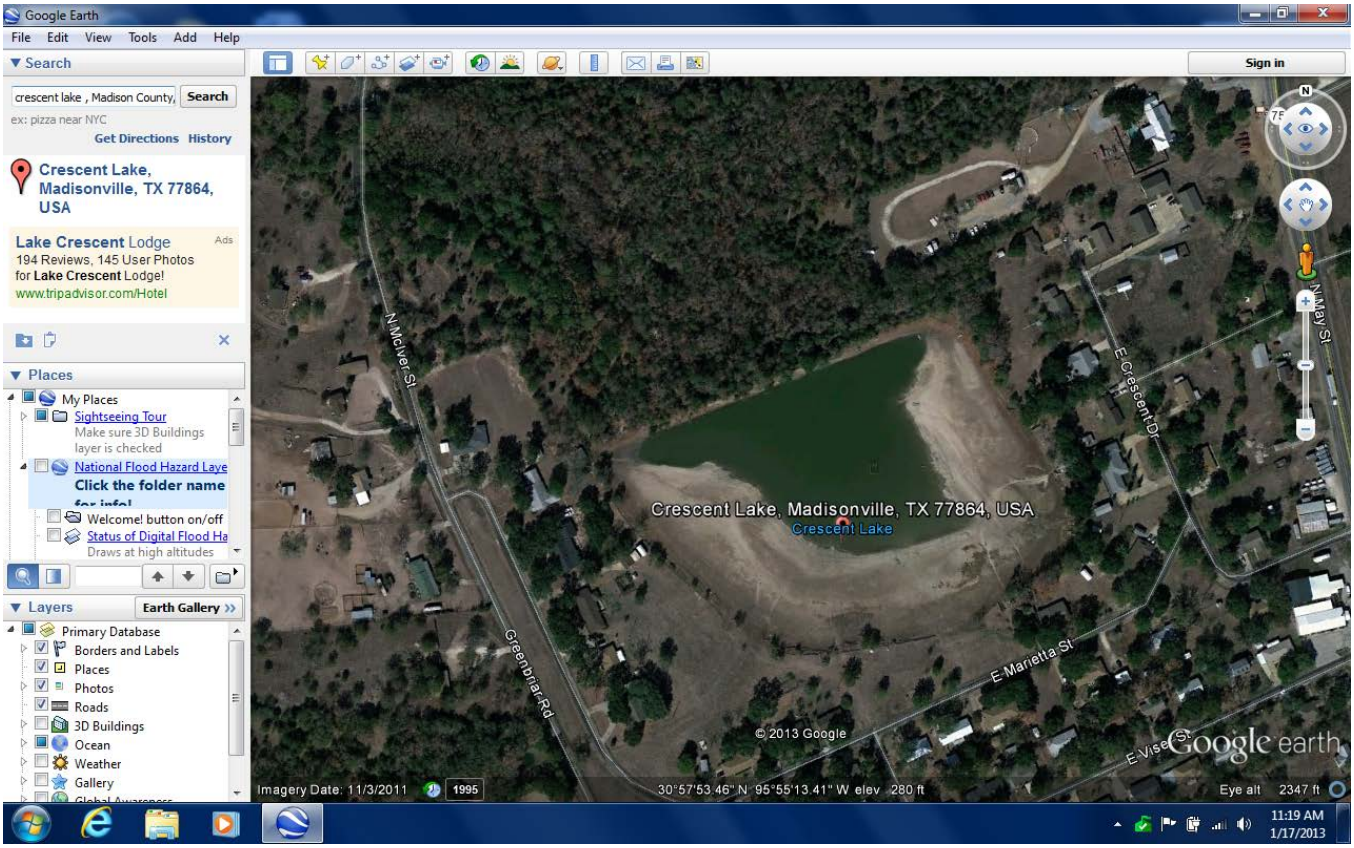


Figure 14-1. Map of Crescent Lake



Crescent Lake is located between West Crescent Street and East Crescent Street in the northwest portion of Madisonville. If the dam were to fail, water would flow northwest from the lake into rural areas and is not expected to impact many structures.

PEOPLE AND PROPERTY AT RISK

High-hazard-potential dams are those at which failure or misoperation would probably cause loss of human life. Significant-hazard-potential dams are those at which failure or misoperation probably would not result in loss of human life but could cause economic loss, environmental damage, disruption of lifeline facilities, or other significant damage. Significant-hazard-potential dams often are located in predominantly rural or agricultural areas but could be located in populated areas having significant infrastructure. Low-hazard-potential dams are those at which failure or misoperation 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.

Table 14-1. Dam Failure Hazard-Potential Classifications, National Inventory of Dams

Hazard Potential Classification	Loss of Human Life	Economic, Environmental, and Lifeline Losses
Low	None expected	Low and generally limited to owner
Significant	None expected	Yes
High	Probable. One or more expected	Yes (but not necessary for this classification)

The State of Texas has 7,413 dams, all regulated by the Texas Commission of Environmental Quality. Of these, 854 are considered "high-hazard," 779 are considered "significant-hazard," and 5,780 are considered "low-hazard." See Table 14-2.

Table 14-2. Summary Status of Texas Dams

State-Regulated Dams			
Total	High Hazard	Significant Hazard	Low Hazard
7,413	854	779	5,780

The National Inventory of Dams maintained by the Federal Emergency Management Agency lists 25 dams in Madison County. Of these, 22 are considered "low hazard," 1 is considered a "significant hazard," and 2 are considered "high hazard." Table 14.3 shows the number of high, significant, and low-hazard dams in Madison County according to the National Inventory of Dams. Table 14.4 lists each dam and rating, followed by possible number of people and structures impacted in the case of dam failure.

Table 14-3. Summary Status of Dams in Madison County

High	Significant	Low	Undetermined	Total
2	1	22	0	25

Table 14-4. Hazard Ratings and Impact of Dams in Madison County

Dam	Hazard Rating	People Impacted	Structures Impacted	Potential Depth of Water
Town Branch Ws Scs Site 1 Dam	High	110	48	Up to 10 feet deep
Town Branch Ws Scs Site 2 Dam	High	39	27	Up to 6 feet deep
Crescent Lake Dam	Significant	2	2	Up to 1 foot deep

POTENTIAL DAMAGES AND LOSSES

Table 14-5 shows the risk to people and buildings of failure of high-hazard dams in Madison County. HAZUS-MH inventory was used to estimate potential exposure, losses, and affected population due to dam failure. There have been no previous occurrences of dam failure at high hazard dams in the Madison County.

Table 14-5. Exposure of People and Buildings to Failure of High-Hazard Dams in Madison County

Affected		
Exposure		Number of People at Risk
Number of Buildings	Value ($1,000)	
77	859	151

WHY EXCESSIVE HEAT IS A THREAT

Texas is known for its long hot summers. These conditions can pose problems for those not accustomed to the climate or who are outside for prolonged periods of time. Excessive heat is defined as temperatures that hover 10 degrees or more above the high average temperature for a particular region and last for several weeks.

Excessive heat can pose a threat even to individuals and communities that are accustomed to high temperatures. Heat disorders can occur when victims are overexposed to heat or have over-exercised for their age and physical condition. Heat kills by pushing the body beyond its limits. Under normal conditions an internal thermostat produces perspiration that evaporates and cools the body. In excessive heat and high humidity, however, evaporation is slowed, and the body must work extra hard to maintain a normal temperature.

Excessive heat kills more people nationally than any other natural disaster. According to the Center for Climatic Research at the University of Delaware, an average of 1,500 American city dwellers die every year from the effects of excessive heat. Elderly residents, young children, those who are overweight, and people suffering from serious illnesses are especially prone to heat-related problems. According to the Federal Emergency Management Agency, between 1936 and 1975, nearly 20,000 people succumbed to the effects of heat and radiation from the sun. Excessive heat disorders include sunburn, heat cramps, heat exhaustion, and heat stroke. Heat stroke is a severe medical emergency.

