Limestone County Hazard Mitigation Plan

Limestone County Office of Emergency Management

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EXECUTIVE SUMMARY

Purpose and Process of Development

This mitigation plan is a five-year blueprint for the future, aimed at making communities in Limestone County disaster resistant by reducing or eliminating the long-term risk from a full range of 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 & Part 206; and the Texas Division of Emergency Management standards. An open public process was established to provide multiple opportunities for all sectors in Limestone County to become involved in the planning process and make input during its drafting stage.

Hazards Facing Limestone County

Mitigation is defined as the effort to reduce the loss of life and property by lessening the impact of disasters. This Limestone County Hazard Mitigation Plan ("Plan") is aimed at reducing or eliminating the long-term risk of loss of life and property damage from a full range of disasters.

The Plan identifies and assesses the potential impact of eight natural hazards that threaten Limestone County and the participating cities of Coolidge, Groesbeck, Kosse, Mexia, Tehuacana and Thornton.

The hazards include, in alphabetical order; dam failure, drought, flood, hail, thunderstorm, tornado, wildfire and winter storms.

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. Multi-Hazards Model (HAZUS-MH). The hazards were then ranked based on potential damages in terms of lives lost, dollars lost, and other relevant community factors.

Mitigation Goals

Mitigation goals are general guidelines that articulate a desired end state. The goals of this Plan are to:

- Protect the lives and property of residents within Limestone County;
- Seek funding in order to implement developed mitigation actions; and
- Be “disaster ready” by implementing those mitigation actions when possible.

The Plan is intended to serve as a basis for future funding that may become available from State or Federal grants and technical assistance programs. It will enable the County to take advantage of rapidly developing mitigation grant opportunities as they arise.

Mitigation Actions

Mitigation Actions are the proposed projects or ideas that a jurisdiction may implement in order to lessen or eliminate the impact or severity of disasters on that jurisdiction.

Multiple mitigation actions are presented for each participating jurisdiction to reduce the loss of life and property within their community.

Each action is presented in the Plan along with a description of the action, costs, benefits, responsible organization for overseeing implementation, estimated completion date, potential funding sources, and related objective(s). The mitigation actions are based upon their effect on the overall risk to life and property, ease of implementation, political and community support, and funding.

The County and participating jurisdictions will seek to obtain the necessary funding to implement the mitigation actions set forth when possible. However, in this era of increased demands and constrained resources at all levels of government, the lack of resources, especially from external sources, may hamper the ability of the jurisdictions to implement some mitigation actions identified in the Plan or to implement them within the timeframe specified.

Plan Maintenance

This section discusses how the Plan will be implemented, evaluated and improved over time by the participating jurisdictions and how the public will continue to be involved in the hazard mitigation planning process throughout the next five years.

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Section One: The Planning Process

Preparation of the Plan

The Limestone County Hazard Mitigation Plan covers Limestone County and six cities that participated throughout the planning process. The Plan identifies and assesses the potential impact of eight natural hazards that threaten human life and property.

The Plan was developed in accordance with the provisions of the Disaster Mitigation Act of 2000 (Public Law 106-390), the Pre-Disaster Mitigation Grant Program, 44 Code of Federal Regulations Part 201.6 and 206, and the planning standards adopted by the Texas Division of Emergency Management.

This mitigation plan was created for Limestone County in 2011-2014 by the Limestone County Office of Emergency Management, along with their contractor, Larner Consulting. It was funded by the Federal Emergency Management Agency (FEMA) under a mitigation planning grant awarded to Limestone County on August 31, 2010.

The participants in this plan were initially part of a larger mitigation plan created in 2006 by the Heart of Texas Council of Governments (HOTCOG). Whereas the 2006 version contained multiple counties within the HOTCOG region, this new mitigation plan covers only Limestone County and the cities of Coolidge, Groesbeck, Kosse, Mexia, Tehuacana and Thornton.

Ultimately, this Plan is designed to help build a sustainable community that, when confronted by natural disasters, will sustain fewer losses and will be able to recover more quickly. It is also intended to:

- minimize disruption to the region following a disaster;
- streamline the disaster recovery process by having in place pre-identified actions that can be taken to reduce or eliminate future damage;
- provide the basis for the Small Business Administration to make low interest, fixed rate loans to small businesses for the purpose of implementing mitigation measures to protect their commercial real property (buildings) or leasehold improvements or contents from disaster related damage;
- capitalize on Federal funding that may become available after the disaster strikes; and

- ensure that the region maintains its eligibility to the full range of future Federal disaster relief. After November 1, 2004, eligibility to certain forms of Federal mitigation funding to cities and counties is dependent upon having a FEMA-approved Hazard Mitigation Plan in place.

The Plan is intended to serve as a basis for future funding that may become available from State or Federal grants and technical assistance programs. It will enable the County and participating jurisdictions to take advantage of rapidly developing mitigation grant opportunities as they arise.

Potential funding sources for implementation are identified for each proposed action. These include general revenues, bonds, grants and federal grants. The County and participating jurisdictions will seek to obtain the necessary funding to implement the mitigation actions set forth when possible.

Jurisdictional Participation

The jurisdictions participating in this Plan include Limestone County and the cities of Coolidge, Groesbeck, Kosse, Mexia, Tehuacana and Thornton.

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 a kick-off meeting, mitigation workshops 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 2014-2019.

The Limestone County Office of Emergency Management (OEM) led the HMT during the process to update the plan. The OEM, led by the county's Emergency Management Coordinator (EMC), organized the first mitigation workshop for participating jurisdictions. The EMC led the development of the plan at the local level and provided information to the plan committee, which was comprised of the HMT members. A contractor from Larner Consulting provided the draft documents and talking points during the group's meetings. All members of the committee participated together in open discussions on what their vulnerabilities are to natural disasters. Each committee member was later asked to review the draft documents during the update process and to provide new information regarding their jurisdictions. The HMT assisted in identifying hazards, assessing risks, and developing mitigation actions that can strengthen their communities. Appendix A identifies Hazard Mitigation Team members in greater detail.

Local team members were tasked to review and analyze the information that pertained to their local jurisdiction to determine if additional detail was needed, such as in the case of mitigation actions.

Jurisdictional representatives formed a new local HMT and attended a Kick-Off meeting on March 28, 2011 in Groesbeck, Texas. The purpose of the workshop was to explain the process for updating the Plan, the respective roles and responsibilities of each participating jurisdiction, and to seek localized information for the plan. Members of the HMT also identified any unique hazards for their jurisdiction that varied from those hazards affecting Limestone County as a whole.

A second mitigation meeting was held by the HMT on September 20, 2011 in Groesbeck. The team members discussed the goals and objectives for the Plan, provided input and reviewed the risk assessment, and reviewed previous mitigation actions and discussed new ones. The team also reviewed the rankings of the natural hazards and voted to change the priority order of them. This is due to the changing conditions of the hazards since early 2011. For example, drought and wildfire were moved up in the rankings due to the extreme drought that the area experienced in the summer of 2011, and the high probability of a wildfire occurring due to the amount of dry brush available to burn.

The following is a summary of the sections in the Plan and the role that each member of the Hazard Meeting Team had during the process:

- The Executive Summary was created to reflect changes in the development of the plan. Whereas the original plan contained multiple counties within the Heart of Texas Council of Government (HOTCOG) region, this updated plan reflects a focus on Limestone County and the participating jurisdictions.

- Section 1: *The Planning Process* was revised to reflect the local planning process undertook by Limestone County and the cities of Coolidge, Groesbeck, Kosse, Mexia, Tehuacana and Thornton. This includes the formation of the local Hazard Mitigation Team to review and analyze each section of the plan. In addition, a series of mitigation workshops were held in coordination with Limestone County Office of Emergency Management.
- Section 2: *Limestone County at a Glance* was updated to reflect a focus on Limestone County and the participating jurisdictions, since the original HOTCOG mitigation plan contained multiple counties and dozens of cities.
- Section 3: *Hazards Limestone County Faces* was revised to reflect a focus on Limestone County rather than the multiple counties in the original HOTCOG multi-jurisdiction mitigation plan.
- Sections 4-11 contain the risk assessment for each of the eight (8) hazards listed in the plan and was written to reflect any changes to the risks that can affect the Limestone County region. The HMT discussed the hazards that could affect their jurisdiction and listed them in priority order.
- Section 12: *Mitigation Vision, Goals, and Objectives* contain the vision, goals, and objectives of the Plan.
- Section 13: *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.
- Section 14: *Mitigation Actions* contains actions to be undertaken by the county and each participating jurisdiction to mitigate the hazards identified in Sections 4 through 11. This section contains proposed action items to help achieve the vision, goals and objectives listed in Section 12.
- Section 15: *Plan Implementation and Maintenance Procedures* discusses the plan maintenance procedures and was written to reflect how Limestone County and the participating jurisdictions will maintain, update and evaluate the plan during the next 5 years.

Assessing Risks

Eight hazards that have affected and may again affect Limestone County and participating jurisdictions were examined by the HMT based on a review of historical records, national data sources, existing plans and reports, and discussions with local, regional, state, federal, and national experts.

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

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

An inventory was taken of populations, buildings, infrastructure and facilities classified as “critical” or “special”, or housing hazardous materials. Appendix B contains a full list of critical facilities for the participating jurisdictions.

Potential dollar losses from each hazard were estimated using the Federal Emergency Management Agency’s Hazards U.S. Multi-Hazards Model (HAZUS-MH). 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 modeled distinct hazard and inventory parameters (e.g., wind speed and building types) to determine potential damages and losses in the built environment. The second 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 provide a factual basis for determining what 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 4 through 11 of this Plan appear generally in priority order, based on risk to the County as a whole, with the greatest hazards appearing first.

Developing Mitigation Actions

Following the workshops, members of the Hazard Mitigation Team updated their mitigation actions to implement the ideas set forth. A structured process was used to develop, prioritize and update the mitigation actions for this Plan. It included the following steps:

- Hazard mitigation team members conducted a benefit-cost review of the proposed action items. Each team member considered the benefits that would result from the mitigation actions in their community 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.
- Hazard mitigation team members then 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 14.
- In formulating mitigation actions, team members examined potential mitigation actions that address existing and new buildings and infrastructure. Each team member considered mitigation actions addressing new buildings and infrastructure although not all mitigation actions considered were ultimately included in their plans due to limited capabilities, prohibitive costs, low benefit/cost ratio or other concerns.
- 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.

Public Participation

An open public process was established to give all areas of Limestone County an opportunity to become involved in the planning process. This helped to ensure that the Plan reflects a comprehensive, County-wide approach. Those invited to participate included the Honorable Judge Daniel Burkeen of Limestone County and Matt Groveton, the Emergency Management Coordinator (EMC) for Limestone County. Additional stakeholders invited to participate included Jeff Dunbar of the City of Coolidge, Carl Malone of the City of Kosse, Nina Perez of

the City of Mexia, Beth Carpenter with the City of Tehuacana and Bill Smith with the City of Thornton. In addition, Frank Patterson, the Emergency Management Coordinator of the neighboring jurisdiction of McLennan County was also invited to participate, as well as Tim Hood, the Mitigation Planner for the Heart of Texas Council of Government (HOTCOG).

Public input was solicited during the drafting stage and will be solicited again prior to the adoption of the plan. The public was encouraged to review and comment on the mitigation plan during the drafting stage. A draft of the plan was placed on the Limestone County's Office of Emergency Management (OEM) website in 2013 for the public to review and provide comments. A notice was provided at the County Courthouse building that the plan was made available for public review on the OEM website. An email address was included on the notice and the OEM website to provide the public an opportunity to comment on the Plan. However, no public comments were received.

A public meeting will occur in Limestone County prior to the plan being adopted by each participating jurisdictions Governing Body. The public will be notified that each Governing Body is considering the plan for formal adoption and will be given the location where the public can inspect the plan and submit comments. During each Governing Body meeting, a formal opportunity to comment on the plan will be provided in advance of Governing Body action passing resolutions adopting the plan. This process will occur after FEMA has reviewed the mitigation plan.

Following adoption of the plan in 2014, the public will continue to be involved in the maintenance process in the plan. See Section 15 for more information.

Partnerships in Planning

In developing the Plan, the County OEM was assisted by federal and state agencies, including the Federal Emergency Management Agency (FEMA) of the Department of Homeland Security, the Texas Division of Emergency Management (TDEM), the Texas Water Development Board (TWDB), and the Texas Forest Service (TFS).

A variety of existing studies and plans were reviewed as part of the planning process. In particular, the Limestone County local floodplain ordinance was reviewed to determine if floodplain management could be strengthened in an effort to mitigate floods. Requiring the addition of freeboard for building permits in the floodplain is one way to increase safety. The HMT also reviewed the City

of Groesbeck's building codes to determine if stronger ordinances would help strengthen new buildings from some hazards, such as tornadoes.

Sources of the information included FEMA Flood Insurance Rate Maps, the National Oceanic and Atmospheric Administration (NOAA), the Texas Water Development Board, the Texas Commission on Environmental Quality and the Texas State Mitigation Plan 2013. Section 13 and the hazard-specific sections of the plan summarize the findings from the studies, plans, reports and technical information.

Section Two: Limestone County at a Glance

Geography

Limestone County is in central Texas about 30 miles due east of Waco. Mexia, its largest community, is approximately 80 miles south of Dallas. Fort Parker, near the Navasota River in what is now central Limestone County, was the earliest actual settlement in the vicinity. The County comprises 931 square miles and the reported population in 2014 was 23,384.

The land, on the divide between the Brazos and Trinity Rivers, is drained by the Navasota River and its tributaries, which split the county in two. Bodies of water include Lake Mexia, Springfield Lake, and Lake Limestone. Natural resources of the county are clays, including kaolin and ceramic clays, limestone, industrial sand, glauconite, lignite coal, oil, and gas.

Limestone County can claim fame for its varied weather and weather-related events. The average annual precipitation is 38 inches, and temperatures range from an average low of 37 degrees F in January to an average high of 96 degrees F in July. It is not unusual, however, for temperatures to reach highs in the triple digits, and lows in the winter months well below the freezing mark.

Tornadoes, hailstorms, flash floods, severe winter and ice storms, and drought and excessive heat also plague the area. In 1902, an F2 tornado was reported in Limestone County, killing at least three people. Tornadoes and tornado winds caused $2.5 million in damages in the county in 1990. In 1998, the spring started cool and wet, but turned dry and warm in May. Large hail fell in isolated areas of the county in May and wind damage was widespread with storms that same month. The summer was hot and dry, with 56 100-degree days from May to October, 29 of them in a row in parts of central and north central Texas. Limestone County reported 43 excessive-heat deaths from 1998-2000, 32 of them occurring in July 1998. The economic loss and property damage in weather-related events in Limestone County from 1950-2003 topped $93 million. The county again experienced a hot and dry summer in 2011 with extreme drought and wildfires being reported throughout the region. Economic losses and property damage totals are still being calculated for the county.

Population

The population of Limestone County in 2014 is 23,384 people. The largest city in Limestone County is Mexia with a population of 7,459. The county seat is the City of Groesbeck, with a population of over 4,500.

Land Use

Limestone County has over 1,000 farms comprising over 400,000 acres. The primary crops are corn, wheat, hay, grain, cotton, ornamental fruit and pecans. Livestock plays an important role in the Limestone County economy, with cow-calf, stocker cattle, horses, goats, sheep, beef cattle and dairy cattle leading the way. Market value is estimated at over $30 million.

The major minerals in the county include oil and gas, lignite, crushed rock and limestone.

The major lakes in the county include Lake Limestone and Lake Mexia.

Development Trends

Although all of the communities in Limestone County are projected to grow in population, the cities of Mexia and Groesbeck are the only metropolitan areas in the area and therefore may face the most severe development challenges, and thus pressure to build in areas that are hazard-prone. Several of the smaller towns and communities will, however, deal with similar problems of maintaining the quality of life during periods of growth and paying for new schools, roads, and other types of infrastructure.

As part of the five-year plan update in 2019, 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.

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:

- have a population less than 3,000 and are not a remote area within the corporate boundaries of a larger city and,
- 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, the City of Kosse is the only community within Limestone County that is considered small and impoverished.

Section Three: Hazards Limestone County Faces

A risk assessment evaluated the probability of occurrence of a hazard event and the potential associated losses in Limestone 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: the Federal Emergency Management Agency's Hazards U.S. Multi-Hazards Model (HAZUS-MH), which is 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 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. Accordingly, various modules and beta version of the HAZUS-MH software were used in combination to estimate losses from earthquake, wind, and flood hazards.

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 in Limestone County

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.

Table 3-1 on the next page shows the study area, as well as the population density of Limestone County (based on Census 2012) and a numeric breakdown of the population and total estimated dollar exposure by key occupancy that was the basis of the risk assessment presented in this report. A detailed list of critical facilities can be found in Appendix B.

Table 3-1: Population and Building Distribution by Key Occupancy in Limestone County

Jurisdiction	Population (2010)	Residential Buildings		Commercial Buildings		Critical Facilities
		Number	Value ($)	Number	Value ($)	Number
Limestone County	23,585	9,400	$1.8 M	48	$200 K	1
Coolidge	878	240	$101 K	5	$20 K	0
Groesbeck	4,328	3,400	$350 K	12	$100 K	2
Kosse	501	230	$110 K	6	$22 K	0
Mexia	6,902	3,700	$421 K	15	$110 K	2
Tehuacana	316	287	$80 K	3	$15 K	1
Thornton	528	324	$90 K	9	$20 K	0

Hazards of Concern in Limestone County

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

- Dam failure
- Drought
- Flooding
- Hail
- Thunderstorms
- Tornadoes
- Wildfires
- Winter storms

Historical Disaster Declarations

Of the 1,037 major disaster declarations in the 50 states, the District of Columbia, and nine U.S. territories between 1972 and 2010, the state of Texas, at 84, claims the highest number of presidential disaster declarations for any state or territory. Presidential disaster declarations and Small Business Administration declarations for Limestone County are identified in Table 3-3.

Table 3-3: Disaster Declarations in Limestone County

County	Year	Disaster Number	Primary Incident Type	Presidential Declaration	SBA Declaration
Limestone	1979	1642	Flood	No	Yes
Limestone	1989	828 DR	Flood	Yes	Yes
Limestone	1990	863 DR	Flood	Yes	Yes
Limestone	1991	930 DR	Flood	Yes	Yes
Limestone	2005	1624 DR	Fire	Yes	Yes
Limestone	2007	1709 DR	Flood	Yes	Yes

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.

Economic Impact

The economic loss results are presented 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), and
- The annualized loss ratio (ALR), which expresses estimated annualized losses as a fraction of the building inventory replacement value.

The estimated AL addresses the two key components of risk: the probability of a hazard event 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.

Using the previously described methodology, statistical results were obtained for some of the different hazards profiled earlier. Estimated annualized losses for winter storm, tornado, hail, thunderstorm, and wildfire are summarized in Table 3-4. It should be noted that dollar loss estimates are not available for individual participating jurisdictions or for all hazards, including dam failure, drought and flood, and thus those hazards are not included in table 3-4.

Table 3-4: Summary of the Annualized Loss Estimates ($1,000)

County	Winter storm	Tornado	Hail	Thunder-storm	Wildfire
Limestone	45	166	175	39	2,809

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 Emergency Operations Center, or 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 plants),
- 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

Based on the probability of occurrence, the expected impact and absolute economic losses, the hazards in Limestone County are ranked below in priority order from most severe threat (flood) to least (dam failure):

- Flood
- Drought
- Wildfire
- Tornado
- Thunderstorm

- Hail
- Winter Storm
- Dam Failure

Hazard ranking depends on the probability of occurrence of a disaster within a period of time measured in time (or "return period"). An Exceeding Probability Curve (EP-Curve) provides the full picture of ranking at different return periods. At different return periods, the hazard loss rankings are different.

The Exceeding Probability (EP) curves are a way of showing the likelihood of disasters with varying levels of loss occurring. The EP curve for each of the counties displays the expected monetary loss (x-axis) as it correlates with the annual probability of occurrence of the loss (y-axis) for any given hazard. These curves are based on historical records of disasters within each county and on statistical modeling.

The annualized loss is the expected losses from all possible future events (considering all magnitude and frequencies), averaged over an annual basis.

Table 3-5 ranks hazard risks for Limestone County at a ten-year return period.

Table 3-5: Hazard Risk Ranking in Limestone County, Ten Year Return Period

1	Flood	**5**	Thunderstorm
2	Drought	**6**	Hail
3	Wildfire	**7**	Winter Storm
4	Tornado	**8**	Dam Failure

Unique Hazards

This plan is a multi-jurisdictional mitigation plan developed to address common risks faced by all the participating jurisdictions in Limestone County. However, members of the Hazard Mitigation Team also conducted an assessment of risks and identified any unique hazards for their jurisdiction that varied from those hazards affecting Limestone County as a whole. Table 3-6 provides an overall summary of the participating jurisdictions vulnerability to each hazard. The table also reflects any unique hazards for each jurisdiction's risks where they vary from the risks facing the entire planning area.

For all participating jurisdictions, 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 3-6 provides an overall summary of the participating jurisdictions vulnerability to each hazard. These ratings were developed based on the best acceptable data. 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% 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% 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% 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% of property destroyed or with major damage.

