

DALLAS COUNTY
MISSOURI
2018 Multi-Jurisdictional
Natural Hazard Mitigation Plan

Approved August 6, 2018





FEMA

August 6, 2018

Mr. Ernie Rhodes, Director
State Emergency Management Agency
P. O. Box 116
Jefferson City, Missouri 65102

Subject: Review of the Dallas County, Missouri Hazard Mitigation Plan Update

Dear Mr. Rhodes:

The purpose of this letter is to provide the status of the above referenced Local Hazard Mitigation Plan, pursuant to the requirements of 44 CFR Part 201 - Mitigation Planning and the Local Multi-Hazard Mitigation Planning Guidance. The Local Hazard Mitigation Plan Review Tool documents the Region's review and compliance with all required elements of 44 CFR Part 201.6, as well as identifies the jurisdictions participating in the planning process. FEMA's approval will be for a period of five years effective starting with the approval date indicated below.

Prior to the expiration of the plan the community will be required to review and revise their plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval in order to continue to be eligible for mitigation project grant funding.

Plan Name	Date Submitted	Date Approved	Date of Plan Adoption	Date of Plan Expiration	Review Status
Dallas County	June 29, 2018	August 6, 2018	March 26, 2018	August 6, 2023	Approved

If you have any questions or concerns, please contact Joe Chandler, Planning Team Lead, at (816) 283-7071.

Sincerely,

Michael Scott
Mitigation Division Director

CONTRIBUTORS

Dallas County Hazard Mitigation Planning Committee

Jurisdictional Representatives

Name	Title	Department	Jurisdiction/Agency/Organization
Sherry Berry	Disaster Coordinator	County Commission	Dallas County
Kevin Sharpe	Presiding Commissioner	County Commission	Dallas County
Scott Rice	Sheriff	Administration	Dallas County Sheriff
Debby Dryer	Assistant Superintendent	Administration	Dallas County R-I School District
Debby Polston	Assistant to the Mayor	Administration	City of Buffalo
Brandon Kenall	Mayor	Administration	City of Buffalo
Greg Cunningham	Fire Chief	Fire Department/EMD	City of Buffalo
Rich Wilkinson	Police Chief	Police, EMC	City of Buffalo
Terry Lane	Emergency Management Director	Emergency Management	Dallas County
Sacha Montgomery	Clerk	Administration	Village of Louisburg
Larry Senyard	Fire Chief	Administration	Urbana Rural Fire Department
Greg Owens	Firefighter	Fire Department	Urbana Rural Fire Department

Stakeholder Representatives

Name	Title	Department	Agency/Organization
Hollie Elliott	Executive Director	Economic Development	Dallas County
Shannon Jackson	EPHS	Dallas County Health	Dallas County Health Department
Tanya Watson	Director	Administration	Buffalo Chamber of Commerce

TABLE OF CONTENTS

CONTRIBUTORS *i*
 Dallas County Hazard Mitigation Planning Committee *i*
 Stakeholder Representatives *i*
TABLE OF CONTENTS *ii*
EXECUTIVE SUMMARY *iii*
PREREQUISITES *v*
 Model Resolution *vi*

1 Introduction And Planning Process 1.1
2 Planning Area Profile And Capabilities 2.1
3 Risk Assessment 3.1
4 Mitigation Strategy 4.1
5 Plan Maintenance Process 5.1

Appendix A: References
Appendix B: Planning Process
Appendix C: Completed/Deleted Mitigation Actions
Appendix D: Adoption Resolutions

EXECUTIVE SUMMARY

The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from hazards. Dallas County and participating jurisdictions and school/special districts developed this multi-jurisdictional local hazard mitigation plan update to reduce future losses from hazard events to Dallas County and its communities and school/special districts. The plan is an update of a plan that was approved on December 12, 2013. The plan and the update were prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 to result in eligibility for the Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance Grant Programs.

The Dallas County Multi-Hazard Mitigation Plan is a multi-jurisdictional plan that covers the following five jurisdictions that participated in the planning process:

- Unincorporated Dallas County
- City of Buffalo
- Village of Louisburg
- Dallas County R-I School District
- Urbana Rural Volunteer Fire Department

Local jurisdictions that were invited but did not participate in the Plan include:

- City of Urbana
- Buffalo Rural Fire District
- Long Lane Fire District
- Louisburg Fire District
- Southern Dallas Fire District
- Windyville Fire District

When the future five-year update is developed for this plan, those that did not participate in this update will be invited again to participate.

Dallas County and the entities listed above developed a Multi-Jurisdictional Hazard Mitigation Plan that was approved by FEMA on December 12, 2013 (hereafter referred to as the *2013 Hazard Mitigation Plan*). This current planning effort serves to update that previously approved plan.

The plan update process followed a methodology prescribed by FEMA, which began with the formation of a Mitigation Planning Committee (MPC) comprised of representatives from Dallas County and participating jurisdictions. The MPC updated the risk assessment that identified and profiled hazards that pose a risk to Dallas County and analyzed jurisdictional vulnerability to these hazards. The MPC also examined the capabilities in place to mitigate the hazard damages, with emphasis on changes that have occurred since the previously approved plan was adopted. The MPC determined that the planning area is vulnerable to several hazards that are identified, profiled, and analyzed in this plan. Riverine and flash flooding, winter storms, severe thunderstorms/hail/lightning/high winds, and tornadoes are among the hazards that historically have had a significant impact.

Based upon the risk assessment, the MPC updated goals for reducing risk from hazards. The goals are listed below:

1. Protect lives and minimize injury to citizens.
2. Preserve and protect property, infrastructure, and the local economy from the negative impacts of natural hazards.
3. Ensure the continued operation of government, emergency services.

To advance the identified goals, the MPC developed recommended mitigation actions, which are detailed in Chapter 4 of this plan. The MPC developed an implementation plan for each action, which identifies priority level, background information, and ideas for implementation, responsible agency, timeline, cost estimate, potential funding sources, and more.

PREREQUISITES

44 CFR requirement 201.6(c)(5): The local hazard mitigation plan shall include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan. For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.

This plan has been reviewed by and adopted with resolutions or other documentation of adoption by all participating jurisdictions and schools/special districts. The documentation of each adoption is included in Appendix D, and a model resolution is included on the following page.

The following jurisdictions participated in the development of this plan and have adopted the multi-jurisdictional plan.

- Unincorporated Dallas County
- City of Buffalo
- Village of Louisburg
- Dallas County R-I School District
- Urbana Rural Volunteer Fire Department

Model Resolution

(LOCAL GOVERNING BODY/SCHOOL DISTRICT), Missouri RESOLUTION NO. _____

A RESOLUTION OF THE (LOCAL GOVERNING BODY /SCHOOL DISTRICT) ADOPTING THE (PLAN NAME)

WHEREAS the (local governing body/school district) recognizes the threat that natural hazards pose to people and property within the (local governing body/school district); and

WHEREAS the (local governing body/school district) has participated in the preparation of a multi-jurisdictional local hazard mitigation plan, hereby known as the (plan name), hereafter referred to as the Plan, in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in the (local governing body/school district) from the impacts of future hazards and disasters; and

WHEREAS the (local governing body) recognizes that land use policies have a major impact on whether people and property are exposed to natural hazards, the (local governing body/school district) will endeavor to integrate the Plan into the comprehensive planning process; and

WHEREAS adoption by the (local governing body/school district) demonstrates their commitment to hazard mitigation and achieving the goals outlined in the Plan.

NOW THEREFORE, BE IT RESOLVED BY THE (LOCAL GOVERNMENT/SCHOOL DISTRICT), in the State of Missouri, THAT:

In accordance with (local rule for adopting resolutions), the (local governing body/school district) adopts the final FEMA-approved Plan.

ADOPTED by a vote of __ in favor and ___ against, and ___ abstaining, this day of _____, _____.

By (Sig):
Print name:

ATTEST:
By (Sig.):
Print name:

APPROVED AS TO FORM:
By (Sig.):
Print name:

1 INTRODUCTION AND PLANNING PROCESS

1	INTRODUCTION AND PLANNING PROCESS	1.1
1.1	<i>Purpose</i>	1.1
1.2	<i>Background and Scope</i>	1.1
1.3	<i>Plan Organization</i>	1.2
1.4	<i>Planning Process</i>	1.3
1.4.1	Multi-Jurisdictional Participation.....	1.5
1.4.2	The Planning Steps	1.6

1.1 PURPOSE

Hazard Mitigation is the process of preparing for and taking action in order to reduce the long-term risk of natural disasters to financial and human consequences. Mitigation actions may be implemented prior to, during, or after a hazard event; however, it has been demonstrated that hazard mitigation is most effective when based on long-term inclusive, comprehensive plan that is developed before a disaster has occurred (<http://www.fema.gov/what-mitigation>).

By participating in the planning process and meeting the necessary requirements to do so, communities, school districts, and other special district jurisdictions become eligible to apply for mitigation grant funding. FEMA has implemented the various hazard mitigation provisions through the Code of Federal Regulations (CFR) at 44 CFR Part 201. The CFR provisions set forth the mitigation plan requirements for local and tribal governments as a condition of receiving FEMA hazard mitigation assistance. Local governments, schools, or other publicly funded districts that do not participate or adopt a hazard mitigation plan will not be eligible to apply for grants as stated under 44 CFR §201.6. Section 322 of the Robert T. Stafford Relief and Emergency Assistance Act (P.L. 93-288), as amended by the Disaster Mitigation Act of 2000 (DMA) (P.L. 106-390), provides for States, Tribes and local governments to undertake a risk-based approach to reducing risks to natural hazards through mitigation planning.

1.2 BACKGROUND AND SCOPE

As required by 44 CFR §201.6(d)(3), a local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts and changes in priorities, and resubmit it for approval every five (5) years in order to continue to be eligible for mitigation project grant funding. The 2018 Dallas County Multi-Jurisdictional Natural Hazard Mitigation Plan, from here on referred to as the Plan, is a revision of the previous five-year update adopted December 12, 2013 which was the first five year update of the original plan completed in 2005.

The Plan is a major rewrite of the 2013 Plan and reflects changes in priorities and development, and the continued commitment of local governments to mitigate the impact of natural hazards in Dallas County. Local jurisdictions that participated in the 2013 Plan and are continuing participation in the 2018 Plan include:

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- Dallas County
 - City of Buffalo
 - Village of Louisburg
 - Dallas County R-I School District
 - Urbana Rural Volunteer Fire Department

Local jurisdictions that were invited but did not participate in the Plan include:

- City of Urbana
- Buffalo Rural Fire District
- Long Lane Fire District
- Louisburg Fire District
- Southern Dallas Fire District
- Windyville Fire District

All jurisdictions received letter and email communications notifying representatives of upcoming meetings and participation requirements. Additionally, County and adjacent jurisdiction contacts reached out to jurisdictions to encourage participation. Jurisdictions listed above were not represented during the planning process and did not meet the minimum planning participation requirements.

The local mitigation plan is the representation of the jurisdictions' commitment to reduce risks from natural hazards, serving as a guide for decision makers as they commit resources to reducing the effects of natural hazards. Information in the Plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future.

1.3 PLAN ORGANIZATION

This plan is organized into five chapters. The chapters are summarized below. This is a change from previous plans, table 1.1. Summarizes changes made.

- Chapter 1: Introduction and Planning Process
- Chapter 2: Planning Area Profile and Capabilities
- Chapter 3: Risk Assessment
- Chapter 4: Mitigation Strategy
- Chapter 5: Plan Implementation and Maintenance
- Appendices

Table 1.1 summarizes the changes made in the Plan by chapter.

Table 1.1. Changes Made in Plan Update

Plan Chapter	Summary of Changes Made
Introduction	<ul style="list-style-type: none"> • General Format Changes
Profile & Capabilities	<ul style="list-style-type: none"> • General Format Changes • Added Geological and Karst features map • Critical features moved to Ch. 3 • Added table showing Unemployment, Poverty, education, and language percentages • Historic Sites and endangered species list moved to Ch. 3. • Added table showing FEMA HMA grants approved and still pending in the county. • Expanded jurisdictional Profiles and Mitigation Capabilities section.
Risk Assessment	<ul style="list-style-type: none"> • General format updates • Expanded introduction section • Added Assets at Risk of exposure to current population and structures • Added Critical Facilities inventory of all included jurisdictions • Added inventory of parks, historical sites, and endangered species. • Added table for agricultural-related jobs and information and Major employers • Added Land Use Development section for development since previous plan and future land use expected. • Added climate change impact to specific hazards • Expanded Community profiles for each jurisdiction.
Mitigation Strategy	<ul style="list-style-type: none"> • General format updates • Updated mitigation actions development process • Included actions eliminated and reason for removal • Updated progress made towards mitigation goals from earlier plan • Discussed funding sources, lead agencies and status of continuing, revised and new actions
Plan Maintenance	<ul style="list-style-type: none"> • General format updates • Updated the responsibilities for plan monitoring, evaluation, and implementation.

1.4 PLANNING PROCESS

44 CFR Requirement 201.6(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

The Southwest Missouri Council of Governments (SMCOG) was contracted to facilitate the plan development process. SMCOG staff met with the Dallas County EMDs during an initial scoping meeting to develop contact information for the area stakeholders and local jurisdiction representatives to establish the Mitigation Planning Committee (MPC). Meeting locations and schedules were discussed, and the most effective way to inform and include the public was determined. Also discussed was previous plan maintenance and any updates made since 2013. It was determined that the document had not been officially updated, but previously identified actions had been discussed at LEPC meetings annually.

The planning process included the kick-off meeting and four subsequent MPC meetings. SMCOG staff were responsible for producing the draft and final plan update in a FEMA-approvable document, and coordinating with the SEMA and FEMA plan reviews.

Specific information about agenda items for the MPC meetings are presented in Section 1.4.2. SMCOG also assisted in soliciting public involvement in the planning process by providing sample surveys and questions to the County EMD for the creation of a public survey, and the drafting and sending of a press release seeking public comment. Notification of the MPC meetings on December 6, 2017, January 24, 2018, February 21, 2018, March 28, 2018, and May 2, 2018 were sent via press release to the Buffalo Reflex, the newspaper of widest distribution in the County. Meeting dates and items to be discussed for all meetings, including the kick-off meeting on December 6, 2017, were posted on the SMCOG website in advance. Drafts of the Plan were also posted on the website for public comment during the drafting of the Plan and prior to the Plan being submitted for approval. Appendix B provides documentation of the planning process including public involvement solicitations and meeting notices.

The preliminary draft of the plan was posted on the SMCOG website for public review and comment on May 1, 2018. A public notice was published in the Buffalo Reflex seeking public input on the draft plan. A final draft of the Plan was posted on the SMCOG website on June 26, 2018 before the Plan was submitted for SEMA/FEMA approval. On both occasions a press release was sent to the Buffalo Reflex notifying news outlets that the Plan was available for public comment. Input from city and county officials was solicited through distribution of drafts of plan elements for discussion and review at scheduled meetings and other communications with individual community representatives and elected officials.

Neighboring jurisdictions were notified via email and letters, a notification was sent to adjacent county Emergency Management Directors, Chambers of Commerce, local and regional agencies, such as; OACAC, Health Department, American Red Cross, and special districts. A complete listing of agencies invited to participate in the planning process and what meetings they were invited to attend is included in Appendix B.

Table 1.2 shows the MPC members and the entities they represent, along with their titles.

Table 1.2. Jurisdictional Representatives Dallas County Mitigation Planning Committee

Name	Title	Department	Jurisdiction/Agency /Organization
Sherry Berry	Disaster Coordinator	County Commission	Dallas County
Kevin Sharpe	Presiding Commissioner	County Commission	Dallas County
Scott Rice	Sheriff	Administration	Dallas County Sheriff
Debby Dryer	Assistant Superintendent	Administration	Dallas County R-I School District
Debby Polston	Assistant to the Mayor	Administration	City of Buffalo
Brandon Kenall	Mayor	Administration	City of Buffalo
Greg Cunningham	Fire Chief	Fire Department/ EMD	City of Buffalo
Rich Wilkinson	Police Chief	Police, EMC	City of Buffalo
Terry Lane	Emergency Management Director	Emergency Management	Dallas County
Sacha Montgomery	Clerk	Administration	Village of Louisburg
Larry Senyard	Fire Chief	Administration	Urbana Rural Fire Department
Greg Owens	Firefighter	Fire Department	Urbana Rural Fire Department
Stakeholders			

Hollie Elliott	Executive Director	Economic Development	Dallas County
Shannon Jackson	EPHS	Dallas County Health	Dallas County Health Department
Tanya Watson	Director	Administration	Buffalo Chamber of Commerce

1.4.1 Multi-Jurisdictional Participation

44 CFR Requirement §201.6(a)(3): Multi-jurisdictional plans may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the plan.

The Plan serves as a written document of the planning process. Active participation of local jurisdiction representatives and stakeholders in the hazard mitigation planning process is essential if the Plan is to have value. To be eligible for mitigation funding, local governments must adopt the FEMA-approved update of the Plan. The participation of the local government stakeholders in the planning process is considered critical to successful implementation of this plan. Each jurisdiction that is seeking approval for the Plan must have its governing body adopt the updated plan, regardless the degree of modifications. SMCOG collaborated with the local governments in Dallas County to assure participation in the planning process and the development of a plan that represents the needs and interests of Dallas County and its local jurisdictions. Appendix D contains resolutions for jurisdictions adopting the Plan.