Table 15-1. Urban Heat Deaths

City	Duration of heat wave	Heat-related deaths	% increase in deaths over norm
Chicago	7 days in 1995	739	147
New York	7 days in 1972	891	62
Los Angeles	9 days in 1955	946	122
Kansas City	1 month in 1980	236	65
St. Louis	1 month in 1980	308	57

According to the National Aeronautical and Space Administration, recent years have seen record-breaking temperatures. 1998 was the hottest year on record; 2002 was the second-warmest year on record; and 2009 was the third-warmest year on record.

HAZARD PROFILE

Excessive heat waves usually come on subtly, raising summer temperatures higher than normal, leaving casualties in their wake. Excessive heat can have a major impact, causing multiple deaths, but sparing property. With excessive heat, there is normally insignificant physical destruction; although the possibility exists for roads to buckle, trains to derail, and livestock may die depending on the duration and severity.

The frequency of occurrence of excessive heat in Madison County is likely, with an event probable in the next year. There are seasonal patterns to excessive heat waves, with an event most likely to occur in the summer months. Warning time is long with a slow speed of onset.

Excessive heat can also cause utility outages due to an increased demand for electricity. Utility outages can severely cripple a city's ability to provide services. Facilities can become inoperable and have to be closed without power or water.

The University of Delaware's Center for Climatic Research has a warning system for excessive heat events. Local warning systems that may be utilized for excessive heat events include local television and radio stations and the Internet.

HISTORY OF EXCESSIVE HEAT IN MADISON COUNTY

Table 15-2. Historical Excessive Heat Events

Type	Date	Magnitude	Death	Injury	Property Damage	Crop Damage	Notes
Heat Wave	7/21/1995	N/A	0	0	0	0	Entire county affected
Excessive Heat	6/26/1999	N/A	0	0	0	0	Entire county affected
Excessive Heat	8/1/1999	N/A	0	0	0	0	Entire county affected
Excessive Heat	7/6/2000	N/A	0	0	0	0	Entire county affected
Excessive Heat	8/29/2000	N/A	0	0	0	0	Entire county affected
Excessive Heat	9/1/2000	N/A	0	0	0	0	Entire county affected
Heat	6/24/2009	N/A	0	0	0K	0K	Entire county affected attributed to the heat, but data not specific

							on location
Excessive Heat	8/1/2011	NA	0	0	TBD	TBD	Entire County Affected by excessive heat during the summer of 2011, with August being the most severe month.

LOCATION OF HAZARDOUS AREAS

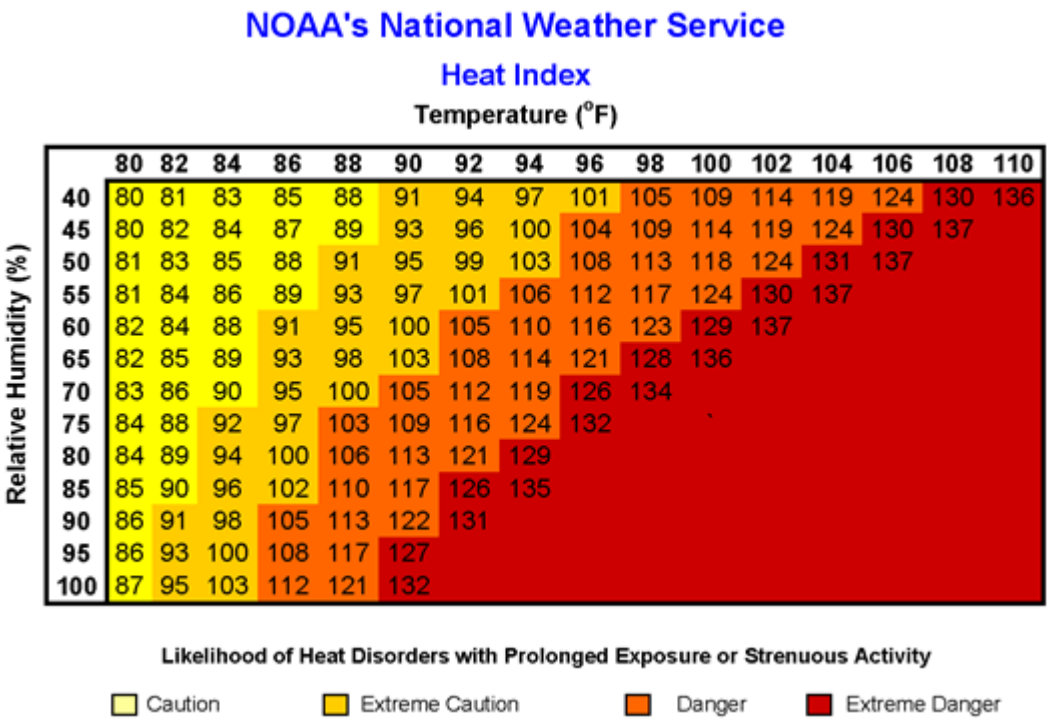
The entire area of Madison County and the participating jurisdictions is subject to excessive heat.

PEOPLE AND PROPERTY AT RISK

The entire population of Madison County is at risk from excessive heat, but those at highest risk are the poor, the elderly, those who live alone, and those who lack access to transportation and air-conditioning. People living in urban areas may be at greater risk from the effects of a prolonged heat wave than people living in rural regions.

The extent of excessive heat in Madison County can be temperatures above 100 degrees for several days or weeks in a row. During the summer of 2011, temperatures above 100 degrees were recorded for over 30 days in Madison County.

Based on the Heat Index Chart located on page 103, the extent of excessive heat in Madison County can be placed in the Danger Range when the conditions are present of high temperatures and high relative humidity.



POTENTIAL DAMAGES AND LOSSES

Potential dollar loss estimates for excessive heat are not available. The potential impact of excessive heat on Madison County is the possible deaths of the poor, the elderly, those who live alone, and those who lack access to transportation and air-conditioning.

SECTION 16: OTHER MITIGATION ACTIONS

FEDERAL EMERGENCY MANAGEMENT AGENCY PROGRAMS

The effectiveness of previously implemented hazard mitigation measures was examined as part of the hazard mitigation planning process. The effectiveness of each previously implemented mitigation program was evaluated based on its effect on overall risk to life and property, ease of implementation and political and community support.

A total of 6 Presidential and Small Business Administration Disaster Declarations have been issued since 1965 for Madison County, paving the way for assistance by the Federal Emergency Management Agency (FEMA) and other federal agencies. FEMA's Individual Assistance Program helps disaster victims to secure temporary housing, low-interest loans, unemployment assistance, and legal aid; makes grants to low-income individuals; conducts crisis counseling; and assists victims with income tax, Social Security, and veteran's benefits issues.

"Public Assistance" is aid to state or local governments and certain private non-profit entities to pay part of the approved costs (generally 75 percent) of rebuilding a community's damaged infrastructure. Public assistance may include debris removal; emergency protective measures; repair, replacement, or restoration of damaged public property; loans needed by communities to restore essential government functions; and grants for public schools.

Through the Hazard Mitigation Grant Program (HMGP), FEMA has financially helped the state to permanently reduce or eliminate future damages and losses due to natural hazards. HMGP funds promote safer building practices that improve existing structures and supporting infrastructure. The HMGP currently provides post-disaster funds, which can be used anywhere in the state, equal to 7.5 percent of obligations for individual and public assistance. Grants are for planning and projects, including acquisition of real property, relocation and demolition of structures, seismic retrofitting, strengthening of existing structures, initial implementation of vegetative management programs, elevation of residential structures, elevation or dry flood-proofing of non-residential structures, and other activities that bring a structure into compliance with the floodplain management requirements of the NFIP. A review of the state's HMGP records reveals no hazard mitigation projects conducted within Madison County. There were also no Project Impact, Pre-Disaster Mitigation, or Hurricane Property Protection Mitigation Projects.