The ratings have been abbreviated in order to fit into Table 3-6. The ratings have been shortened to:

- S = Substantial
- Maj = Major
- Min = Minor
- L = Limited

Table 3-6: Overall Summary Descriptions of Jurisdictions' Vulnerability to Hazards in Limestone County

Jurisdiction	Dam Failure	Drought	Flooding	Hail	Winter Storm	Thunderstorm	Tornado	Wildfire
Limestone County	Min	Maj	Min	Min	Min	Min	Min	Min
Coolidge	L	Min	Min	L	L	Min	Min	L
Groesbeck	L	Min	Min	Min	Min	Min	Maj	Min
Kosse	L	Min	Min	L	L	L	Min	L
Mexia	L	Min	Min	Min	Min	Min	Min	Min
Tehuacana	L	Min	Min	L	L	L	L	L
Thornton	L	Min	Min	L	L	L	L	L

Historical Frequency

Sections 4 through 11 of this plan contain reviews of the historical frequency of occurrence and/or loss and damage estimates, by hazard, in Limestone County and participating jurisdictions.

Information on the expected frequency of occurrence in these sections and 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.

Conclusions

The hazard-event profiles relevant to Limestone 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. For example: How often may a particular disaster occur? Who is most likely to be affected? What area is most likely to be affected and how bad can it get?

Sections 4 through 11 of this plan contain reviews of the historical frequency of occurrence and/or loss and damage estimates in Limestone County for each hazard for each participating jurisdiction. 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.

SECTION 4: FLOOD

Why Floods Are a Threat

Texas consistently outranks other states in deaths and damages from floods, due to its size and location, according to American Hazardscapes: The Regionalization of Hazards and Disasters, published by the National Academy Press.

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. Flooding takes many forms in Limestone County. Below is more information related to flooding.

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 Limestone 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 over-bank 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 5-to-7-degrees Fahrenheit warmer than normal, thus contributing to the 1998 flooding.

Tropical Flooding

Hurricanes and tropical storms also bring floods. Between 1900 and 2010, thirty-seven hurricanes made landfall in Texas. Four were a Category 4 on the Saffir-Simpson scale, ten were Category 3, nine were Category 2 and twelve were Category 1.

Limestone County is not immune to the death and destruction that tropical systems can bring, however, it is not expected to be impacted by any major tropical flooding.

Hazard Profile for Limestone County

Major flooding and flash flooding events in Limestone County and the participating jurisdictions can have a minor severity of impact: it 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% of property destroyed or with major damage.

The frequency of occurrence of flooding is likely, with an event possible within the next five years.

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

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.

Flooding occurs in seasonal patterns. 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 flooding occur during the spring (April, May and June) and fall (October, November, and December).

History of Flooding

Flood events in Limestone County reported to the National Weather Service at http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms are listed in Table 4-1.

Table 4-1: Reported Flood Events, January 1, 1950, to August 31, 2012

Inj: injuries **Prop D**: property damage **Crop D**: crop damage

48 FLOOD event(s) were reported in **Limestone County, Texas** between **04/30/1950** and **08/31/2011**.

*Click on **Location or County** to display Details.*

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Texas								
Location or County	**Date**	**Time**	**Type**	**Mag**	**Dth**	**Inj**	**PrD**	**CrD**
1 Groesbeck	07/31/1995	0814	Flash Flood	N/A	0	0	0	0
2 Mexia	07/31/1995	1030	Flash Flood	N/A	0	0	0	0
3 Mexia	08/01/1995	1430	Flash Flood	N/A	0	0	15K	0
4 Groesbeck	04/04/1997	03:07 AM	Flash Flood	N/A	0	0	0	0
5 Groesbeck	04/04/1997	08:10 AM	Flash Flood	N/A	0	0	0	0
6 TXZ161	04/04/1997	09:35 PM	Flood	N/A	0	0	0	0
7 Groesbeck	04/04/1997	10:00 AM	Flash Flood	N/A	0	0	0	0
8 Mexia	04/04/1997	11:53 AM	Flash Flood	N/A	0	0	0	0
9 Mexia	12/20/1997	08:55 PM	Flash Flood	N/A	0	0	0	0
10 Groesbeck	01/05/1998	01:00 AM	Flash Flood	N/A	0	0	0	0
11 Groesbeck	01/05/1998	10:00 PM	Flash Flood	N/A	0	0	0	0
12 Groesbeck	01/06/1998	01:20	Flash Flood	N/A	0	0	0	0

		AM						
13 Mexia	01/06/1998	05:36 PM	Flash Flood	N/A	0	0	0	0
14 Groesbeck	01/07/1998	05:39 AM	Flash Flood	N/A	0	0	0	0
15 Groesbeck	01/07/1998	12:25 AM	Flash Flood	N/A	0	0	0	0
16 Mexia	01/07/1998	12:25 AM	Flash Flood	N/A	0	0	0	0
17 Groesbeck	04/04/1999	02:10 PM	Flash Flood	N/A	0	0	0	0
18 Mexia	05/04/2000	10:22 AM	Flash Flood	N/A	0	0	0	0
19 Countywide	06/11/2000	04:30 PM	Flash Flood	N/A	0	0	0	0
20 Groesbeck	06/11/2000	09:55 AM	Flash Flood	N/A	0	0	0	0
21 Kosse	07/16/2002	10:25 AM	Flash Flood	N/A	0	0	0	0
22 Mexia	12/03/2002	09:50 AM	Flash Flood	N/A	0	0	0	0
23 Countywide	02/21/2003	12:30 AM	Flash Flood	N/A	0	0	25K	0
24 Groesbeck	06/09/2004	09:56 PM	Flash Flood	N/A	0	0	0	0
25 Groesbeck	06/10/2004	03:00 AM	Flash Flood	N/A	0	0	0	0
26 Thornton	06/26/2004	08:35 AM	Flash Flood	N/A	0	0	0	0
27 Groesbeck	06/26/2004	09:49 PM	Flash Flood	N/A	0	0	0	0
28 Groesbeck	08/10/2005	05:40 AM	Flash Flood	N/A	0	0	0	0
29 Countywide	03/28/2006	06:16	Flash Flood	N/A	0	0	50K	0

		AM						
30 Groesbeck	05/06/2006	01:40 AM	Flash Flood	N/A	0	0	0	0
31 Groesbeck	12/29/2006	20:44 PM	Flash Flood	N/A	0	0	0K	0K
32 Groesbeck	01/13/2007	11:03 AM	Flash Flood	N/A	0	0	5K	0K
33 Groesbeck	03/12/2007	05:20 AM	Flash Flood	N/A	0	0	0K	0K
34 Coolidge	03/29/2007	19:09 PM	Flash Flood	N/A	0	0	0K	0K
35 Groesbeck	05/26/2007	11:30 AM	Flash Flood	N/A	0	0	0K	0K
36 Kosse	05/27/2007	09:38 AM	Flash Flood	N/A	0	0	0K	0K
37 Groesbeck	07/03/2007	17:15 PM	Flash Flood	N/A	0	0	0K	0K
38 Mexia	07/14/2007	05:00 AM	Flash Flood	N/A	0	0	0K	0K
39 Kosse	08/19/2008	07:33 AM	Flash Flood	N/A	0	0	50K	0K
40 Mexia	10/06/2008	18:00 PM	Flash Flood	N/A	0	0	0K	0K
41 Mexia	04/18/2009	09:00 AM	Flash Flood	N/A	0	0	20K	0K
42 Kosse	04/28/2009	10:37 AM	Flash Flood	N/A	0	0	1.0M	0K
43 Mexia	04/28/2009	15:30 PM	Flash Flood	N/A	0	0	0K	0K
44 Oletha	10/26/2009	09:17 AM	Flood	N/A	0	0	0K	0K
45 Shiloh	10/26/2009	09:17 AM	Flood	N/A	0	0	0K	0K
46 Mexia	05/14/2010	15:59	Flash Flood	N/A	0	0	0K	0K

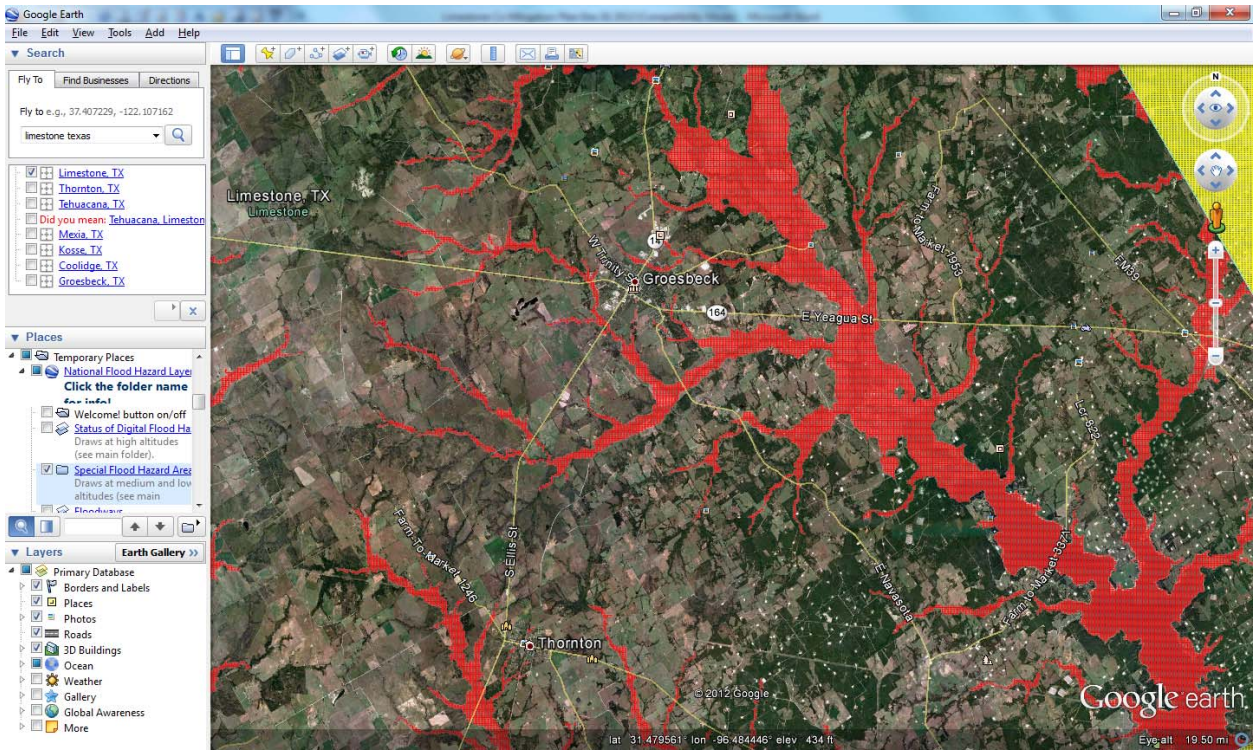
		PM						
47 Groesbeck	06/09/2010	20:18 PM	Flash Flood	N/A	0	0	15K	0K
48 Oak Hill	06/10/2010	06:06 AM	Flash Flood	N/A	0	0	50K	0K
				TOTALS:	0	0	1.230M	0

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. Figures 4-1 through 4 - 7 (following pages) depicts the flood zones where there is potential for damage to property and loss of life in Limestone County and participating jurisdictions. The flood zones on the maps are depicted in red color.

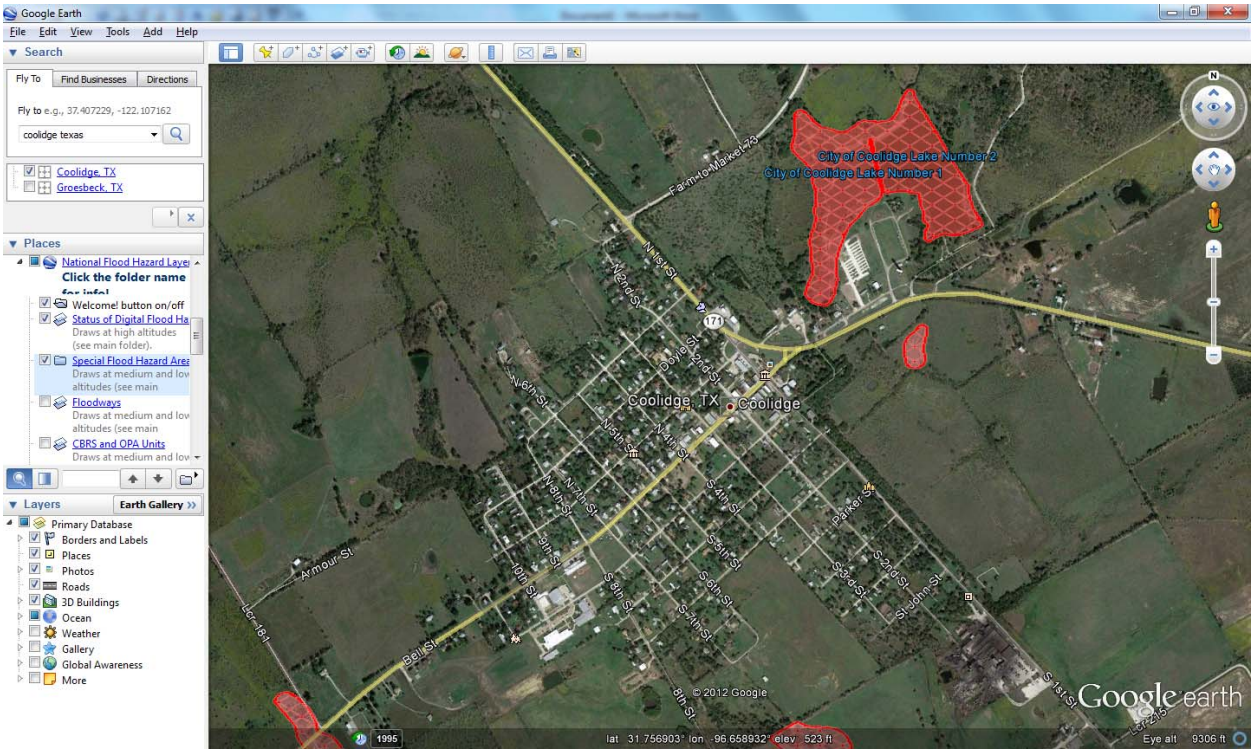
For more details, please view the actual FIRM maps kept at the Limestone County Office of Emergency Management located at 200 West State Street, Groesbeck, Texas 76642, or, view the maps on-line at FEMA's Map Center located at https://msc.**fema**.gov/.

Figure 4-1: Riverine Flooding Potential, Limestone County



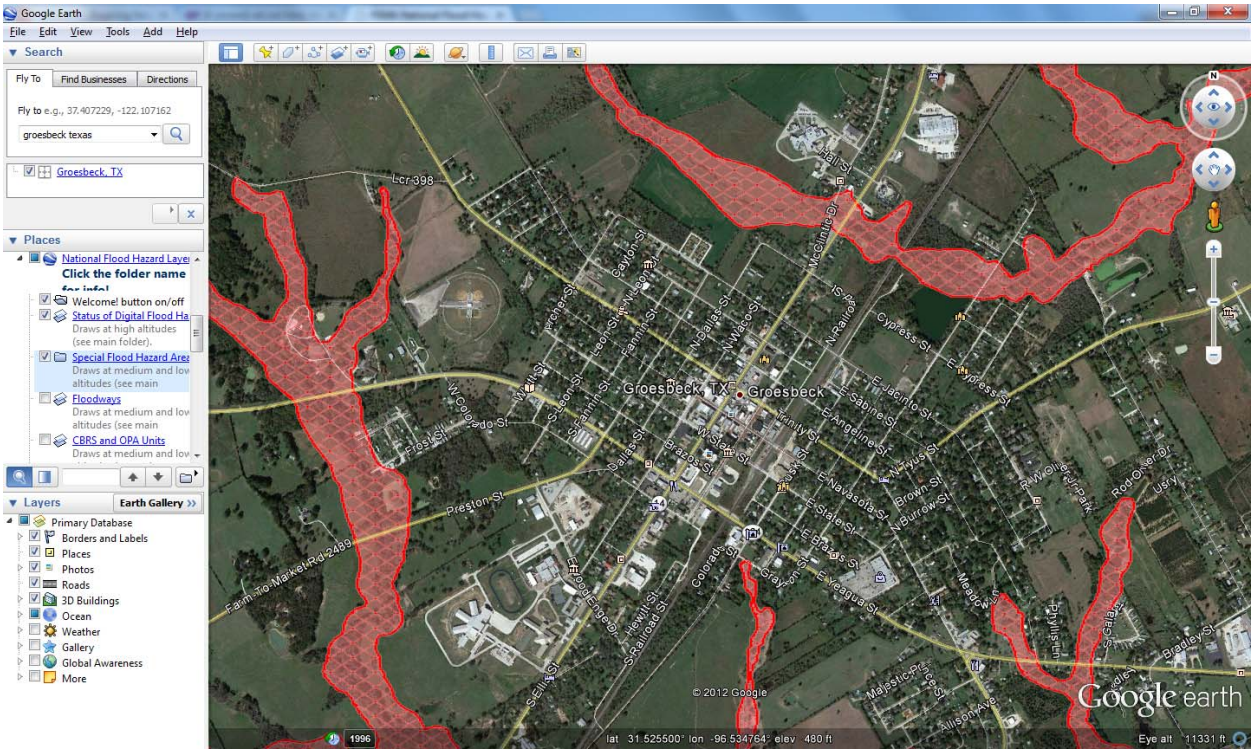
The 100-year flood zone on the map is depicted in red.

Figure 4-2: Riverine Flooding Potential, City of Coolidge



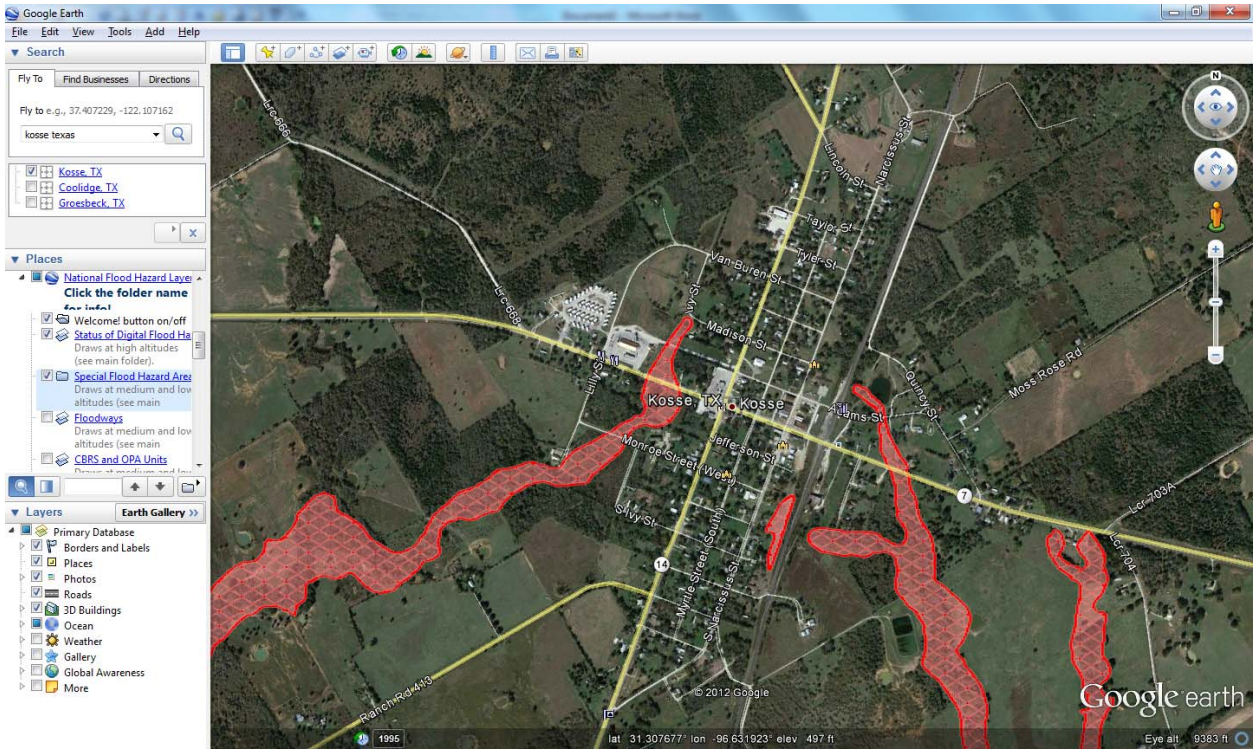
The 100-year flood zone on the map is depicted in red.