County Commissioners, incorporated communities, public schools, special districts, and various other stakeholders in mitigation planning were invited to a kick-off meeting for the Plan update on December 6, 2017. At this meeting it was explained that the Disaster Mitigation Act (DMA) requires each jurisdiction participating in the planning process officially adopt the plan. The criteria for participation that each jurisdiction must meet in order to be considered a “participant” in the Plan was established at this meeting and include the following: 1.7

- Participation in at least two (2) MPC meetings, by either direct participation or authorized representation;
- Each participating jurisdiction must provide to the MPC sufficient information to support plan development by completion and return of Data Collection Questionnaires;
- Provide documentation to show time donated to the planning effort;
- All participants should formally adopt the mitigation plan prior to submittal to SEMA and FEMA for final approval.

In order to be included in the plan as a participating jurisdiction, each jurisdiction was required to send a representative to two (2) meetings, completion of the data collection questionnaire, complete in-kind time documentation (if applicable), and formally adopt the plan as minimum requirements. Jurisdictions that met the minimum requirements and are considered to have satisfactorily participated in the planning process. In addition to public outreach solicited through SMCOG, each participating jurisdiction was strongly encouraged to seek public input at an open public meeting or through various forms of input solicitation.

Table 1.3 shows the representation of each participating jurisdiction at the planning meetings and the provision of responses to the data collection questionnaire. All jurisdictions participating in the Plan either reviewed or commented on the draft Plan, participated in the update/development of mitigation actions, documented the donation of time, and passed an adoption resolution. Meeting sign-in sheets are located in Appendix B.

Table 1.3. Jurisdictional Participation in Planning Process

Jurisdiction	Kick-off Meeting	Meeting #2	Meeting #3	Meeting #4	Meeting #5	Data Collection Questionnaire Response	Documented Donated time	Adoption Resolution
Dallas County	X	X	X	X	X	X	X	X
City of Buffalo	X	X	X	X	X	X	X	X
Village of Louisburg	X	X		X	X	X	X	X
Dallas County R-I	X	X			X	X	X	X
Urbana Rural Fire Department	X	X	X	X	X	X	X	X

1.4.2 The Planning Steps

FEMA’s Local Mitigation Planning Handbook (March 1, 2013), Local Mitigation Plan Review Guide (October 1, 2011), and Integrating Hazard Mitigation into Local Planning: Case Studies and Tools for Community Officials (March 1, 2013) were used as the sources for developing the Plan update process. The development of the plan followed the 10-step planning process adapted from FEMA’s Community Rating System (CRS) and Flood Mitigation Assistance programs. The 10-step process allows the Plan to meet funding eligibility requirements of the Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, Community Rating System, and Flood Mitigation Assistance Program. Table 1.4 shows how the CRS process aligns with the Nine Task Process outlined in the 2013 Local Mitigation Planning Handbook.

Table 1.4 is a summary of how SMCOG staff used the Nine Task Process to develop the update to the Plan.

Table 1.4. County Mitigation Plan Update Process

Community Rating System (CRS) Planning Steps (Activity 510)	Local Mitigation Planning Handbook Tasks (44 CFR Part 201)
Step 1. Organize	Task 1: Determine the Planning Area and Resources Task 2: Build the Planning Team 44 CFR 201.6(c)(1)
Step 2. Involve the public	Task 3: Create an Outreach Strategy 44 CFR 201.6(b)(1)
Step 3. Coordinate	Task 4: Review Community Capabilities 44 CFR 201.6(b)(2) & (3)
Step 4. Assess the hazard	Task 5: Conduct a Risk Assessment 44 CFR 201.6(c)(2)(i) 44 CFR 201.6(c)(2)(ii) & (iii)
Step 5. Assess the problem	
Step 6. Set goals	Task 6: Develop a Mitigation Strategy 44 CFR 201.6(c)(3)(i); 44 CFR 201.6(c)(3)(ii); and 44 CFR 201.6(c)(3)(iii)
Step 7. Review possible activities	
Step 8. Draft an action plan	
Step 9. Adopt the plan	Task 8: Review and Adopt the Plan
Step 10. Implement, evaluate, revise	Task 7: Keep the Plan Current
	Task 9: Create a Safe and Resilient Community 44 CFR 201.6(c)(4)

Step 1: Organize the Planning Team (Handbook Tasks 1 & 2)

In July 2017, SMC0G entered into cooperative agreements with SEMA and Dallas County to prepare this multi-jurisdictional plan for public entities in Dallas County. Discussions on the development of the Dallas County Multi-Jurisdictional Natural Hazard Mitigation Plan began on September 27, 2017 with an introductory scoping meeting attended by SMC0G staff, the County Emergency Management Director and the Buffalo Police Chief/Emergency Manager. This meeting was conducted to discuss the timeline for developing the hazard mitigation plan, the planning process, identification of stakeholders and community organizations to include in the planning process, and dates for five planning committee meetings, beginning with a kick-off meeting on December 6, 2017 to initiate participation of jurisdictions and public entities in the planning process.

The Emergency Management Director (EMD) and SMC0G staff identified prospective participant representatives and stakeholders and a contact list was prepared for mailing an invitation letter to the kick-off meeting. The list of invitees included local elected officials, municipal government staff, county government staff, emergency services personnel, public school administrators, members from health and social services organizations, utility providers, EMDs from adjacent counties, and volunteer organizations. A complete list of invitees is in Appendix B.

The MPC met on several occasions from December, 2017 through May 2018 to collaborate on the development of the Plan update. Participants assisted in data collection; reviewed and revised the Plan’s goals and mitigation strategies; and provided reviews and comments on the Plan throughout the update process. Communication with MPC members occurred throughout the planning process through phone conversations, letters, and email correspondence in addition to committee meetings. Table 1.5 shows the meeting schedule and items discussed for MPC meetings.

Table 1.5. Schedule of MPC Meetings

Meeting	Topic	Date
Informational Scoping Meeting	<ul style="list-style-type: none"> • Discussion of general process of updating the Hazard Mitigation Plan • Prepared planning committee members and reviewed contact list • Planned future dates for the planning committee. • Discussed communication with the public, stakeholders, city officials, and other jurisdictions to make aware of hazard mitigation meetings • Discussed previous plan maintenance and established procedure for future plan maintenance 	September 27, 2017
Kick-off Meeting	<ul style="list-style-type: none"> • Introduction to Hazard Mitigation • The Planning Process • Participation Requirements • Future Meeting Dates 	December 6, 2017
Planning Meeting #2	<ul style="list-style-type: none"> • Participation Requirements • The Planning Process- Recap • Risk Assessment • Mitigation Strategies Preview • Future Meeting Dates 	January 24, 2018

Planning Meeting #3	<ul style="list-style-type: none"> • Participation Requirements • The Planning Process- Recap • Mitigation Strategies: Goals and Actions • Future Meeting Dates 	February 21, 2018
Planning Meeting #4	<ul style="list-style-type: none"> • Participation Recap • Planning Process Overview • Mitigation Strategies Prioritization • Future Meeting Date 	March 28, 2018
Planning Meeting #5	<ul style="list-style-type: none"> • Participation Recap • Planning Process Overview • Action Tracker Website • Funding and Implementation Mechanisms • Plan Adoption & Maintenance 	May 2, 2018

Step 2: Plan for Public Involvement (Handbook Task 3)

44 CFR Requirement 201.6(b): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.

Options for soliciting public input on the Plan were discussed at the MPC kick-off meeting held on December 6, 2017. SMCOG staff explained the importance of public involvement during the planning process. It was determined that SMCOG staff would advertise MPC meetings through press releases to the Buffalo Reflex. In addition, meeting dates and invitations were posted on the SMCOG website along with drafts of the Plan for public comment during the drafting stage and prior to submission of the Plan to SEMA for approval. Press releases were sent to local news publications, and legal notices published in the Buffalo Reflex when the drafts of the Plan were posted to the SMCOG website for public comment during the drafting stage on May 1, 2018. A final draft of the Plan was posted on the SMCOG website on June 26, 2018 prior to being submitted to SEMA for approval. Copies of affidavits of publication for legal notices, Screen captures of the SMCOG website, and copies of press releases are included in Appendix B.

It was also discussed at the kick-off meeting that solicitation of public input would be sought by members of the MPC through announcements at gatherings and other public meetings, such as board of alderman, county commission meetings, board of education meetings and local emergency planning committee meetings. Additionally, it was determined that SMCOG staff would provide survey samples to the County EMD, and the committee would work together to finalize an online community survey. This survey was advertised via press release and the Dallas County R-1 School District placed the survey on its website. The Dallas County EMD Facebook page shared the survey to assist in soliciting public input. Thirty responses were received in the three-week time period that the survey was open. A summary of responses to the survey include:

- 40% (14) were from Unincorporated Dallas County; 28% (10) from Buffalo; 14% (5) from Long Lane.
- Respondents ranked the top three hazards most likely to occur as: Severe Thunderstorm, Severe Winter Weather, and Tornadoes.
- Respondents felt the highest impact would be from: Tornadoes, Wildfire, and Severe Thunderstorms.

-
- New tornado safe room construction had the most support with 73% (25), followed by structural retrofitting of existing buildings to add tornado safe rooms, with 67% (23).

Public input and comments has been integrated into the Risk Assessment chapter and have helped reflect action items for selected jurisdictions.

Step 3: Coordinate with Other Departments and Agencies and Incorporate Existing Information (Handbook Task 3)

44 CFR Requirement 201.6(b): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process. (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

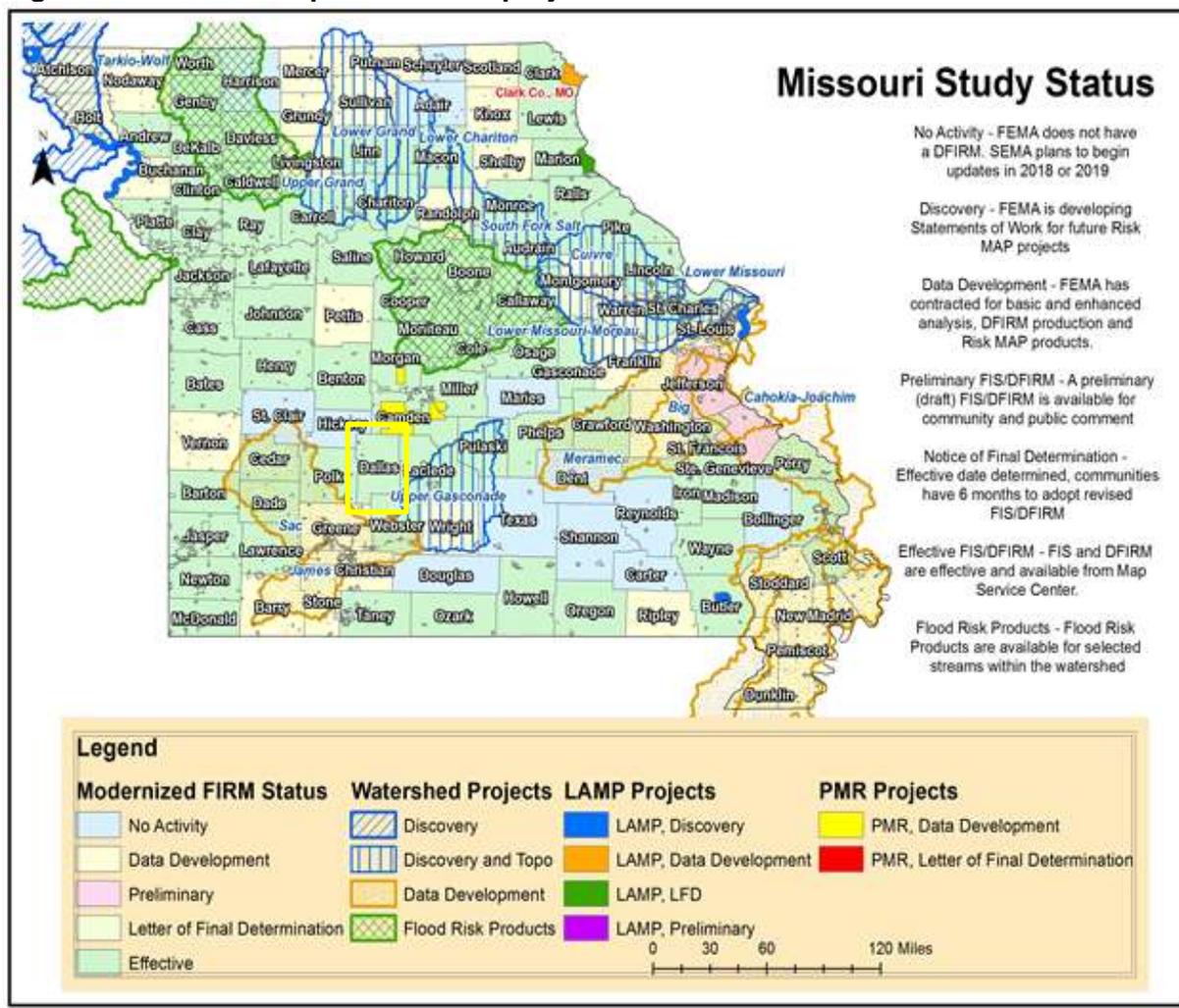
As stated in Section 1.4, neighboring communities, businesses, academia, and other non-profit interests were notified via email and letters, a notification was sent to adjacent county Emergency Management Directors, local and regional agencies, such as; OACAC, Health Departments, and special districts. A complete listing of agencies invited to participate in the planning process and what meetings they were invited to attend is included in Appendix B.

Coordination with FEMA Risk MAP Project

There was no coordination with FEMA RiskMAP projects during the update of this plan, as there were no current projects underway.

Figure 1.1 displays locations of RiskMAP deployed watersheds and current projects in Missouri. Dallas County is outlined in yellow.

Figure 1.1. Map of RiskMAP projects



Integration of Other Data, Reports, Studies, and Plans

A significant amount of information presented in the Plan has been updated and revised based on the review and incorporation of existing plans, studies, reports and technical information. Appendix A contains a listing of references to plans, studies, reports and technical information to incorporate into hazard profiles, risk assessment, profile and capability sections. A few examples of information incorporated from the review of existing plans, etc. include:

- Dallas County Emergency Operations Plan
- 2013 Missouri State Hazard Mitigation Plan
- State Department of Natural Resources (DNR) dam information, the National Inventory of Dams (NID), dam inspection reports,
- Missouri Department of Conservation (MDC) wildfire statistics
- Wildland/Urban Interface and Intermix areas from the SILVIS Lab - Department of Forest Ecology and Management - University of Wisconsin

Step 4: Assess the Hazard: Identify and Profile Hazards (Handbook Task 5)

At the second MPC meeting on January 24, 2018 profiles of identified hazards from the 2013 Plan were presented. Storm event data from the National Centers for Environmental Information for the five year period since the adoption of the 2013 Plan were included in the hazard profiles. The presentation incorporated data from studies, reports, and technical information available through internet research. During the process of identifying hazards the MPC reviewed:

- Previous disaster declarations in the county
- Hazards in the most recent State Hazard Mitigation Plan
- Hazards identified in the previously approved hazard mitigation plan.

The MPC was asked to prioritize the identified hazards based on probability of occurrence, human impact, and property impact. Additional information about the conclusions drawn can be found in the Risk Assessment chapter of the Plan.

Step 5: Assess the Problem: Identify Assets and Estimate Losses

Identified assets in the planning area include population, structures, critical facilities and infrastructure, and other important assets that may be at risk to hazards. The inventory of assets for each jurisdiction was derived from parcel data from the Dallas County Assessor, the Dallas County Structures GIS dataset from MISDIS, local jurisdiction data collection questionnaires, and the U.S. Census. Potential losses to existing development were estimated based on hazard event scenarios. In most cases the county assessor's values were used to estimate structure losses in impacted areas for structure occupancy types. The methodology for estimating losses varies by hazard. Loss estimates are included in each hazard profile of the Risk Assessment chapter.

Step 6: Set Goals (Handbook Task 6)

The MPC conducted a discussion session during their third meeting on February 21, 2018 to review and update the Plan goals. The MPC also reviewed the goals from current surrounding county plans.

In the 2013 Plan, the organization of the actions included broad goals and a set of objectives linking the actions to the goals. The MPC opted to keep the goals from the 2013 Plan and eliminate the objective statements, moving forward with broad goals and specific mitigation actions. Objectives seemed to add a layer of complication and potential confusion. During this update process, the intent was to provide a usable set of actions that each jurisdiction was able to work towards partial or full implementation, and objectives seemed unnecessary.

The Plan update goals and objectives are as follows:

Goal 1 – Protect lives and minimize injury to citizens.

Goal 2 – Preserve and protect property, infrastructure, and the local economy from the negative impacts of natural hazards.

Goal 3 – Ensure the continued operation of government, emergency services.

Step 7: Review Possible Mitigation Actions and Activities

The focus of the MPC meeting on February 21, 2018 was an update of the mitigation actions and discuss potential new actions. For a comprehensive range of mitigation actions to consider, the MPC reviewed the following information during the meeting:

- A list of actions proposed in the previous mitigation plan and discussing each individually regarding progress made and continued relevance
- Input during meetings
- Responses to Data Collection Questionnaires- where jurisdictions had reported progress made on previous actions

Jurisdiction representatives on the MPC were encouraged to review the details of the risk assessment vulnerability analysis specific to their jurisdiction, and the previously identified mitigation actions prior to the meeting. Representatives were provided a link to the FEMA's publication, *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (January 2013)*. This document was developed by FEMA as a resource for identification of a range of potential mitigation actions for reducing risk to natural hazards and disasters. Additionally, survey responses which identified community support for specific mitigation actions were reviewed and discussed.

During the meeting, few new actions were proposed by the committee, but numerous actions were reworded. Much of the discussion surrounded making actions SMART: specific, measurable, achievable, relevant, and time-bound. SMCOG staff provided some recommended altered language for some items, and general discussion by the MPC provided some changes to many actions and to which jurisdictions actions were relevant.