PREVIOUS PLANNING EFFORTS

A number of jurisdictions in Madison County have also undertaken previous planning efforts that have complemented the region-wide planning conducted during the development of this Hazard Mitigation Action Plan. These other related planning efforts include development of hazard analyses, Annex P, comprehensive plans, capital improvement plans, drainage and stormwater plans, long-range growth plans and flood mitigation plans. Table 16-1 details these previous planning efforts.

Table 16-1. Previous Planning Efforts for Madison County Jurisdictions

Jurisdiction	Received EM Grant Funds? Y(es), N(o)	Planning Documents Completed for State Department of Emergency Management		Other Planning Efforts Undertaken (list)
		Basic Plan	Annexes*	
Madison County	Y	Y	All	Dept. of Justice terrorism vulnerability assessment
City of Madisonville	Y	Y	All	
City of Midway	Y	Y	All	

* Annexes

- Annex A Warning
- Annex B Communications
- Annex C Shelter and Mass Care
- Annex D Radiological Protection
- Annex E Evacuation
- Annex F Firefighting and Fire/Rescue
- Annex G Law Enforcement
- Annex H Health and Medical Services
- Annex I Emergency Public Information
- Annex J Damage Assessment/Recovery
- Annex K Public Works and Engineering
- Annex L Utilities
- Annex M Resource Management
- Annex N Direction and Control
- Annex O Human Services
- Annex P Hazard Mitigation
- Annex Q Hazardous Materials and Oil Spill Response
- Annex R Search and Rescue
- Annex S Transport
- Annex T Donations Management
- Annex U Legal
- Annex V Terrorist Incident Response

BUILDING AND FIRE CODES

Building codes are laws, ordinances, or government regulations that set forth standards and requirements for the construction, maintenance, operation, occupancy, use, or appearance of buildings, premises, and dwelling units. Building codes are an effective way to ensure that

development is built to withstand natural hazards. Building codes apply primarily to new construction.

Adherence to existing building codes and standards is essential to maintain public safety and promote an effective local mitigation program—so much so that the insurance industry has moved to rate communities according to their ability to enforce the building code and by the qualifications and training of their staff.

There are four principal types of building codes, promulgated by various code organizations:

- Uniform Building Code, promulgated by the International Conference of Building officials (ICBO),
- National Building Code, promulgated by the Building Officials and Code Administrators International, Inc. (BOCA),
- Standard Building Code, promulgated by the Southern Building Code Congress, International (SBCCI), and
- International Building Codes, promulgated by the International Code Council (ICC).

The building codes are periodically reviewed by the respective organizations and revised, as appropriate, when new requirements and materials are introduced. In the past, local governments have adopted these codes either in their entirety or as amended to adapt them to their local conditions. Legislation passed by the Texas Legislature in 2001, however, now requires communities to adopt the International Building Code.

Table 16-2 shows the effective date of each jurisdiction's building code, the name of the code, the type of code on which it is based, and whether any amendments have been made.

Table 16-2. Building Codes for Madison County jurisdictions

Jurisdiction	Current Building Code							
	Effective Date	Name	Type					Amendments made (Y /N)
			UBC	NBC	SBC	IBC	Other	
Madison County	NA							
City of Madisonville	September 1993; amended November 1999	Southern Building Code; at present, National Building Code		X				N
City of Midway	NA							

FIRE CODES

Fire codes are laws, ordinances, or government regulations that set forth standards and requirements for the construction, maintenance, operation, occupancy, use, or appearance of buildings, premises, and dwelling units in order to prevent damage and loss of life from fire hazards.

There are three principal types of fire codes, promulgated by various code organizations. They are:

- Uniform Fire Code (UFC), published by the International Fire Code Institute,
- International Fire Code (IFC), published by the International Code Council, and
- Standard Fire Code (SFC), published by the SBCC.

The fire codes are periodically reviewed and revised by the relevant organizations, as appropriate, when new requirements and materials are introduced. Local governments have adopted these codes either in their entirety or amended them as appropriate to their local conditions.

Table 16-3 shows the effective date of each jurisdiction's fire code, the name of the code, the type of code on which it is based, and whether any amendments have been made.

Table 16-3. Fire Codes of Madison County Jurisdictions

Jurisdiction	Current Fire Code					
	Effective Date	Name	Type			
			UFC	IFC	SFC	Other
Madison County	NA					
City of Madisonville	September 1993; amended November 1993	International Fire Code		X		
Midway	NA					

INSPECTION AND PERMITTING PROCESSES

Adherence to existing building and fire codes and standards is essential to maintaining public safety and promoting an effective local mitigation program. New buildings can fail in a disaster if builders or inspectors do not adequately observe the code. Studies of the damage caused by

Hurricane Andrew in 1992 attributed one-quarter of the storm's total damages to "shoddy workmanship and poor enforcement of building codes."

Well-trained inspectors are more likely to recognize building practices that are suspect with regard to hazard resilience than are poorly trained or untrained inspectors. Training is critical to the inspection and permitting process.

Table 16-4 shows the number of building inspectors and their average years of experience in each jurisdiction and, of those, the number certified. It also shows the number of building starts and inspections conducted in the last twelve months.

Table 16-4. Building Inspections and Permitting for Madison County jurisdictions

Jurisdiction	Number of:				
	Building Inspectors (FTEs)	Inspectors Certified	Yrs. Experience (Average)	Building Starts (last 12 months)	Inspections (last 12 months)
Madison County	NA				
City of Madisonville	1	1	1	25	25
City of Midway	NA				

A vigorous fire inspection process and well-trained inspectors are critical to saving lives and property from fire hazards. Table 16-5 below shows the number of fire inspectors in each jurisdiction and their average years of experience. It also gives the number certified and number having received the Texas State Certification course.

Table 16-5. Fire Inspections and Permitting

Jurisdiction	Fire Inspectors (FTEs)	Fire Inspectors Certified	Completed State Cert. Course	Years Experience (Average)	Inspecttons (last 12 months)
Madison County	NA				
City of Madisonville	Volunteers only	1	TEEX certification	10	15
City of Midway	NA				

BUILDING CODE EFFECTIVENESS GRADING SCHEDULES AND FIRE RATINGS

The Insurance Services Office maintains Building Code Effectiveness Grading (BCEG) ratings and Public Protection Classification (PPC) ratings. The latter gauge the capacity of the local fire department to respond if flames engulf a property. PPC ratings are recorded for each individual street address in Texas.

There are 10 classes of ratings in BCEG schedule. Class 1 is the best rating, i.e., strongest program of building code enforcement, and 10 is the lowest rating. The date identified is the date of the rating by ISO. This rating applies to all structures built after that date and can lead to lower insurance rates.

Table 16-6. Community Mitigation Classifications as of July 1, 2003

Jurisdiction	Fire Inspectors (FTEs)	Fire Inspectors Certified	Completed State Cert. Course	Years Experience (Average)	Inspections (last 12 months)
Madison County	NA				
City of Madisonville	Volunteers only	1	TEEX certification	10	15
City of Midway	NA				

FLOODPLAIN MANAGEMENT ORDINANCES

Table 16-7 below describes the floodplain management ordinances currently in use in Madison County, while Table 16-8 provides information regarding floodplain administration. This includes the number of: people on the administrator's staff; certified managers; inspections in the past month; and variances.

Table 16-7. Floodplain Management Ordinances in Madison County

Jurisdiction	Current Flood Ordinance	
	Effective Date	Description
Madison County	Most recently updated:	Restrict or prohibit uses that are dangerous to health, safety, or property in times of flood. Control the alteration of natural flood plain stream channels and natural protective barriers. Control filling, grading,

	June 13, 2011	dredging, and other development that may increase flood damage.
City of Madisonville	January 1978	Restrict or prohibit uses that are dangerous to health, safety, or property in times of flood. Control the alteration of natural flood plain stream channels and natural protective barriers. Control filling, grading, dredging, and other development that may increase flood damage.
City of Midway	NA	No designated floodplain areas within the city limits of Midway.