Figure 4-3: Riverine Flooding Potential, City of Groesbeck



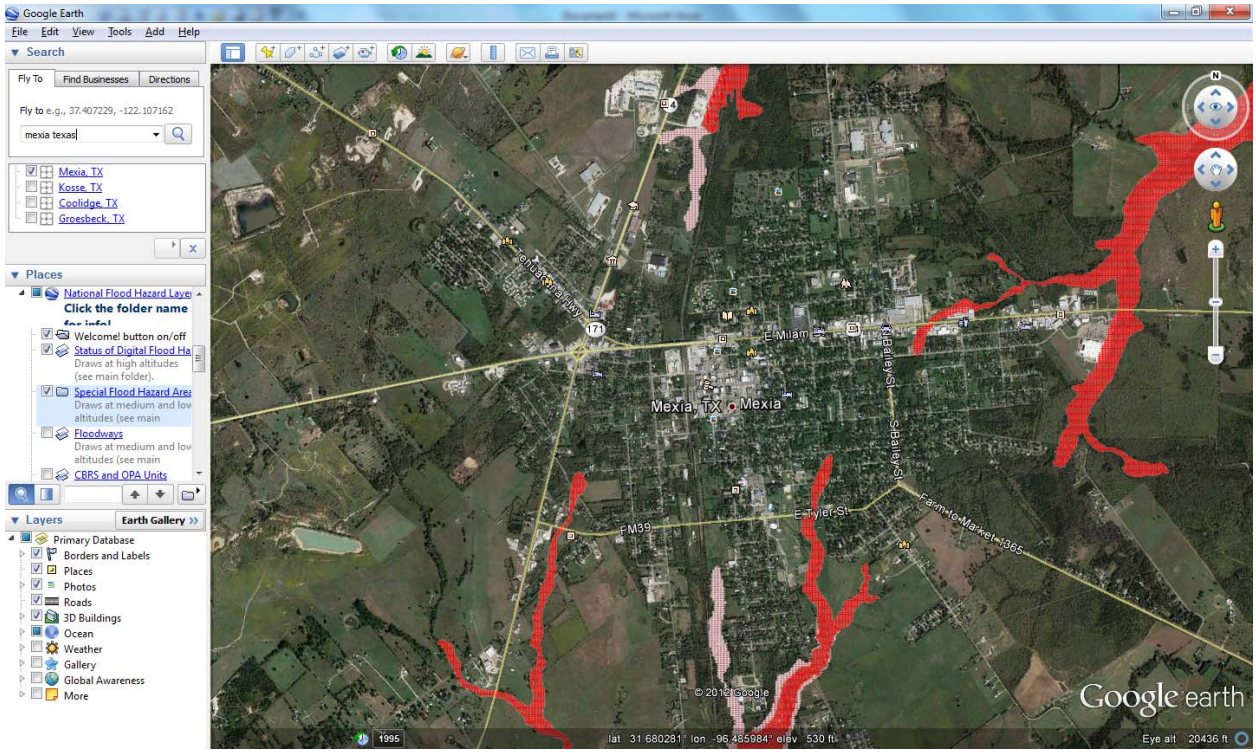
The 100-year flood zone on the map is depicted in red.

Figure 4-4: Riverine Flooding Potential, City of Kosse



The 100-year flood zone on the map is depicted in red.

Figure 4-5: Riverine Flooding Potential, City of Mexia



The 100-year flood zone on the map is depicted in red.

Figure 4-6: Riverine Flooding Potential, City of Tehuacana

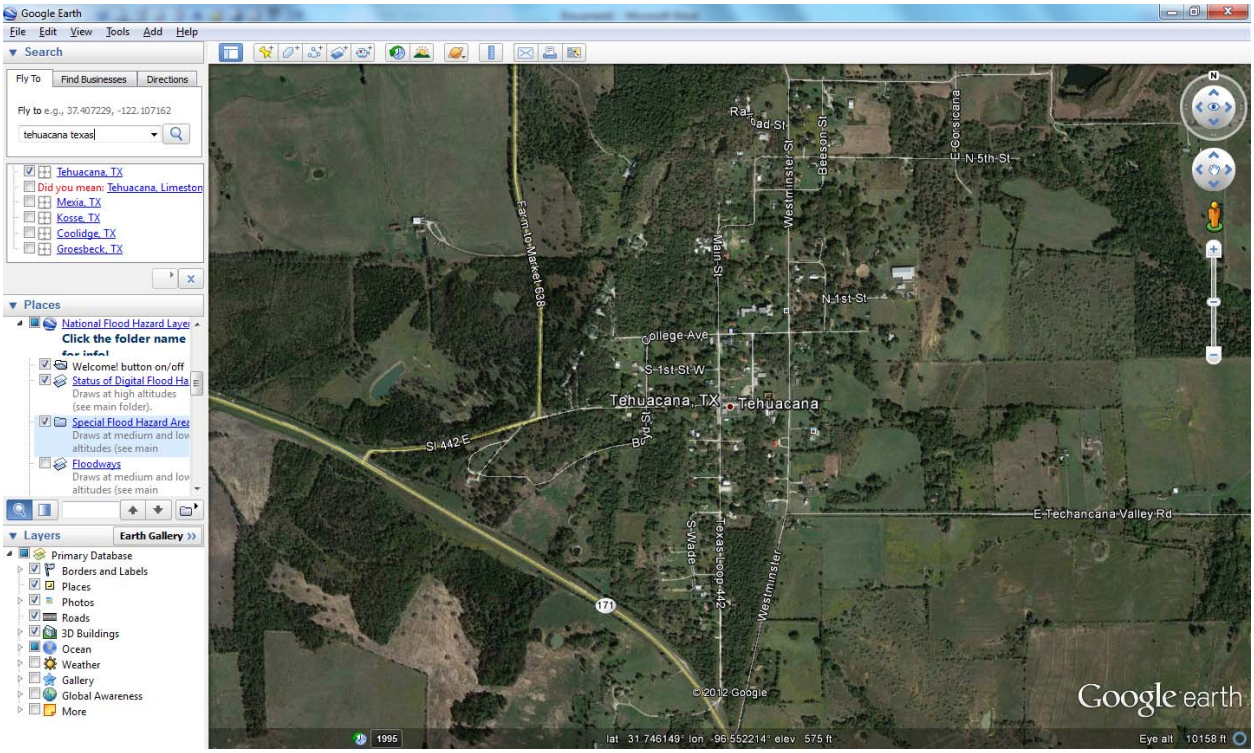
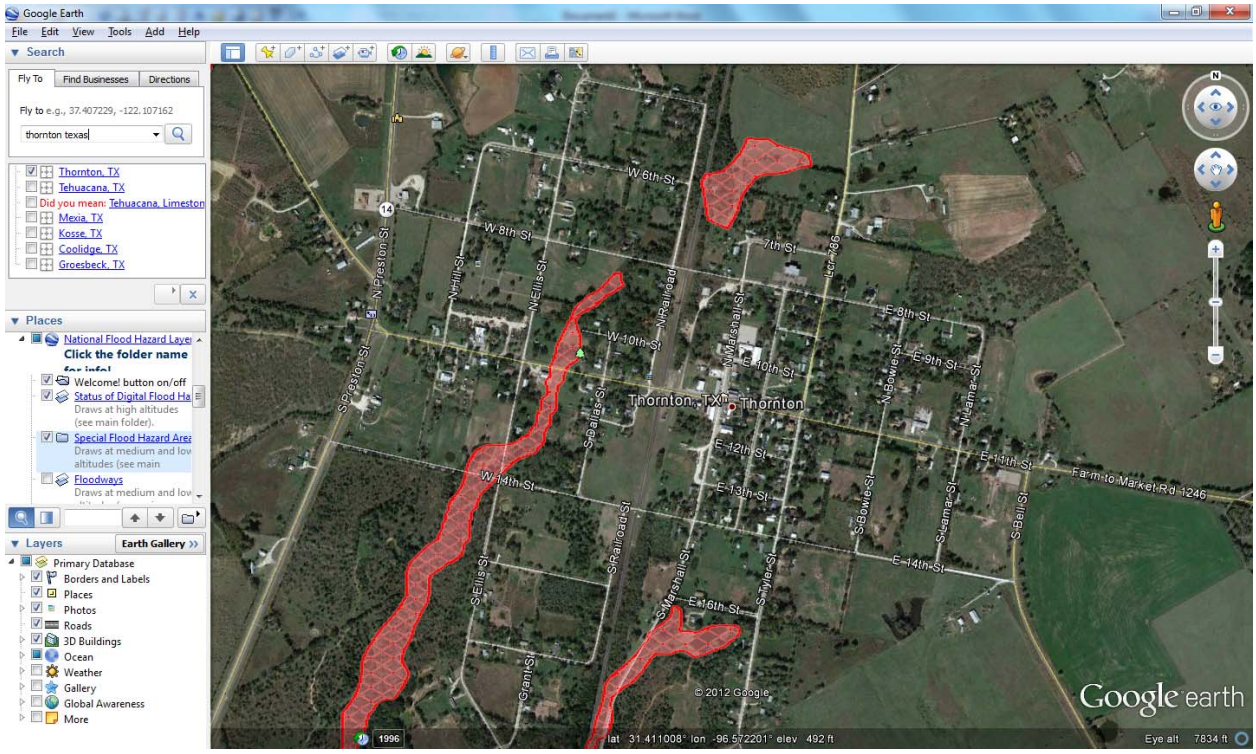


Figure 4-7: Riverine Flooding Potential, City of Thornton



The 100-year flood zone on the map is depicted in red.

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. Currently, the three communities of Limestone County, Groesbeck and Mexia participate in the NFIP.

Participating in the NFIP is voluntary. The communities of Coolidge, Kosse, Tehuacana and Thornton do not participate in the NFIP. There are currently over 50 flood insurance policies in force in participating Limestone County communities. Table 4-2 provides details about the NFIP policies in place for Limestone County.

Table 4-2: National Flood Insurance Program, Policies and Losses for Limestone County

Community	Policies in Effect	Total Coverage ($1,000)	Total Losses	Dollars Paid, Historical
Limestone Co.	47	$3,089	134	$1,286,387
Groesbeck	2	$137	0	0
Mexia	4	$471	11	$78,291

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.

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

People and Property at Risk

To assess flood risk, 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. 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.

There are 422 buildings at risk to floods in Limestone County, with the majority of them located in rural Limestone County. Their high risk to floods is based on their location in or near the Special Flood Hazard Area (SFHA) of the Navasota River. None of the participating cities in this plan are located on or near the Navasota River, and therefore have much less risk to floods. The cities of Groesbeck and Mexia do have a few buildings at risk to flooding based on their locations near local flood plains, however, the remaining participating jurisdictions have no significant number of buildings that are at risk to flooding. More information related to the location of floodplains may be obtained by viewing the FEMA Flood Insurance Rate Maps located at the Limestone County Office of Emergency Management or by viewing the flood maps online at https://msc.**fema**.gov/.

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.

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 4-3 shows the estimated buildings and people at risk to flooding.

Table 4-3: Potential Affected Exposure for 100-Year Flood (Riverine Flooding)

County	Residential		Commercial		Population at Risk to Flooding
	Number of Buildings	Exposure ($1,000)	Number of Buildings	Exposure ($1,000)	
Limestone	422	69,837	1	404	702

Potential impacts to critical facilities and infrastructure are provided in Table 4-4.

Table 4-4: Critical Facilities and Infrastructure Potentially Damaged, Limestone County

County	Critical Facilities		
	Total Number	Number Inside the 300-foot Buffer Around River Reach	Percentage Susceptible to Flooding
Limestone	4	0	0.00%

Repetitive Flood Losses

A repetitive loss property is defined by FEMA as a property that is currently insured through the National Flood Insurance Program (NFIP) that has experienced two or more losses from floods of $1,000 or more in any rolling 10-year period since 1978. Properties on the Target Repetitive Loss list are those that have experienced two losses within a 10-year period that exceed the value of the structure; three losses within the life of the structure that exceed the value of the structure; or four or more losses. Repetitive losses are provided in Table 4-5.

Table 4-5: Repetitive Losses in Limestone County

County	City	NFIP ID	Insured	Property Count[1]	Loss Count[2]	Loss Payments
Limestone County						
Limestone	Limestone County	480910	No	20	55	$547,018.48
Limestone	Limestone County	480910	SDF	1	3	$68,655.89
Limestone	Limestone County	480910	Yes	3	8	$74,729.07
Limestone	Mexia	480442	No	1	2	$10,581.37
Total				**25**	**68**	**$700,984.81**

Limestone County has 24 Repetitive Loss (RL) properties and the City of Mexia has 1 RL property.

All of these repetitive loss properties are residential. None are commercial properties.

[1] Number of repetitive loss properties.
[2] Total number of losses from the repetitive loss properties in the jurisdiction.

SECTION 5: DROUGHT

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. Figure 5-1 provides the definitions of drought classifications.

Figure 5-1: 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.

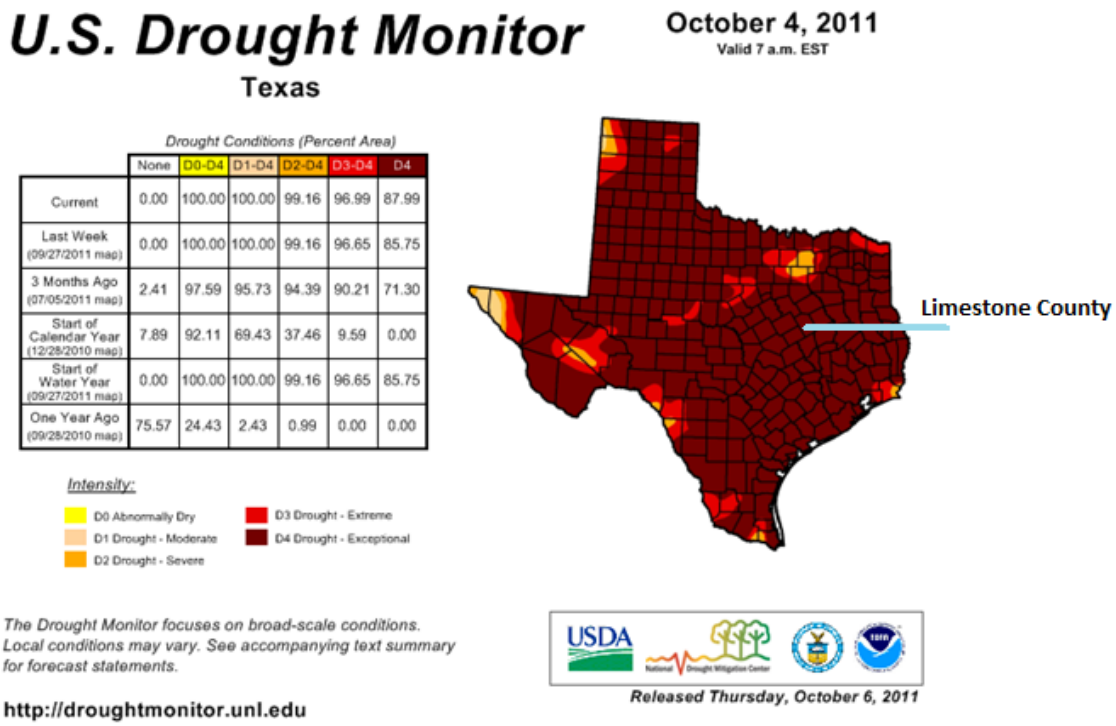
Source: Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy, FEMA

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.

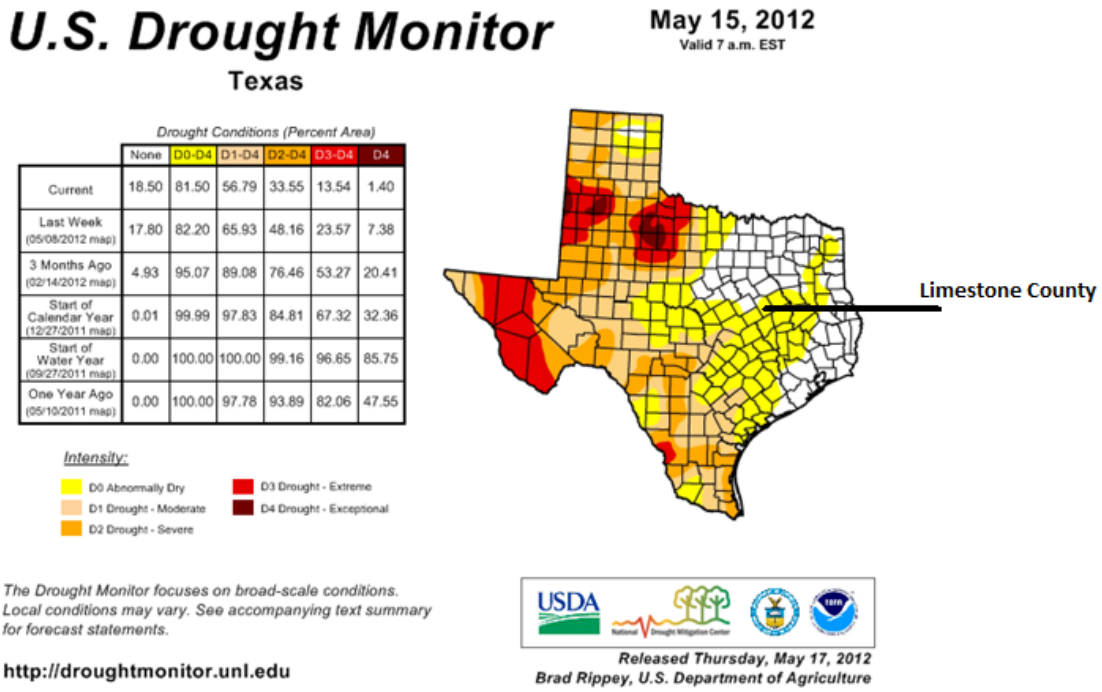
Droughts can affect a large area and range in size from a couple of counties to several states. Their impact on wildlife and area farming is enormous. Droughts can kill crops, grazing land, edible plants and even in severe cases, trees. Agricultural losses in Texas from the 1996 drought are estimated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

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.

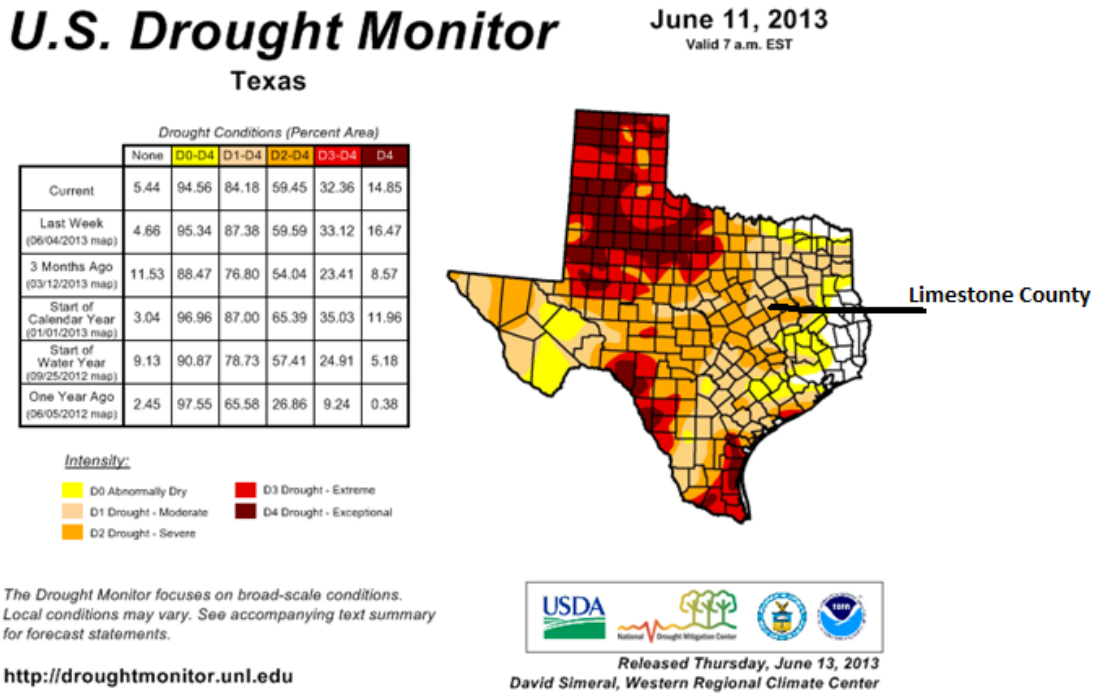
Droughts occur regularly in Texas and are a normal condition. They can vary greatly, however, in their intensity and duration. On average, a yearlong drought takes place somewhere in Texas once every 3 years and a major drought every 20 years. Major droughts can last for years. In the summer of 2011, all of Limestone County was experiencing a “severe” drought event. Agricultural losses from this on-going drought have yet to be determined.



By the spring of 2012, conditions in Limestone County had improved as the region received some much needed rain. The county was then rated as “moderate” on the drought monitor.



By the spring of 2013, conditions in Limestone County were rated as “severe” on the drought monitor.



Hazard Profile

The potential severity of impact of droughts in Limestone County is substantial, with more than 50% of property destroyed or with major damage especially taking into consideration the economic losses that may result from agricultural losses. However, the potential severity of impact on the other participating jurisdictions in this plan is considered minor, with no major damage or agricultural losses. Some water pipes may break due to the shifting of dry ground, however.

There are no defined geographic boundaries for drought and all areas of Limestone County can be affected equally.

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

According to the Palmer Drought Index, shown in Table 5.3, the extent of droughts can range from minor or moderate to extreme or exceptional. The maximum extent of drought that can affect Limestone County and the participating jurisdictions would be exceptional. This occurred during the summer and fall of 2011. The minimum extent of drought that can affect Limestone County and the participating jurisdictions would be moderate. This occurred during the spring 2012 and summer of 2013 after some much needed rain.

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 H.B. 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.

History of Drought

Drought events in Limestone County reported to the National Weather Service at http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms are listed in Table 5-1.