Step 8: Draft an Action Plan

At the fourth MPC meeting on March 28, 2018, representatives were provided with pre-populated STAPLEE scoring sheets each action item identified for their jurisdiction. The method was used to develop a priority score for proposed actions. This meeting also included action worksheets to clarify what department or position would be responsible for implementing the action, potential funding sources, timeline, and local planning mechanisms for implementation. The action plans are listed for each jurisdiction in the Mitigation Strategy chapter. MPC members worked in groups to score each action for their jurisdiction and provide information pertaining to implementing those actions on a local level. During the meeting, SMCOG staff provided an overview of scoring criteria and example action worksheets. MPC members were encouraged to use the STAPLEE scoring to determine which actions applied to their jurisdiction. Numerous actions were eliminated due to non-applicability or low feasibility scores.

Step 9: Adopt the Plan (Handbook Task 8)

The final meeting on May 2, 2018 provided a wrap-up and opportunity to answer any questions pertaining to plan adoption. The final plan must be approved by the governing body of each jurisdiction by resolution to be eligible for hazard mitigation assistance. Adoption resolutions are included in Appendix D.

Step 10: Implement, Evaluate, and Revise the Plan (Handbook Tasks 7 & 9)

At the final MPC meeting on May 2, 2018, SMCOG staff discussed the FEMA action tracker website for assistance in implementing mitigation actions. The MPC also discussed potential funding sources for mitigation projects, and the process for reviewing and monitoring the plan. Dallas County Emergency Management will be charged with scheduling and staffing annual meetings, and keeping the plan updated. The overall strategy has been updated and is presented in the Plan Maintenance chapter.

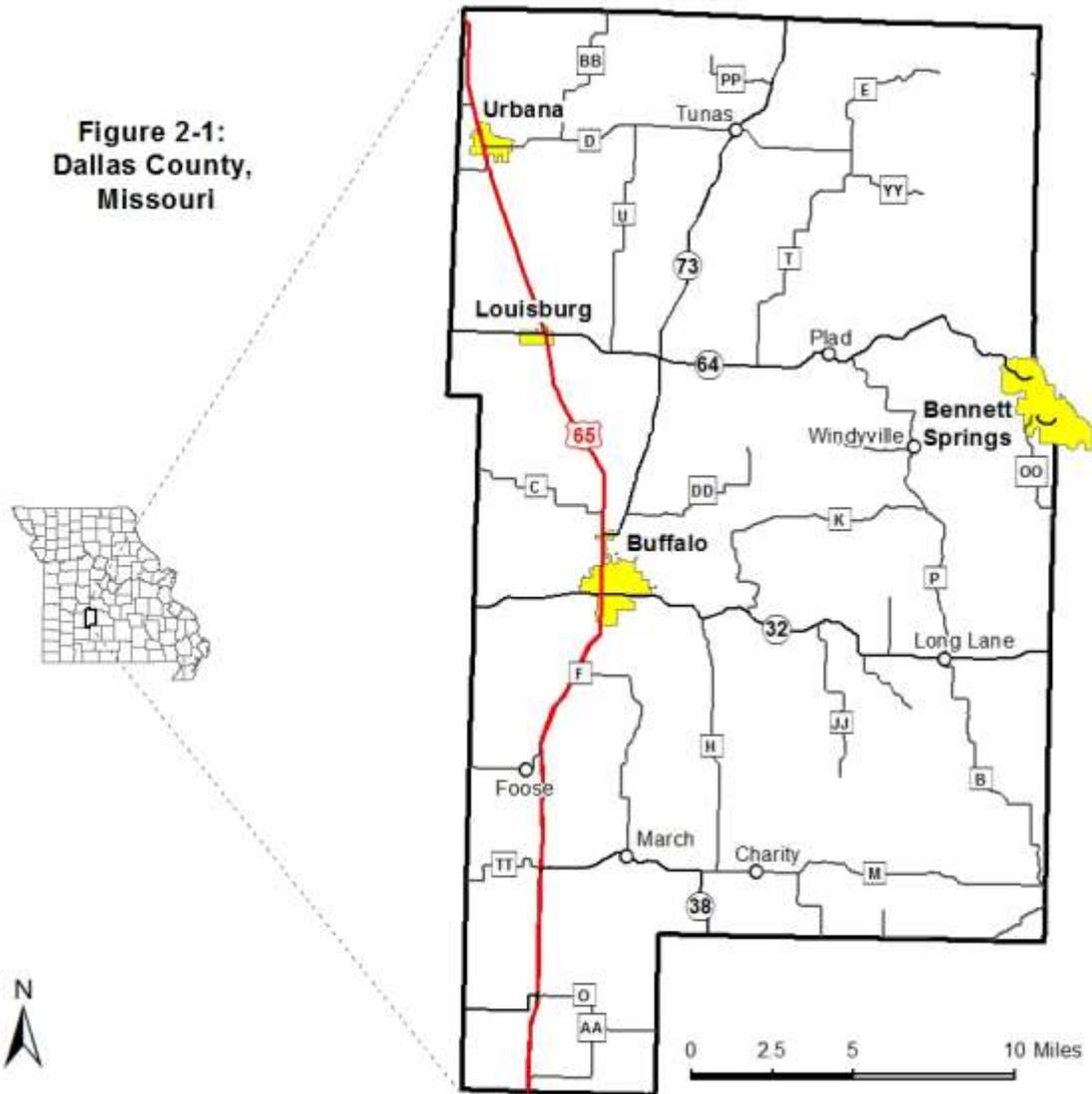
2 PLANNING AREA PROFILE AND CAPABILITIES

2	PLANNING AREA PROFILE AND CAPABILITIES	2.1
2.1	<i>Dallas County Profile.....</i>	2.2
2.1.2	Geography, Geology and Topography.....	2.3
2.1.3	Climate	2.5
2.1.4	Population/Demographics	2.6
2.1.5	History	2.7
2.1.6	Occupations	2.8
2.1.7	Agriculture.....	2.9
2.1.8	FEMA Hazard Mitigation Assistance Grants in Planning Area	2.9
2.2	<i>Jurisdictional Profiles and Mitigation Capabilities.....</i>	2.10
2.2.1	Unincorporated Dallas County.....	2.10
2.2.2	City of Buffalo.....	2.13
2.2.3	Village of Louisburg	2.15
2.2.4	Urbana Rural Volunteer Fire	2.21
2.2.5	Public School District Profiles and Mitigation Capabilities	2.21

2.1 Dallas County Profile

Dallas County is located in Southwest Missouri and is bordered by Greene County to the southwest, Webster County to the south, Laclede County to the east, Camden County to the north, Hickory County to the northwest and Polk County to the west.

Figure 2.1. Map of Dallas County



The 2015 American Community Survey estimates the Dallas county population at 16,342. This is a 2.5% decrease in population compared to 2010 population estimates of 16,777.

The growth since 2010 was less than the growth experienced by both the state of Missouri and the United States as a whole over the same time period, which were 8.9 and 14.8 percent respectively.

The median household income (MHI) for Dallas County is \$37,695 according to 2016 estimates, well below the state and national medians of \$51,746 and \$57,617. The percent change in MHI experienced by Dallas County was a 1 percent decrease since 2010, lower than both the state and national increase of 14 and 13 percent.

According to the 2016 ACS estimates, the median home value in Dallas County is \$101,300. This is lower than the state of Missouri as a whole (\$141,200), and lower than the entire United States (\$184,700).

2.1.2 Geography, Geology and Topography

Dallas County covers 542.83 square miles, including 541.54 square miles of land and 1.29 square miles of surface water. Incorporated communities include the cities of Buffalo and Urbana and the Village of Louisburg. There are also several unincorporated areas in the county, including Tunas, Plad and Windyville in the northern section of the county and Long Lane, Charity, Foose and March in the southern section. The City of Buffalo is the county seat.

Dallas County is located on the Ozarks Plateau of the Interior Highlands physiographic province. The entire county lies on the Salem Plateau division of the Ozarks Plateau (McBee, 1991). The Salem Plateau is characterized by rolling uplands and rugged hills with steep ridges and bluffs bordering rivers, streams, and deep drainage channels. Elevations range from 1,000 to 1,400 feet.

The topographic landscape varies as a result of uplift, erosion, and deposition. The western part of the county has streams that flow many more miles before discharge in the Pomme de Terre and Osage Rivers, and therefore, the landscape consists of smoother slopes. By contrast, the Niangua River converges with the Osage River a short distance to the north of Dallas County. Thus, the eastern part of the county has steeper slopes, and greater relief (McBee, 1991). The county is underlain by sedimentary rocks ranging from Ordovician age, from the Gasconade, Roubidoux, and Jefferson City Formations. There are also rocks of Mississippian age in areas of isolated monadnocks in the west-central part of the county. These are the Compton, the Northview, and Pierson Formations and Burlington Keokuk Limestone.

The county has several structural features, including faults and grabens (wide rift valleys), resulting from tectonic forces. The few faults and grabens, however, have relatively little impact on soil patterns. Geologic formations, listed from oldest to youngest, Gasconade, Roubidoux, and Jefferson City and Cotter Dolomite formations. The soils in the county formed in unconsolidated superficial deposits include residuum, loess, colluvium and alluvium. Most areas of the county have residuum and colluvium, except for relatively small areas that have a thin mantle of loess or alluvium. The consolidated bedrock exposed in the county is conspicuous and locally significant in areas of rock outcrops and shallow soils (McBee, 1991).

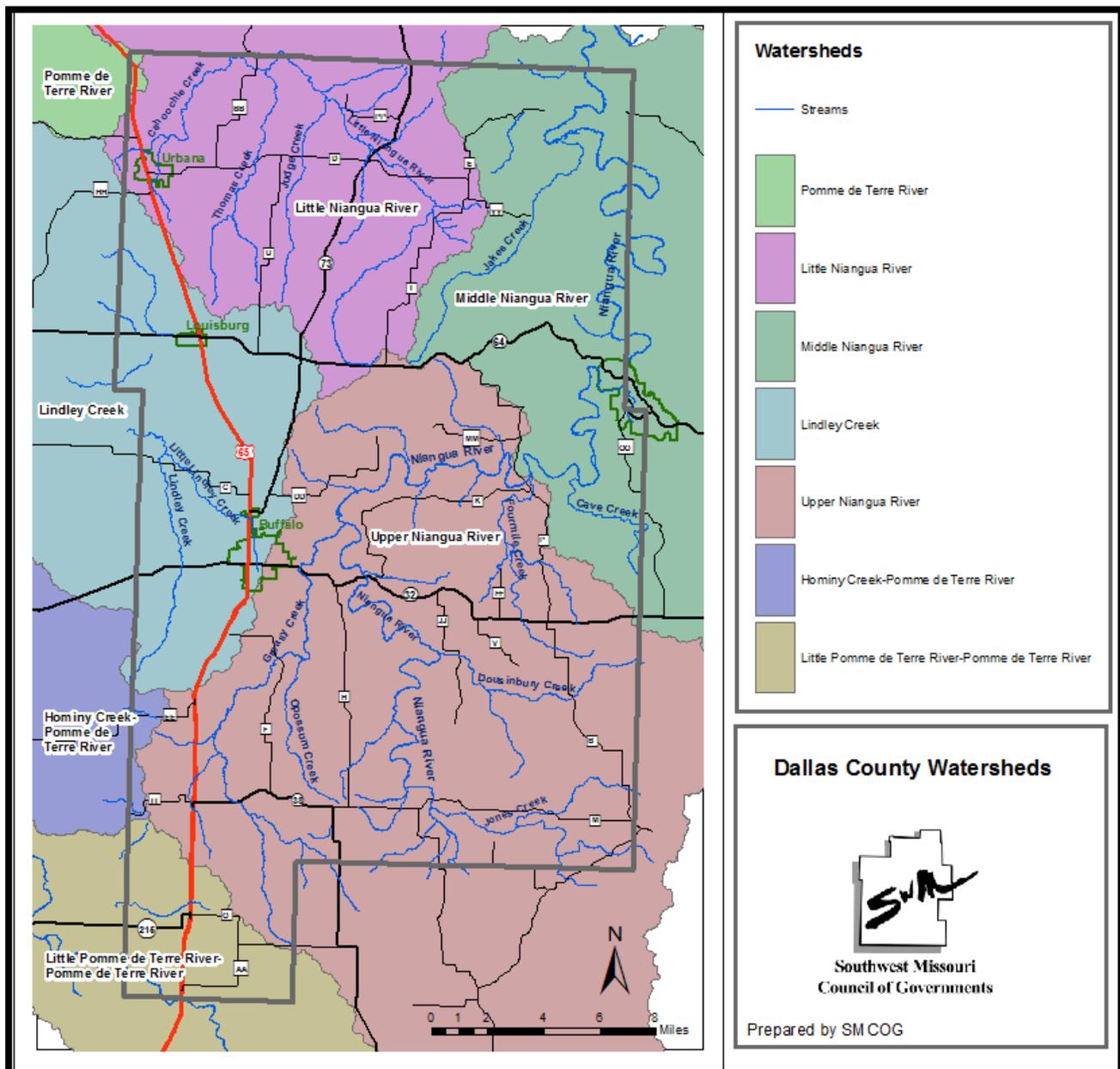
Dallas County lies within watersheds of the Osage River Basin: the Niangua River, the Lindley Creek, and the Pomme de Terre River watersheds. The Niangua River watershed encompasses 279,000 acres within Dallas County. The Little Niangua River is the major tributary of the Niangua River, as well as Greasy Creek, Dousinbury Creek, Fourmile Creek, and Durlington Creek. It originates in central Dallas County and drains the northeastern part of the county. Pomme de Terre River and its tributaries drain the southwestern part of the county. Lindley Creek, one of the main tributaries of this river, drains the west central part of the county, and it receives discharges of the City of Buffalo's wastewater treatment plant.

The City of Buffalo is located near Greasy Creek, but only Little Lindley Creek runs through the city. East Branch flows along the eastern boundary of the Village of Urbana. The Little Niangua River runs through the unincorporated settlement of Tunas in northern Dallas County. Fourmile Creek runs through Long Lane in southeastern Dallas County. The headwaters of several small tributary streams also flow through parts of communities in Dallas County, including the Village of Louisburg.

The county is well drained as a whole, and has abundant springs such as Bennett, Big Sweet, Big Black, and Walnut Springs (McBee, 1991; Schulz, 2003). Bennett Spring is the fourth largest spring in the state of Missouri. It has a daily output of over 100 million gallons of water. This spring is located within Bennett Spring State Park in eastern Dallas County and western Laclede County (www.lebanonmo.org).

There are seven watersheds located, in part, in Dallas County. Figure 2.2. is a map of the watershed boundaries in Dallas County, Missouri.

Figure 2.2. Watershed Boundaries in Dallas County, Missouri



2.1.3 Climate

Dallas County is hot in the summer and moderately cold in the winter. In summer, the average temperature is 76° F and the average daily maximum temperature is 87° F. During the winter, the average temperature is 35° F and the average daily minimum temperature is 24° F. Snow usually falls every winter, but the snow cover typically lasts only a few days. The average seasonal snowfall is about 15 inches. Rainfall is fairly heavy and is well distributed throughout the year. The total annual precipitation is 40.32 inches, of which 22 inches, or 55 percent, usually falls from April through September. Thunderstorms occur on about 57 days each year. The prevailing wind is from the south-southwest. The average wind speed is highest, 13 miles per hour, in spring.

2.1.4 Population/Demographics

Table 2.1 Provides the total county population and the populations for participating cities, and the unincorporated county for 2000, 2010, and 2015 estimates. Dallas County's population increased from 15,661 in 2000 to 16,777 in 2010, a seven (7) percent increase in ten years. This growth is attributable to increasing employment opportunities, easy access to major highways and lower cost of living. Moderate population growth and the proportion of unincorporated population reflect Dallas County's character as a predominantly rural county. Unincorporated population represented 78.7 percent of the total population in 2000, decreasing to 74.1 percent of total population in 2010. The community of Louisburg also experienced population decline during the last decade.

Table 2.1. Dallas County Population 2000-2010 by Community

Jurisdiction	2000 Population	2010 Population	2015 Population Estimates	2000-2010 # Change	2010-2015 # Change	2000-2010 % Change	2010-2015 % Change
Dallas County	15,689	16,777	16,342	1,088	-435	6.9	-2.5
City of Buffalo	2,781	3,084	3,066	303	-18	10.8	-0.5
Village of Louisburg	147	122	146	-25	24	-17.0	19.6

Source: U.S. Bureau of the Census, Decennial Census, American Community Survey *population includes the portions of these cities in adjacent counties

Table 2.2 provides age specific data by five year age group for Dallas County's population in 2010. The youth represent slightly over 32 percent of the total population in Dallas County, while working-aged citizens (19-64 years) accounted for 62.5 percent of the population. The retirement-aged population (65 and over) constitutes 17.1 percent of the population. The three largest cohorts though, are the 45-54, 55- 64 and 35-44 age groups.

The median age in 2000 was 37.9 years and increased to 43.3 years in 2010. Median age for the United States is 37.8 years.