Table 16-8. Jurisdictional Floodplain Administration Process

Jurisdiction	Number of:				
	Floodplain administration professional staff	Certified floodplain managers	Average years of experience of professional staff	Inspections in last twelve months	Floodplain variances in last twelve months
Madison County	1	1	10	2	0
City of Madisonville	1	0	0	0	0
City of Midway	0	0	0	0	0

FEMA Community Assistance Program Involvement

The Federal Emergency Management Agency's Community Assistance Program (CAP) is a product-oriented financial assistance program directly related to the flood loss reduction objectives of the NFIP. States and communities that are participating in the NFIP are eligible for this assistance. The CAP is intended to identify, prevent, and resolve floodplain management issues in participating communities before they develop into problems requiring enforcement action. The program involves Community Assistance Contacts (CACs) and Community Assistance Visits (CAVs). During CACs and CAVs, officials discuss current local ordinances, the number of floodplain insurance policies in the community, floodplain administration, permitting, and annexation issues. Table 16-9 shows the dates of CACs and CAVs and the date the files were closed according to FEMA records.

Table 16-9. Community Assistance Contacts and Community Assistance Visits from FEMA in Madison County (2006-2011)

Jurisdiction	CAC	CAV
Madison County	03/10/2011 08/19/2008 10/02/2007	None
Madisonville	03/10/2011 04/07/2009 08/16/2008 06/21/2006	None

PREVIOUS ACTION ITEMS

The following items submitted from the previous 2005 plan have been addressed. No other jurisdictions were able to complete their action items due to the 25% local match in funds that is required.

Madison County	
ACTION: Install an early warning system for hazard events.	
Action Completed	Reverse 911 system installed. Global Connect system is now in usage and Reverse 911 is redundant.
Follow Up	Need to acquire redundant warning system(s). Reverse 911 needs to be improved – currently takes 8-9 hours to contract entire county.
Madison County	
ACTION: Adopt routine fire hydrant maintenance and map all hydrant locations.	
Action Ongoing	Maps provided for City of Madisonville VFD. North Zulch MUD provided maps for North Zulch VFD.
Madison County	
ACTION: Identify repetitive loss properties for future Hazard Mitigation Grant Program funding.	
Action Completed	Repetitive loss properties have been identified.

Madison County	
ACTION: Distribute flood insurance handouts with all permit applications.	
Action Ongoing	Flood insurance handouts distributed with all permit applications. This action continues to be on-going.
Madison County	
ACTION: Develop mutual aid agreements with neighboring communities' fire, law, public works, and health departments to pool resources and ensure that disaster damages are limited to the maximum possible extent.	
Action Completed	Mutual aid agreements developed to pool resources.
Madison County	
ACTION: Routinely clean and repair stormwater drains.	
Action Ongoing	Project is ongoing.
City of Madisonville	
ACTION: Routinely clean and repair stormwater drains.	
Action Completed	Project is ongoing.

SECTION 17: CURRENT MITIGATION ACTIONS

Brazos Valley Council of Governments	
ACTION: Individual Safe-Room Program for existing structures	
Hazard	Tornado, hurricane, severe winter storm, thunderstorm
Background	Currently, there are not enough individual safe-rooms located throughout the county to help protect people against tornadoes or other severe weather events.
Benefits	Allowing individuals to take shelter inside their own homes prevents them from leaving and attempting to find a community safe-room location.
Priority	High
Estimated cost	$3,000 for each individual safe room
Responsible organization	BVCOG with participation through the Madison County OEM
Target completion date	2017
Funding sources	FEMA mitigation grants
Related objective(s)	1.3, 1.4, 1.5, 5.1
City of Madisonville	
ACTION: Create a regional map modernization program and prioritize mapping needs. Enhance GIS system with digital floodplain and topographic data. Need to convert city floodplain data to digital.	
Hazard	Flooding, wildfires , hailstorms, excessive heat, drought
Background	The City of Madisonville has not had good mapping capabilities in the past. Better maps are needed showing hazards areas and topography.
Benefits	Better identification of areas that may be at risk of disaster; more information for the public to take into account risks; and assistance for Emergency Medical Systems, Fire Department and law enforcement with improved information and maps.
Priority	High

Estimated cost	$15,000
Responsible organization	City of Madisonville
Target completion date	2016
Funding sources	General revenue and grants
Madison County	
ACTION: Develop drought contingency plans outlining actions to take at varying levels of drought.	
Hazard	Drought
Background	Will make sure that all water systems in the county have a drought contingency plan on file with the Emergency Management Coordinator of Madison County
Benefits	Help improve the county's water supply during drought conditions.
Priority	Medium
Estimated cost	$1,000
Responsible organization	Madison County Soil Conservation Science Dept.
Target completion date	2016
Funding sources	General revenues
Madison County	
ACTION: Adopt fire hydrant maintenance and map all locations.	
Hazard	Fire
Background	There is a need to always be aware of where fire hydrants are located and ensure that they are working properly.
Benefits	This will help ensure that fire hydrants are in proper working condition when needed.
Priority	Medium

Estimated cost	$2,000
Responsible organization	Madison County
Target completion date	2018
Funding sources	General revenues
City of Madisonville	
ACTION: Expand storm water drains to accommodate more flood flows.	
Hazard	Flood, thunderstorms, hurricanes
Background	This action will set up a routine system for cleaning and repair of stormwater drains.
Benefits	Will help keep flooding within the city to a minimum.
Priority	Medium
Estimated cost	$1,500
Responsible organization	Public Works Department
Target completion date	2016
Funding sources	General revenues
City of Midway	
ACTION: Increase the amount of fire hydrants available and map their locations.	
Hazard	Fire
Background	There is a need to always be aware of where fire hydrants are located and ensure that they are working properly.
Benefits	This will help ensure that fire hydrants are in proper working condition when needed.
Priority	Medium
Estimated cost	$1,000

Responsible organization	Midway Public Utilities
Target completion date	2016
Funding sources	General revenues
Cities of Madisonville, Midway, Normangee and North Zulch MUD	
ACTION: Build a new dual use community safe room	
Hazard	Tornado, Hurricane, Winter Storm, Hail, Thunderstorm, Excessive Heat
Background	These communities have no safe room shelter from severe storms. Each city will attempt to secure funds FEMA grant funds and build their own community safe room to provide shelter. During periods of excessive heat, the safe room may be used as a cooling center for people who lack air-conditioning.
Benefits	Having a hardened facility will provide necessary protection to citizens
Priority	Medium
Estimated cost	$200,000 for each safe room
Responsible organization	Office of Emergency Management for each jurisdiction (Madisonville, Midway, Normangee, North Zulch MUD
Target completion date	2018
Funding sources	FEMA Hazard Mitigation Grants
Cities of Madisonville, Midway, Normangee and North Zulch MUD	
ACTION: Public Outreach and Education	
Hazard	Tornado, Hurricane, Winter Storm, Hail, Thunderstorm, Excessive Heat
Background	Each community will present educational materials to their citizens about the dangers of severe storms and how to find shelter to escape the hazard event.
Benefits	Can save lives.
Priority	Medium
Estimated cost	$200

Responsible organization	Office of Emergency Management for each jurisdiction (Madisonville, Midway, Normangee, North Zulch MUD
Target completion date	2018
Funding sources	Local funds
Madison County	
ACTION: Harden the existing Emergency Operations Center (EOC) to meet wind resistance standards.	
Hazard	Tornado and/or Hurricane Winds
Background	Madisonville's EOC resides in the County Courthouse. Strengthening the courthouse roof and installing shatter –proof glass windows helps to ensure that the EOC remains in function during times of disasters.
Benefits	Having an EOC that can remain in function during times of disaster helps to protect its' citizens and enable a faster response.
Priority	Medium
Estimated cost	$250,000
Responsible organization	Madison County Office of Emergency Management
Target completion date	2016
Funding sources	FEMA Hazard Mitigation Grants
City of Madisonville	
ACTION: Develop drought contingency plans	
Hazard	Drought
Background	Develop a plan outlining actions to take at varying levels of drought
Benefits	Helps conserve water supplies for public consumption or fire-fighting capabilities