Table 5-1: Reported Drought Events, April 30, 1950, to August 31, 2011

29 DROUGHT event(s) were reported in **Limestone County, Texas** between **04/30/1950** and **08/31/2011**.

*Click on **Location or County** to display Details.*

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Texas								
Location or County	**Date**	**Time**	**Type**	**Mag**	**Dth**	**Inj**	**PrD**	**CrD**
1 LIMESTONE	08/01/1996	12:00 AM	Drought	N/A	0	0	0	0
2 LIMESTONE	07/01/1998	12:00 AM	Drought	N/A	0	0	0	0K
3 LIMESTONE	08/01/2000	12:00 AM	Drought	N/A	0	0	0	0
4 LIMESTONE	09/01/2000	12:00 AM	Drought	N/A	0	0	0	0
5 LIMESTONE	07/01/2005	12:00	Drought	N/A	0	0	0	60.0M

		AM						
6 LIMESTONE	11/01/2005	12:00 AM	Drought	N/A	0	0	0	120.0M
7 LIMESTONE	12/01/2005	12:00 AM	Drought	N/A	0	0	0	120.0M
8 LIMESTONE	01/01/2006	12:00 AM	Drought	N/A	0	0	0	1.0B
9 LIMESTONE	02/01/2006	12:00 AM	Drought	N/A	0	0	0	300.0M
10 LIMESTONE	03/01/2006	12:00 AM	Drought	N/A	0	0	0	200.0M
11 LIMESTONE	06/06/2006	12:00 AM	Drought	N/A	0	0	0	100.0M
12 LIMESTONE	07/01/2006	12:00 AM	Drought	N/A	0	0	0	100.0M
13 LIMESTONE	08/01/2006	12:00 AM	Drought	N/A	0	0	0	100.0M
14 LIMESTONE	09/01/2006	12:00 AM	Drought	N/A	0	0	0	80.0M
15 LIMESTONE	11/01/2006	00:00 AM	Drought	N/A	0	0	0K	800K
16 LIMESTONE	06/24/2008	00:00 AM	Drought	N/A	0	0	0K	0K
17 LIMESTONE	07/01/2008	00:00 AM	Drought	N/A	0	0	0K	25K
18 LIMESTONE	08/01/2008	00:00 AM	Drought	N/A	0	0	0K	5K
19 LIMESTONE	03/10/2009	00:00 AM	Drought	N/A	0	0	0K	10K
20 LIMESTONE	04/01/2009	00:00 AM	Drought	N/A	0	0	0K	25K
21 LIMESTONE	07/01/2009	00:00 AM	Drought	N/A	0	0	0K	10K
22 LIMESTONE	08/01/2009	00:00	Drought	N/A	0	0	0K	25K

		AM						
23 LIMESTONE	09/01/2009	00:00 AM	Drought	N/A	0	0	0K	5K
24 LIMESTONE	01/01/2011	01:00 AM	Drought	N/A	0	0	0K	5K
25 LIMESTONE	03/07/2011	00:00 AM	Drought	N/A	0	0	0K	7K
26 LIMESTONE	04/01/2011	00:00 AM	Drought	N/A	0	0	0K	20K
27 LIMESTONE	05/01/2011	00:00 AM	Drought	N/A	0	0	0K	10K
28 LIMESTONE	06/01/2011	00:00 AM	Drought	N/A	0	0	0K	40K
29 LIMESTONE	07/01/2011	00:00 AM	Drought	N/A	0	0	0K	10K
				TOTALS:	0	0	0	2.181B

In addition to the previous occurrences of drought listed above by NOAA, Limestone County continued to experience a severe drought through December of 2011. The drought was reduced to moderate in May 2013.

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 Limestone 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 Limestone 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 5-2 shows annualized expected exposure by county.

Table 5-2: Annualized Expected Agricultural Product Market Value Exposed to Drought in Limestone County

County	Annualized Expected Exposure ($)
Limestone	$6,940

Annualized Expected Exposure numbers are not available for the remaining jurisdictions in this plan.

The Palmer Drought Severity Index is shown below in Table 5-3 to demonstrate the extent that drought can reach in Limestone County.

Table 5-3: Palmer Drought Severity 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

SECTION 6: WILDFIRES

Why Wildfires Are a Threat

This mitigation plan addresses only major wildfires. For purposes of this plan, major wildfire events are those that were greater than or equal to two-alarm fires. A wildfire may be defined as a sweeping and destructive conflagration especially in a wilderness or a rural area.

A wildfire is any fire occurring on grassland, forest, or prairie, regardless of ignition source, damages, or benefits. According to the National Fire Plan, 2000, the wildfire 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.

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.

Wildfires can occur at any time of the year. Climatic conditions such as severe freezes and drought can significantly increase the intensity of wildfires since these conditions kill vegetation, creating a prime fuel source for 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.

Hazard Profile

Wildfire events can have a major severity of impact for rural Limestone County. 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.

Major wildfire events in Limestone County are likely, with an event is possible in the next five years.

The National Fire Plan 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." For Limestone County, the urban/Wildland interface exists primarily in rural Limestone County, where residents have built structures within close proximity to woods and trees. These areas are at higher risk of being impacted by wildfires than the participating cities are, due to the lack of heavy vegetation and dry brush within these cities. Limestone County and the participating cities can reduce their vulnerability to wildfires by increasing the urban/wildland interface zone around structures to over 50 feet, meaning that all heavy brush and trees are not allowed to grow within 50 feet of any existing or new structure.

The extent of wildfire in Limestone County can include hundreds of acres burned, dozens of structures damaged or destroyed, and possible loss of life. The extent of wildfire in the participating cities is that some acreage may be burned and a few structures damaged or destroyed. Table 6-1 shows the extent of wildfire for each participating jurisdiction.

Table 6-1: Potential Wildfire Extent in Limestone County

Jurisdiction	Potential Structures Impacted	Potential Acreage Impacted
Limestone County	24	400
Coolidge	2	20
Groesbeck	16	75
Kosse	6	25
Mexia	4	23
Tehuacana	6	20
Thornton	4	15

Location of Hazardous Areas

Figures 6-1 through 6-7 shows the possible location of wildfires in Limestone County, based on the Texas Forest Service wildfire ignition density measures. Limestone County falls mostly into the moderate risk category in the map below.

This overall hazard rating by the Texas Forest Service is descriptive and not predictive, based on wide-ranging parameters.

Figure 6-1: Potential Wildfire Location in Limestone County

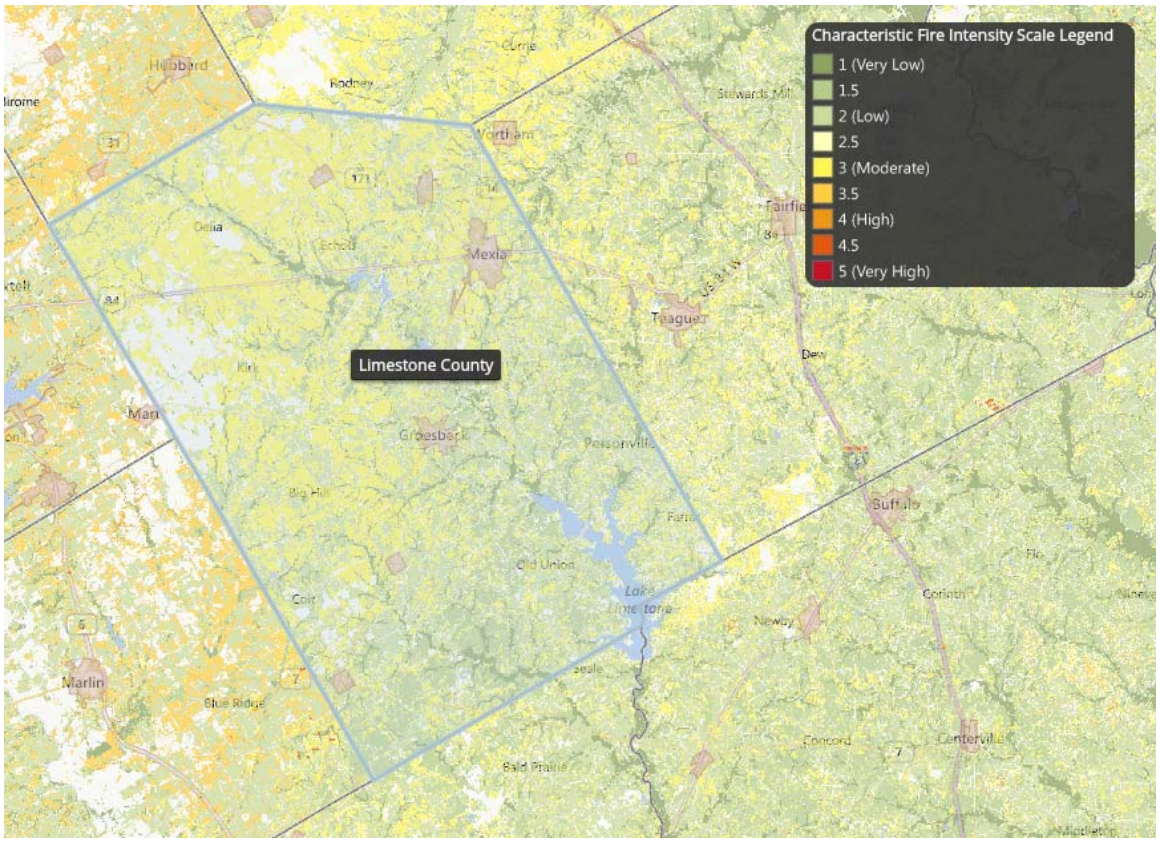


Figure 6-2: Potential Wildfire Location in Coolidge

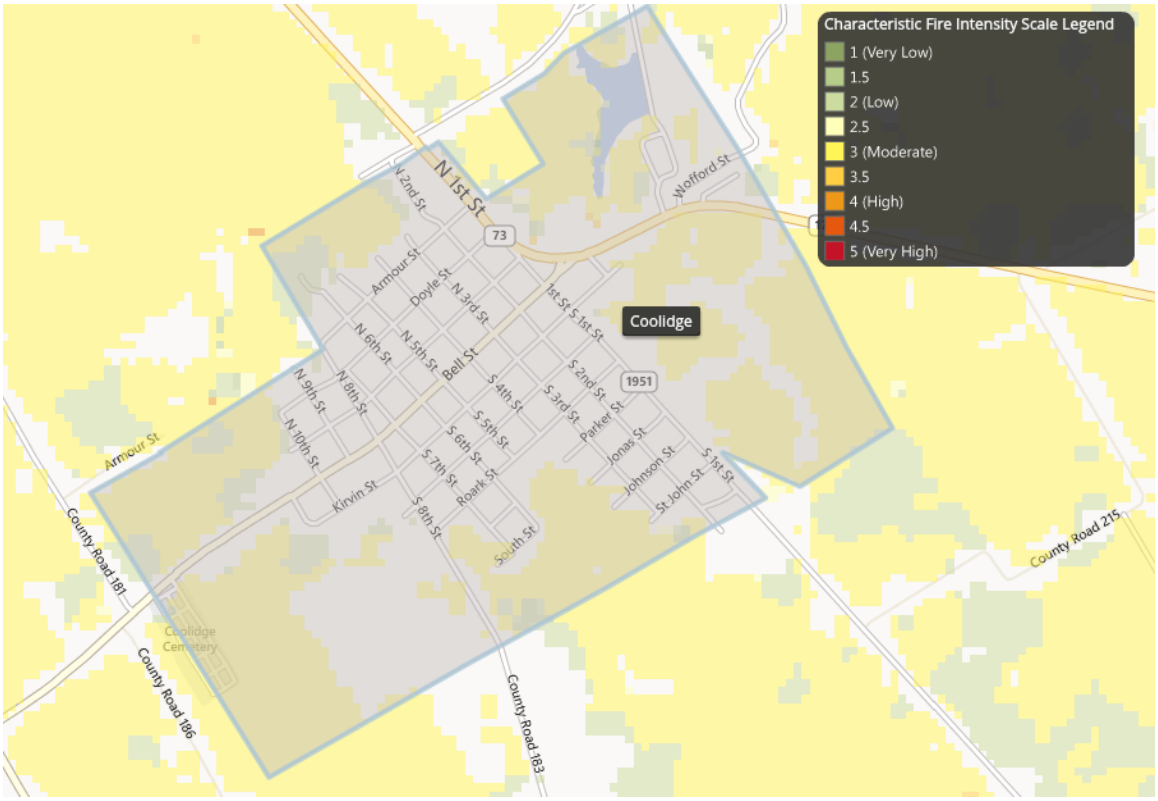


Figure 6-3: Potential Wildfire Location in Groesbeck

Figure 6-4: Potential Wildfire Location in Kosse

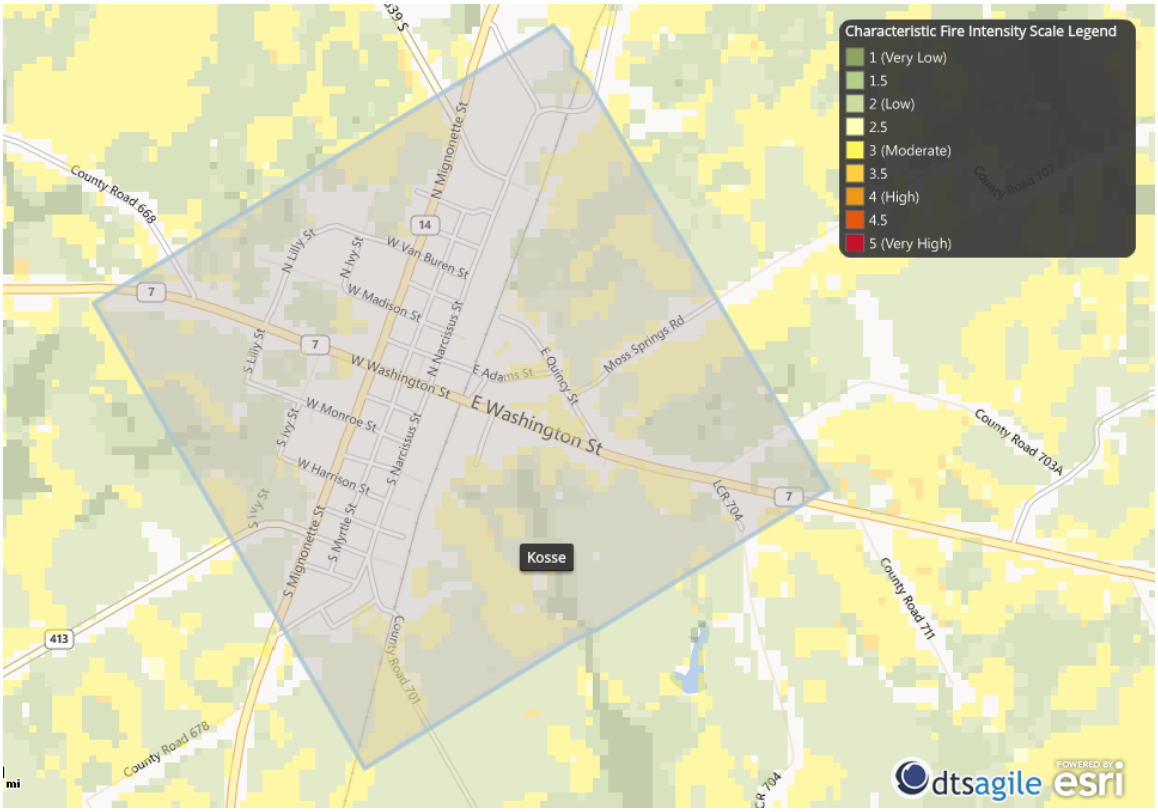


Figure 6-5: Potential Wildfire Location in Mexia

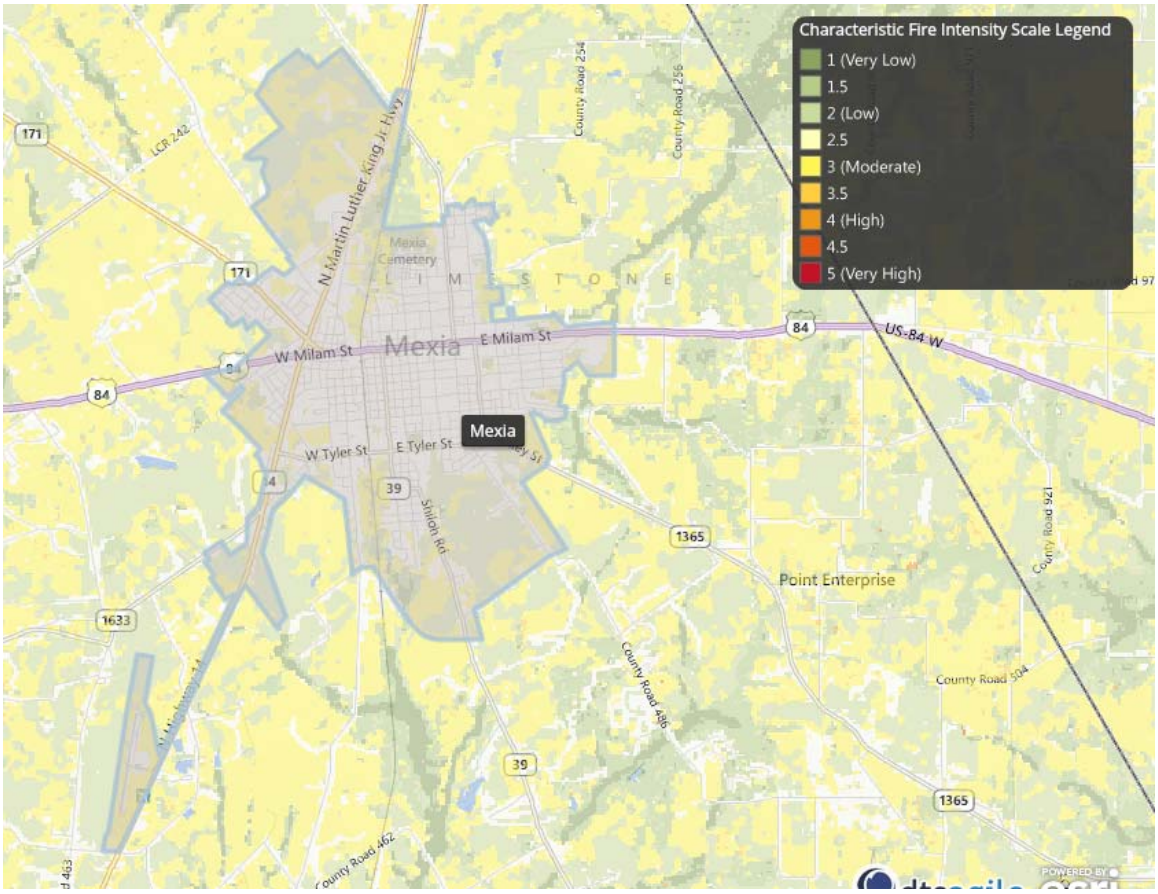


Figure 6-6: Potential Wildfire Location in Tehucana

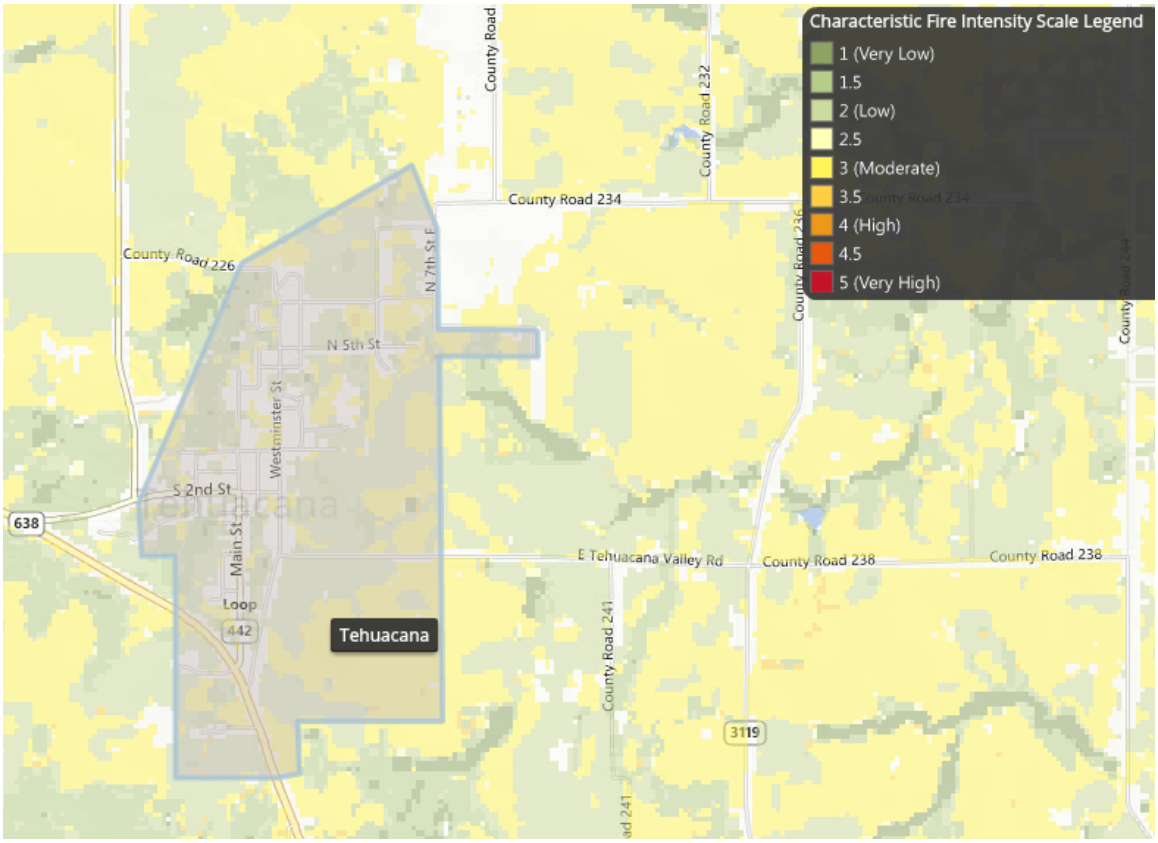
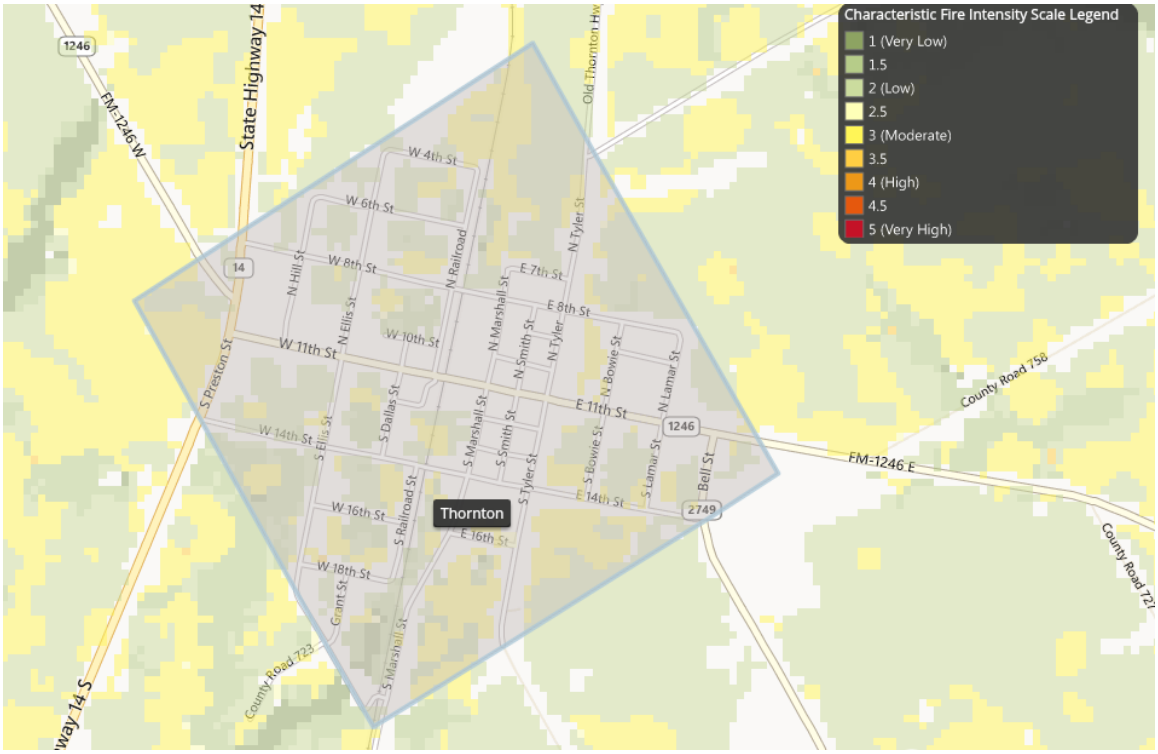


Figure 6-7: Potential Wildfire Location in Thornton



History of Wildfire

Figure 6-3 shows the number of wildfire incidents and the total acreage burned in Limestone County. There are been no previous reports of wildfires within the city limits of the jurisdictions that participated in this plan.