Table 2.2. Dallas County Population Age Composition, Missouri, United States Comparison

Age Group	# of People	Percent	Missouri Percent	United States Percent
Persons under 5 years old	1,010	6.1%	6.2%	6.3%
Persons 5 to 9 years old	1,345	8.1%	6.5%	6.5%
Persons 10 to 14 years old	915	5.5%	6.5%	6.5%
Persons 15 to 19 years old	1,054	6.4%	6.7%	6.7%
Persons 20 to 24 years old	821	5.0%	7.1%	7.1%
Persons 25 to 34 years old	1,696	10.3%	13.2%	13.5%
Persons 35 to 44 years old	1,763	10.7%	12.1%	12.8%
Persons 45 to 54 years old	2,300	13.9%	13.9%	13.9%
Persons 55 to 59 years old	1,325	8.0%	6.9%	6.6%
Persons 60 to 64 years old	1,128	6.8%	6.0%	5.8%
Persons 65 to 74 years old	1,804	10.9%	8.3%	7.9%
Persons 75 to 84 years old	1,048	6.3%	4.6%	4.3%
Persons 85 and older	299	1.8%	2.0%	1.9%
Total	16,564	-	-	-
Median Age	43.3	-	38.3	37.8

Source: U.S. Bureau of the Census, 2011-2015 American Community Survey 5-Year Estimates.

The University of South Carolina developed an index to evaluate and rank the ability to respond to, cope with, recover from, and adapt to disasters. The index synthesizes 30 socioeconomic variables which research literature suggests contribute to reduction in a community's ability to prepare for, respond to, and recover from hazards. SoVI® data sources include primarily those from the United States Census Bureau.

The index is a comparative metric that facilitates the examination of the differences in social vulnerability among counties. SoVI® is a valuable tool for policy makers and practitioners. It graphically illustrates the geographic variation in social vulnerability. It shows where there is uneven capacity for preparedness and response and where resources might be used most effectively to reduce the pre-existing vulnerability. SoVI® also is useful as an indicator in determining the differential recovery from disasters.

Dallas County's SoVI® score is 0.629999995 placing it in the 61.1th percentile when compared to the rest of the nation. This score means that 61.1 percent of the nation is more resilient to hazards and disasters. The state score is 29. The main determinants of the score are qualities of the population based on race and class, wealth, elderly residents, Hispanic ethnicity, special needs individuals, Native American ethnicity, and the service industry employment.

Table 2.3 Provides additional demographic and economic indicators for Dallas County and incorporated communities compared to the state of Missouri and the United States. The county as a whole had slightly higher percentage of unemployed and families living below the poverty level than the state of Missouri or the United States. In terms of education, the percentage of population in the county that were high school graduates was less than both Missouri and the United States. The percentage of the county population that spoke a language other than English in the home was considerably lower than both Missouri and the United States.

Table 2.3. Unemployment, Poverty, Education, and Language Percentage Demographics, Dallas County, Missouri

Jurisdiction	Total in Labor	Percent of Population Unemployed	Percent of Families Below the Poverty Level	Percentage of Population (High School graduate)	Percentage of Population (Bachelor's degree or higher)	Percentage of population (spoken language other than English)
Dallas County	5,943	4.8	18.6	81.4	13.2	5.2
City of Buffalo	878	5.8	23.8	78.0	24.8	5.7
Village of Louisburg	39	5.8	28.7	78.6	28.0	0.0
Missouri	3,034,524	7.5	14.0	88.8	27.6	6.0
United States	158,897,82	8.3	12.7	87.0	30.3	21.1

Source: U.S. Census, 2011 American Community Survey, 5-year Estimates.

2.1.5 History

The Ozarks region, including Dallas County, was claimed by France until purchased by the United States in the form of the Louisiana Purchase in 1803. The Dallas County area was first inhabited by the Osage Indians who ceded the territory in 1808. Mark Reynolds is credited as the first white settler in Dallas County circa 1832. Permanent settlers began arriving from Tennessee, Kentucky, Indiana and Ohio in the early 1830s. Dallas County officially became a county on January 29, 1841, formed from Polk County. Buffalo was established as the county seat. The county was first called Niangua, but because of difficulty in spelling and pronouncing the name, it was renamed to Dallas in

December of 1844. It was named after George M. Dallas, the then Vice President-elect of the United States (<http://www.sos.mo.gov/archives/history/counties.asp>).

Nearly two-thirds of the Dallas County citizens supported the Union during the Civil War. No companies were organized in the county for Confederate service, but some of the sympathizers left to join commands in the South. Dallas County did not experience a large amount of devastation from the war; however, the residents were subjected to violence and killings by scouting parties from both sides as well as Bushwhackers. Other communities in Dallas County were established after the Civil War (McBee, 1991).

In the second half of 1800s, part of the economy of the county was based on zinc, lead and fuller's earth mining. Fuller's earth was used for cleaning wool of its grease, and one of the first veins discovered in the United States was discovered in Dallas County in 1882. However, attempts to get a railroad through the county failed, which seriously affected its economy (McBee, 1991). By 1900, agriculture was the main economic factor of Dallas County. The number of farms jumped from 1,414 in 1880 to 2,371 in 1900. Total acreage increased from 193,366 acres to 257,765. Wheat, corn and hog production were predominant until 1920. After 1920, commercial dairy production dominated farming in Dallas County. The total number of farms began to decrease after 1950 as farms consolidated. Farm numbers dropped from 2,151 in 1950 to 1,369 in 2007, but average farm size had increased from 136 to 163 acres. During this time, beef and poultry production greatly increased. Hay replaced wheat and corn as the major crop.

2.1.6 Occupations

Occupation information for the Dallas County labor force comes from the American Community Survey 5-year estimates 2011-2015. Management, Business, Science, and Arts Occupations includes education and healthcare practitioner and technician occupations among others. Service Occupation includes healthcare support and protective services, such as firefighters and law enforcement in addition to food preparation and personal care services. The other occupation classifications are well defined. Table 2.4 contains occupation statistics for the participating incorporated cities and the county as a whole.

Table 2.4. Occupation Statistics, Dallas County, Missouri

Place	Management, Business, Science, and Arts Occupations	Service Occupations	Sales and Office Occupations	Natural Resources, Construction, and Maintenance Occupations	Production, Transportation, and Material Moving Occupations
Dallas County	1,593	958	1,538	958	1,200
City of Buffalo	155	225	254	58	186
Village of Louisburg	4	16	5	0	14

Source: U.S. Census, 2011 American Community Survey, 5-year Estimates.

This information comes from the American Community Survey 5-year estimates that can be accessed through the American Factfinder website. See details above.

2.1.7 Agriculture

According to the United States Department of Agriculture (USDA) 2012 Agricultural Census, there were 1,188 farms covering 217,912 acres in Dallas County. The average farm size was 183 acres, which was slightly less than the average farm size in Missouri at 285 acres. The average market value per farm is \$426,668 and \$2,326 per acre, with a market value of agricultural products sold of \$47,710,000. Of the total, 12% was from crop sales, while the other 88% came from livestock, poultry, and their products. Dallas county ranks 72nd in Missouri in value of agriculture products sold. In addition, 53% of principal operators reported their primary occupation was something other than farming.

2.1.8 FEMA Hazard Mitigation Assistance Grants in Planning Area

From 1993-2017, jurisdictions in Dallas County have been awarded \$2,059,944 in Hazard Mitigation Assistance grants. Hazard mitigation assistance in the county has been used to fund the construction of safe rooms in communities and schools. Table 2.5 lists information on hazard mitigation assistance projects in Dallas County.

Table 2.5. FEMA HMA Grants in Dallas County from 1993-2017

Project Type	Sub applicant	Award Date	Project Total
206.2: Safe Room (Tornado and Severe Wind Shelter) – Public Structures	City of Buffalo	2013-08-30	608,400
206.2: Safe Room (Tornado and Severe Wind Shelter) – Public Structures	City of Buffalo	2013-04-24	1,451,544
Total			2,059,944

Source: Missouri State Emergency Management Agency

2.2 Jurisdictional Profiles and Mitigation Capabilities

This section will include individual profiles for each participating jurisdiction. It will also include a discussion of previous mitigation initiatives in the planning area. There will be a summary table indicating specific capabilities of each jurisdiction that relate to their ability to implement mitigation opportunities. The unincorporated county is profiled first, followed by the incorporated communities, the special districts, and the public school districts.

2.2.1 Unincorporated Dallas County

Dallas County's jurisdiction includes all unincorporated areas within the county boundaries. Dallas County is a third class county and is governed by a three-member Commission. Under the provisions of RSMo §49.010, counties are divided into two districts of nearly equal population (in Dallas County, the northern district and the southern district). Each district elects one commissioner and the presiding commissioner is elected by the county as a whole. Commissioners serve four year terms.

The County's elected governing body; the Board of County Commissioners directs the general administration of County Government. The Commission sets broad operating policies, enacts ordinances and establishes budgets as mandated by State law. The County enters into contracts with other public agencies to ensure the smooth flow of services including law enforcement, construction and maintenance of public roads and bridges, and the operations of county offices, equipment and services. The 2010 population of Dallas County was 16,777, with 2015 estimate of 16,342 equating to a 2.5% population decrease.

The departments/staff of the County government include:

- Board of Commissioners
- Emergency Management Coordinator
- Mapping specialist/ Assessor
- Public Works Official
- NFIP Floodplain Administrator
- Local Emergency Planning Committee
- Dallas County Road and Bridge
- Economic Development (part-time)
- County Recorder
- County Treasurer

Mitigation Initiatives/Capabilities include:

- County Mitigation Plan
- Three (3) outdoor warning sirens: 2 in Buffalo, 1 in Urbana

Table 2.6 provides information on Unincorporated Dallas County's mitigation capabilities based on the Data Collection Questionnaire.

Table 2.6. Unincorporated Dallas County Mitigation Capabilities

Capabilities	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	N/A
Builder's Plan	N/A
Capital Improvement Plan	N/A
Local Emergency Plan	N/A
County Emergency Plan	Yes
Local Recovery Plan	N/A
County Recovery Plan	N/A
Local Mitigation Plan	N/A
County Mitigation Plan	Yes
Local Mitigation Plan (PDM)	N/A
County Mitigation Plan (PDM)	N/A
Economic Development Plan	N/A
Transportation Plan	N/A
Land-use Plan	N/A
Flood Mitigation Assistance (FMA) Plan	N/A
Watershed Plan	N/A
Firewise or other fire mitigation plan	N/A
School Mitigation Plan	N/A
Critical Facilities Plan (Mitigation/Response/Recovery)	N/A
Policies/Ordinance	
Zoning Ordinance	N/A
Building Code	N/A
Floodplain Ordinance	Yes
Subdivision Ordinance	N/A
Tree Trimming Ordinance	N/A
Nuisance Ordinance	N/A
Storm Water Ordinance	N/A
Drainage Ordinance	N/A
Site Plan Review Requirements	N/A
Historic Preservation Ordinance	N/A
Landscape Ordinance	N/A
Iowa Wetlands and Riparian Areas Conservation Plan	N/A
Debris Management Plan	N/A
Program	
Zoning/Land Use Restrictions	N/A
Codes Building Site/Design	N/A
National Flood Insurance Program (NFIP) Participant	Yes
NFIP Community Rating System (CRS) Participating Community	No
Hazard Awareness Program	N/A
National Weather Service (NWS) Storm Ready	N/A
Building Code Effectiveness Grading (BCEGs)	N/A
ISO Fire Rating	N/A
Economic Development Program	Yes
Land Use Program	N/A
Public Education/Awareness	N/A
Property Acquisition	N/A
Planning/Zoning Boards	N/A

Stream Maintenance Program	N/A
Tree Trimming Program	No
Engineering Studies for Streams (Local/County/Regional)	No
Mutual Aid Agreements	Yes
Studies/Reports/Maps	
Hazard Analysis/Risk Assessment (Local)	N/A
Hazard Analysis/Risk Assessment (County)	N/A
Flood Insurance Maps	Yes
FEMA Flood Insurance Study (Detailed)	No
Evacuation Route Map	No
Critical Facilities Inventory	No
Vulnerable Population Inventory	No
Land Use Map	No
Staff/Department	
Building Code Official	-----
Building Inspector	-----
Mapping Specialist (GIS)	Shelly Jasper Assessor – Full Time
Engineer	-----
Development Planner	-----
Public Works Official	Carl Bliss – (s) Larry Berry – (n) F.T.
Emergency Management Director	Terry Lane Part Time
NFIP Floodplain Administrator	Sherry Berry Full Time
Bomb and/or Arson Squad	-----
Emergency Response Team	-----
Hazardous Materials Expert	Terry Lane Trained
Local Emergency Planning Committee	-----
County Emergency Management Commission	-----
Sanitation Department	N/A
Transportation Department	N/A
Economic Development Department	N/A
Housing Department	N/A
Planning Consultant	N/A
Regional Planning Agencies	Yes Southwest Missouri Council of Governments
Historic Preservation	N/A
Non-Governmental Organizations (NGOs)	
American Red Cross	No
Salvation Army	No
Veterans Groups	Yes Lonnie Howard PT
Environmental Organization	-----
Homeowner Associations	-----
Neighborhood Associations	-----
Chamber of Commerce	Yes
Community Organizations (Lions, Kiwanis, etc.)	Yes
Local Funding Availability	
Ability to apply for Community Development Block Grants	Yes
Ability to fund projects through Capital Improvements funding	Yes
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	No
Impact fees for new development	No
Ability to incur debt through special tax bonds	No
Ability to incur debt through private activities	No

Ability to withhold spending in hazard prone areas	No
--	----

Source: Data Collection Questionnaire, 2018

2.2.2 City of Buffalo

The City of Buffalo is located in central Dallas County and is the County Seat. Buffalo is a fourth class city and has a Mayor/Board of Aldermen form of government with six aldermen elected from three wards. The Mayor is elected at-large. In 2010 the population was 3,084 and decreased just slightly to 3,066 according to 2015 estimates, a .5% decrease. City departments and staff include:

- Board of Aldermen
- Building Inspector (part-time)
- City Clerk
- Mapping Specialist
- Public Works Official
- Emergency Management Coordinator
- Emergency Response Team
- Hazardous Materials Expert
- Sanitation Department
- Economic Development (part-time)
- Local Emergency Planning Committee

Mitigation capabilities include:

- City Emergency Operations Plan
- Floodplain ordinance
- Two (2) outdoor warning sirens
- Two (2) FEMA rated saferooms: Buffalo High School & Mallory Elementary

Table 2.7 provides information on Buffalo's mitigation capabilities based on the Data Collection Questionnaire.

Table 2.7. City of Buffalo Mitigation Capabilities

Capability	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	Yes
Builder's Plan	N/A
Capital Improvement Plan	N/A
Local Emergency Plan	Yes – in process of update
County Emergency Plan	N/A
Local Recovery Plan	N/A
County Recovery Plan	N/A
Local Mitigation Plan	N/A
County Mitigation Plan	Yes - 2013
Local Mitigation Plan (PDM)	N/A
County Mitigation Plan (PDM)	N/A
Economic Development Plan	N/A
Transportation Plan	N/A
Land-use Plan	N/A
Flood Mitigation Assistance (FMA) Plan	N/A
Watershed Plan	N/A
Firewise or other fire mitigation plan	N/A
School Mitigation Plan	N/A

Critical Facilities Plan (Mitigation/Response/Recovery)	N/A
Policies/Ordinance	Status Including Date of Document or Policy
Zoning Ordinance	Yes
Building Code	Yes - 2013
Floodplain Ordinance	Yes
Subdivision Ordinance	N/A
Tree Trimming Ordinance	N/A
Nuisance Ordinance	N/A
Storm Water Ordinance	N/A
Drainage Ordinance	N/A
Capability	Status Including Date of Document or Policy
Site Plan Review Requirements	N/A
Historic Preservation Ordinance	N/A
Landscape Ordinance	N/A
Iowa Wetlands and Riparian Areas Conservation Plan	N/A
Debris Management Plan	N/A
Program	Status Including Date of Document or Policy
Zoning/Land Use Restrictions	N/A
Codes Building Site/Design	N/A
National Flood Insurance Program (NFIP) Participant	Yes
NFIP Community Rating System (CRS) Participating Community	N/A
Hazard Awareness Program	N/A
National Weather Service (NWS) Storm Ready	N/A
Building Code Effectiveness Grading (BCEGs)	N/A
ISO Fire Rating	N/A
Economic Development Program	N/A
Land Use Program	N/A
Public Education/Awareness	N/A
Property Acquisition	N/A
Planning/Zoning Boards	N/A
Stream Maintenance Program	N/A
Tree Trimming Program	N/A
Engineering Studies for Streams (Local/County/Regional)	N/A
Mutual Aid Agreements	N/A
Studies/Reports/Maps	Status Including Date of Document or Policy
Hazard Analysis/Risk Assessment (Local)	N/A
Hazard Analysis/Risk Assessment (County)	N/A
Flood Insurance Maps	N/A
FEMA Flood Insurance Study (Detailed)	N/A
Evacuation Route Map	N/A
Critical Facilities Inventory	N/A
Vulnerable Population Inventory	N/A
Land Use Map	N/A
Staff/Department	Status Including Date of Document or Policy
Building Code Official	N/A
Building Inspector	Michael Stewart
Mapping Specialist (GIS)	Debby Polston
Engineer	Toth- Consulting Firm
Development Planner	N/A
Public Works Official	John Hardin
Emergency Management Coordinator	Rich Wilkinson
NFIP Floodplain Administrator	Debby Polston
Bomb and/or Arson Squad	Rich Wilkinson
Emergency Response Team	Rich Wilkinson
Hazardous Materials Expert	Greg Cunningham
Local Emergency Planning Committee	N/A
County Emergency Management Commission	N/A
Sanitation Department	Gus
Transportation Department	N/A

Economic Development Department	Holly Elliot
Housing Department	N/A
Planning Consultant	N/A
Regional Planning Agencies	Southwest Missouri Council of Governments
Historic Preservation	BOA
Non-Governmental Organizations (NGOs)	Status Including Date of Document or Policy
American Red Cross	N/A
Salvation Army	N/A
Capability	Status Including Date of Document or Policy
Veterans Groups	N/A
Environmental Organization	N/A
Homeowner Associations	N/A
Neighborhood Associations	N/A
Chamber of Commerce	Tayna Watson
Community Organizations (Lions, Kiwanis, etc.	N/A
Local Funding Availability	Status Including Date of Document or Policy
Ability to apply for Community Development Block Grants	Yes
Ability to fund projects through Capital Improvements funding	Yes
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	Yes
Ability to incur debt through general obligation bonds	Yes
Ability to incur debt through special tax bonds	Yes
Ability to incur debt through private activities	Yes
Ability to withhold spending in hazard prone areas	N/A

Source: Data Collection Questionnaire

2.2.3 Village of Louisburg

The Village of Louisburg is located in the northwest part of Dallas County. Louisburg is an incorporated as a Village, governed by a Chair and Board of Trustees. In 2010 the population was 122 and the ACS 2015 population estimate is 146, a 19.6% increase. Village departments and staff include:

- Board of Trustees
- Village Clerk

Mitigation capabilities include:

- County emergency plan
- USDA awarded outdoor warning siren – not yet installed

Table 2.8 provides information on Louisburg’s mitigation capabilities based on the Data Collection Questionnaire.