Priority	High
Estimated cost	$1,000
Responsible organization	City of Madisonville Public Works
Target completion date	2017
Funding sources	General revenues
Cities of Midway, Normangee and North Zulch MUD	
ACTION: Develop and coordinate public education campaign.	
Hazard	Drought, Wildfires
Background	Informing the public on how to conserve water during a drought, and informing the public about how to prevent wildfires.
Benefits	Having an informed public can reduce the amount of water used during a drought and also help prevent the accidental creation of wildfires
Priority	High
Estimated cost	$1,000
Responsible organization	Office of Emergency Management for each jurisdiction (Midway, Normangee, North Zulch MUD
Target completion date	2017
Funding sources	General revenues
Cities of Madisonville, Midway, Normangee and North Zulch MUD	
ACTION: Burn Bans	
Hazard	Wildfires, Drought, Excessive Heat
Background	Implement an ordinance to prevent outdoor brush burning during conditions that can cause wildfires.
Benefits	Can prevent property damage and save lives.
Priority	High

Estimated cost	$500
Responsible organization	Office of Emergency Management for each jurisdiction (Madisonville, Midway, Normangee, North Zulch MUD
Target completion date	2016
Funding sources	General
City of Madisonville	
ACTION: Develop and coordinate public education campaign.	
Hazard	Drought and Wildfires
Background	Informing the public on how to conserve water during a drought, and informing the public about how to prevent wildfires.
Benefits	Having an informed public can reduce the amount of water used during a drought and also help prevent the accidental creation of wildfires
Priority	High
Estimated cost	$1,000
Responsible organization	City of Madisonville Public Works Dept.
Target completion date	2016
Funding sources	General revenue
City of Madisonville	
ACTION: Per NFIP participation, improve drainage along waterways to protect new and existing structures from the 100-year flood.	
Hazard	Flooding
Background	Flooding along Town Branch Creek causes severe flooding along Elm Street and Trinity Street
Benefits	Having improved culverts beneath the road bridges will allow all water to pass beneath the roads, thus allowing EMS vehicles to safely reach the city hospital
Priority	High

Estimated cost	$4,000
Responsible organization	Madisonville Public Works Dept.
Target completion date	2016
Funding sources	A flood study grant from the Texas Water Development Board and a FEMA mitigation grant to complete the project
Madison County	
ACTION: Designate POD locations with generators.	
Hazard	Hurricane, severe winter storms, thunderstorms, flooding, wildfire
Background	Having an organized Points of Distribution (POD) with back-up generators is a necessity to help mitigate against certain hazards
Benefits	A POD that functions smoothly helps get citizens out of harms away and safely provides them with necessary items.
Priority	Medium
Estimated cost	$3,000
Responsible organization	Madison County Office of Emergency Management
Target completion date	2017
Funding sources	General revenue, FEMA mitigation grants
North Zulch Municipal Utility District (MUD)	
ACTION: Adopt routine fire hydrant maintenance and map all locations.	
Hazard	Fire
Background	There is a need to always be aware of where fire hydrants are located and ensure that they are working properly.
Benefits	This will help ensure that fire hydrants are in proper working condition when needed.
Priority	Medium

Estimated cost	$1,000
Responsible organization	North Zulch MUD
Target completion date	2016
Funding sources	General revenues
Madison County	
ACTION: Create dam failure inundation maps	
Hazard	Dam Failure, flood
Background	Although a dam failure event is unlikely in Madison County, there have been no studies of potential damages from a dam failure done before.
Benefits	A risk assessment would help the community to plan for and mitigate the potential damages from a dam failure
Priority	Medium
Estimated cost	$50,000
Responsible organization	Madison County
Target completion date	2016
Funding sources	General revenue or a flood study grant from the Texas Water Development Board
City of Madisonville	
ACTION: Tree Limb removal program to protect existing power supplies	
Hazard	Severe winter storms, hurricane winds
Background	Fallen trim limbs onto power lines can cause electrical power to go out.
Benefits	Having power lines functioning during a disaster helps the local community better coordinate the response during times of disaster
Priority	Medium
Estimated cost	$1,000

Responsible organization	City of Madisonville Public Works
Target completion date	2017
Funding sources	General revenue
City of Madisonville	
ACTION: Back-up generator for waste-water system	
Hazard	Hurricane, flood, severe winter storms
Background	Madisonville needs a generator for their waste-water lift station
Benefits	Loss of power to a waste-water system can cause the system to fail. Having a back-up generator will mitigate that problem
Priority	Medium
Estimated cost	$50,000
Responsible organization	City of Madisonville Public Works
Target completion date	2015
Funding sources	FEMA Mitigation Funds (under the 5% Initiative category of HMGP)
Madison County	
ACTION: Public Outreach and Education	
Hazard	Drought
Background	Notifying the public about the availability of crop insurance
Benefits	During times of drought, agricultural areas can be affected dramatically. Having crop insurance can help off-set the costs of losing a crop.
Priority	High
Estimated cost	$500
Responsible	Madison County Extension Agent

organization	
Target completion date	2016
Funding sources	General Revenue
Madison County	
ACTION: Fan Distribution campaign	
Hazard	Excessive Heat, drought
Background	A program to raise funds to purchase fans and then deliver them to those who need relief during times of excessive heat
Benefits	Many elderly have problems with excessive heat and cannot afford to pay for an air conditioned home. Free fans will help to mitigate the hazard
Priority	Medium
Estimated cost	$2,000
Responsible organization	Madison County Health Resource Center
Target completion date	2016
Funding sources	General Revenue
Madison County	
ACTION: Home delivered meals	
Hazard	Excessive Heat
Background	While providing free Home Delivered Meals, the driver can check up on the occupants of the house to determine if they are in need of a free fan to help off-set the affects of excessive heat
Benefits	Having the public looked after and taken care of will reduce the amount of time the EMS will be needed to assist those citizens later when they are affected by the excessive heat
Priority	Medium
Estimated cost	$200

Responsible organization	Madison County Health Resource Center
Target completion date	2016
Funding sources	General Revenue
City of Madisonville	
ACTION: Installation of Lightning Protection for existing buildings	
Hazard	Thunderstorms and wildfires
Background	Installing lightning rods on the tops of water towers will help reduce the chances of the towers being struck by lightning.
Benefits	Having good water pressure at all times is crucial to the county being able to maintain fire-fighting capabilities. Since lightning from thunderstorms can start wildfires, the county needs to be able to respond quickly with available water.
Priority	Medium
Estimated cost	$1,000
Responsible organization	City of Madisonville Public Works
Target completion date	2016
Funding sources	General Revenue
City of Madisonville	
ACTION: Early Warning Systems	
Hazard	Thunderstorms
Background	Having an early warning system in place can help warn the public about an upcoming hazard event
Benefits	Having an informed citizenry can help save lives
Priority	Medium
Estimated cost	$1,000

Responsible organization	City of Madisonville
Target completion date	2016
Funding sources	General Revenue
City of Madisonville	
ACTION: Strengthen Building Codes for new buildings	
Hazard	Hail
Background	Strengthen and continue to re-adopt building codes that will help build disaster resistant buildings
Benefits	Building codes can help to protect buildings by having them built to the best possible industry standards
Priority	Medium
Estimated cost	$200
Responsible organization	City of Madisonville
Target completion date	2016
Funding sources	General Revenue
Madison County	
ACTION: Public Outreach and Education	
Hazard	Hail
Background	Since the county cannot enforce building codes (for anyplace outside of the floodplain) then informing the public about how to protect themselves and their homes from the dangers of hail storms is the next best thing
Benefits	Having an informed public can help save lives and reduce property damage
Priority	Medium
Estimated cost	$200