Figure 6-3: Wildfire Incidents and Losses in Limestone County, 1989-2013

Location	Date	Acreage Burned
Limestone County	September 1997	200
Limestone County	August 1998	125
Limestone County	February 2002	45
Limestone County	July 2001	100

People and Property at Risk

There is no defined geographic hazard boundary for wildfires. All people, buildings, critical facilities and infrastructure within Limestone County and participating jurisdictions are considered exposed to the wildfire hazard and could potentially be impacted. Rural areas of Limestone County have the highest risk of being impacted by a wildfire event, while the participating cities have a low risk of being impacted. Below is figure 6-4, which shows the potential extent of wildfire for each participating jurisdiction.

Figure 6-4: Potential Wildfire Extent in Limestone County

Jurisdiction	Potential Structures Impacted	Potential Acreage Impacted
Limestone County	24	400
Coolidge	2	20
Groesbeck	16	75
Kosse	6	25
Mexia	4	23
Tehuacana	6	20
Thornton	4	15

SECTION 7: TORNADOES

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 7-1: 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.

Limestone 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 7-2.

Table 7-2: Variations among Tornadoes

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

Hazard Profile

The impact of tornadoes in Limestone County can be major, they 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. The impact of tornadoes in the participating cities is

considered minor, they 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% of property destroyed or with major damage.

The frequency of occurrence of tornadoes in Limestone County and participating jurisdictions is unlikely, with an event possible in the next ten years.

The maximum extent of tornadoes that can affect Limestone County and participating jurisdictions is an EF4, which according to the Enhanced Fujita Scale, would be an incredibly strong tornado with winds speeds over 200 miles per hour.

Because it cannot be predicted where a tornado will touch down, all buildings and facilities in Limestone County are considered to be exposed to the tornado hazard and could potentially be impacted.

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.

History of Tornadoes

Historical evidence, as reflected in Table 7-3 (next page), shows that most of Limestone County is vulnerable to tornado activity. There is no defined hazard boundary for 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 7-3.

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 7-3: Historical Tornado Events for Limestone County as Reported to the National Weather Service, 04/30/1950 to 08/31/2011

http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms

21 TORNADO(s) were reported in **Limestone County, Texas** between **04/30/1950** and **08/31/2011**.

*Click on **Location or County** to display Details.*

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Texas								
Location or County	**Date**	**Time**	**Type**	**Mag**	**Dth**	**Inj**	**PrD**	**CrD**
1 LIMESTONE	06/09/1962	1115	Tornado	F0	0	0	0K	0
2 LIMESTONE	08/13/1963	1520	Tornado	F0	0	0	0K	0
3 LIMESTONE	03/10/1973	0611	Tornado	F4	0	0	0K	0
4 LIMESTONE	06/03/1973	1700	Tornado	F2	0	0	250K	0
5 LIMESTONE	05/25/1976	1515	Tornado	F2	0	0	25K	0
6 LIMESTONE	05/13/1985	1415	Tornado	F0	0	0	0K	0
7 LIMESTONE	04/19/1986	1617	Tornado	F1	0	2	250K	0

8 LIMESTONE	04/27/1990	1540	Tornado	F1	0	0	0K	0
9 LIMESTONE	04/27/1990	1540	Tornado	F3	0	0	2.5M	0
10 LIMESTONE	04/27/1990	1645	Tornado	F2	0	8	25.0M	0
11 LIMESTONE	04/27/1990	1705	Tornado	F1	0	0	0K	0
12 Thornton	04/12/1996	08:10 PM	Tornado	F0	0	0	0	0
13 Groesbeck	04/28/1996	06:00 PM	Tornado	F0	0	0	0	0
14 Thornton	03/30/2002	01:21 PM	Tornado	F2	0	0	250K	0
15 Personville	03/30/2002	01:55 PM	Tornado	F0	0	0	3K	0
16 Kosse	12/29/2006	13:42 PM	Tornado	F2	1	20	1.0M	0K
17 Mexia	12/29/2006	14:12 PM	Tornado	F0	0	0	10K	0K
18 Coolidge	04/25/2011	17:53 PM	Tornado	EF0	0	0	0K	0K
19 Groesbeck	04/26/2011	18:35 PM	Tornado	EF1	0	0	150K	0K
20 Lost Prairie	04/26/2011	18:48 PM	Tornado	EF0	0	0	0K	0K
21 Thornton	04/26/2011	20:57 PM	Tornado	EF0	0	0	0K	0K
				TOTALS:	1	30	29.438M	0

Table 7-4: Overall Historical Impact of Tornadoes in Limestone County

County	Number of Events	Max. Extent on the F-Scale
Limestone	21	F4

People and Property at Risk

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

Potential Damages and Losses

Table 7-5 shows potential annualized expected property losses in Limestone County. Annualized expected property losses for the participating cities in this plan are not currently available.

Table 7-5: Annualized Expected Property Losses ($)

County	Annualized Expected Property Losses
Limestone	$16,600

SECTION 8: 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 F. Sometimes, on a hot summer day, this air originates near the ground at 100 degrees F. 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 F, 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

Thunderstorms are generally localized events. The severity of impact of thunderstorms in Limestone County and participating jurisdictions 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 Limestone County and participating jurisdictions is highly likely, with an event possible in the next three years.

The maximum extent that thunderstorm winds in Limestone County and participating jurisdictions can reach is 78 knots. Some minor localized flooding may also occur if the thunderstorms bring substantial rain amounts.

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

Warning times for thunderstorms is generally minimal or no warning time.

History of Thunderstorms

Table 8-1 gives aggregated historical thunderstorm information for Limestone County. Historical thunderstorm events are detailed in Table 8-2. 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 in Limestone County, as indicated in Figure 8-1.

Table 8-1: Thunderstorms in Limestone County, 2000-2011

County	Number of Events
Limestone	35

Table 8-2: Historical Thunderstorms in Limestone County, 2000-2011

http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms

35 THUNDERSTORM WINDS event(s) were reported in **Limestone County, Texas** between **04/30/2000** and **08/31/2011**.

*Click on **Location or County** to display Details.*

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Texas								
Location or County	**Date**	**Time**	**Type**	**Mag**	**Dth**	**Inj**	**PrD**	**CrD**
1 Mexia	05/28/2001	02:19 AM	Tstm Wind	58 kts.	0	0	0	0
2 Kosse	03/19/2002	08:45 PM	Tstm Wind	0 kts.	0	0	1K	0
3 Groesbeck	05/01/2003	08:50	Tstm Wind	52 kts.	0	0	0	0

		PM						
4 Mexia	06/12/2003	05:55 PM	Tstm Wind	52 kts.	0	0	0	0
5 Coolidge	06/15/2003	02:15 AM	Tstm Wind	52 kts.	0	0	2K	0
6 Groesbeck	06/01/2004	10:28 PM	Tstm Wind	61 kts.	0	0	25K	0
7 Kosse	05/08/2005	06:56 AM	Tstm Wind	52 kts.	0	0	0	0
8 Mexia	05/08/2005	07:15 AM	Tstm Wind	52 kts.	0	0	2K	0
9 Mexia	07/02/2005	09:00 PM	Tstm Wind	50 kts.	0	0	10K	0
10 Mexia	07/02/2005	09:06 PM	Tstm Wind	50 kts.	0	0	0	0
11 Groesbeck	07/02/2005	09:15 PM	Tstm Wind	65 kts.	0	0	0	0
12 Groesbeck	07/02/2005	09:20 PM	Tstm Wind	65 kts.	0	0	5K	0
13 Thornton	05/06/2006	01:14 AM	Tstm Wind	52 kts.	0	0	30K	0
14 Thornton	10/26/2006	17:36 PM	Thunderstorm Wind	61 kts.	0	0	0K	0K
15 Coolidge	03/29/2007	17:20 PM	Thunderstorm Wind	56 kts.	0	0	15K	0K
16 Coolidge	03/30/2007	17:05 PM	Thunderstorm Wind	50 kts.	0	0	10K	0K
17 Mexia	09/05/2007	06:29 AM	Thunderstorm Wind	52 kts.	0	0	6K	0K
18 Tehuacana	03/03/2008	05:23 AM	Thunderstorm Wind	52 kts.	0	0	0K	0K
19 Forest Glade	03/03/2008	05:25 AM	Thunderstorm Wind	50 kts.	0	0	125K	0K
20 Mexia Muni Arpt	03/03/2008	05:29	Thunderstorm Wind	50 kts.	0	0	5K	0K

		AM						
21 Mexia	03/03/2008	17:35 PM	Thunderstorm Wind	50 kts.	0	0	5K	0K
22 Coolidge	04/23/2008	22:26 PM	Thunderstorm Wind	50 kts.	0	0	30K	0K
23 Delia	08/03/2008	19:10 PM	Thunderstorm Wind	61 kts.	0	0	40K	0K
24 Forest Glade	10/06/2008	17:52 PM	Thunderstorm Wind	52 kts.	0	0	0K	0K
25 Forest Glade	10/06/2008	18:46 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
26 Mexia	12/27/2008	10:50 AM	Thunderstorm Wind	50 kts.	0	2	2K	0K
27 Kirk	02/10/2009	21:50 PM	Thunderstorm Wind	60 kts.	0	0	10K	0K
28 Watt	02/10/2009	22:00 PM	Thunderstorm Wind	78 kts.	0	0	8K	0K
29 Datura	02/10/2009	22:15 PM	Thunderstorm Wind	75 kts.	0	0	5K	0K
30 Tehuacana	02/10/2009	22:17 PM	Thunderstorm Wind	56 kts.	0	0	0K	0K
31 Thornton	08/23/2009	18:00 PM	Thunderstorm Wind	61 kts.	0	0	15K	0K
32 Pleasant Grove	08/27/2009	13:30 PM	Thunderstorm Wind	50 kts.	0	0	7K	0K
33 Billington	04/23/2010	23:45 PM	Thunderstorm Wind	61 kts.	0	0	10K	0K
34 Coolidge	04/23/2010	23:59 PM	Thunderstorm Wind	65 kts.	0	0	20K	0K
35 Echols	04/26/2011	19:25 PM	Thunderstorm Wind	70 kts.	0	0	75K	0K
				TOTALS:	0	2	463K	0

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 and infrastructure in Limestone County are considered exposed to the hazard and could potentially be impacted. There are currently no annualized expected losses available for Limestone County and participating jurisdictions.

SECTION 9: HAIL

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 Limestone County, since the injuries they cause are generally minor. Hailstorm impacts are also considered limited because they can may 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.

Hail events in Limestone County are likely, with an event possible in the next five years.

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The extent of hail in Limestone County and participating jurisdictions can range from ¾ of an inch up to 2.75 inches, which, according to the Tornado and Storm Research Organization (TORRO) Hailstorm Intensity Scale shown below, is classified as an H7 with baseball 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

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 time. 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.

History of Hailstorms

Historical hail events with hailstone size one inch or greater are listed in Table 9-1.

Figure 9-1: Aggregated Historical Hail Impact for Limestone County (National Climatic Data Center), 2005-2012

County	Number of Events	Maximum Diameter (inches)
Limestone	13	1.75

Table 9-2: Overall Historical Hail Impact in Limestone County (National Climatic Data Center)

http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms

13 HAIL event(s) were reported in **Limestone County, Texas** between **04/30/2005** and **08/31/2011**.

*Click on **Location or County** to display Details.*

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Texas								
Location or County	**Date**	**Time**	**Type**	**Mag**	**Dth**	**Inj**	**PrD**	**CrD**
1 Mexia	07/02/2005	09:00 PM	Hail	0.75 in.	0	0	0	0
2 Coolidge	04/25/2006	04:10 PM	Hail	1.75 in.	0	0	5K	0
3 Kosse	04/29/2006	02:30 AM	Hail	0.75 in.	0	0	0	0
4 Coolidge	04/17/2007	18:48 PM	Hail	0.75 in.	0	0	0K	0K

5 Mexia	05/10/2007	16:05 PM	Hail	1.75 in.	0	0	5K	0K
6 Mexia	05/10/2007	16:24 PM	Hail	1.50 in.	0	0	3K	0K
7 Oak Hill	04/25/2008	16:27 PM	Hail	1.75 in.	0	0	5K	0K
8 Prairie Hill	05/07/2008	16:04 PM	Hail	0.75 in.	0	0	0K	0K
9 Mexia	05/20/2010	18:40 PM	Hail	1.00 in.	0	0	0K	0K
10 Mexia	04/25/2011	17:11 PM	Hail	1.00 in.	0	0	0K	0K
11 Mexia	04/25/2011	17:20 PM	Hail	1.75 in.	0	0	4K	0K
12 Mexia	04/25/2011	17:22 PM	Hail	1.75 in.	0	0	10K	0K
13 Gude	04/25/2011	18:03 PM	Hail	1.75 in.	0	0	2K	0K
				TOTALS:	0	0	34K	0

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 past years it is likely that a higher number of occurrences have not been reported.

Potential Damages and Losses

To estimate losses due to hail, the 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 9-3 shows potential annualized losses for Limestone County. Annualized expected losses estimates are not currently available for the participating cities in this plan.

Table 9-3: Annualized Expected Property & Crop Damage

County	Expected Property Damage ($)
Limestone	17,500

SECTION 10: WINTER STORMS

Why Winter Storms Are a Threat

A winter storm is an event in which the varieties of precipitation are formed that only occur at low temperatures, such as snow or sleet, or a rainstorm where ground temperatures are low enough to allow ice to form (i.e. freezing rain).

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 Limestone County usually start out as powerful cold fronts that push south from central Canada.

Most of the precipitation seen in Limestone County 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

Winter storms have no geographic boundaries, the entire planning area is at risk for the location of winter storms.

The severity of impact of winter storms in Limestone County and all participating jurisdictions is considered minor and the event may cause 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% of property destroyed or with major damage.

The frequency of occurrence of a winter storm in Limestone County and all participating jurisdictions is likely, with an event possible in the next 5 years.

The extent of winter storms in Limestone County and all participating jurisdictions 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 Limestone County and participating jurisdictions include low temperatures below 32 degrees, freezing rain and sleet, and/or snow amounts up to 3-8 inches.

Warning time for winter storms is generally six to twelve hours.

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 Limestone County from 2000 to 2012 are presented in Table 10-2, along with reported injuries, deaths and damages. All participating jurisdictions in this plan were also affected by the same winter storms, since the hazard event has no defined geographic boundaries.

Table 10-2: Severe Winter Storms, Limestone County, 2000–2012

Type	Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Winter storm	Limestone	1/25/2000	0	0	0	0
Winter storm	Limestone	12/12/2000	0	0	0	0
Winter storm	Limestone	12/25/2000	0	0	0	0
Winter storm	Limestone	12/31/2000	0	0	0	0
Heavy Snow	Limestone	01/01/2001	0	0	0	0
Ice Storm	Limestone	11/27/2001	0	0	0	0
Winter storm	Limestone	02/24/2003	0	0	15.0M	0
Winter storm	Limestone	12/22/2004	0	0	0	0
Winter storm	Limestone	12/07/2005	0	0	0	0
Winter storm	Limestone	02/18/2006	0	0	0	0
Ice Storm	Limestone	01/14/2007	0	0	5.0K	0
Winter storm	Limestone	12/15/2008	0	0	0	0
Ice Storm	Limestone	01/27/2009	0	0	70.0K	0
Heavy Snow	Limestone	02/11/2010	0	0	20.0K	0
Winter storm	Limestone	02/11/2010	0	0	10.0K	0

People and Property at Risk

Winter storms usually impact large geographical areas; thus, all the population, buildings, critical facilities and infrastructure in Limestone County and participating jurisdictions 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 Limestone County. Annualized losses are currently not available for the participating cities in this plan.

Table 10-3: Potential Annualized Losses due to Winter Storms in Limestone County

Location	Annualized Expected Property Losses ($)
Limestone	$450,000

SECTION 11: 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

Failure of a major dam in Limestone County is a highly unlikely event, with an event possible in the next twenty years. If a major dam should fail, however, the

severity of impact could be minor, due to the dams being located in rural areas. The 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% of property destroyed or with major damage.

The extent of a major dam failure in Limestone County is that several thousand gallons of water could be released at a sudden and unexpected rate. Some buildings and a few people could be impacted, but no major damages are expected, and the floodwaters are expected to stay on the dam owner's property.

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.

Location of Hazardous Areas

The Texas Commission on Environmental Quality defines a significant hazard dam as having the possibility of causing economic or environmental damages. Fort Parker Lake in Limestone County is considered a significant-hazard dam. The map below shows the location of Fort Parker Lake Dam.

Figure 11-1: Location of Fort Parker Lake Dam

The map below shows the possible inundation areas in case of dam failure.

Figure 11-2: Fort Parker Lake Dam Possible Inundation Location

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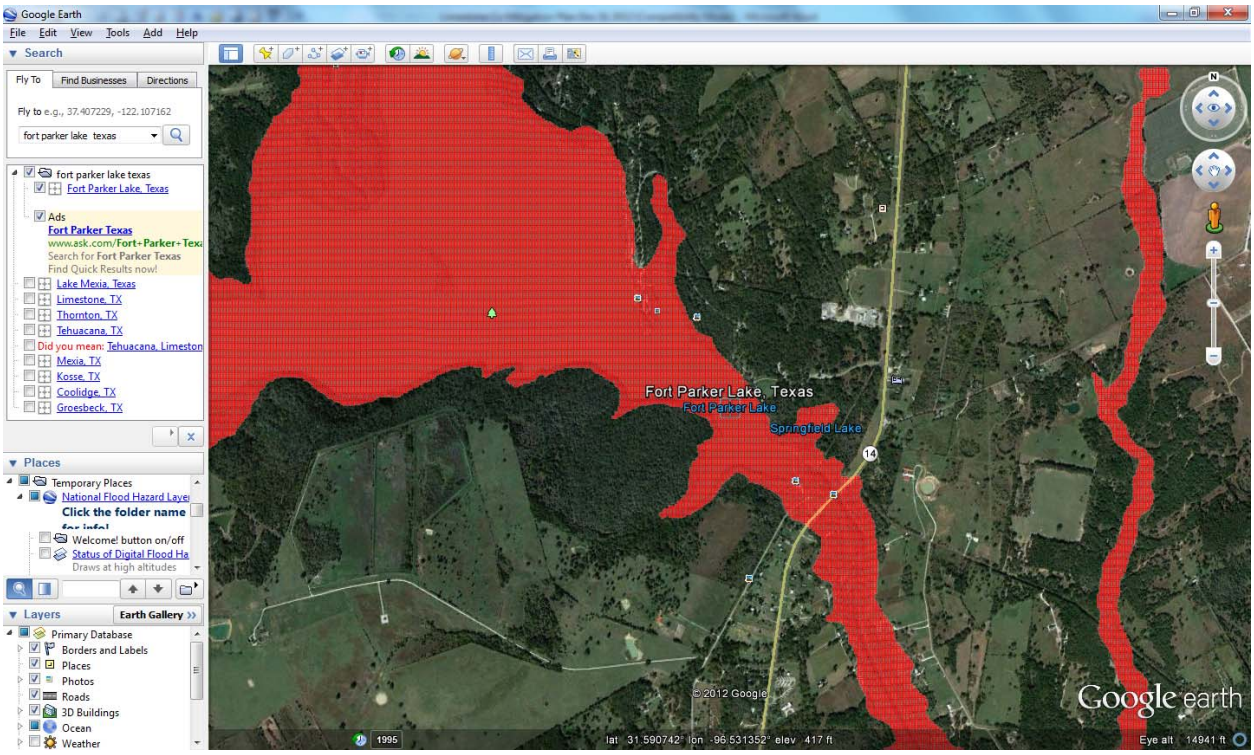

Potential Damages and Losses

Table 11-1 shows the risk to people and buildings of failure to significant hazard dams in Limestone County. There have been no previous occurrences of dam failure in Limestone County. Due to the participating cities having no vulnerabilities to dam failure, only Limestone County will present action items to mitigate dam failure in Section 14 of this plan.