Table 2.8. Village of Louisburg

Capability	Status Including Date of Document or Policy
Planning Capabilities	
Comprehensive Plan	No
Builder's Plan	No
Capital Improvement Plan	No
Local Emergency Plan	No
County Emergency Plan	Yes
Local Recovery Plan	No
County Recovery Plan	No
Local Mitigation Plan	No
County Mitigation Plan	Yes
Local Mitigation Plan (PDM)	No

County Mitigation Plan (PDM)	No
Economic Development Plan	No
Transportation Plan	No
Land-use Plan	No
Flood Mitigation Assistance (FMA) Plan	No
Watershed Plan	No
Firewise or other fire mitigation plan	No
School Mitigation Plan	No
Critical Facilities Plan (Mitigation/Response/Recovery)	No
Policies/Ordinance	Status Including Date of Document or Policy
Zoning Ordinance	No
Building Code	No
Floodplain Ordinance	No
Subdivision Ordinance	No
Tree Trimming Ordinance	No
Nuisance Ordinance	No
Storm Water Ordinance	No
Drainage Ordinance	No
Capability	Status Including Date of Document or Policy
Site Plan Review Requirements	No
Historic Preservation Ordinance	No
Landscape Ordinance	No
Iowa Wetlands and Riparian Areas Conservation Plan	No
Debris Management Plan	No
Program	Status Including Date of Document or Policy
Zoning/Land Use Restrictions	No
Codes Building Site/Design	No
National Flood Insurance Program (NFIP) Participant	No
NFIP Community Rating System (CRS) Participating Community	No
Hazard Awareness Program	No
National Weather Service (NWS) Storm Ready	No
Building Code Effectiveness Grading (BCEGs)	No
ISO Fire Rating	No
Economic Development Program	No
Land Use Program	No
Public Education/Awareness	No
Property Acquisition	No
Planning/Zoning Boards	No
Stream Maintenance Program	No
Tree Trimming Program	No
Engineering Studies for Streams (Local/County/Regional)	No
Mutual Aid Agreements	No
Studies/Reports/Maps	Status Including Date of Document or Policy
Hazard Analysis/Risk Assessment (Local)	No
Hazard Analysis/Risk Assessment (County)	Yes- part of 2018 plan
Flood Insurance Maps	No
FEMA Flood Insurance Study (Detailed)	No
Evacuation Route Map	No
Critical Facilities Inventory	No
Vulnerable Population Inventory	No
Land Use Map	No
Staff/Department	Status Including Date of Document or Policy
Building Code Official	No
Building Inspector	No
Mapping Specialist (GIS)	No
Engineer	No
Development Planner	No
Public Works Official	No

Emergency Management Coordinator	No
NFIP Floodplain Administrator	No
Bomb and/or Arson Squad	No
Emergency Response Team	No
Hazardous Materials Expert	No
Local Emergency Planning Committee	No
County Emergency Management Commission	No
Sanitation Department	No
Transportation Department	No
Economic Development Department	No
Housing Department	No
Planning Consultant	No
Regional Planning Agencies	Yes- Southwest Missouri Council of Governments
Historic Preservation	No
Non-Governmental Organizations (NGOs)	Status Including Date of Document or Policy
American Red Cross	No
Salvation Army	No
Capability	Status Including Date of Document or Policy
Veterans Groups	No
Environmental Organization	No
Homeowner Associations	No
Neighborhood Associations	No
Chamber of Commerce	No
Community Organizations (Lions, Kiwanis, etc.	No
Local Funding Availability	Status Including Date of Document or Policy
Ability to apply for Community Development Block Grants	Yes
Ability to fund projects through Capital Improvements funding	No
Authority to levy taxes for a specific purpose	Yes
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	No
Ability to incur debt through general obligation bonds	No
Ability to incur debt through special tax bonds	No
Ability to incur debt through private activities	No
Ability to withhold spending in hazard prone areas	No

Source: Discussion with community representative

Table 2.9. Mitigation Capabilities Summary Table

CAPABILITIES	Unincorporated Dallas County	City of Buffalo	Village of Louisburg
Planning Capabilities			
Comprehensive Plan	N/A	Yes – in process of update	N/A
Builder's Plan	N/A	N/A	N/A
Capital Improvement Plan	N/A	N/A	N/A
Local Emergency Plan	N/A	N/A	N/A
County Emergency Plan	Yes	N/A	N/A
Local Recovery Plan	N/A	N/A	N/A
County Recovery Plan	N/A	N/A	N/A
Local Mitigation Plan	N/A	N/A	N/A
County Mitigation Plan	Yes	Yes - 2013	N/A
Debris Management Plan	N/A	N/A	N/A
Economic Development Plan	N/A	N/A	N/A
Transportation Plan	N/A	N/A	N/A
Land-use Plan	N/A	N/A	N/A
Flood Mitigation Assistance (FMA) Plan	N/A	N/A	N/A
Watershed Plan	N/A	N/A	N/A
Firewise or other fire mitigation plan	N/A	N/A	N/A
Critical Facilities Plan (Mitigation/Response/Recovery)	N/A	N/A	N/A
Policies/Ordinance			
Zoning Ordinance	N/A	Yes	N/A
Building Code	N/A	Yes - 2013	N/A
Floodplain Ordinance	Yes	Yes	N/A
Subdivision Ordinance	N/A	N/A	N/A
Tree Trimming Ordinance	N/A	N/A	N/A
Nuisance Ordinance	N/A	N/A	N/A
Storm Water Ordinance	N/A	N/A	N/A
Drainage Ordinance	N/A	N/A	N/A
Site Plan Review Requirements	N/A	N/A	N/A
Historic Preservation Ordinance	N/A	N/A	N/A
Landscape Ordinance	N/A	N/A	N/A
Program			
Zoning/Land Use Restrictions	N/A	N/A	N/A
Codes Building Site/Design	N/A	N/A	N/A
Hazard Awareness Program	N/A	Yes	N/A
National Flood Insurance Program (NFIP) Participant	Yes	Yes	No
NFIP Community Rating System (CRS) Participating Community	No	N/A	N/A
National Weather Service (NWS) Storm Ready	N/A	N/A	N/A
Building Code Effectiveness Grading (BCEGs)	N/A	N/A	N/A

CAPABILITIES	Unincorporated Dallas County	City of Buffalo	Village of Louisburg
ISO Fire Rating	N/A	N/A	N/A
Economic Development Program	Yes	N/A	N/A
Land Use Program	N/A	N/A	N/A
Public Education/Awareness	N/A	N/A	N/A
Property Acquisition	N/A	N/A	N/A
Planning/Zoning Boards	N/A	N/A	N/A
Stream Maintenance Program	N/A	N/A	N/A
Tree Trimming Program	No	N/A	N/A
Engineering Studies for Streams (Local/County/Regional)	No	N/A	N/A
Mutual Aid Agreements	Yes	N/A	N/A
Studies/Reports/Maps			
Hazard Analysis/Risk Assessment (Local)	No	N/A	N/A
Hazard Analysis/Risk Assessment (County)	No	N/A	N/A
Flood Insurance Maps	Yes	N/A	N/A
FEMA Flood Insurance Study (Detailed)	No	N/A	N/A
Evacuation Route Map	No	N/A	N/A
Critical Facilities Inventory	No	N/A	N/A
Vulnerable Population Inventory	No	N/A	N/A
Land Use Map	No	N/A	N/A
Staff/Department			
Building Code Official	N/A	N/A	N/A
Building Inspector	N/A	Michael Stewart	N/A
Mapping Specialist (GIS)	Shelly Jasper	Debby Polston	N/A
Engineer	N/A	Toth Consulting Firm	N/A
Development Planner	N/A	N/A	N/A
Public Works Official	Carl Bliss	John Hardin	N/A
Emergency Management Coordinator	Terry Lane	Rich Wilkinson	N/A
NFIP Floodplain Administrator	Sherry Berry	Debby Polston	N/A
Bomb and/or Arson Squad	N/A	Rich Wilkinson	N/A
Emergency Response Team	N/A	Rich Wilkinson	N/A
Hazardous Materials Expert	Terry lane	Greg Cunningham	N/A
Local Emergency Planning Committee	N/A	N/A	N/A
County Emergency Management Commission	N/A	N/A	N/A
Sanitation Department	N/A	Gus	N/A
Transportation Department	N/A	N/A	N/A
Economic Development Department	N/A	Holly Elliot	N/A
Housing Department	N/A	N/A	N/A
Planning Consultant	N/A	N/A	N/A
Regional Planning Agencies	Yes	Southwest Missouri Council of Governments	N/A
Historic Preservation	N/A	BOA	N/A

CAPABILITIES	Unincorporated Dallas County	City of Buffalo	Village of Louisburg
Non-Governmental Organizations (NGOs)			
American Red Cross	No	N/A	N/A
Salvation Army	No	N/A	N/A
Veterans Groups	Yes	N/A	N/A
Environmental Organization	N/A	N/A	N/A
Homeowner Associations	N/A	N/A	N/A
Neighborhood Associations	N/A	N/A	N/A
Chamber of Commerce	Yes	Tayna Watson	N/A
Community Organizations (Lions, Kiwanis, etc.)	Yes	N/A	N/A
Local Funding Availability			
Ability to apply for Community Development Block Grants	Yes	Yes	N/A
Ability to fund projects through Capital Improvements funding	Yes	Yes	N/A
Authority to levy taxes for a specific purpose	Yes	Yes	N/A
Fees for water, sewer, gas, or electric services	No	Yes	N/A
Impact fees for new development	No	Yes	N/A
Ability to incur debt through general obligation bonds	No	Yes	N/A
Ability to incur debt through special tax bonds	No	Yes	N/A
Ability to incur debt through private activities	No	Yes	N/A
Ability to withhold spending in hazard prone areas	No	N/A	N/A

Source: Data Collection Questionnaires, 2018

2.2.4 Urbana Rural Volunteer Fire

The Urbana Rural Fire Department is governed by an eight member board of directors. The department is a membership dues based organization serving the city of Urbana and surrounding areas. The department provides fire suppression and basic medical response.

Mitigation related capabilities include:

- Completed Firewise evaluation
- Mutual aid agreements with Dallas and Hickory Counties
- Emergency response team (firefighters act in capacity)
- Conduct fire education courses at schools.
- Provide free smoke alarms through Red Cross
- One (1) outdoor warning siren in area

2.2.5 Public School District Profiles and Mitigation Capabilities

This section provides general information about the participating school district in the plan. There are four school districts in the county, but only two with facilities located in Dallas County. Only Dallas County R-I participated in this plan update. Hickory County R-I participated in the Hickory County Hazard Mitigation Planning process. Figure 2.3 is a map of school district boundaries in Dallas County. Table 2.1 displays enrollment data for Dallas County R-I facilities.

Table 2.1. Dallas County R-I School District Buildings and Enrollment Data, 2017

District Name	Building Name	Building Enrolment
Dallas County R-I	Buffalo High School	483
Dallas County R-I	Mallory Elementary	632
Dallas County R-I	Buffalo Prairie Middle School	386

<http://mcds.dese.mo.gov/quickfacts/Pages/District-and-School-Information.aspx>

Figure 2.3. Dallas County School Districts

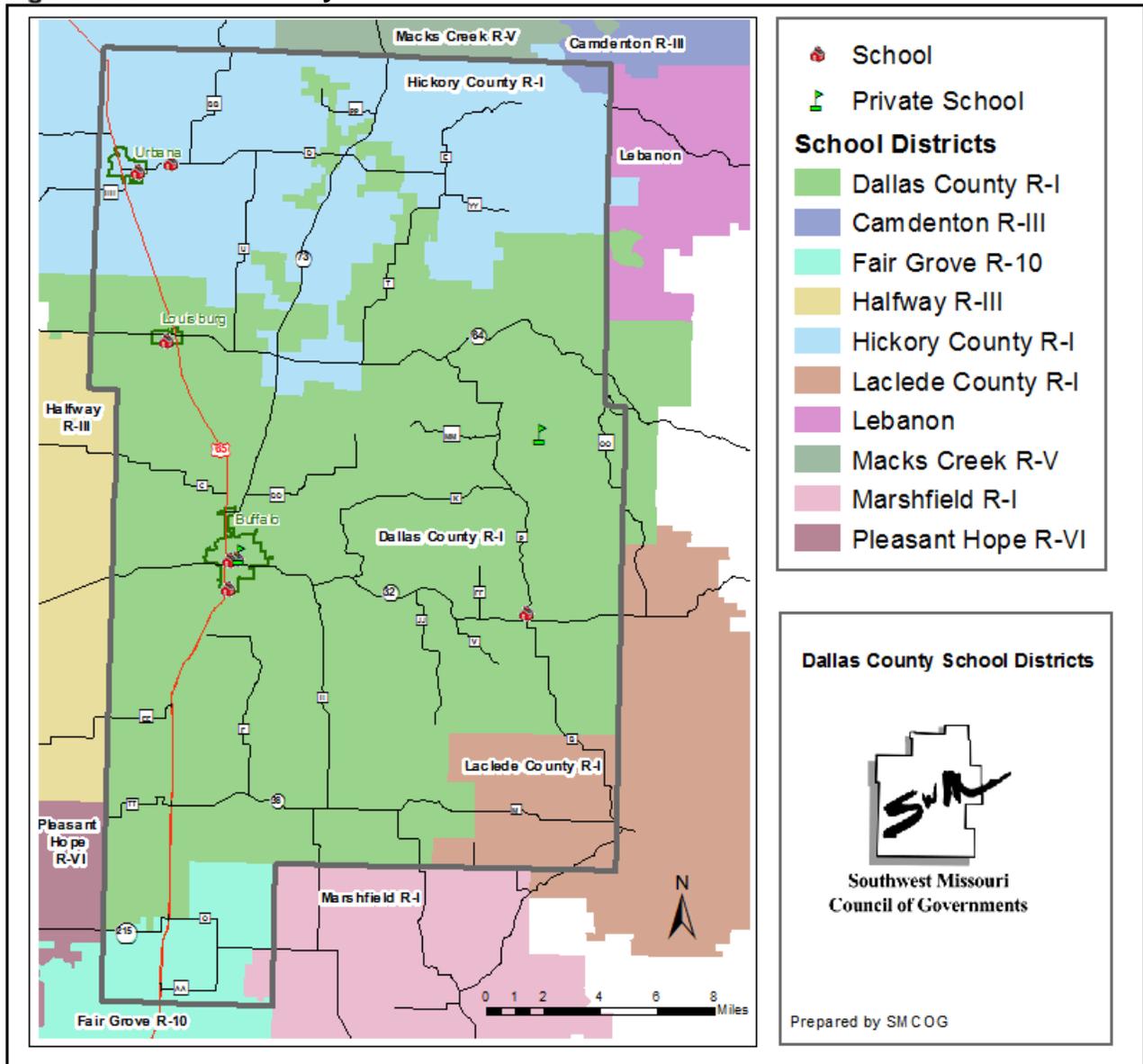


Table 2.2. Summary of Mitigation Capabilities - Dallas County R-I School District

Capability	Dallas County R-I School District
Planning Elements	
Master Plan/ Date	Yes
Capital Improvement Plan/Date	Yes
School Emergency Plan / Date	Yes
Weapons Policy/Date	Yes
Personnel Resources	
Full-Time Building Official (Principal)	Yes
Emergency Manager	Yes
Grant Writer	No
Public Information Officer	Yes
Financial Resources	
Capital Improvements Project Funding	Yes
Local Funds	Yes
General Obligation Bonds	Yes
Special Tax Bonds	Yes
Private Activities/Donations	
State And Federal Funds/Grants	Yes
Other	
Public Education Programs	Yes
Capability	
Privately Or Self- Insured?	N/A
Fire Evacuation Training	N/A
Tornado Sheltering Exercises	Yes
Public Address/Emergency Alert System	Yes
NOAA Weather Radios	Yes
Lock-Down Security Training	N/A
Mitigation Programs	N/A
Tornado Shelter/Saferoom	Yes
Campus Police	Yes