Responsible organization	Madison County
Target completion date	2016
Funding sources	General Revenue
City of Madisonville	
ACTION: Public Outreach and Education	
Hazard	Dam Failure, flood
Background	Research which areas in the city could be affected by a dam failure and notifying the public about the availability of flood insurance
Benefits	Having an informed public about the dangers of living in a dam failure inundation area, and the importance of having flood insurance, can help save lives and property destruction
Priority	Medium
Estimated cost	$40,000
Responsible organization	City of Madisonville Floodplain Administrator
Target completion date	2016
Madison County	
ACTION: Create and display signage for evacuations and detour routes in emergency hazard situations.	
Hazard	Wildfires
Background	During evacuations, some roads may be closed. The public should be notified with signage on the best alternative route to go.
Benefits	Having an informed public about the of dangers of wildfires and how to safely evacuate will save lives.
Priority	Medium
Estimated cost	$1,000

Responsible organization	Madison County
Target completion date	2016
Madison County	
ACTION: Back-up generator for waste-water system	
Hazard	Hurricane, flood, severe winter storms
Background	Madison County needs a generator for their waste-water lift station
Benefits	Loss of power to a waste-water system can cause the system to fail. Having a back-up generator will mitigate that problem
Priority	Medium
Estimated cost	$50,000
Responsible organization	Madison County
Target completion date	2016
Funding sources	FEMA Mitigation Funds (under the 5% Initiative category of HMGP)
City of Midway	
ACTION: Back-up generator for waste-water system	
Hazard	Hurricane, flood, severe winter storms
Background	Midway needs a generator for their waste-water lift station
Benefits	Loss of power to a waste-water system can cause the system to fail. Having a back-up generator will mitigate that problem
Priority	Medium
Estimated cost	$50,000
Responsible organization	City of Midway Office of Emergency Management
Target completion	2016

date	
Funding sources	FEMA Mitigation Funds (under the 5% Initiative category of HMGP)
City of Midway	
ACTION: Build a community safe-room	
Hazard	Hurricane, flood, severe winter storms, drought
Background	Midway needs a safe room to provide citizens shelter during extreme weather.
Benefits	Provides protection to citizens and saves lives.
Priority	Medium
Estimated cost	$950,000
Responsible organization	City of Midway Office of Emergency Management
Target completion date	2018
Funding sources	FEMA Mitigation Funds
Funding sources	FEMA mitigation grants, general revenue
City of Normangee	
ACTION: Acquire homes located in the flood plain.	
Hazard	Floods and hurricanes
Background	Acquiring homes from the identified flood hazard areas prevents future loss of life or property damage.
Benefits	Saves lives and prevents future property damages.
Priority	Medium
Estimated cost	$50,000
Responsible organization	City of Normangee
Target completion	2018

date	
Funding sources	General revenues
North Zulch Municipal Utility District (MUD)	
ACTION: Back-up generator for waste-water system	
Hazard	Hurricane, flood, severe winter storms
Background	North Zulch MUD needs a generator for their waste-water lift station
Benefits	Loss of power to a waste-water system can cause the system to fail. Having a back-up generator will mitigate that problem.
Priority	Medium
Estimated cost	$50,000
Responsible organization	North Zulch MUD
Target completion date	2016
Funding sources	FEMA Mitigation Funds (under the 5% Initiative category of HMGP)
City of Midway	
ACTION: Acquisition of Repetitive Loss (RL) homes from the 100-year flood plain.	
Hazard	Flood
Background	Per NFIP participation, the city will acquire any Repetitive Loss properties that are located in the city, should any be placed on FEMA's RL list.
Benefits	Removal of structures and people from the 100-year flood plain can save lives and prevent property damage.
Priority	Medium
Estimated cost	$53,500
Responsible organization	City of Midway
Target completion	2018

date	
Funding sources	Repetitive Loss Mitigation Grants from the Texas Water Development Board
City of Midway	
ACTION: Elevation of Repetitive Loss (RL) homes in the 100-year flood plain.	
Hazard	Flood
Background	Per NFIP participation, the city, when unable to acquire the property, will elevate any Repetitive Loss properties that are located in the city, should any be placed on FEMA's RL list.
Benefits	Elevation of structures within the 100-year flood plain can save lives and prevent property damage.
Priority	Medium
Estimated cost	$33,000
Responsible organization	City of Midway
Target completion date	2018
Funding sources	Repetitive Loss Mitigation Grants from the Texas Water Development Board
Madison County	
ACTION: Community Safe Room	
Hazard	Winter storm, Tornado, Hailstorm, Thunderstorm, Excessive Heat
Background	Build a dual-use community safe room to provide county residents with shelter during severe storm events
Benefits	Can save lives.
Priority	Medium
Estimated cost	$300,000
Responsible organization	Madison County Office of Emergency Management
Target completion	2018

date	
Funding sources	FEMA HMGP, PDM grants
Madison County	
ACTION: Burn Bans	
Hazard	Wildfire, Drought, Excessive Heat
Background	The county will pass an resolution banning outdoor brush burning during periods when wildfire conditions exist.
Benefits	Can save lives and prevent property damage.
Priority	High
Estimated cost	$200
Responsible organization	Madison County Office of Emergency Management
Target completion date	2018
Funding sources	Local funds
Madison County	
ACTION: Burying overhead power lines to the Emergency Operation Center	
Hazard	Winter Storm
Background	Exposed power lines to the Emergency Operations Center, which is a critical facility, leaves it vulnerable to power outages from severe storms.
Benefits	Burying the power lines ensures that the Emergency Operations Center can function smoothly during severe winter storms by keeping the power on.
Priority	Medium
Estimated cost	$10,000
Responsible organization	Madison County Office of Emergency Management
Target completion	2015

date	
Funding sources	FEMA HMGP grants
Madison County	
ACTION: Elevate existing homes located downstream of Town Branch Dam in the dam failure inundation zone	
Hazard	Dam Failure
Background	Some homes that were built in Madison County are located downstream of Tom Branch Dam, and could be vulnerable to flooding in the case of a dam failure.
Benefits	Can save lives and prevent property damage by elevating structures above the Base Flood Elevation in the dam inundation zones.
Priority	Medium
Estimated cost	$80,000 per structure
Responsible organization	Madison County Office of Emergency Management
Target completion date	2017
Funding sources	FEMA HMGP Grants and FMA Grants
City of Madisonville	
ACTION: Acquire existing homes located downstream of Town Branch Dam and Crescent Lake Dam within the city limits of Madisonville	
Hazard	Dam Failure
Background	Some existing homes were built in the City of Madisonville downstream of Tom Branch Dam and Crescent Lake Dam that could be vulnerable to flooding in the case of a dam failure.
Benefits	Can save lives and prevent property damage by permanently removing structures from the dam inundation zones.
Priority	Medium
Estimated cost	$70,000 per structure
Responsible	City of Madisonville Office of Emergency Management

organization	
Target completion date	2018
Funding sources	FEMA HMGP Grants and FEMA FMA Grants
City of Normangee	
ACTION: Elevate existing homes located in the identified special flood hazard area (the 100-year floodplain)	
Hazard	Floods
Background	Some existing homes were built in the City of Normangee in low-lying areas that could be vulnerable to flooding.
Benefits	Can save lives and prevent property damage by elevating existing homes to have the first flood above the Base Flood Elevation.
Priority	Low
Estimated cost	$80,000 per structure
Responsible organization	City of Normangee Office of Emergency Management
Target completion date	2017
Funding sources	FEMA HMGP Grants and FEMA FMA Grants
North Zulch MUD	
ACTION: Acquire existing homes located in the identified special flood hazard area (the 100-year floodplain)	
Hazard	Floods
Background	Some existing homes in the North Zulch MUD area were built in low-lying areas that could be vulnerable to flooding.
Benefits	Can save lives and prevent property damage by permanently removing structures from the 100-year floodplain.
Priority	Low
Estimated cost	$80,000 per structure

Responsible organization	North Zulch MUD Office of Emergency Management
Target completion date	2018
Funding sources	FEMA HMGP Grants and FEMA FMA Grants

SECTION 18: PLAN IMPLEMENTATION AND MAINTENANCE PROCEDURES

IMPLEMENTATION

This section discusses how this Hazard Mitigation Plan will be implemented by Madison County and the participating jurisdictions listed in this plan. 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.