Table 11-1: Exposure of People and Buildings to Failure of High-Hazard Dams in Limestone County

County	Number of Buildings	Number of People
Limestone	6	3

SECTION 12: GOALS & OBJECTIVES

Mitigation Vision

The **overall goal** of this Hazard Mitigation Plan is to reduce or eliminate the long-term risk to loss of life and property damage from the full range of disasters.

The mitigation **vision** of a safe, secure, and Limestone County is:

- Buildings located outside of hazardous areas and built to withstand the natural and man-caused hazards that threaten them;
- An informed citizenry and active volunteer cadre protecting their families, homes, workplaces, communities, and livelihoods from the effects of disasters.
- Area communities integrating hazard-mitigation concerns into decisions on growth and future development;
- Increased resistance to disaster as an integral part of the livability and sustainability of the community;
- Communities integrating cost-effective mitigation programs into routine planning and budgeting decisions;
- Smart communities investing in mitigation while leveraging state, Federal, and private resources; and

A partnership of local, state and Federal governments, voluntary agencies, business and industry, and individual citizens focused on preventing or reducing the loss of life and property from the full range of hazards.

Mitigation Goals and Objectives

Overall Goal

To reduce or eliminate the long-term risks to loss of life and property damage in Limestone County from a range of disasters.

Goal 1 **Increase public understanding, support and demand for hazard mitigation.**

Objective 1.1 Heighten public awareness of a range of natural and man-caused hazards they face.

Objective 1.2 Educate the public on actions they can take to prevent or reduce the loss of life or property from all hazards.

Objective 1.3 Publicize and encourage the adoption of appropriate hazard mitigation measures.

Goal 2 **Protect public health and safety.**

Objective 2.1 Advise the public about health and safety precautions to guard against injury and loss of life from hazards.

Objective 2.2 Maximize the utilization of the latest technology to provide adequate warning, communication, and mitigation of hazard events.

Objective 2.3 Reduce the danger to, and enhance protection of, dangerous areas during hazard events.

Objective 2.4 Protect critical facilities and services.

Goal 3 **Protect existing and new properties.**

Objective 3.1 Reduce repetitive losses to the National Flood Insurance Program.

Objective 3.2 Use the most cost-effective approaches to protect existing buildings and public infrastructure from hazards.

Objective 3.3 Enact and enforce regulatory measures to ensure that development will not put people in harm's way or increase threats to existing properties.

Goal 4 **Build and support local capacity and commitment to continuously become less vulnerable to hazards.**

Objective 4.1 Build and support local partnerships to continuously become less vulnerable to hazards.

Objective 4.2 Build a cadre of committed volunteers to safeguard the community before, during, and after a disaster.

Objective 4.3 Build hazard mitigation concerns into planning and budgeting processes.

Goal 5 **Promote growth in a sustainable manner.**

Objective 5.1 Incorporate hazard mitigation into the long-range planning and development activities.

Objective 5.2 Promote beneficial uses of hazardous areas while expanding open space and recreational opportunities.

Objective 5.3 Utilize regulatory approaches to prevent creation of future hazards to life and property.

Goal 6 **Maximize the resources for investment in hazard mitigation.**

Objective 6.1 Maximize the use of outside sources of funding.

Objective 6.2 Maximize participation of property owners in protecting their properties.

Objective 6.3 Maximize insurance coverage to provide financial protection against hazard events.

Objective 6.4 Prioritize mitigation projects, based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.

SECTION 13: PREVIOUSLY IMPLEMENTED MITIGATION ACTIONS

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 29 Presidential and 26 Small Business Administration Disaster Declarations have been issued since 1965 for the six counties in the Heart of Texas Council of Governments, paving the way for assistance by the Federal Emergency Management Agency and other Federal agencies.[3] 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 defined as aid to state or local governments to pay part of the approved costs (generally 75 percent) of rebuilding a community's damaged infrastructure. Public assistance (PA) 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. There have been no PA projects declared for Limestone County since 1998.[4]

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[5] 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,

[3] U.S. Federal Emergency Management Agency

[4] The Texas Division of Emergency Management's records for PA projects only date back as far as the year 1998.

[5] Prior to Fiscal Year 2003, the HMGP provided funding equal to 15 percent of obligations for individual and public assistance.

and other activities that bring a structure into compliance with the floodplain management requirements of the National Flood Insurance Program. A review of the HMGP records reveals no projects in Limestone County under the Project Impact, Pre-Disaster Mitigation Grant Program, or Hurricane-Property Protection Mitigation programs.

The U.S. Army Corps of Engineers provide a myriad of services that help reduce the risk of loss of life and property damage. Recently seven different studies/projects regarding water resources planning and development were conducted by the Fort Worth District of the Corps of Engineers for the Heart of Texas Region. One of the studies involved Limestone Lake in Limestone County. The project name, date, and description are listed below in Table 13-1.

Table 13-1: USACE Studies in Limestone County

Project Name	Date of Project	Date of Completion	Project Description
Limestone Lake Hydrographic Survey	Summer 2002	July, 2003	The hydrographic survey was conducted in 2002 and lake volume was determined.

The Texas Water Development Board (TWDB) administers the FEMA Flood Mitigation Assistance Program (FMAP), which provides planning and project grants aimed at reducing the number of structures that have incurred repetitive losses and are insured through the National Flood Insurance Program. FMAP Planning grants may be used to develop or update Flood Mitigation Plans. Project grants may be used to mitigate insured structures by activities such as acquiring structures and real property, dry floodproofing, and elevating structures and structure elements. Only activities specified in a FEMA-approved Flood Mitigation Plan are eligible for project grants.

TWDB Flood Protection Planning Grants provide State funds for regional flood protection planning, considering the needs of the entire watershed, including upstream or downstream effects of proposed solutions. Eligible activities under Flood Protection Planning include studies and analyses to identify problems resulting from or relating to flooding; determine views and needs of the affected public; identify potential solutions; estimate benefits and costs of potential solutions, including structural and nonstructural measures; evaluate environmental, social, and cultural factors; and recommend feasible solutions to flooding. There have been no TWDB Grants provided to Limestone County.

A number of jurisdictions within Limestone County have undertaken previous planning efforts. As shown in Table 13-2, only one jurisdiction has received Emergency Management Performance Grants (EMPG) from FEMA. These grants are intended to help develop comprehensive, all-hazards emergency management and improve local capabilities for emergency planning, preparedness, mitigation, response, and recovery. Assistance includes grant funding covering 13 key functional areas, including laws and authorities; hazard identification and risk assessment; hazard management; resource management; planning; direction, control, and coordination; communications and warning; operations and procedures; logistics and facilities; training; exercises; public education and information; and finance and administration.

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 13-2 details these previous planning efforts.

Table 13-2: Previous Planning Efforts in Limestone County

Jurisdiction	Received EM Grant Funds?	Planning Documents Completed for State Department of Emergency Management		Other Planning Efforts Undertaken (list)
		Basic Plan	Annexes**	
Limestone County				
Limestone County	N	Y	A, B, C, E, F, G, H, I, M, N, O, V	FEMA Hazard Mitigation Grant Program plan DOJ/DPA
City of Coolidge*	N	Y		
City of Groesbeck	N	Y		DOJ/DPA
City of Kosse*	N	Y		
City of Mexia	Y	Y	Annexes A-G and P	Comprehensive plan DOJ/DPA
City of Tehuacana*	N	Y		

Jurisdiction	Received EM Grant Funds?	Planning Documents Completed for State Department of Emergency Management		Other Planning Efforts Undertaken (list)
		Basic Plan	Annexes**	
City of Thornton	N	N	None	Texas Water Development Board Flood Protection Program plan

**Annex A	Warning	Annex R	Search and Rescue
Annex B	Communications	Annex S	Transport
Annex C	Shelter and Mass Care	Annex T	Donations
Annex D	Radiological Protection	Annex U	Legal
Annex E	Evacuation	Annex V	Terrorist Incident
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		

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 13-3, on the following page, 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. Only the cities have the authority to adopt building codes; counties do not have this authority.

Table 13-3: Building Codes

	Current Building Code							
			Type					
Jurisdiction	Effective Date[6]	Name	UBC	NBC	SBC	IBC	Other	Amend-ments made (Y /N)
Limestone County								
Limestone County	NA							
City of Coolidge*	-	-	-	-	-	-	-	-
City of Groesbeck	-	-	-	-	-	-	-	-
City of Kosse*	-	-	-	-	-	-	-	-
City of Mexia	1994	Standard Building Code			X			Y
City of Tehuacana*	-	-	-	-	-	-	-	-
City of Thornton	NA							

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

[6] "NA" in this column indicates that the jurisdiction responded but has no building code.

introduced. Local governments have adopted these codes either in their entirety or amended them as appropriate to their local conditions.

Table 13-4 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. As with building codes, participating cities have the authority to adopt fire codes, whereas counties do not.

Table 13-4: Fire Codes of Limestone County

Jurisdiction	Current Fire Code					
	Effective Date[7]	Name	Type			
			UFC	IFC	SFC	Other
Limestone County						
Limestone County	NA					
City of Coolidge*	-	-	-	-	-	-
City of Groesbeck	-	-	-	-	-	-
City of Kosse*	-	-	-	-	-	-
City of Mexia	1994	Standard Fire Code			X	
City of Tehuacana*	-	-	-	-	-	-
City of Thornton	NA					

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.

[7] "NA" in this column indicates that the jurisdiction responded but has no fire code.

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 13-5: Community Mitigation Classifications

	Personal Rating	Commercial Rating	Chose not to participate	No recognized program	No Notes	Not listed	Most Recent Date
Limestone County							
Limestone County						**X**	
Coolidge*				**X**			**1997**
Groesbeck	**08**	**08**					**1997**
Kosse*						**X**	
Mexia	**05**	**05**					**1997**
Tehuacana*					**X**		
Thornton					**X**		

Table 13-6 below describes the floodplain management ordinances currently in use in Limestone County, while Table 13-7 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 13-6: Floodplain Management Ordinances in Limestone County

Jurisdiction	Current Flood Ordinance	
	Effective Date[8]	Description
Limestone County		
Limestone County	09-16-2011	Requires all development in the 100-year floodplain to be permitted by the local jurisdiction.
City of Coolidge	NA	NA
City of Groesbeck	09-16-2011	Requires all development in the 100-year floodplain to be permitted by the local jurisdiction.
City of Kosse	NA	NA
City of Mexia	09-16-2011	Requires all development in the 100-year floodplain to be permitted by the local jurisdiction.
City of Tehuacana	NA	NA
City of Thornton	NA	NA

Table 13-7: Jurisdictional Floodplain Administration Process

Jurisdiction	Number of:				
	Floodplain administration professional staff[9]	Certified floodplain managers	Average yrs of experience/professional staff	Inspections (last 12 months)	Floodplain variances (last 12 months)
ounty					
Limestone County	**1**		**0**		
City of Groesbeck	**1**		**2**		

Jurisdiction	Number of:				
	Floodplain administration professional staff[9]	Certified floodplain managers	Average yrs of experience/pr ofessional staff	Inspections (last 12 months)	Floodplain variances (last 12 months)
City of Mexia	1		1		

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 National Flood Insurance Program (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.

Jurisdiction	Dates		
	CAC	CAV	Closed
Limestone County	07/23/96	NA	11/20/96
Groesbeck	08/23/94	NA	03/03/95
Mexia	08/23/94	NA	03/03/95

SECTION FOURTEEN: MITIGATION ACTIONS

The following mitigation actions are ideas proposed by Limestone County and the participating jurisdictions to attempt to mitigate the known hazards that can have negative effects on the county and participating jurisdictions.

Each mitigation action table includes a description of the action, the estimated costs (if available), and the benefits derived if the project is ever funded and completed. Each table also includes the responsible organization for completing the action, an implementation schedule, objective(s) to which it is to achieve, the priority status of each action, and the potential funding sources.

Limestone County and the participating jurisdictions will seek to obtain the necessary funding to implement the mitigation actions set forth when possible.

However, in this era of increased demands and constrained resources at all levels of government, the lack of resources, especially from external sources, may hamper the ability of the jurisdictions to implement some mitigation actions identified in the plan or to implement them within the timeframe specified.

Since mitigation grants generally do not pay for 100% of the necessary funds to complete the action, each participating jurisdiction will consider economic factors before deciding whether or not to apply for any of these grants.

LIMESTONE COUNTY

Jurisdiction	Limestone County
Action	Place high intensity outdoor warning sirens in county population centers at risk in disasters. The warning sirens would be organized by quadrants and linked to communication centers for activation.
Hazard	Floods, tornadoes, thunderstorms, wildfires
Background	There are currently no warning systems for the majority of the county at risk of flood, tornado, or other disaster. The lack of a warning system greatly increases the potential for loss of life.
Benefits	Advanced warning for a large segment of county population, thereby increasing the safety of life.
Priority	High
Estimated cost	$1,500,000
Responsible organization	Limestone County OEM
Target completion date	December 2017
Funding sources	***FEMA mitigation grants, DHS grants, general revenues***

Jurisdiction	Limestone County
Action	**Develop a comprehensive water storage plan for wildfire structural fire response in rural areas. Locate the areas of high brush accumulation and then remove the dry brush from those areas.**
Hazard	Wildfires
Background	There is no current assessment of water resources for fire operations in rural areas and no program to remove the dangerous brush.
Benefits	Provide adequate firefighting capabilities in rural areas to protect both new and existing structures.
Priority	High
Estimated cost	$20,000
Responsible organization	Limestone County OEM

Target completion date	December 2018
Funding sources	***FEMA mitigation grants, Texas Forest Service grants, general revenues***

Jurisdiction	Limestone County
Action	Survey flood-prone areas of the county and increase culvert sizes in those areas to prevent future flooding.
Hazard	Floods
Background	Numerous areas of the county are susceptible to periodic flooding.
Benefits	Protection of life for county residents and protection of new and existing buildings.
Priority	High
Estimated cost	$500
Responsible organization	Limestone County OEM
Target completion date	December 2016
Funding sources	***FEMA mitigation grants, Texas Water Development Board, general revenues***

Jurisdiction	Limestone County
Action	Per the National Flood Insurance Program (NFIP) continued compliance, acquire homes located in the identified flood hazard area.
Hazard	Floods
Background	Portions of Limestone County can be vulnerable to flooding after severe thunderstorms. Some older structures were built in the identified flood hazard area.
Benefits	Existing buildings will be removed permanently from the identified flood hazard area, thus preventing future damages due to floods.
Priority	High
Estimated cost	$50,000 per structure

Responsible organization	Limestone County
Target completion date	January 2017
Funding sources	***FEMA mitigation grants, Texas Water Development Board, general revenues***

Jurisdiction	Limestone County
Action	Per the National Flood Insurance Program (NFIP) continued compliance, elevate homes located in the identified flood hazard area.
Hazard	Floods
Background	Portions of Limestone County can be vulnerable to flooding after severe thunderstorms. Some older structures were built in the identified flood hazard area.
Benefits	Existing buildings will be elevated permanently from the identified flood hazard area, thus preventing future damages due to floods.
Priority	High
Estimated cost	$40,000 per structure
Responsible organization	Limestone County OEM
Target completion date	December 2016
Funding sources	***FEMA mitigation grants, Texas Water Development Board, general revenues***

Jurisdiction	Limestone County
Action	Acquire homes located in the identified flood hazard area downstream of Fort Parker Lake Dam.
Hazard	Dam Failure
Background	Portions of Limestone County downstream of Lake Fort Parker can be vulnerable to flooding. Some older structures were built in the identified flood hazard area.
Benefits	Buildings will be removed permanently from the identified flood hazard area, thus preventing future damages due to floods.
Priority	Medium

Estimated cost	$50,000 for each structure
Responsible organization	Limestone County OEM
Target completion date	June 2018
Funding sources	***FEMA mitigation grants, Texas Water Development Board, general revenues***

Jurisdiction	Limestone County
Action	Prevent any new structures from being located in the identified flood hazard area downstream of Fort Parker Lake Dam.
Hazard	Dam Failure
Background	Portions of Limestone County downstream of Lake Fort Parker can be vulnerable to flooding. Some older structures were built in the identified flood hazard area.
Benefits	New buildings and structures will not be allowed to be built downstream of Lake Fort Parker in the identified flood hazard area by amending the local floodplain ordinance.
Priority	Low
Estimated cost	No cost
Responsible organization	Limestone County OEM
Target completion date	December 2015
Funding sources	***NA***

Jurisdiction	Limestone County
Action	Build a dual-use community safe room
Hazard	Tornado, Thunderstorm, Winter Storm, Hail
Background	The community does not have many reinforced structures that can protect the citizens from severe storm events.
Benefits	A reinforced building for residents to go during severe storm events can save lives.
Priority	High
Estimated cost	$50,000

Responsible organization	Limestone County OEM
Target completion date	December 2017
Funding sources	***FEMA mitigation grants, Texas Water Development Board, general revenues***

Jurisdiction	Limestone County
Action	Community Outreach and Education
Hazard	Tornado, Thunderstorm, Winter Storm, Hail
Background	The community can educate citizens on the dangers of severe storm events and how to take cover in their own homes.
Benefits	Educating residents on where to go during severe storm events can save lives.
Priority	Medium
Estimated cost	$500
Responsible organization	Limestone County OEM
Target completion date	December 2016
Funding sources	***General revenues***

Jurisdiction	Limestone County
Action	Individual Safe Room Program
Hazard	Tornado, Thunderstorm, Winter Storm, Hail
Background	Local residents may place individual safe rooms inside their existing or new home for protection from severe storm events.
Benefits	A reinforced building within their own existing or new home for residents to go during severe storm events can save lives.
Priority	High
Estimated cost	$3,000 for each individual safe room
Responsible organization	Limestone County OEM
Target completion date	December 2017

Funding sources	***FEMA mitigation grants, Texas Water Development Board, general revenues***

Jurisdiction	Limestone County
Action	Implement Burn Bans
Hazard	Wildfire
Background	Local residents would be instructed not to burn brush outdoors during periods of drought or other conditions that are prone to cause wildfires.
Benefits	Prevention of wildfires can save lives and prevent property damage to new and existing buildings.
Priority	High
Estimated cost	No cost
Responsible organization	Limestone County OEM
Target completion date	December 2014
Funding sources	***NA***

Jurisdiction	Limestone County
Action	Community Outreach and Education
Hazard	Wildfire
Background	The community can educate citizens on the dangers of wildfires and how to preserve a Wildland/Urban Interface around their homes.
Benefits	Educating residents on how to protect their homes against wildfires can save lives.
Priority	Medium
Estimated cost	$400
Responsible organization	Limestone County OEM
Target completion date	December 2016
Funding sources	***FEMA mitigation grants, Texas Forest Service, general revenues***

Jurisdiction	Limestone County
Action	Community Outreach and Education
Hazard	Drought
Background	The community can educate citizens on the dangers of drought and how to conserve water around the home.
Benefits	Educating residents on how to save water can help conserve local water supplies for drinking or fighting wildfires
Priority	Medium
Estimated cost	$200
Responsible organization	Limestone County OEM
Target completion date	June 2014
Funding sources	***FEMA mitigation grants, general revenues***

Jurisdiction	Limestone County
Action	Implement their Drought Contingency Plan response stages
Hazard	Drought
Background	The local Drought Contingency Plan contains specific, quantified targets for water use restrictions. This includes drought response stages with triggers to begin and end at each stage.
Benefits	Each drought response stage will reduce the availability of water for certain events. Examples include not allowing the watering of lawns during the day or encouraging the use of xeriscape landscapes.
Priority	Medium
Estimated cost	No Cost
Responsible organization	Limestone County OEM
Target completion date	January 2014
Funding sources	***NA***

Jurisdiction	Limestone County
Action	Improving roof sheathing to prevent hail penetration.
Hazard	Hail
Background	For new construction as well as retrofitting existing buildings, require roof sheathing techniques to minimize hail damage.
Benefits	Can prevent property damage to new and existing structures.
Priority	Low
Estimated cost	No Cost
Responsible organization	Limestone County OEM
Target completion date	March 2016
Funding sources	***NA***