Data Collection Questionnaires, 2018

3 RISK ASSESSMENT

3.1 Hazard Identification	3.4
3.1.1 <i>Review of Existing Mitigation Plans</i>	3.4
3.1.2 <i>Review Disaster Declaration History</i>	3.5
3.1.3 <i>Research Additional Sources</i>	3.7
3.1.4 <i>Hazards Identified</i>	3.9
3.1.5 <i>Multi-Jurisdictional Risk Assessment</i>	3.10
3.2 Assets at Risk	3.10
3.2.1 <i>Total Exposure of Population and Structures</i>	3.10
Unincorporated County and Incorporated Cities.....	3.10
3.2.2 <i>Critical and Essential Facilities and Infrastructure</i>	3.12
3.2.3 <i>Other Assets</i>	3.16
3.3 Land Use and Development	3.18
3.3.1 <i>Development Since Previous Plan Update</i>	3.18
3.3.2 <i>Future Land Use and Development</i>	3.21
3.4 Hazard Profiles, Vulnerability, and Problem Statements	3.23
Hazard Profiles.....	3.23
Vulnerability Assessments.....	3.24
Problem Statements.....	3.25
3.4.1 <i>Dam Failure</i>	3.25
Hazard Profile.....	3.25
Vulnerability.....	3.29
Problem Statement.....	3.30
3.4.2 <i>Drought</i>	3.32
Hazard Profile.....	3.32
Vulnerability.....	3.35
Problem Statement.....	3.36
3.4.3 <i>Earthquakes</i>	3.38
Hazard Profile.....	3.38
Vulnerability.....	3.42
Problem Statement.....	3.43
3.4.4 <i>Extreme Heat</i>	3.44
Hazard Profile.....	3.44
Vulnerability.....	3.47
Problem Statement.....	3.48
3.4.5 <i>Wildfires</i>	3.49
Hazard Profile.....	3.49

Vulnerability.....	3.52
Problem Statement.....	3.53
3.4.6 Flooding (Flash and River).....	3.54
Hazard Profile	3.54
Vulnerability.....	3.63
Problem Statement.....	3.67
3.4.7 Land Subsidence/Sinkholes.....	3.68
Hazard Profile	3.68
Vulnerability.....	3.70
Problem Statement.....	3.71
3.4.8 Thunderstorm/High Winds/Lightning/Hail.....	3.73
Hazard Profile	3.73
Vulnerability.....	3.80
Problem Statement.....	3.81
3.4.9 Tornado.....	3.82
Hazard Profile	3.82
Vulnerability.....	3.87
Problem Statement.....	3.88
3.4.10 Winter Weather/Snow/Ice/Severe Cold.....	3.90
Hazard Profile	3.90
Vulnerability.....	3.94
Problem Statement.....	3.95

44 CFR Requirement §201.6(c)(2): [The plan shall include] A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

The goal of the risk assessment is to estimate the potential loss in Dallas County, including loss of life, personal injury, property damage, and economic loss, from a hazard event. The risk assessment process allows communities and school/special districts in Dallas County to better understand their potential risk to the identified hazards. It will provide a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

This is an update of the previous Dallas County Hazard Mitigation Plan adopted in December of 2013. According to the U.S. Census Bureau July 1, 2016 population estimate, the population of Dallas County decreased to 16,448 from 16,777 at the time of the 2010 decennial census. The population has decreased approximately 329 people since the Dallas County Hazard Mitigation Plan was adopted in 2013. According to the building permit data from the U.S. Census Bureau, 6 single family residences were added to the building stock from 2013 to 2017. The reported construction cost of these new structures was \$1,442,504.

Dallas County is classified as a third class county and is governed by a three-member Commission. Under the provisions of RSMo §49.010, counties are divided into two districts of nearly equal population (in Dallas County, the northern district and the southern district). Each district elects one commissioner and the presiding commissioner is elected by the county as a whole. Commissioners serve four year terms.

This chapter is divided into four main parts:

- **Section 3.1 Hazard Identification** identifies the hazards that threaten Dallas County and provides a factual basis for elimination of hazards from further consideration;
- **Section 3.2 Assets at Risk** provides Dallas County's total exposure to natural hazards, considering critical facilities and other community assets at risk;
- **Section 3.3 Future Land Use and Development** discusses areas of planned future development;
- **Section 3.4 Hazard Profiles and Vulnerability Analysis** provides more detailed information about the hazards impacting Dallas County. For each hazard, there are three sections: 1) Hazard Profile provides a general description and discusses the threat to Dallas County, the geographic location at risk, potential severity/magnitude/extent, previous occurrences of hazard events, probability of future occurrence, risk summary by jurisdiction, impact of future development on the risk; 2) Vulnerability Assessment further defines and quantifies populations, buildings, critical facilities, and other community/school or special district assets at risk to natural hazards; and 3) Problem Statement briefly summarizes the problem and develops possible solutions.

3.1 Hazard Identification

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type...of all natural hazards that can affect the jurisdiction.

The Plan profiles all natural hazards that can affect Dallas County. The natural hazards that can affect the county have been identified in the 2013 Dallas County Plan and the 2013 Missouri State Plan. Natural hazards are naturally occurring climatological, hydrological or geologic events that have a negative effect on people and the built environment. Natural hazards identified include:

- Dam Failure
- Drought
- Earthquake
- Extreme Heat
- Wildfire
- Riverine and Flash Flood
- Land Subsidence/Sinkholes
- Severe Thunderstorm/ High Winds/ Lightning/ Hail
- Tornado
- Winter Weather/ Snow/ Ice/ Severe Cold

No new natural hazards have been identified since the adoption of the previous plan. The 2013 Missouri State Plan also addresses human-caused, and technological hazards; however, these will not be in the plan update.

3.1.1 Review of Existing Mitigation Plans

The MPC review of the hazards identified in the previously approved plan, as well as the hazards identified in the most recent state plan. The hazards identified in the 2013 Dallas County Plan are identified in the 2013 Missouri State Plan. The State Plan also includes levee failure as well as structural and urban fire in addition to wildfire. Human-caused and technological hazards identified in the State Plan include:

- CBRNE Attack
- Civil Disorder
- Cyber Disruption
- Hazardous Materials
- Mass Transportation Accidents
- Nuclear Power Plants
- Public Health Emergencies/Environmental Issues
- Special Events
- Terrorism
- Utility Interruptions and System Failures

In Missouri, local plans customarily include only natural hazards, as only natural hazards are required by federal regulations to be included. It was determined to include only natural hazards. The MPC

agreed that human-caused and technological hazards are addressed in a Regional Homeland Security Oversight Committee (RHSOC) Threat and Hazard Identification Risk Assessment (THIRA) and that including only natural hazards would meet the needs of local entities participating in the plan update.

Levee failure was omitted due to the fact that the National Levee Database, maintained by the U.S. Army Corps of Engineers (USACE), shows no federal levees located in Dallas County and planning committee research revealed no records of levees within Dallas County. Although it is likely that levees exist, such as low-head agricultural levees, no records indicate that a breach or overtopping of these levees would impact property other than that of the levee owner. Damage to residential structures is unlikely. Landslides occur in all 50 states; however, this hazard is not likely to have much of a notable impact on Dallas County due to soil profile, geology, and climate factors. In addition, the risk of coastal storms, hurricanes, tsunamis, avalanche, and volcanic activity does not exist in Dallas County due to the county's location in the central United States. Therefore, these hazards are not included in this risk assessment for Dallas County.

3.1.2 Review Disaster Declaration History

From 1990 to present, Dallas County has experienced severe storms, tornadoes, flooding, straight-line winds, and severe winter storms. All of these natural hazard events triggered federal disaster declarations. Federal and/or state declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. If the disaster is so severe that both the local and state governments' capacities are exceeded; a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

FEMA also issues emergency declarations, which are more limited in scope and do not include the long-term federal recovery programs of major disaster declarations. Determinations for declaration type are based on scale and type of damages and institutions or industrial sectors affected. The Robert T. Stafford Disaster Relief and Emergency Assistance Act, (PL 100-707) requires that all requests for a declaration by the President must be made by the governor of the affected state. State and federal officials conduct a Preliminary Damage Assessment (PDA) to show that the disaster is of such severity and magnitude that effective response is beyond state and local capabilities. Based on the governor's request, the president may declare that a major disaster or emergency exists, thus activating federal programs to assist in the response and recovery effort. Not all programs are activated for every disaster. Some declarations will provide only individual assistance or public assistance, while others provide both. FEMA also issues emergency declarations, which are more limited in scope and do not include the long-term federal recovery programs of major disaster declarations. Determinations for declaration type are based on scale and type of damages and institutions or industrial sectors affected. (<https://www.fema.gov/disaster-declaration-process>)

Since 1993, Dallas County has experienced fourteen (14) hazard events that triggered federal disaster declarations. The most recent was declared on June 2, 2017. Flooding was included in 13 out of 14 events that triggered FEMA disaster declaration. Twelve also included severe storms and eight declarations also included tornadoes. Five of the 14 events triggered both individual and public assistance.

Table 3.1 lists the federal FEMA disaster declarations that included Dallas County from 1990 to present.

Table 3.1. FEMA Disaster Declarations that included Dallas County, Missouri, 1990-Present

Disaster Number	Description	Declaration Date	Incident Period	Individual Assistance (IA) Public Assistance (PA)
4317	Severe Storms, Tornadoes, Straight-Line Winds, Flooding	June 2, 2017	April 28- May 11, 2017	Public Assistance
4250	Severe Storms, Tornadoes, Straight-Line Winds, Flooding	January 21, 2016	December 23, 2015- January 9, 2016	Public Assistance
4238	Severe Storms, Tornadoes, Straight-Line Winds, Flooding	August 7, 2015	May 15, 2015 - July 27, 2015	Public Assistance
4144	Severe Storms, Straight-Line Winds, Flooding	September 6, 2013	August 2- August 14, 2013	Public Assistance
1961	Severe Winter Storm and Snowstorm	March 23, 2011	January 31, 2011 – February 5, 2011	Public Assistance
1847	Severe Storms, Tornadoes, Flooding	June 19, 2009	May 8 – May 16, 2009	Public Assistance
1749	Severe Storms & Flooding	March 19, 2008	March 17 – May 9, 2008	Individual and Public Assistance
1742	Severe Storms, Tornadoes, Flooding	February 5, 2008	January 7 – January 10, 2007	Public Assistance
1728	Severe Storms and Flooding	September 21, 2007	August 19 – August 21, 2007	Public Assistance
1676	Severe Winter Storms and Flooding	January 15, 2007	January 12 – January 22, 2007	Public Assistance
1463	Severe Storms Tornadoes, and Flooding	May 6, 2003	May 4 – May 30, 2003	Individual & Public Assistance
1412	Severe storms, Tornadoes, and Flooding	May 6, 2002	April 24 – June 10, 2002	Individual & Public Assistance
1054	Severe storms, Tornadoes, Hail, and Flooding	June 2, 1995	May 13 – June 23, 1995	Individual & Public Assistance
995	Severe storms & Flooding	July 9, 1993	June 10 – October 25, 1993	Individual & Public Assistance

Source: Federal Emergency Management Agency, <https://www.fema.gov/data-visualization-summary-disaster-declarations-and-grants>

Table 3.2 lists all participating governmental jurisdictions' total public assistance received for each disaster declaration from 2002-2017.

Table 3.2. Disaster Declarations Federal Share Obligated, 2002-2017

Disaster Number	Description	Damage Category	Total Federal Share Obligated
Dallas County			
4317	Severe Storms, Tornadoes, Straight-Line Winds, Flooding	Protective Measures, Roads and Bridges	\$80,428.57
4250	Severe Storms, Tornadoes, Straight-Line Winds, Flooding	Debris Removal, Roads and Bridges	\$239,834.92
4238	Severe Storms, Tornadoes, Straight-Line Winds, Flooding	Roads and Bridges	\$299,391.58

4144	Severe Storms, Straight-Line Winds, Flooding	Roads and Bridges	\$127,586.60
1961	Severe Winter Storm and Snowstorm	Protective Measures, Public Buildings	\$47,557.48
1847	Severe Storms, Tornadoes, Flooding	Protective Measures, Debris Removal, Public Buildings, Recreational or Other	\$190,117.66
1749	Severe Storms & Flooding	Roads and Bridges	\$64,129.32
1742	Severe Storms, Tornadoes, Flooding	Roads and Bridges	\$7,187.25
1728	Severe Storms and Flooding	Protective Measures, Debris Removal, Roads and Bridges	\$650,101.31
1676	Severe Winter Storms and Flooding	Protective Measures, Debris Removal, Public Utilities, Public Buildings	\$939,257.74
1463	Severe Storms Tornadoes, and Flooding	Protective Measures, Debris Removal, Roads and Bridges	\$39,226.34
1412	Severe Storms, Tornadoes, and Flooding	Protective Measures, Debris Removal, Roads and Bridges, Recreational or Other	\$1,726,599.91
Total			\$4,411,418.68
City of Buffalo			
1412	Severe Storms, Tornadoes, and Flooding	Protective Measures, Debris Removal, Roads and Bridges, Recreational or Other	\$5,909.63
1676	Severe Winter Storms and Flooding	Protective Measures, Debris Removal, Public Utilities, Public Buildings	\$2,097,46.68
1847	Severe Storms, Tornadoes, and Flooding	Protective Measures, Debris Removal, Public Buildings, Recreational or Other	\$1,023.71
1961	Severe Winter Storm and Snowstorm	Protective Measures, Public Buildings	\$19,855.30
Total			2,365,35.32
Village of Louisburg			
1412	Severe Storms, Tornadoes, and Flooding	Debris Removal, Roads and Bridges, Recreational or Other	\$932.03
Total			\$932.03

Source :SEMA, 2018

3.1.3 Research Additional Sources

A variety of sources were researched for data on natural hazards. Primary sources included FEMA, SEMA, National Oceanic and Atmospheric Administration (NOAA), and National Centers for Environmental Information (NCEI). The U.S. Geological Survey (USGS) and the Center for Earthquake Research and Information (CERI) were major sources for earthquake information. The Missouri

Department of Natural Resources (MDNR) Dam Safety Division provided information concerning dams and the Missouri Department of Conservation (MDC). Other information sources included county officials; existing city, regional and state plans; and information from local officials. The additional sources of data on locations and past impacts of hazards in Dallas County include:

- Missouri Hazard Mitigation Plans (2013)
- Dallas County Multi-Jurisdictional Hazard Mitigation Plan (2013)
- Federal Emergency Management Agency (FEMA)
- Missouri Department of Natural Resources (MDNR)
- National Drought Mitigation Center Drought Reporter
- US Department of Agriculture's (USDA) Risk Management Agency Crop Insurance Statistics
- National Agricultural Statistics Service (Agriculture production/losses)
- Data Collection Questionnaires completed by each jurisdiction
- State of Missouri GIS data
- Flood Insurance Administration
- Hazards US (HAZUS)
- National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information;
- Local Plans to the extent available
- County Emergency Management
- SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin
- U.S. Army Corps of Engineers
- U.S. Department of Transportation
- United States Geological Survey (USGS)

The only centralized source of data for many of the weather-related hazards is the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI). Although it is usually the best and most current source, there are limitations to the data which should be noted. The NCEI documents the occurrence of storms and other significant weather phenomena having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce. In addition, it is a partial record of other significant meteorological events, such as record maximum or minimum temperatures or precipitation that occurs in connection with another event. Some information appearing in the NCEI may be provided by or gathered from sources outside the National Weather Service (NWS), such as the media, law enforcement and/or other government agencies, private companies, individuals, etc. An effort is made to use the best available information but because of time and resource constraints, information from these sources may be unverified by the NWS. Those using information from NCEI should be cautious as the NWS does not guarantee the accuracy or validity of the information.

The NCEI damage amounts are estimates received from a variety of sources, including those listed above in the Data Sources section. For damage amounts, the NWS makes a best guess using all available data at the time of the publication. Property and crop damage figures should be considered as a broad estimate. Damages reported are in dollar values as they existed at the time of the storm event. They do not represent current dollar values.

The database currently contains data from January 1950 to September 2017, as entered by the NWS. Due to changes in the data collection and processing procedures over time, there are unique periods

of record available depending on the event type. The following timelines show the different time spans for each period of unique data collection and processing procedures.

- Tornado: From 1950 through 1954, only tornado events were recorded.
- Tornado, Thunderstorm Wind and Hail: From 1955 through 1992, only tornado, thunderstorm wind and hail events were keyed from the paper publications into digital data. From 1993 to 1995, only tornado, thunderstorm wind and hail events have been extracted from the Unformatted Text Files.
- All Event Types (48 from Directive 10-1605): From 1996 to present, 48 event types are recorded as defined in NWS Directive 10-1605. Hazards Identified

It should be noted that injuries and deaths caused by a storm event are reported on an area-wide basis. When reviewing a table resulting from an NCEI search by county, the death or injury listed in connection with that county search did not necessarily occur in that county.

3.1.4 Hazards Identified

The natural hazards that can possibly, or have affected Dallas County, are profiled in alphabetical order. All hazards do not affect every jurisdiction participating in the Plan. **Table 3.3** provides a summary of the jurisdictions that may be affected by each hazard. An “x” in the table indicates that jurisdictions are affected by the hazard, and a “-” indicates the hazard is not applicable to that jurisdiction.

Table 3.3. Hazards Identified for Each Jurisdiction

Jurisdiction	Dam Failure	Drought	Earthquake	Extreme Heat	Wildfires	Flooding (River and Flash)	Land Subsidence/ Sinkholes	Thunderstorm/Lightning/Hail/High Wind	Tornado	Winter Weather/ Snow/Ice/ Severe Cold
Dallas County	-	X	X	X	X	X	X	X	X	X
Buffalo	-	X	X	X	X	X	-	X	X	X
Louisburg	-	X	X	X	X	X	-	X	X	X
Schools and Special Districts										
Dallas County R-I	-	X	X	X	X	X	X	X	X	X
Urbana Rural Volunteer Fire	-	X	X-	X	X	X	X	X	X	X

3.1.5 Multi-Jurisdictional Risk Assessment

The risk assessment assesses each participating jurisdiction's vulnerability to each hazard that can affect Dallas County. Many of the hazards identified in the risk assessment have the same probability of occurrence throughout Dallas County. The hazards that vary across Dallas County in terms of risk include grass or wildland fire, river flood, flash flood, and sinkholes/land subsidence. These differences are detailed in each hazard profile under geographic location and vulnerability.