Each participating city and Madison County will be responsible for implementing its own mitigation action plans contained in Section 17. Each action has been assigned to a specific person or local government office that is responsible for implementing it. The governing bodies of each participating jurisdiction have adopted the mitigation action plan for their jurisdictions. Copies of the governing body resolutions are contained in Appendix E.

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 or a specific implementation date also has been assigned to each action as an incentive for seeing the action through to completion and to gauge whether actions are timely implemented.

Participating jurisdictions will integrate implementation of their mitigation action plans with other, existing planning mechanisms such as capital improvement plans, long range growth plans, master stormwater and drainage plans, and regional planning efforts. Jurisdictions will ensure that the actions contained in the mitigation action plans are reflected in these other planning efforts. These other planning efforts will be used to advance the mitigation strategies of the jurisdictions.

Upon formal adoption of the plan, hazard mitigation team members from each jurisdiction will review all comprehensive land use plans, capital improvement plans, transportation plans, and any building codes to guide and control development. The hazard mitigation team members will work to integrate the hazard mitigation strategies into these other plans and codes. Each jurisdiction will conduct periodic reviews of their comprehensive and land use plans and policies and analyze the need for any amendments in light of the approved hazard mitigation plan. 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.

The Brazos Valley Council of Governments is committed to supporting the cities and counties in the valley as they implement their mitigation plans. BVCOG 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 this mitigation action plan. BVCOG will work with participating jurisdictions to

advance the goals of this hazard mitigation plan through its routine, ongoing, long-range planning, budgeting, and work processes.

EVALUATION AND ENHANCEMENT

Periodic revisions and updates of the plan are required to ensure that the goals, objectives, and mitigation action plans for Madison County are kept current. More important, revisions may be necessary to ensure that the plan is in full compliance with federal regulations and state statutes. This portion of the plan outlines the procedures for completing such revisions and updates.

Monitoring and Five-Year Plan Review and Update

Hazard mitigation team members from each jurisdiction (see Appendix C) are responsible for continual monitoring those components of the hazard mitigation plan that pertains to their jurisdiction. As part of the monitoring process, team members will assess any changes in risk; determine whether implementation of mitigation actions is on schedule or if there are any implementation problems, such as technical, political, legal or coordination issues; and reflect changes in land development or programs that affect mitigation priorities or actions. On an annual basis, participating jurisdictions will notify the Brazos Valley Council of Governments of any needed changes in the plan based upon their monitoring activities.

This mitigation action plan will be formally reviewed and updated every five years to determine whether significant changes may have occurred in Madison County that could affect the plan. The five-year review and update may be conducted under the auspices of the Brazos Valley Council of Governments, with participation by Madison County and its jurisdictions. Increased development, increased exposure to certain hazards, the development of new mitigation capabilities or techniques, and revisions to federal or state legislation are examples of changes that may affect the currency of the plan. Criteria to be included in the evaluation will include, at a minimum:

- The goals and objectives address current and expected conditions;
- The nature, magnitude, and/or type of risks has changed;
- The current resources are appropriate for implementing the plan;
- There are implementation problems, such as technical, political, legal, or coordination issues with other agencies;
- The outcomes have occurred as expected; and,
- The agencies and other partners participated as originally proposed.

The review also will give community officials an opportunity to evaluate successful actions and to explore the possibility of documenting losses avoided because of actions taken. The plan also will need to be revised to reflect lessons learned following a disaster declaration or to address specific circumstances arising from changing conditions surrounding disaster events.

The five-year review will begin in spring 2015 and be completed by fall 2015. As part of the plan review process, participating jurisdictions will be asked to review each goal and objective to determine their continued relevance; review the risk assessment portion of the plan to determine if the information should be updated or modified; report on the status of each of their mitigation actions; report on which implementation processes worked well, any difficulties encountered, how coordination efforts are proceeding, and which mitigation actions should be revised; and evaluate the effectiveness of their mitigation action plans and recommend changes or amendments. The results will be summarized in a formal report issued by the BVCOG that will include an evaluation of the effectiveness and appropriateness of the plan, and will recommend required or desirable changes.

As part of the five-year plan update, depending upon resource availability, a review will be undertaken of development trends in each jurisdiction and vulnerability. Also as part of the five-year plan update, depending upon resource availability, a review will be undertaken for each hazard of the type and number of existing and future buildings, infrastructure and critical facilities within each hazard area, and an estimate will be undertaken of the vulnerability of critical facilities and infrastructure in terms of potential dollar losses from each hazard. Also depending upon resource availability, land uses and development trends will also be re-examined, including the types of development occurring, location, expected intensity, and pace by land use for each jurisdiction. This will help complete and improve future vulnerability assessment efforts. Based on the analysis, a summary of vulnerability will be provided for participating jurisdictions below the county level.

Plan Amendments and Updates

At any time, minor technical changes may be made to the plan to keep it up to date. However, any changes to the 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 participating jurisdictions.

After initial adoption, any amendment to the mitigation action plans contained in Section 17 must also be approved by the governing body of the participating city or county and submitted to BVCOG for inclusion in an amended plan.

Any amendment to the plan must undergo an open public process. The city or county proposing the amendment is responsible for gathering public input. Input on a proposed amendment will be sought during a formal review and comment period of not less than 30 days. The proposed change will be also posted on BVCOG's website.

At the end of the comment period, the proposed amendment and all comments will be forwarded to the governing body of the proposing jurisdiction for consideration. If no comments are received from the reviewing parties within the specified review period, this will also be noted. The governing body will then review the proposed amendment and comments received, and vote to accept, reject, or amend the proposed change. The public will have an opportunity to provide input during the governing body meeting at which the request is

considered. Upon ratification, the amendment will be transmitted to the BVCOG for inclusion in the overall plan and to the Texas Division of Emergency Management.

In determining whether to recommend approval or denial of a plan amendment request, the following factors will be considered:

- 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;
- Changes in information, data, or assumptions from those on which the plan was based.

CONTINUED PUBLIC INVOLVEMENT

Public input was an integral part of the preparation of this plan and will continue to be essential as the Plan grows and changes. As with any officially adopted plan or ordinance, a significant change to this Plan shall require an opportunity for the public to make its views known.

This Hazard Mitigation Action Plan will be posted continuously on the website of the Brazos Valley Council of Governments and the Madison County Office of Emergency Management, where the public is invited to provide ongoing feedback. The public will be notified that the plan is available on the websites through local media outlets. Copies of the plan also will be kept in each jurisdiction and at the Brazos Valley COG office for public inspection and review. For more information, please contact the BVCOG at 3991 East 29th St., Bryan, Texas 77802; telephone (979) 595-2800; fax (979) 595-2810.