Jurisdiction	Limestone County
Action	Purchase and placement of National Oceanic and Atmospheric Administration (NOAA) weather radios in existing critical facilities such as fire stations, police stations and within the Emergency Operations Center (EOC) of the Limestone County Courthouse.
Hazard	Winter Storms
Background	NOAA weather radio is the primary tool for early warning of weather events.
Benefits	Public safety; early alerting of the public
Priority	High
Estimated cost	$1,000
Responsible organization	Limestone County OEM
Target completion date	June 2015
Funding sources	***FEMA mitigation grants, Local Funds***

CITY OF GROESBECK

Jurisdiction	City of Groesbeck
Action	Upgrade and supplement the existing warning system to provide an early warning system for hazard events.
Hazard	Floods, tornadoes, thunderstorms, wildfires, winter storm
Background	The City of Groesbeck has one warning siren that is used for fire and for all other warnings (i.e., weather, terrorism, any other hazard event). This siren is located at City Hall near the center of the city. Outlying residents are unable to hear the warning signal.
Benefits	Multiple warning sirens would benefit all areas of town with adequate warnings.
Priority	High
Estimated cost	$80,000
Responsible organization	City of Groesbeck OEM
Target completion date	December 2017
Funding sources	***FEMA mitigation grants, DHS grants, general revenues***

Jurisdiction	City of Groesbeck
Action	Build a community safe room
Hazard	Tornadoes, thunderstorms, hail, winter storm
Background	The City of Groesbeck has limited structures strong enough to withstand a tornado or other high wind events.
Benefits	To provide protection for public health and safety.
Priority	High
Estimated cost	$365,000
Responsible organization	City of Groesbeck OEM
Target completion date	December 2017
Funding sources	***FEMA mitigation grants, DHS grants, general revenues***

Jurisdiction	City of Groesbeck
Action	Enforce updated requirements to ensure standard tie-down of mobile homes.
Hazard	Floods, tornadoes, thunderstorms
Background	The City of Groesbeck currently has an ordinance in effect that requires standard tie-downs for mobile homes within the city. The city budget has not included extra enforcement action to check all mobile homes within the city.
Benefits	A strict enforcement of tie-downs on mobile homes would help protect property and lives in high winds and/or tornadoes.
Priority	High
Estimated cost	$25,000
Responsible organization	City of Groesbeck
Target completion date	June 2016
Funding sources	***FEMA mitigation grants, DHS grants, general revenues***

Jurisdiction	City of Groesbeck
Action	Per the National Flood Insurance Program (NFIP) continued compliance, elevate homes located in the identified flood hazard area.
Hazard	Floods
Background	Portions of Groesbeck can be vulnerable to flooding after severe thunderstorms. Some older structures were built in the identified flood hazard area.
Benefits	Existing buildings will be elevated permanently from the identified flood hazard area, thus preventing future damages due to floods.
Priority	High
Estimated cost	$40,000 per structure
Responsible organization	Groesbeck OEM
Target completion date	December 2016
Funding sources	***FEMA mitigation grants, Texas Water Development Board, general revenues***

Jurisdiction	City of Groesbeck
Action	Per the National Flood Insurance Program (NFIP) continued compliance, acquire homes located in the identified flood hazard area.
Hazard	Floods
Background	Portions of Groesbeck can be vulnerable to flooding after severe thunderstorms. Some older structures were built in the identified flood hazard area.
Benefits	Existing buildings will be acquired to remove them permanently from the identified flood hazard area, thus preventing future damages due to floods.
Priority	High
Estimated cost	$40,000 per structure
Responsible organization	Groesbeck OEM
Target completion date	December 2016
Funding sources	***FEMA mitigation grants, Texas Water Development Board, general revenues***

Jurisdiction	City of Groesbeck
Action	Community Outreach and Education
Hazard	Tornado, Thunderstorm, Winter Storm, Hail
Background	The community can educate citizens on the dangers of severe storm events and how to take cover in their own homes.
Benefits	Educating residents on where to go during severe storm events can save lives.
Priority	Medium
Estimated cost	$500
Responsible organization	Groesbeck OEM
Target completion date	December 2016
Funding sources	***General revenues***

Jurisdiction	City of Groesbeck
Action	Individual Safe Room Program
Hazard	Tornado, Thunderstorm, Winter Storm, Hail
Background	Local residents may place individual safe rooms inside their existing or new home for protection from severe storm events.
Benefits	A reinforced building within their own existing or new home for residents to go during severe storm events can save lives.
Priority	High
Estimated cost	$3,000 for each individual safe room
Responsible organization	Groesbeck OEM
Target completion date	December 2017
Funding sources	***FEMA mitigation grants, Texas Water Development Board, general revenues***

Jurisdiction	City of Groesbeck
Action	Implement Burn Bans
Hazard	Wildfire
Background	Local residents would be instructed not to burn brush outdoors during periods of drought or other conditions that are prone to cause wildfires.
Benefits	Prevention of wildfires can save lives and prevent property damage to new and existing buildings.
Priority	High
Estimated cost	No cost
Responsible organization	Groesbeck OEM
Target completion date	December 2014
Funding sources	***NA***

Jurisdiction	City of Groesbeck
Action	Community Outreach and Education
Hazard	Wildfire
Background	The community can educate citizens on the dangers of wildfires and how to preserve a Wildland/Urban Interface around their homes.
Benefits	Educating residents on how to protect their homes against wildfires can save lives. .
Priority	Medium
Estimated cost	$400
Responsible organization	Groesbeck OEM
Target completion date	December 2016
Funding sources	***FEMA mitigation grants, Texas Forest Service, general revenues***

Jurisdiction	City of Groesbeck
Action	Community Outreach and Education
Hazard	Drought
Background	The community can educate citizens on the dangers of drought and how to conserve water around the home.
Benefits	Educating residents on how to save water can help conserve local water supplies for drinking or fighting wildfires
Priority	Medium
Estimated cost	$200
Responsible organization	Groesbeck OEM
Target completion date	June 2014
Funding sources	***FEMA mitigation grants, general revenues***

Jurisdiction	City of Groesbeck
Action	Implement their Drought Contingency Plan response stages
Hazard	Drought

Background	The local Drought Contingency Plan contains specific, quantified targets for water use restrictions. This includes drought response stages with triggers to begin and end at each stage.
Benefits	Each drought response stage will reduce the availability of water for certain events. Examples include not allowing the watering of lawns during the day or encouraging the use of xeriscape landscapes.
Priority	Medium
Estimated cost	No Cost
Responsible organization	Groesbeck OEM
Target completion date	January 2014
Funding sources	***NA***

Jurisdiction	City of Groesbeck
Action	Improving roof sheathing to prevent hail penetration.
Hazard	Hail
Background	For new construction as well as retrofitting existing buildings, require roof sheathing techniques to minimize hail damage.
Benefits	Can prevent property damage to new and existing structures.
Priority	Low
Estimated cost	No Cost
Responsible organization	Groesbeck OEM
Target completion date	March 2016
Funding sources	***NA***

Jurisdiction	City of Groesbeck
Action	Purchase and place NOAA weather radios in existing critical facilities such as fire and police stations.
Hazard	Winter Storms
Background	NOAA weather radio is the primary tool for early warning of weather events.

Benefits	Public safety; early alerting of the public
Priority	High
Estimated cost	$1,000
Responsible organization	City of Groesbeck OEM
Target completion date	November 2014
Funding sources	***FEMA mitigation grants, Local Funds***

CITY OF MEXIA

Jurisdiction	City of Mexia
Action	Build a new building for the City of Mexia Police Department. This building would be hardened and could be used as a shelter for natural disasters and as a backup Emergency Operations Center.
Hazard	Floods, tornadoes, thunderstorms, wildfires, winter storms, hail
Background	The existing police department is upstairs above City Hall. There is no handicap access to the department. The building is old and the wiring is a safety hazard. The office space is inadequate. Units are separated with CID in a different building.
Benefits	Increased public service, better management of space and storage, more effective department, and improved disaster response.
Priority	High
Estimated cost	$250,000 to $500,000
Responsible organization	City of Mexia Police Department and OEM
Target completion date	December 2017
Funding sources	***FEMA mitigation grants, general revenues***

Jurisdiction	City of Mexia
Action	Install repeater system for the City of Mexia Police Department and replacement of old radio units that will not convert with the new repeater system.
Hazard	Floods, tornadoes, thunderstorms, wildfires, winter storms, hail
Background	Antenna system is for regular radio only. At some points in the city the hand held radios will reach dispatch, but it can barely be heard. As for as an officer safety issue goes, this is a major problem.
Benefits	Increased communications for the department.
Priority	High
Estimated cost	$8000 to $12,000
Responsible organization	City of Mexia Police Department
Target completion date	December 2015
Funding sources	***FEMA mitigation grants, Dept. of Homeland Security (DHS) grants***

Jurisdiction	City of Mexia
Action	Installing hail resistant roofing and siding to the Police Dept Bldg
Hazard	Floods, tornadoes, thunderstorms, wildfires, winter storm, hail
Background	Strengthening the roof of the critical facilities ensures their protection.
Benefits	Allows for critical facilities to still function during severe storms.
Priority	High
Estimated cost	$150,000
Responsible organization	City of Mexia Police Department and OEM
Target completion date	June 2016
Funding sources	***FEMA mitigation grants, Dept. of Homeland Security (DHS) grants, general revenues***

Jurisdiction	City of Mexia
Action	Adopt routine fire hydrant maintenance
Hazard	Wildfires
Background	Fire hydrants are old. There is also a lack of fire hydrants and small water mains in some areas.
Benefits	Improve water supply, replace older fire hydrants with standard size hydrants and add hydrants in areas where needed.
Priority	High
Estimated cost	$100,000 to $150,000
Responsible organization	City of Mexia OEM
Target completion date	December 2017
Funding sources	***FEMA mitigation grants, Texas Forest Service grants, general revenues***

Jurisdiction	City of Mexia
Action	Improve emergency management radio coverage and reception.
Hazard	Floods, tornadoes, thunderstorms, wildfires
Background	There is a shortage of radios and pagers to properly equip personnel.
Benefits	Improved communications will lead to a faster and more effective response.
Priority	High
Estimated cost	$20,000
Responsible organization	City of Mexia Fire Department
Target completion date	December 2017
Funding sources	***FEMA mitigation grants, Dept. of Homeland Security (DHS) grants***

Jurisdiction	City of Mexia
Action	Conduct a public awareness campaign to alert the community about emergency management procedures.
Hazard	Floods, tornadoes, thunderstorms, winter storm, hail
Background	The public is currently unaware of what to do in an emergency situation.
Benefits	Public would be aware of procedures to be taken during an emergency.
Priority	High
Estimated cost	$2000
Responsible organization	City of Mexia OEM
Target completion date	December 2017
Funding sources	***FEMA mitigation grants, Dept. of Homeland Security (DHS) grants***

Jurisdiction	City of Mexia
Action	Individual Safe Room Program
Hazard	Tornado, Thunderstorm, Winter Storm, Hail
Background	Local residents may place individual safe rooms inside their existing or new home for protection from severe storm events.
Benefits	A reinforced building within their own existing or new home for residents to go during severe storm events can save lives.
Priority	High
Estimated cost	$3,000 for each individual safe room
Responsible organization	City of Mexia OEM
Target completion date	December 2017
Funding sources	***FEMA mitigation grants, Texas Water Development Board, general revenues***

Jurisdiction	City of Mexia
Action	Implement Burn Bans

Hazard	Wildfire
Background	Local residents would be instructed not to burn brush outdoors during periods of drought or other conditions that are prone to cause wildfires.
Benefits	Prevention of wildfires can save lives and prevent property damage to new and existing buildings.
Priority	High
Estimated cost	No cost
Responsible organization	City of Mexia OEM
Target completion date	December 2014
Funding sources	***NA***

Jurisdiction	City of Mexia
Action	Community Outreach and Education
Hazard	Wildfire
Background	The community can educate citizens on the dangers of wildfires and how to preserve a Wildland/Urban Interface around their homes.
Benefits	Educating residents on how to protect their homes against wildfires can save lives.
Priority	Medium
Estimated cost	$400
Responsible organization	City of Mexia OEM
Target completion date	December 2016
Funding sources	***FEMA mitigation grants, Texas Forest Service, general revenues***

Jurisdiction	City of Mexia
Action	Community Outreach and Education
Hazard	Drought

Background	The community can educate citizens on the dangers of drought and how to conserve water around the home.
Benefits	Educating residents on how to save water can help conserve local water supplies for drinking or fighting wildfires
Priority	Medium
Estimated cost	$200
Responsible organization	City of Mexia OEM
Target completion date	June 2014
Funding sources	***FEMA mitigation grants, general revenues***

Jurisdiction	City of Mexia
Action	Implement their Drought Contingency Plan response stages
Hazard	Drought
Background	The local Drought Contingency Plan contains specific, quantified targets for water use restrictions. This includes drought response stages with triggers to begin and end at each stage.
Benefits	Each drought response stage will reduce the availability of water for certain events. Examples include not allowing the watering of lawns during the day or encouraging the use of xeriscape landscapes.
Priority	Medium
Estimated cost	No Cost
Responsible organization	City of Mexia OEM
Target completion date	January 2014
Funding sources	***NA***

Jurisdiction	City of Mexia
Action	Improving roof sheathing to prevent hail penetration.
Hazard	Hail
Background	For new construction as well as retrofitting existing buildings, require roof sheathing techniques to minimize hail damage.

Benefits	Can prevent property damage to new and existing structures.
Priority	Low
Estimated cost	No Cost
Responsible organization	City of Mexia OEM
Target completion date	March 2016
Funding sources	***NA***

Jurisdiction	City of Mexia
Action	Per the National Flood Insurance Program (NFIP) continued compliance, acquire homes located in the identified flood hazard area.
Hazard	Floods
Background	Portions of Mexia can be vulnerable to flooding after severe thunderstorms. Some older structures were built in the identified flood hazard area.
Benefits	Existing buildings will be removed permanently from the identified flood hazard area, thus preventing future damages due to floods.
Priority	High
Estimated cost	$50,000 per structure
Responsible organization	City of Mexia OEM
Target completion date	January 2017
Funding sources	***FEMA mitigation grants, Texas Water Development Board, general revenues***

Jurisdiction	City of Mexia
Action	Per the National Flood Insurance Program (NFIP) continued compliance, elevate homes located in the identified flood hazard area.
Hazard	Floods

Background	Portions of Mexia can be vulnerable to flooding after severe thunderstorms. Some older structures were built in the identified flood hazard area.
Benefits	Existing buildings will be elevated permanently from the identified flood hazard area, thus preventing future damages due to floods.
Priority	High
Estimated cost	$40,000 per structure
Responsible organization	City of Mexia OEM
Target completion date	December 2016
Funding sources	***FEMA mitigation grants, Texas Water Development Board, general revenues***

Jurisdiction	City of Mexia
Action	Community Outreach and Education
Hazard	Winter Storms
Background	The community can educate citizens on the dangers of winter storms by informing the public about winter storms impacts, such as ice and snow accumulations.
Benefits	Educating residents on how to protect themselves and their homes against winter storm impacts can save lives.
Priority	High
Estimated cost	$500
Responsible organization	City of Mexia OEM
Target completion date	December 2014
Funding sources	***FEMA mitigation grants, general revenues***

Jurisdiction	City of Mexia
Action	Purchase and place NOAA weather radios in existing critical facilities such as fire and police stations.
Hazard	Winter Storms
Background	Public safety; early alerting of the public

Benefits	NOAA weather radio is the primary tool for early warning of weather events.
Priority	High
Estimated cost	$1,000
Responsible organization	City of Mexia OEM
Target completion date	December 2014
Funding sources	***FEMA mitigation grants, Local Funds***

Jurisdiction	City of Mexia
Action	Community Outreach and Education
Hazard	Thunderstorms
Background	The community can educate citizens on the dangers of thunder storms by informing the public about thunder storms impacts, including high winds and lightning.
Benefits	Educating residents on how to protect themselves and their homes against thunderstorm impacts can save lives.
Priority	High
Estimated cost	$500
Responsible organization	City of Mexia OEM
Target completion date	May 2015
Funding sources	***FEMA mitigation grants, general revenues***

Jurisdiction	City of Mexia
Action	Community Outreach and Education
Hazard	Tornado
Background	The community can educate citizens on the dangers of tornado impacts and how to prevent them.
Benefits	Educating residents on how to protect their homes against tornadoes can save lives. Examples include the installation of Individual Safe Rooms.
Priority	High

Estimated cost	$500
Responsible organization	City of Mexia OEM
Target completion date	May 2016
Funding sources	***FEMA mitigation grants, general revenues***

CITY OF COOLIDGE

Jurisdiction	City of Coolidge
Action	Build a dual-use community safe room.
Hazard	Floods, tornadoes, thunderstorms, hail, winter storm, wildfires
Background	The city currently has no hardened facilities that can product citizens in times of disasters
Benefits	Save lives. Residents will have a community safe room to escape from severe storms, and the safe room can have a dual-use for when not used as a safe room disaster shelter.
Priority	High
Estimated cost	$750,000
Responsible organization	City of Coolidge OEM
Target completion date	August 2018
Funding sources	***FEMA mitigation grants***

Jurisdiction	City of Coolidge
Action	Build a flood control project to prevent drainage issues that impact up to 15 homes.
Hazard	Floods, thunderstorms
Background	Some areas of the city are more prone to flood due to poor drainage. A small, localized detention pond would mitigate this.
Benefits	Save lives and reduce flood insurance and recovery costs.

Priority	High
Estimated cost	$750,000
Responsible organization	City of Coolidge
Target completion date	December 2017 OEM
Funding sources	***FEMA mitigation grants***

Jurisdiction	City of Coolidge
Action	Community Outreach and Education
Hazard	Tornado, Thunderstorm, Winter Storm, Hail
Background	The community can educate citizens on the dangers of severe storm events and how to take cover in their own homes.
Benefits	Educating residents on where to go during severe storm events can save lives.
Priority	Medium
Estimated cost	$500
Responsible organization	City of Coolidge OEM
Target completion date	December 2016
Funding sources	***General revenues***

Jurisdiction	City of Coolidge
Action	Individual Safe Room Program
Hazard	Tornado, Thunderstorm, Winter Storm, Hail
Background	Local residents may place individual safe rooms inside their existing or new home for protection from severe storm events.
Benefits	A reinforced building within their own existing or new home for residents to go during severe storm events can save lives.
Priority	High
Estimated cost	$3,000 for each individual safe room

Responsible organization	City of Coolidge OEM
Target completion date	December 2017
Funding sources	***FEMA mitigation grants, Texas Water Development Board, general revenues***

Jurisdiction	City of Coolidge
Action	Implement Burn Bans
Hazard	Wildfire
Background	Local residents would be instructed not to burn brush outdoors during periods of drought or other conditions that are prone to cause wildfires.
Benefits	Prevention of wildfires can save lives and prevent property damage to new and existing buildings.
Priority	High
Estimated cost	No cost
Responsible organization	City of Coolidge OEM
Target completion date	December 2014
Funding sources	***NA***

Jurisdiction	City of Coolidge
Action	Community Outreach and Education
Hazard	Wildfire
Background	The community can educate citizens on the dangers of wildfires and how to preserve a Wildland/Urban Interface around their homes.
Benefits	Educating residents on how to protect their homes against wildfires can save lives.
Priority	Medium
Estimated cost	$400
Responsible organization	City of Coolidge OEM

Target completion date	December 2016
Funding sources	***FEMA mitigation grants, Texas Forest Service, general revenues***

Jurisdiction	City of Coolidge
Action	Community Outreach and Education
Hazard	Drought
Background	The community can educate citizens on the dangers of drought and how to conserve water around the home.
Benefits	Educating residents on how to save water can help conserve local water supplies for drinking or fighting wildfires
Priority	Medium
Estimated cost	$200
Responsible organization	City of Coolidge OEM
Target completion date	June 2014
Funding sources	***FEMA mitigation grants, general revenues***

Jurisdiction	City of Coolidge
Action	Implement their Drought Contingency Plan response stages
Hazard	Drought
Background	The local Drought Contingency Plan contains specific, quantified targets for water use restrictions. This includes drought response stages with triggers to begin and end at each stage.
Benefits	Each drought response stage will reduce the availability of water for certain events. Examples include not allowing the watering of lawns during the day or encouraging the use of xeriscape landscapes.
Priority	Medium
Estimated cost	No Cost
Responsible organization	City of Coolidge OEM

Target completion date	January 2014
Funding sources	***NA***

Jurisdiction	City of Coolidge
Action	Improving roof sheathing to prevent hail penetration.
Hazard	Hail
Background	For new construction as well as retrofitting existing buildings, require roof sheathing techniques to minimize hail damage.
Benefits	Can prevent property damage to new and existing structures.
Priority	Low
Estimated cost	No Cost
Responsible organization	City of Coolidge OEM
Target completion date	March 2016
Funding sources	***NA***

Jurisdiction	City of Coolidge
Action	Purchase and place NOAA weather radios in existing special facilities such as churches and schools.
Hazard	Winter Storms
Background	NOAA weather radio is the primary tool for early warning of weather events.
Benefits	Public safety; early alerting of the public
Priority	High
Estimated cost	$500
Responsible organization	City of Coolidge OEM
Target completion date	August 2018
Funding sources	***FEMA mitigation grants, Local Funds***

CITY OF THORNTON

Jurisdiction	City of Thornton
Action	Build a dual-use community safe room.
Hazard	Floods, tornadoes, thunderstorms, hail, winter storm, wildfires
Background	The city currently has no hardened facilities that can product citizens in times of disasters
Benefits	Save lives. Residents will have a community safe room to escape from severe storms, and the safe room can have a dual-use for when not used as a safe room disaster shelter.
Priority	High
Estimated cost	$750,000
Responsible organization	City of Thornton OEM
Target completion date	August 2018
Funding sources	***FEMA mitigation grants***