Dallas County is fairly uniform in terms of climate, topography, and building construction characteristics. The City of Buffalo is the primary urbanized area within Dallas County, which has more assets at a greater density, and therefore greater vulnerability to weather-related hazards. The Village of Louisburg is incorporated, but has limited development. The City of Buffalo expects to grow and expand City boundaries over the next decade, which will increase vulnerability to natural hazards. This increase, however, can be mitigated through updated building codes and code enforcement, as well as land use planning.

Agricultural uses are primarily located in the rural, unincorporated parts of Dallas County. These areas are especially vulnerable to hail damages or drought

Capabilities and resources to mitigate the impact of natural hazards vary across jurisdictions in Dallas County. These differences will be discussed in greater detail in the vulnerability sections of each hazard.

3.2 Assets at Risk

This section assesses Dallas County population, structures, critical facilities and infrastructure, and other important assets that may be at risk to hazards. The inventory of assets for each jurisdiction were derived from parcel data from the Dallas County Assessor, the Dallas County Structures dataset downloaded from Missouri Spatial Data information Service (MSDIS), and local jurisdiction data collection questionnaires.

3.2.1 Total Exposure of Population and Structures

Unincorporated County and Incorporated Cities

In the following three tables, population data is based on 2015 American Community Survey, Census Bureau data. Building counts and building exposure values are based on parcel data provided by the Dallas County Assessor. Contents exposure values were calculated by factoring a multiplier to the building exposure values based on usage type. The multipliers were derived from the HAZUS MH 2.2 and are defined below in **Table 3.4**. Land values have been purposely excluded from consideration because land remains following disasters, and subsequent market devaluations are frequently short term and difficult to quantify. Another reason for excluding land values is that state and federal disaster assistance programs generally do not address loss of land (other than crop insurance). It should be noted that government-owned properties are usually taxed differently or not at all, and so may not be an accurate representation of true value. Public school district assets and special districts assets are included in the total exposure tables assets by community and county.

Table 3.4 Shows the total population, building count, estimated value of buildings, estimated value of contents and estimated total exposure to parcels for the unincorporated county and each participating

community. **Table 3.5** that follows provides the building value exposures for the county and jurisdictions in Dallas County broken down by usage type. Finally, **Table 3.6** provides the building count total for the county and each participating city in Dallas County broken out by building usage types (residential, commercial, industrial, and agricultural).

Table 3.4. Maximum Population and Building Exposure by Jurisdiction-

Jurisdiction	2015 Population	Building Count	Building Exposure (\$)	Contents Exposure (\$)	Total Exposure (\$)
Buffalo	3,038	2,666	\$88,719,000	\$57,306,950	\$146,025,950
Louisburg	121	260	\$2,533,500	\$1,415,250	\$3,948,750
Unincorporated Dallas County	12,974	27,092	\$372,411,500	\$181,600,200	\$554,011,700
Totals	16,564	30,484	\$420,298,900	\$245,657,200	\$665,956,100

Sources: Population, 2010 U.S. Census; Building Count and Building Exposure, Missouri GIS Database: http://sema.dps.mo.gov/programs/mitigation_management.php; Contents Exposure derived by applying multiplier to Building Exposure based on HAZUS MH 2.1 standard contents multipliers per usage type as follows: Residential (50%), Commercial (100%), Industrial (150%), Agricultural (100%). For purposes of these calculations, government, school, and utility were calculated at the commercial contents rate.

Table 3.5. Building Values/Exposure by Usage Type

Jurisdiction	Residential	Commercial	Agricultural	Total
Buffalo	\$62,824,100	\$25,835,300	\$59,600	\$88,719,000
Louisburg	\$2,236,500	\$291,100	\$5,900	\$2,533,500
Unincorporated Dallas County	\$278,789,800	\$13,518,000	\$28,687,300	\$372,411,500
Totals	\$349,283,400	\$42,184,100	\$28,831,400	\$420,298,900

Source: Missouri GIS Database, http://sema.dps.mo.gov/programs/mitigation_management.php;

Table 3.6. Building Counts by Usage Type

Jurisdiction	Residential Counts	Commercial Counts	Agricultural Counts	Other Counts	Total
Buffalo	1,281	158	51	1,176	2,666
Louisburg	89	7	45	119	260
Unincorporated Dallas County	5,855	87	9,819	11,331	27,092
Totals	7,399	275	9,952	12,858	30,484

Source: Missouri GIS Database, http://sema.dps.mo.gov/programs/mitigation_management.php; Public School Districts and Special Districts

The number of enrolled students at the participating public school district is provided in **Table 3.7** below. Information provided includes the number of buildings, building values (building exposure) and contents value (contents exposure).

Table 3.7. Population and Building Exposure by Jurisdiction-Public School Districts

Public School District	Enrolment	Building Count	Building Exposure (\$)	Contents Exposure (\$)	Total Exposure (\$)
Dallas County R-I	1501	13	48,569,216	8,375,934	56,945,150

Source: <http://mcids.dese.mo.gov/quickfacts/Pages/District-and-School-Information.aspx>, The Building Exposure, Contents Exposure, and Total Exposure amounts come from the completed Data Collection Questionnaires from Public School Districts.

3.2.2 Critical and Essential Facilities and Infrastructure

This section will include information from the Data Collection Questionnaire and other sources concerning the vulnerability of participating jurisdictions' critical, essential, high potential loss, and transportation/lifeline facilities to identified hazards. Definitions of each of these types of facilities are provided below.

- **Essential Facility:** Those facilities that if damaged, would have devastating impacts on disaster response and/or recovery. Examples include: hospitals, medical facilities, police, and fire stations.
- **High Potential Loss Facilities:** Those facilities that would have a high loss or impact on the community. Examples include: power plants, hazardous materials sites, schools, day care centers, nursing homes, and main government buildings.
- **Transportation and lifeline facilities:** Those facilities and infrastructure critical to transportation, communications, and necessary utilities. Examples include: railroads, airports, water treatment facilities, natural gas facilities, pipelines, and communication facilities.

Table 3.8 includes a summary of the inventory of critical and essential facilities and infrastructure in Dallas County. The list was compiled from the Data Collection Questionnaire as well as the following sources:

- HAZUS 4.0

Table 3.8. Inventory of Critical/Essential Facilities and Infrastructure by Jurisdiction

Jurisdiction	Airport Facility	Bus Facility	Childcare Facility	Communications Tower	Electric Power Facility	Emergency Operations	Fire Service	Government	Housing	Shelters	Highway Bridge	Hospital/Health Care	Military	Natural Gas Facility	Nursing Homes	Police Station	Potable Water Facility	Rail	Sanitary Pump Stations	School Facilities	Stormwater Pump Stations	Tier II Chemical Facility	Wastewater Facility	Total	
Buffalo	1		6			1	2	3				1			4	1								1	23
Louisburg							1														3			1	2
Dallas County							7								1	2								1	11
Totals	1		6			1	10	3				1			5	3				3			3	36	

Source: Data Collection Questionnaires; HAZUS.

Figure 3.1 is a map that shows the locations of bridges in Dallas County included in the National Bridge Inventory data set. The NBI data contains a “scour index”, which is a number indicating the vulnerability of a bridge to scour during a flood. Bridges with a scour index between 1 and 3 are considered “scour critical”, or a bridge with a foundation determined to be unstable for the observed or evaluated scour condition. According to this information, there is one scour critical bridge identified in Dallas County. The bridge over the Niangua River on State Route M has a scour index of 3. The map shows the NBI’s classification of each bridge based on structure status and shows the location of the Route M scour critical bridge. The NBI gives definitions for “Functionally Obsolete” and “Structurally Deficient” bridges:

Functionally Obsolete: A functionally obsolete bridge is one that was built to standards that are not used today. These bridges are not automatically rated as structurally deficient, nor are they unsafe. Functionally obsolete bridges are those that do not have adequate lane widths, shoulder widths, or vertical clearances to serve current traffic demand, or those that may be occasionally flooded.

A functionally obsolete bridge is similar to an older house. A house built in 1950 might be perfectly acceptable to live in, but it does not meet all of today’s building codes. Yet, when it comes time to consider upgrading that house or making improvements, the owner must look at ways to bring the structure up to current standards.

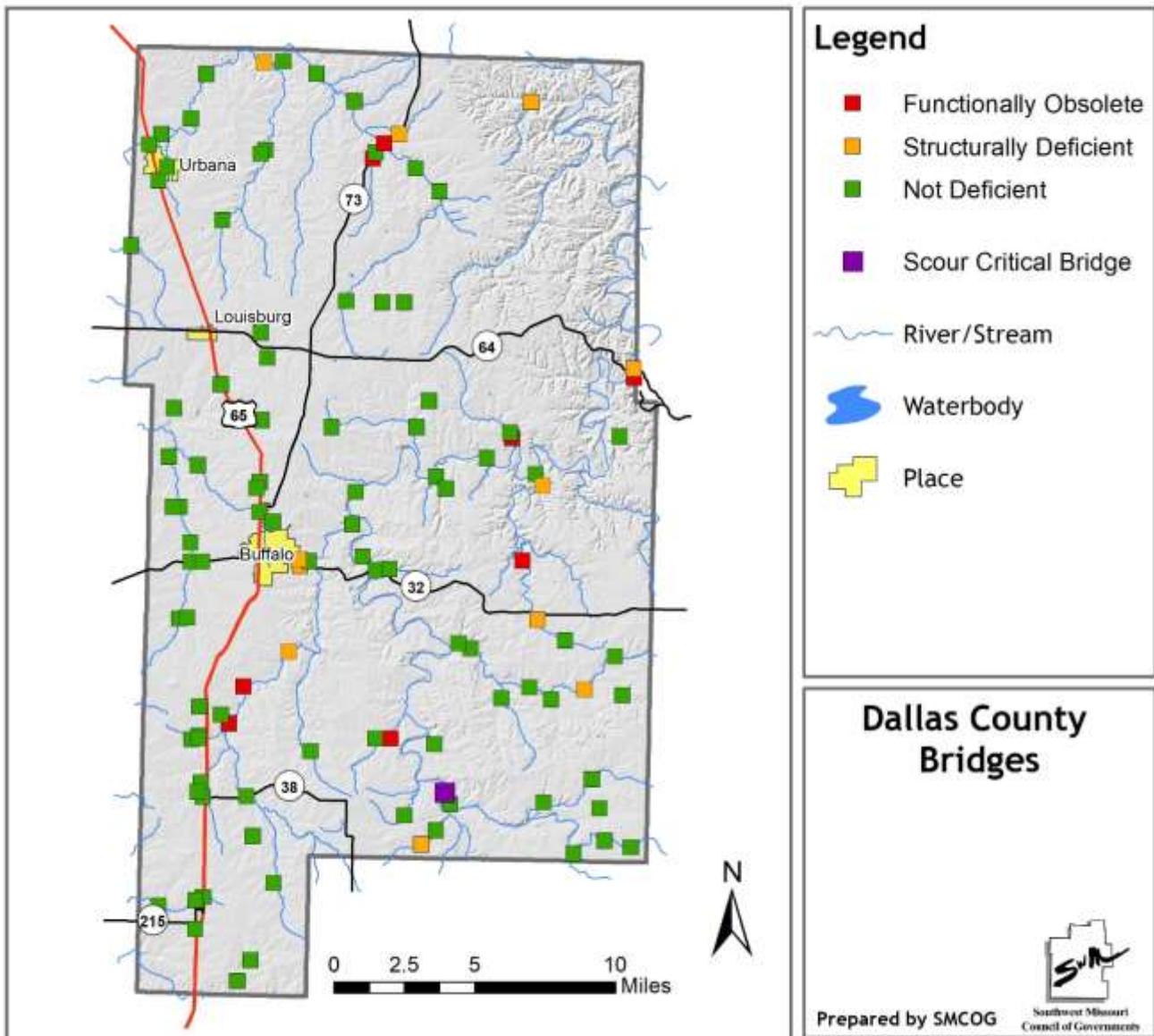
Structurally Deficient: Bridges are considered structurally deficient if:

- Significant load-carrying elements are found to be in poor condition due to deterioration, or
- The adequacy of the waterway opening provided by the bridge is determined to be extremely insufficient to the point of causing intolerable traffic interruptions.

Every bridge constructed goes through a natural deterioration or aging process, although each bridge is unique in the way it ages.

The fact that a bridge is classified under the federal definition as “structurally deficient” does not imply that it is unsafe. A structurally deficient bridge, when left open to traffic, typically requires significant maintenance and repair to remain in service and eventual rehabilitation or replacement to address deficiencies. To remain in service, structurally deficient bridges are often posted with weight limits to restrict the gross weight of vehicles using the bridges.

Figure 3.1. Dallas County Bridges



Source: National Bridge Inventory, 2016

3.2.3 Other Assets

Assessing the vulnerability of Dallas County to disaster also requires data on the natural, historic, cultural, and economic assets of the area. This information is important for many reasons.

- These types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- Knowing about these resources in advance allows for consideration immediately following a hazard event, which is when the potential for damages is higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- The presence of natural resources can reduce the impacts of future natural hazards, such as wetlands and riparian habitats which help absorb floodwaters.
- Losses to economic assets like these (e.g., major employers or primary economic sectors) could have severe impacts on a community and its ability to recover from disaster.

Threatened and Endangered Species: **Table 3.9** shows the Federally Threatened, Endangered, Proposed and Candidate Species in Dallas county.

Table 3.9. Threatened and Endangered Species in Dallas County

Common Name	Scientific Name	Status
Gray bat	Myotis grisescens	Endangered
Indiana bat	Myotis sodalis	Endangered
Niangua darter	Ethostoma nianguae	Threatened
Northern long-eared bat	Myotis septentrionalis	Threatened

Source: U.S. Fish and Wildlife Service, <http://www.fws.gov/midwest/Endangered/lists/missouri-cty.html>

Natural Resources: The Missouri Department of Conservation (MDC) provides a database of lands the MDC owns, leases, or manages for public use. **Table 3.10** provides the names and locations of parks and conservation areas in Dallas County.

Table 3.10. Parks in Dallas County

Area Name	Address	City
Goose Creek Conservation Area	Freight Rd.	Buffalo
Charity Access	Route M	Buffalo
Gossett Conservation Area	Pelican Dr.	Windyville
Big John Access	Steelman Rd.	Buffalo
Williams Ford Access	Benton Branch Rd.	Windyville
Moon Valley Access	Moon Valley Rd.	Windyville
Bennett Spring Fish Hatchery	BSSP 2 Rd.	Bennett Spring
Bennett Spring Access	Highway 64	Bennett Spring
Barclay Conservation Area	Barclay Spring Rd.	Tunas
Lead Mine Conservation Area	State Road YY	Tunas

Source: https://nature.mdc.mo.gov/discover-nature/find/places?area_name=&counties=5688&location%5Bdistance%5D=50&location%5Borigin%5D=

Historic Resources: The National Register of Historic Places is the official list of registered cultural resources worthy of preservation. It was authorized under the National Historic Preservation Act of 1966 as part of a national program. The purpose of the program is to coordinate and support public and private efforts to identify, evaluate, and protect our historic and archeological resources. The

Properties in Dallas County that are on the National Register of Historic Places are listed in **Table 3.11**.

Table 3.11. Dallas County Properties on the National Register of Historic Places

Property	Address	City	Date Listed
Bennett Spring State Park Hatchery-	Off MO A64	Bennett Spring	1985
Bennett Spring State Park Shelter House and Water Gauge Station	Off MO A64	Bennett Spring	1985

Source: Missouri Department of Natural Resources – Missouri National Register Listings by County
<http://dnr.mo.gov/shpo/mnrlist.htm>

Economic Resources: **Table 3.12** shows major non-government employers in Dallas County.

Table 3.12. Major Non-Government Employers in Dallas County

Employer Name	Main Locations	Product or Service	Employees
Oakstar Bank	Buffalo	Commercial Banking	100-249
Colonial Springs Healthcare	Buffalo	Nursing Care	100-249
Premier Home Healthcare	Buffalo	Home Health Services	100-249
Walmart	Buffalo	Department store/ Retailer	50-99
Mfa Farm &	Buffalo	Misc. Crop Farming	50-99
Dallas County Farmers Exchange	Buffalo	Farm Supplies	50-99

Source: Data Collection Questionnaires; Mo Department of Economic Development <https://missouriebs.weebly.com/employers.html>

Agriculture: Agriculture plays a significant role in the Dallas County economy. Much of unincorporated Dallas County is used as farmland and agriculture. **Table 3.13** provides a summary of the agriculture-related jobs in Dallas County.

Table 3.13. Agriculture-Related Jobs in Dallas County

Category	2007	2012	Percent Change
Number of Farms	1,369	1,188	-13%
Land in Farms	222,900 acres	217,912 acres	-2%
Average Size of Farms	163 acres	183 acres	+12%
Market Value of Products Sold			
Crop Sales	N/A	\$5,489,000	N/A
Livestock Sales	N/A	\$43,221,000	N/A
Total	N/A	\$48,710,000	N/A
Average Per Farm	\$33,893	\$40,160	+18%
Government Payments			
Government Payments	\$381,000	\$612,000	+61%
Average Per Farm Receiving Payments	\$5,419	\$2,589	+109%

: https://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/Missouri

3.3 Land Use and Development

3.3.1 Development Since Previous Plan Update

The County has seen limited growth over the past decade. **Table 3.14** provides the population growth statistics for all participating jurisdictions in Dallas County, as well as the county as a whole.