APPENDIX A: ACRONYMS

AL	Annualized Loss
ALR	Annualized Loss Ratio
BCEG	Building Code Effectiveness Grading
BCEGS	Building Code Effectiveness Grading Schedule
BOCA	Building Officials and Code Administrators
BTU	British Thermal Unit
BVCOG	Brazos Valley Council of Governments
CAC	Community Assistance Contact
CAP	Community Assistance Program
CAV	Community Assistance Visit
CDBG	Community Development Block Grant
CERT	Community Emergency Response Team
CFS	Cubic feet per second
CHER-CAP	Comprehensive Hazardous Materials Emergency Response – Capability Assessment Program
CHEMTREC	Chemical Transportation Emergency Center
COG	Council of Governments
COOP	Continuity of Operations Plan
COPS	Community Oriented Police Services
CTP	Cooperating Technical Partner
DEM	Texas Division of Emergency Management
DFIRM	Digital Flood Insurance Rate Map
DOD	Department of Defense
EAS	Emergency Alert System

EM	Emergency Management
EMP	Emergency Management Plan
EMPG	Emergency Management Performance Grants
EMS	Emergency Medical Services
EO	Emergency Operations
EOC	Emergency Operations Center
EP	Exceeding Probability
EPA	United States Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Maps
GIS	Geographic Information System
HAZUS	Federal Emergency Management Agency's Hazards U.S.
HMT	Hazard Mitigation Team
IFC	International Fire Code
ISO	International Organization for Standardization
NFDS	National Fire Danger Rating System
NFIP	National Flood Insurance Program
NHC	National Hurricane Center
NOAA	National Oceanic and Atmospheric Administration
PPC	Public Protection Classification
SFC	Standard Fire Code
TEEX	Texas Engineering Extension Service
UFC	Uniform Fire Code
USACE	U.S. Army Corps of Engineers
USDA	United States Department of Agriculture

APPENDIX B: PUBLIC SURVEYS RESULTS

Zip Code	Number of Responses
75852	2
77872	4
77864	6
Total	**12**

Is your home in a flood plain?

Yes	No	I don't know
	10	2

Do you have flood insurance?

Yes	No	I don't know
	12	

If no, why not?

Respondent in floodplain	County does not participate in flood program.	
Respondent in floodplain	It is not available in this part of the county due to a lack of mapping.	
Respondent in floodplain	Will not issue flood insurance.	3
Respondent in floodplain	Can't afford it.	
Respondent in floodplain	Flood insurance is too expensive to purchase.	
Respondent who does not know if in floodplain	Does not know where flood insurance is available.	
Other respondents	Not necessary; can't afford it; live on hill	6

*Two did not respond to this question.

Please select the hazard you think is the *highest threat* to your neighborhood

Tornado and high wind	2
Transportation accident	
Flood	
Hail	
Hazardous materials spill	
Wildland fire	2
Urban fire	
Drought and extreme heat	1
Pipeline accident	
Terrorism	
Winter storm	
Hurricane	

Please select the hazard you think is the *second highest threat* to your neighborhood:

Tornado and high wind	
Transportation accident	
Flood	
Hail	
Hazardous materials spill	1
Wildland fire	2
Urban fire	
Drought and extreme heat	1
Pipeline accident	1
Terrorism	

Winter storm	
Dam failure	
Hurricane	

In your opinion, what are some steps your local government could take to reduce or eliminate the risk of future damage in your neighborhood?

- Better communication
- Improve drainage. Large culverts and bridges. Law enforcement. Be prepared – continue to educate all XX. Build EOC.
- Improve roads and drainage (2)
- Don't know
- Put in more fire plugs

Has any hazard in your neighborhood increased in severity in recent years?

Yes	**No**	**N/A**	**Comment**
1	2		
Yes, trucks and more trucking of chemicals			
Roads and drainage has had little maintenance. Weather cycles have changed and severity of storms have seemed to increase.			
Don't know			
Wildfire in pastures for the two years.			

Is there another hazard not listed in this survey that you think is a wide-scale threat to your neighborhood?

Yes	**No**	**Comment**
	3	
Terrorist		
Contaminated water/no water		
Sour gas plant		
Don't know		

Do you have a weather radio?

Yes, in my home	Yes, in my office	Yes, both	No
3	2	6	

Does your survey response cover your home or your office?

Home	Office	Both
9	1	1

APPENDIX C: LOCAL HAZARD MITIGATION TEAM

Shelly K Butts	Madison County Emergency Management Coordinator
Kevin Story	City of Madisonville
Thom Jones	Madison Volunteer Fire Department Chief
Lance Ferguson	Midway Volunteer Fire Department Chief
David Douglas	North Zulch Volunteer Fire Department Chief
Beverly Plumlee	Madison County Tax Assessor
Phil Grisham	Madison County Commissioner
Tommy Cornelius	Madison County Commissioner
Chuck Heath	Texas Department of Transportation
Joey Smith	Madisonville Independent School District
Morris Lyon	North Zulch Independent School District
Gary Clendennen	Madisonville Police Department Chief
Ivan Linebaugh	Madison County Sheriff's Office
Sharon Phelps	Chamber of Commerce
Faith Kellar	Texas Department of State Health Services
Jody Butler	Midway City Manager
J.W. Williams	Midway Mayor
Roger Johnson	Madison County Economic Development Coordinator
Sam Cole	North Zulch Municipal Utility District
Reed Edmundson	Madison St. Joseph's Hospital
Linda McGuill	Brazos Valley Council of Governments
Adam Whitefield	Brazos Valley Council of Governments
Suzannah Jones	Texas Engineering Extension Services
David Larner	Texas Engineering Extension Services

1:30 – 3:00

MADISON COUNTY EMERGENCY MANAGEMENT MAP MEETING SIGN IN

October 13, 2011

Name	Company / Organization	Mailing Address	Phone	Fax # or E-mail Address
April Covington	MC	101 W. Main Suite 110	936-349-7090	april.covington@madisoncountytx.org
Kevin Story	C.O.M	210 W. Cottonwood	936-349-5258	
Donna McAdams	DSHS	300 W. School	936-348-3593	donna.mcadams@dshs.state.tx.us
Judge Arthur M. Henson	MC	101 W. Main Suite 110	936-348-2670	art.henson@madisoncountytx.org
Danny Singletary	City of Madisonville	210 W Cottonwood	936-348-2718	Danny.Singletary@CI.Madisonville.TX.US
Beverly Plumlee	Tax office	PO Box 417 m'ville	936-348-8969	beverly.plumlee@madisoncotx.org
Tripp Lewis	Guardian EMS	2104 E. Villa Maria Bryan TX 77802	979 204 6711 ext 2044	tlewis@guardian-ems.com
Adam Whitefield	BVCOG	3	(979) 595-2801	awhitefield@bvcog.org
Linda McGuill	BVCOG	PO Box 4128, Bryan 77805	979-595-2800	lmeguill@bvcag.org
David Lamar	Consultant	9433 Circle Drive Austin TX 78736	512-517-8530	david.lamar@att.net
Reed Edmundson	St Joseph	100 W Cross ST Madisonville TX 77864	936 348 2631	Redmundson@mail.st-joseph.org
Shelly Butts	MCDEM	101 W Main, Ste B-13	936-348-3810	shelly.butts@madisoncountytx.org
Sam Cole	mc pct	101 W main ST	936 348-4033	SAMcole@madisonco.

Sam Cole — North zulch mud

APPENDIX D: CRITICAL FACILITIES IN MADISON COUNTY

County	Name	Type	Cost ($1,000)
Madison	Madisonville Municipal	Airport	4,850.5
Madison	Hensarling	Airport	4,850.5
Madison	Madison St Joseph Health Ctr	Care	3,115.0
Madison	Kmvl 1220	Communication	89.0
Madison	Madisonville Volunteer Fire Dept	Fire Station	534.0
Madison	Txu Lone Star Pipeline Company	Gas	970.1
Madison	Madison County Sheriff	Police Station	1,246.0
Madison	Madisonville Police Department	Police Station	1,246.0
Madison	Railroad	Railway bridge	29.4
Madison	Madisonville Elementary School	School	445.0
Madison	Madisonville High School	School	445.0
Madison	Madisonville Junior High School	School	445.0
Madison	Madisonville Intermediate School	School	445.0
Madison	North Zulch Elem	School	445.0
Madison	North Zulch HS	School	445.0
Madison	City of Midway	WasteWater	
Madison	Madisonville City Of	WasteWater	59,274.0
Madison	North Zulch MUD	WasteWater	
Madison	Tx Dept Of Crim Jus-Ferguson	WasteWater	59,274.0

APPENDIX E: LOCAL ADOPTION RESOLUTIONS

To be included after FEMA issues the "Approvable Pending Adoption Letter"