Jurisdiction	City of Thornton
Action	Build a flood control project to prevent drainage issues that impact up to 15 homes.
Hazard	Floods, thunderstorms
Background	Some areas of the city are more prone to flood due to poor drainage. A small, localized detention pond would mitigate this.
Benefits	Save lives and reduce flood insurance and recovery costs.
Priority	High
Estimated cost	$750,000
Responsible organization	City of Thornton OEM
Target completion date	December 2017
Funding sources	***FEMA mitigation grants***

Jurisdiction	City of Thornton
Action	Community Outreach and Education
Hazard	Tornado, Thunderstorm, Winter Storm, Hail
Background	The community can educate citizens on the dangers of severe storm events and how to take cover in their own homes.
Benefits	Educating residents on where to go during severe storm events can save lives.
Priority	Medium
Estimated cost	$500
Responsible organization	City of Thornton OEM
Target completion date	December 2016
Funding sources	***General revenues***

Jurisdiction	City of Thornton
Action	Individual Safe Room Program
Hazard	Tornado, Thunderstorm, Winter Storm, Hail
Background	Local residents may place individual safe rooms inside their existing or new home for protection from severe storm events.
Benefits	A reinforced building within their own existing or new home for residents to go during severe storm events can save lives.
Priority	High
Estimated cost	$3,000 for each individual safe room
Responsible organization	City of Thornton OEM
Target completion date	December 2017
Funding sources	***FEMA mitigation grants, Texas Water Development Board, general revenues***

Jurisdiction	City of Thornton
Action	Implement Burn Bans

Hazard	Wildfire
Background	Local residents would be instructed not to burn brush outdoors during periods of drought or other conditions that are prone to cause wildfires.
Benefits	Prevention of wildfires can save lives and prevent property damage to new and existing buildings.
Priority	High
Estimated cost	No cost
Responsible organization	City of Thornton OEM
Target completion date	December 2014
Funding sources	***NA***

Jurisdiction	City of Thornton
Action	Community Outreach and Education
Hazard	Wildfire
Background	The community can educate citizens on the dangers of wildfires and how to preserve a Wildland/Urban Interface around their homes.
Benefits	Educating residents on how to protect their homes against wildfires can save lives.
Priority	Medium
Estimated cost	$400
Responsible organization	City of Thornton OEM
Target completion date	December 2016
Funding sources	***FEMA mitigation grants, Texas Forest Service, general revenues***

Jurisdiction	City of Thornton
Action	Community Outreach and Education
Hazard	Drought

Background	The community can educate citizens on the dangers of drought and how to conserve water around the home.
Benefits	Educating residents on how to save water can help conserve local water supplies for drinking or fighting wildfires
Priority	Medium
Estimated cost	$200
Responsible organization	City of Thornton OEM
Target completion date	June 2014
Funding sources	***FEMA mitigation grants, general revenues***

Jurisdiction	City of Thornton
Action	Implement their Drought Contingency Plan response stages
Hazard	Drought
Background	The local Drought Contingency Plan contains specific, quantified targets for water use restrictions. This includes drought response stages with triggers to begin and end at each stage.
Benefits	Each drought response stage will reduce the availability of water for certain events. Examples include not allowing the watering of lawns during the day or encouraging the use of xeriscape landscapes.
Priority	Medium
Estimated cost	No Cost
Responsible organization	City of Thornton OEM
Target completion date	January 2014
Funding sources	***NA***

Jurisdiction	City of Thornton
Action	Improving roof sheathing to prevent hail penetration.
Hazard	Hail
Background	For new construction as well as retrofitting existing buildings, require roof sheathing techniques to minimize hail damage.

Benefits	Can prevent property damage to new and existing structures.
Priority	Low
Estimated cost	No Cost
Responsible organization	City of Thornton OEM
Target completion date	March 2016
Funding sources	***NA***

Jurisdiction	City of Thornton
Action	Community Outreach and Education
Hazard	Floods
Background	The community can educate citizens on the dangers of flood impacts and how to prevent them.
Benefits	Educating residents on how to protect their homes against floods can save lives. Examples include information about the National Flood Insurance Program (NFIP) and home elevation/acquisition mitigation grants.
Priority	High
Estimated cost	$250
Responsible organization	City of Thornton OEM
Target completion date	May 2016
Funding sources	***FEMA mitigation grants***

CITY OF KOSSE

Jurisdiction	City of Kosse
Action	Purchase and place NOAA weather radios in existing special facilities such as churches, schools and high population buildings.
Hazard	Flood, Tornadoes, Thunderstorms and Winter Storms
Background	NOAA weather radio is the primary tool for early warning of weather events.
Benefits	Public safety; early alerting of the public
Priority	High
Estimated cost	$2,000
Responsible organization	City of Kosse OEM
Target completion date	December 2017
Funding sources	***Grants***

Jurisdiction	City of Kosse
Action	Build a dual-use community safe room.
Hazard	Floods, tornadoes, thunderstorms, hail, winter storm, wildfires
Background	The city currently has no hardened facilities that can product citizens in times of disasters
Benefits	Save lives. Residents will have a community safe room to escape from severe storms, and the safe room can have a dual-use for when not used as a safe room disaster shelter.
Priority	High
Estimated cost	$750,000
Responsible organization	City of Kosse OEM
Target completion date	August 2018
Funding sources	***FEMA mitigation grants***

Jurisdiction	City of Kosse
Action	Build a flood control project to prevent drainage issues that impact up to 15 homes.
Hazard	Floods, thunderstorms
Background	Some areas of the city are more prone to flood due to poor drainage. A small, localized detention pond would mitigate this.
Benefits	Save lives and reduce flood insurance and recovery costs.
Priority	High
Estimated cost	$750,000
Responsible organization	City of Kosse OEM
Target completion date	December 2017
Funding sources	***FEMA mitigation grants***

Jurisdiction	City of Kosse
Action	Community Outreach and Education
Hazard	Tornado, Thunderstorm, Winter Storm, Hail
Background	The community can educate citizens on the dangers of severe storm events and how to take cover in their own homes.
Benefits	Educating residents on where to go during severe storm events can save lives.
Priority	Medium
Estimated cost	$500
Responsible organization	City of Kosse OEM
Target completion date	December 2016
Funding sources	***General revenues***

Jurisdiction	City of Kosse
Action	Individual Safe Room Program

Hazard	Tornado, Thunderstorm, Winter Storm, Hail
Background	Local residents may place individual safe rooms inside their existing or new home for protection from severe storm events.
Benefits	A reinforced building within their own existing or new home for residents to go during severe storm events can save lives.
Priority	High
Estimated cost	$3,000 for each individual safe room
Responsible organization	City of Kosse OEM
Target completion date	December 2017
Funding sources	***FEMA mitigation grants, Texas Water Development Board, general revenues***

Jurisdiction	City of Kosse
Action	Implement Burn Bans
Hazard	Wildfire
Background	Local residents would be instructed not to burn brush outdoors during periods of drought or other conditions that are prone to cause wildfires.
Benefits	Prevention of wildfires can save lives and prevent property damage to new and existing buildings.
Priority	High
Estimated cost	No cost
Responsible organization	City of Kosse OEM
Target completion date	December 2014
Funding sources	***NA***

Jurisdiction	City of Kosse
Action	Community Outreach and Education
Hazard	Wildfire

Background	The community can educate citizens on the dangers of wildfires and how to preserve a Wildland/Urban Interface around their homes.
Benefits	Educating residents on how to protect their homes against wildfires can save lives.
Priority	Medium
Estimated cost	$400
Responsible organization	City of Kosse OEM
Target completion date	December 2016
Funding sources	***FEMA mitigation grants, Texas Forest Service, general revenues***

Jurisdiction	City of Kosse
Action	Community Outreach and Education
Hazard	Drought
Background	The community can educate citizens on the dangers of drought and how to conserve water around the home.
Benefits	Educating residents on how to save water can help conserve local water supplies for drinking or fighting wildfires
Priority	Medium
Estimated cost	$200
Responsible organization	City of Kosse OEM
Target completion date	June 2014
Funding sources	***FEMA mitigation grants, general revenues***

Jurisdiction	City of Kosse
Action	Implement their Drought Contingency Plan response stages
Hazard	Drought
Background	The local Drought Contingency Plan contains specific, quantified targets for water use restrictions. This includes drought response stages with triggers to begin and end at each stage.

Benefits	Each drought response stage will reduce the availability of water for certain events. Examples include not allowing the watering of lawns during the day or encouraging the use of xeriscape landscapes.
Priority	Medium
Estimated cost	No Cost
Responsible organization	City of Kosse OEM
Target completion date	January 2014
Funding sources	***NA***

Jurisdiction	City of Kosse
Action	Improving roof sheathing to prevent hail penetration.
Hazard	Hail
Background	For new construction as well as retrofitting existing buildings, require roof sheathing techniques to minimize hail damage.
Benefits	Can prevent property damage to new and existing structures.
Priority	Low
Estimated cost	No Cost
Responsible organization	City of Kosse OEM
Target completion date	March 2016
Funding sources	***NA***

CITY OF TEHUACANA

Jurisdiction	City of Tehuacana
Action	Purchase generators to power existing emergency communications
Hazard	Flood, Tornadoes, Thunderstorms and Winter Storms
Background	There are currently no generators to provide back-up power for emergency communications.
Benefits	Power supply during emergencies.
Priority	High
Estimated cost	$20,000
Responsible organization	City of Tehuacana OEM
Target completion date	December 2017
Funding sources	***Grants***

Jurisdiction	City of Tehuacana
Action	Build a dual-use community safe room.
Hazard	Floods, tornadoes, thunderstorms, hail, winter storm, wildfires
Background	The city currently has no hardened facilities that can product citizens in times of disasters
Benefits	Save lives. Residents will have a community safe room to escape from severe storms, and the safe room can have a dual-use for when not used as a safe room disaster shelter.
Priority	High
Estimated cost	$750,000
Responsible organization	City of Tehuacana OEM
Target completion date	August 2018
Funding sources	***FEMA mitigation grants***

Jurisdiction	City of Tehuacana
Action	Build a flood control project to prevent drainage issues that impact up to 15 homes.
Hazard	Floods, thunderstorms
Background	Some areas of the city are more prone to flood due to poor drainage. A small, localized detention pond would mitigate this.
Benefits	Save lives and reduce flood insurance and recovery costs.
Priority	High
Estimated cost	$750,000
Responsible organization	City of Tehuacana OEM
Target completion date	December 2017
Funding sources	***FEMA mitigation grants***

Jurisdiction	City of Tehuacana
Action	Community Outreach and Education
Hazard	Tornado, Thunderstorm, Winter Storm, Hail
Background	The community can educate citizens on the dangers of severe storm events and how to take cover in their own homes.
Benefits	Educating residents on where to go during severe storm events can save lives.
Priority	Medium
Estimated cost	$500
Responsible organization	City of Tehuacana OEM
Target completion date	December 2016
Funding sources	***General revenues***

Jurisdiction	City of Tehuacana
Action	Individual Safe Room Program
Hazard	Tornado, Thunderstorm, Winter Storm, Hail

Background	Local residents may place individual safe rooms inside their existing or new home for protection from severe storm events.
Benefits	A reinforced building within their own existing or new home for residents to go during severe storm events can save lives.
Priority	High
Estimated cost	$3,000 for each individual safe room
Responsible organization	City of Tehuacana OEM
Target completion date	December 2017
Funding sources	***FEMA mitigation grants, Texas Water Development Board, general revenues***

Jurisdiction	City of Tehuacana
Action	Implement Burn Bans
Hazard	Wildfire
Background	Local residents would be instructed not to burn brush outdoors during periods of drought or other conditions that are prone to cause wildfires.
Benefits	Prevention of wildfires can save lives and prevent property damage to new and existing buildings.
Priority	High
Estimated cost	No cost
Responsible organization	City of Tehuacana OEM
Target completion date	December 2013
Funding sources	***NA***

Jurisdiction	City of Tehuacana
Action	Community Outreach and Education
Hazard	Wildfire
Background	The community can educate citizens on the dangers of wildfires and how to preserve a Wildland/Urban Interface around their homes.

Benefits	Educating residents on how to protect their homes against wildfires can save lives.
Priority	Medium
Estimated cost	$400
Responsible organization	City of Tehuacana OEM
Target completion date	June 2016
Funding sources	***FEMA mitigation grants, Texas Forest Service, general revenues***

Jurisdiction	City of Tehuacana
Action	Community Outreach and Education
Hazard	Drought
Background	The community can educate citizens on the dangers of drought and how to conserve water around the home.
Benefits	Educating residents on how to save water can help conserve local water supplies for drinking or fighting wildfires
Priority	Medium
Estimated cost	$200
Responsible organization	City of Tehuacana OEM
Target completion date	June 2015
Funding sources	***FEMA mitigation grants, general revenues***

Jurisdiction	City of Tehuacana
Action	Implement their Drought Contingency Plan response stages
Hazard	Drought
Background	The local Drought Contingency Plan contains specific, quantified targets for water use restrictions. This includes drought response stages with triggers to begin and end at each stage.
Benefits	Each drought response stage will reduce the availability of water for certain events. Examples include not allowing the watering of lawns during the day or encouraging the use of xeriscape landscapes.

Priority	Medium
Estimated cost	No Cost
Responsible organization	City of Tehuacana OEM
Target completion date	January 2014
Funding sources	***NA***

Jurisdiction	City of Tehuacana
Action	Improving roof sheathing to prevent hail penetration.
Hazard	Hail
Background	For new construction as well as retrofitting existing buildings, require roof sheathing techniques to minimize hail damage.
Benefits	Can prevent property damage to new and existing structures.
Priority	Low
Estimated cost	No Cost
Responsible organization	City of Tehuacana OEM
Target completion date	March 2016
Funding sources	***NA***

Jurisdiction	City of Tehuacana
Action	Community Outreach and Education
Hazard	Floods
Background	The community can educate citizens on the dangers of flood impacts and how to prevent them.
Benefits	Educating residents on how to protect their homes against floods can save lives. Examples include information about the National Flood Insurance Program (NFIP) and home elevation/acquisition mitigation grants.
Priority	High
Estimated cost	$250

Responsible organization	City of Tehuacana OEM
Target completion date	December 2016
Funding sources	***FEMA HMGP Grants***

Jurisdiction	City of Tehuacana
Action	Purchase and place NOAA weather radios in existing special facilities such as churches and schools.
Hazard	Winter Storm
Background	NOAA weather radio is the primary tool for early warning of weather events
Benefits	Public safety; early alerting of the public
Priority	High
Estimated cost	$500
Responsible organization	City of Tehuacana OEM
Target completion date	May 2015
Funding sources	***FEMA mitigation grants, Local Funds***

SECTION FIFTEEN: PLAN MAINTENANCE

IMPLENTATION

This section discusses how this mitigation plan will be implemented by Limestone County and participating jurisdictions of Coolidge, Groesbeck, Kosse, Mexia, Tehuacana and Thornton. It also addresses how the plan will be evaluated and improved over time and how the public will continue to be involved in the hazard mitigation planning process.

The County and each participating City will be responsible for implementing its own Mitigation Actions contained in Section 14. Each action has been assigned to a specific person or local government office that is responsible for implementing each specific action. When the governing body of each participating jurisdiction has adopted the mitigation plan for its jurisdiction, copies of the governing body resolutions will be contained in Appendix C (pending approval).

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 has also 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 Actions through other, already existing planning mechanisms such as the Mitigation Annex P of the City of Mexia Emergency Operation Plan (OEP) and the local floodplain ordinances of Limestone County and the cities of Groesbeck and Mexia.

Other planning mechanisms, such as capital improvement plans, long-range growth plans, master stormwater and drainage plans, and regional planning efforts do not exist in this area. However, if in the future a jurisdiction develops such a plan, then the jurisdiction will ensure that the actions contained in the plan are reflected in these other planning efforts.

Upon formal adoption of the plan, hazard mitigation team members from each jurisdiction will review all building codes, if present, to guide and control development. The hazard mitigation team members will work to integrate the hazard mitigation strategies into these building codes.

Each jurisdiction will conduct periodic reviews of any other relevant plans that they may have and analyze the need for any amendments in light of the approved hazard mitigation plan. Participating jurisdictions will ensure that emergency management 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 the hazard mitigation team member for each jurisdiction.

Periodic revisions and updates of the plan are required to ensure that the goals, objectives, and Mitigation Actions are kept current. More importantly, 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.

Hazard mitigation team members from each jurisdiction are responsible for continual monitoring those components of the hazard mitigation plan that pertains to their jurisdiction. Table 15-1 below lists each jurisdictions representative and title.

Table 15-1: Representatives from Participating Jurisdictions

Jurisdiction/Agency	Name	Title
Limestone County	Matt Groveton	Emergency Management Coordinator (EMC)
City of Coolidge	Jeff Dunbar	EMC
City of Groesbeck	Matt Groveton	EMC
City of Kosse	Carl Malone	EMC
City of Mexia	Nina Perez	EMC
City of Tehuacana	Beth Carpenter	EMC
City of Thornton	Bill Smith	EMC

As part of the monitoring process, team members will assess any changes in risk; use a tracking system to 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 Limestone County Office of Emergency Management of any needed changes in the plan based upon their monitoring activities.

Representatives from each participating jurisdiction are also responsible for evaluating the components of the plan that pertains to their jurisdiction. The evaluation process will include accessing the effectiveness of the plan at achieving its stated purposes and goals. The team members will meet once a year to discuss the status of action items and evaluate whether the plan has been effective. Measures to improve efficiency will be implemented, if necessary.

This plan will be formally reviewed every five years to determine whether there have been significant changes in the County that might affect the plan.

This plan will be formally reviewed within every five years to determine whether there have been significant changes in the County that might affect the plan.

Procedure for Revisions and Updates

- Three years out from plan expiration, the Limestone County OEM will begin writing the plan update and will submit the draft plan to TDEM.
- 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.
- Two years out from plan expiration, the revised draft plan will be submitted to TDEM, and eventually FEMA for review and approval.
- One year out from plan expiration, the revised plan will be Approved Pending Adoption by FEMA and will then be re-adopted by all of the participating jurisdictions.

The five-year review will be conducted under the auspices of the Limestone County Office of Emergency Management (OEM). 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. 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. 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.

Based on the review, the plan will be updated or revised at least every five years. As part of the plan review under the auspices of the OEM, 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 OEM that will include an evaluation of the effectiveness and appropriateness of the Plan, and will recommend required or desirable changes.

Data is not currently available to describe vulnerability in terms of types and numbers of future buildings, infrastructure and critical facilities. Depending upon resource availability, during the five-year plan update process, an analysis will be conducted for all jurisdictions of vulnerability in terms of the types and numbers of future buildings, infrastructure and critical facilities located in identified hazard areas.

Plan Amendments and Continued Public Participation

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. As long as the plans of existing jurisdictions are not affected, additional jurisdictions may be added to the plan without requiring the existing jurisdictions to re-adopt the plan.

After initial adoption, amendments to the plan must be approved by the governing body of the participating county, city or and/or the local Office of Emergency Management. Upon ratification, the amendment will be submitted to the Texas Division of Emergency Management.

Public input was an integral part of the preparation of this plan and will continue to be essential as the plan grows and changes. The public will continue to be involved in the maintenance process of the plan. 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. A public meeting will occur two years after FEMA approval of the plan is issued. The purpose of the public meeting will be to update the public on the status of mitigation actions and to seek input and comments. A second public meeting will occur two years following the first one. The public will be notified of the meetings through notices posted at the County Courthouse and on the website of the Limestone County Office of Emergency Management (OEM).

This Hazard Mitigation Action Plan will be posted continuously on the website of the Limestone County OEM, where the public is invited to provide ongoing feedback. The public will be notified that the plan is available on the website through notices posted at the County Courthouse building located at 200 West State Street, Groesbeck, Texas 76642. Copies of the plan also will be kept in each jurisdiction participating in this plan for public inspection and review. For more information, contact the Limestone Office of Emergency Management at telephone (254) 747-0641.

Appendix A: Limestone County Hazard Mitigation Team (HMT)

Name	Jurisdiction	Title	Role
Matt Groveton	Limestone County	Emergency Management Coordinator (EMC)	Lead the HMT during the development of the plan, organized meetings, reviewed final draft of plan.
Jeff Dunbar	Coolidge	EMC	Provided local jurisdictional data, reviewed drafts, attended meetings.
Matt Groveton	Groesbeck	EMC	Provided local jurisdictional data, reviewed drafts, attended meetings.
Carl Malone	Kosse	EMC	Provided local jurisdictional data, reviewed drafts, attended meetings.
Nina Perez	Mexia	EMC	Provided local jurisdictional data, reviewed drafts, attended meetings.
Beth Carpenter	Tehuacana	EMC	Provided local jurisdictional data, reviewed drafts, attended meetings.
Bill Smith	Thornton	EMC	Provided local jurisdictional data, reviewed drafts, attended meetings.

David Larner	NA	Mitigation Planner	Provided talking points during the meetings, composed drafts of the plan, submitted draft plans to TDEM and revised drafts as necessary.

Appendix B: Critical Facilities

Location	Name	Type
Limestone County	Emergency Operations Center	Emergency Management
Groesbeck	Groesbeck Fire Dept	Fire Station
Groesbeck	Groesbeck Police Dept.	Police Station
Mexia	Mexia Fire Dept.	Fire Station
Mexia	Mexia Police Dept.	Police Station
Tehuacana	Tehuacana VFD	Fire Station

Appendix C: Resolutions approving the Plan