Table 3.14. County Population Growth, 2000-2010

Jurisdiction	Total Population 2010	Total population 2015	2010-2015 # Change	2010-2015 % Change
Dallas County	16,777	16,342	-435	-2.5%
Buffalo	3,084	3,066	-18	-0.5%
Louisburg	122	146	24	19.6%

Source: U.S. Bureau of the Census, Decennial Census; Population Statistics are for entire incorporated areas as reported by the Census bureau

Population growth or decline is generally accompanied by increases or decreases in the number of housing units. Increases in population add to the built environment and increase risk and exposure to hazard events.

Table 3.15 provides the change in numbers of housing units in Dallas County from 2010 to 2015. The totals for 2015 were taken from the American Community Survey 2011-2015 five year estimates. It should be noted that there is a margin of error associated with these values. MPC member knowledge regarding Buffalo housing development would contradict ACS data, as Buffalo has seen several residential housing units added since 2010.

Table 3.15. Change in Housing Units, 2010-2015

Jurisdiction	Housing Units 2010	Housing Units 2015	2010-2015 # Change	2010-2015 % change
Dallas County	7,597	7,595	-2	-0.02%
Buffalo	1,518	1,354	-164	-10.8%
Louisburg	82	79	-3	-3.6

Source: U.S. Bureau of the Census, Decennial Census; Population Statistics are for entire incorporated areas as reported by the U.S. Census Bureau

From the 2010 US Census to the 2015 American Community Survey, Dallas County has seen a declining population. The population has decreased about 2.5% since 2010, and the rate of growth is not expected to change drastically in the near future. The number of housing units in the county has decreased by 0.02% in the same time period. **Figures 3.2** and **3.3** are population density maps depicting block group population at the time of the 2010 census and the 2015 ACS, respectively. Each dot on the maps represents 20 people. The maps display much of the population as small groups of people.

Figure 3.2. Dallas County Dot Density by Census Block, 2010

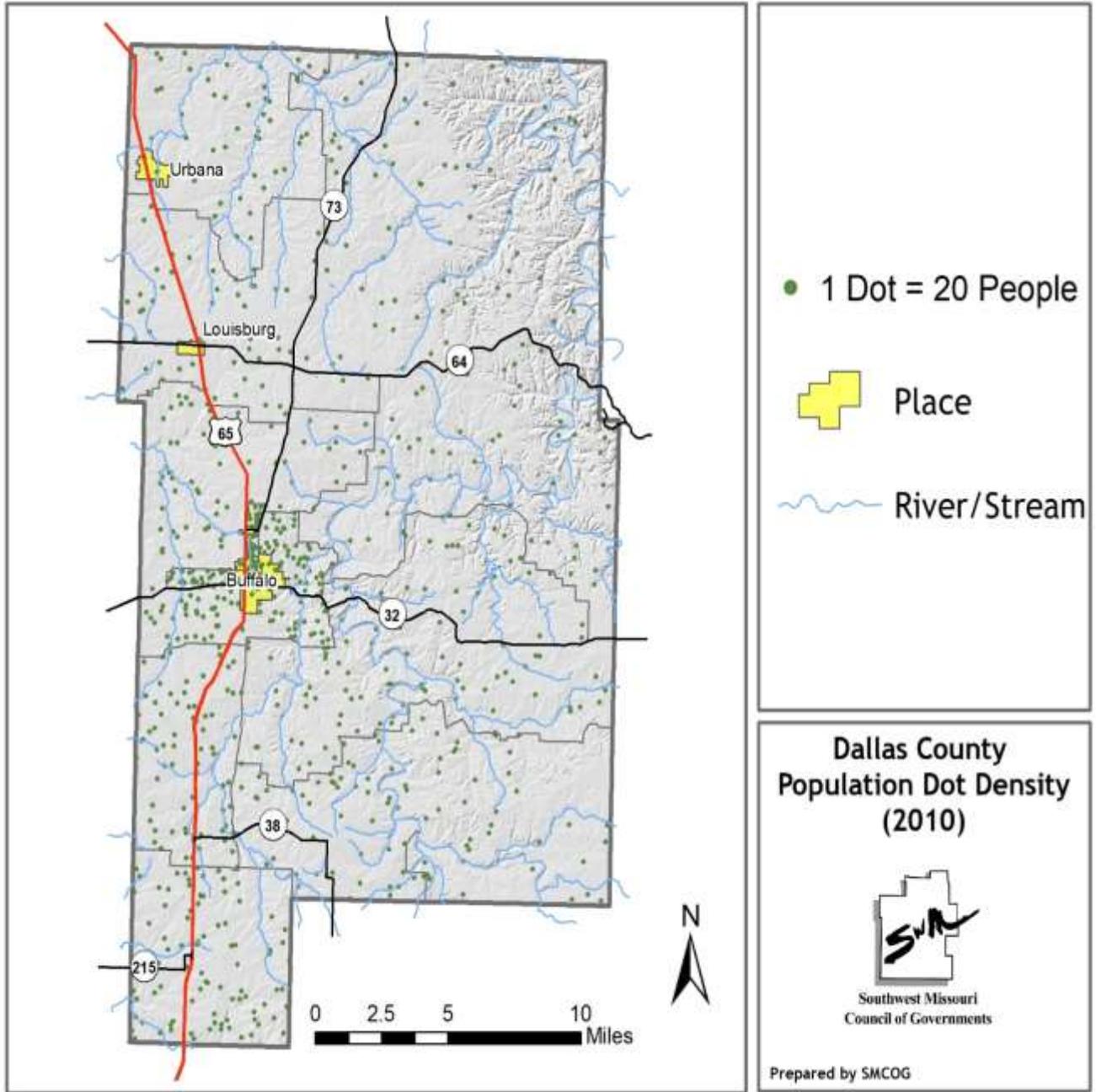
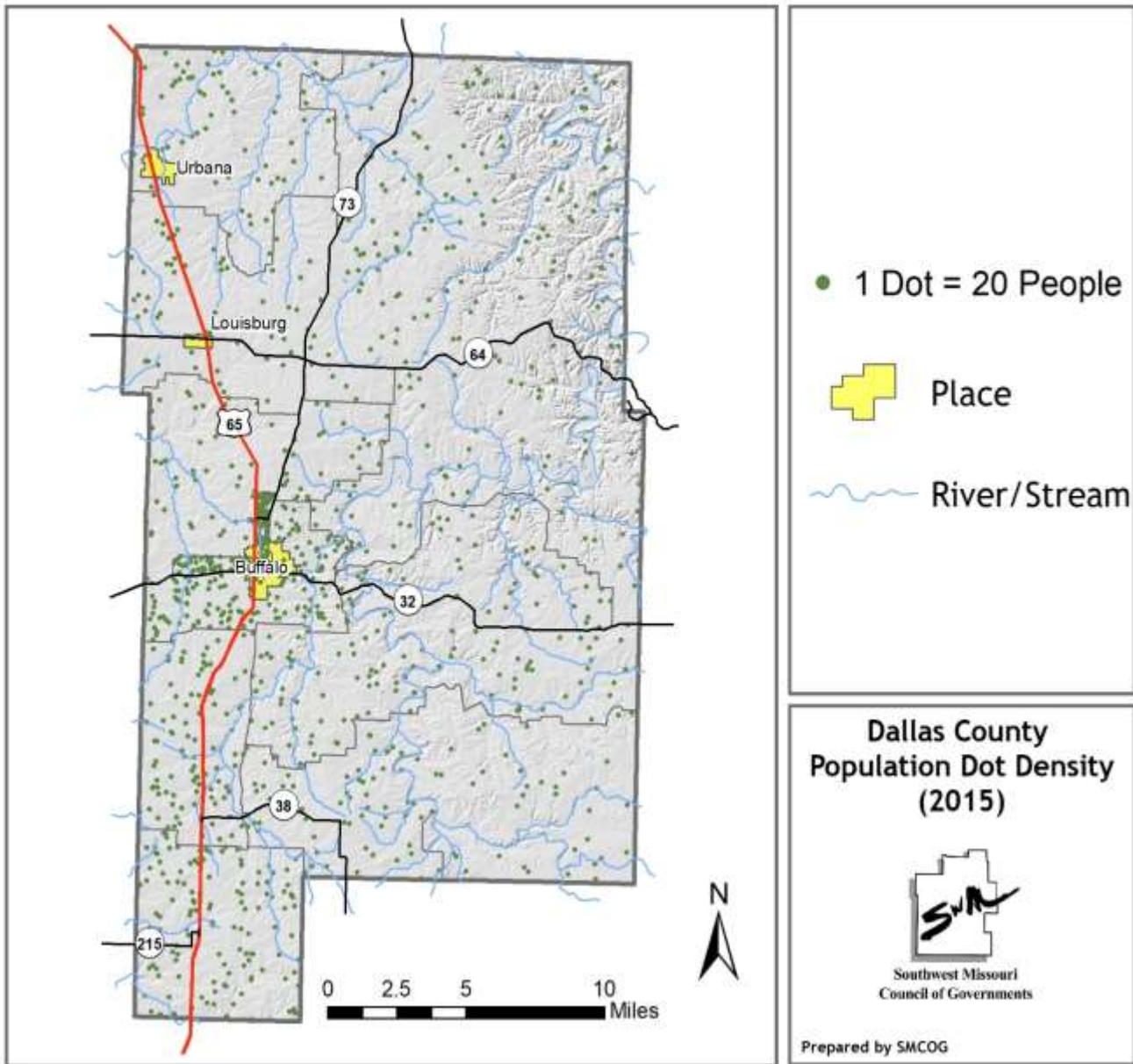


Figure 3.3. Dallas County Dot Density by Census Block, 2015



Dallas County communities have, overall, experienced varying degrees of growth and decline since the previous plan update. According to U.S. Census data the Village of Louisburg has seen some minor growth, where all other communities have experienced population decline. The city of Buffalo has experienced some growth and development, even though Census data does not reflect that information. Unincorporated Dallas County has remain relatively stagnant and not seen any substantial growth or development since the previous plan update. A summary of each jurisdiction is provided below.

City of Buffalo

The City of Buffalo has seen some growth since the previous plan update, but not a substantial population or development increase. There have been some new businesses and houses constructed which adds to exposure of the community, but staying well within the current capabilities. The City has been conscious to keep any new development out of the floodplain or to mitigate any issues with

structures located near high risk areas.

Village of Louisburg

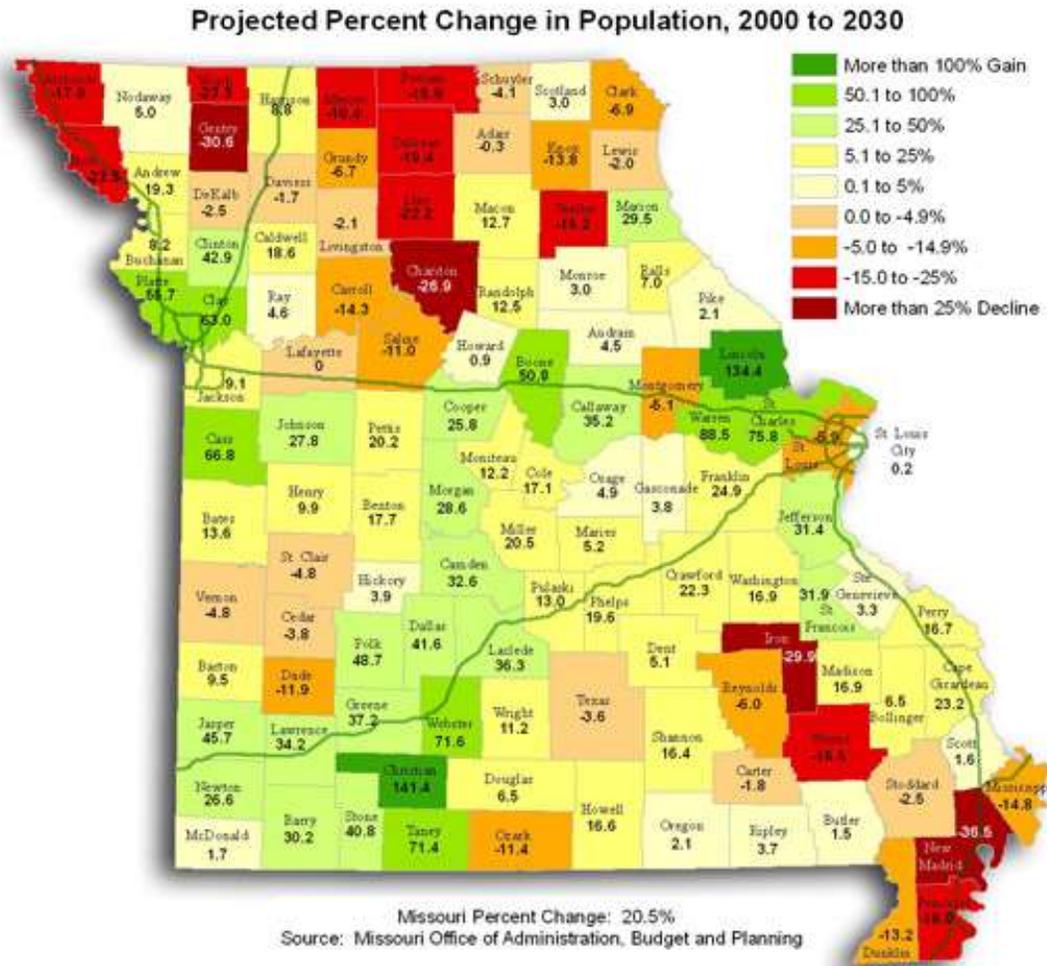
The Village of Louisburg experienced little to no development since the previous plan. The ACS estimates show an increase in population since 2010, but it is likely those estimates are a bit high and not realistic.

3.3.2 Future Land Use and Development

Dallas County is expected to see growth in the next decade. While the county as a whole is estimated to have lost population since 2010, the Missouri Office of Administration, Budget and Planning has projected that Dallas County will see a 41.6% increase in population by 2030. **Figure 3.4** shows the expected population change for each county in the state of Missouri. Dallas County, as well as all adjacent counties expect to see increased population. The county does not have a comprehensive plan or any land use controls other than the floodplain ordinance. The floodplain coordinator does enforce the floodplain ordinance when necessary.

The remaining discussion in this section provides future growth and development information, where available, relative to each participating jurisdiction. Much of the information included is from the community data collection questionnaires, or where incomplete questionnaires were returned presumptions were made for future development based on past trends.

Figure 3.4. Projected Percent Change in Population, 2000 to 2030



City of Buffalo

Buffalo expects to see some new facilities and development over the next five years, but did not provide details regarding what or where. The current comprehensive plan was updated in 1995, but the City was undergoing an update of the comprehensive plan during this hazard mitigation plan update. It is anticipated that there may be some annexations in the future that would expand the boundaries of Buffalo, thus increasing the exposure to natural hazards.

Buffalo plans to continue enforcing its floodplain ordinance and the incorporation of hazard mitigation actions is expected in the new comprehensive plan.

Village of Louisburg

The Village of Louisburg has not experienced much growth, and does plan to have any new development in the next five years. The Village does not have a comprehensive plan or any guiding land use regulations.

School District's Future Development

Dallas R-I

District enrollment is expected to stay stagnant, perhaps with a small increase. The district had experienced declining enrollment for the past decade, but saw a slight increase for the 2017-2018 school year. Dallas R-I hopes to construct a technical center on the high school campus, as well as a regulation size track. The schools district has two FEMA rated shelters, one community-wide shelter is located at the high school and the other at the elementary school but is not available to the public.

Special District's Future Development

Urban Rural Fire District

The Urbana Rural Fire District does not anticipate any expansion in the next five years. No expansion of service boundaries or facilities is expected.

3.4 Hazard Profiles, Vulnerability, and Problem Statements

Each hazard will be analyzed individually in a hazard profile. The profile will consist of a general hazard description, location, severity/magnitude/extent, previous events, future probability, a discussion of risk variations between jurisdictions, and how anticipated development could impact risk. At the end of each hazard profile will be a vulnerability assessment, followed by a summary problem statement.

Hazard Profiles

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the...location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

The level of information presented in the profiles will vary by hazard based on the information available. With each update of this plan, new information will be incorporated to provide better evaluation and prioritization of the hazards that affect Dallas County. Detailed profiles for each of the identified hazards include information categorized as follows:

Hazard Description: This section consists of a general description of the hazard and the types of impacts it may have on a community or school/special district.

Geographic Location: This section describes the geographic location of the hazard in Dallas County. Where available, use maps to indicate the specific locations of Dallas County that are vulnerable to the subject hazard. For some hazards, the entire planning area is at risk.

Severity/Magnitude/Extent: This includes information about the severity, magnitude, and extent of a hazard. For some hazards, this is accomplished with description of a value on an established scientific scale or measurement system, such as an EF2 tornado on the Enhanced Fujita Scale. Severity, magnitude, and extent can also include the speed of onset and the duration of hazard events. Describing the severity/magnitude/extent of a hazard is not the same as describing its potential impacts on a community. Severity/magnitude/extent defines the characteristics of the hazard regardless of the people and property it affects.

Previous Occurrences: This section includes available information on historic incidents and their impacts. Historic event records form a solid basis for probability calculations.

Probability of Future Occurrence: The frequency of recorded past events is used to estimate the likelihood of future occurrences. Probability was determined by dividing the number of recorded events by the number of years and multiplying by 100. This gives the percent chance of the event happening in any given year. For events occurring more than once annually, the probability will be reported 100% in any given year, with a statement of the average number of events annually.

Vulnerability Assessments

Requirement §201.6(c)(2)(ii) :[The risk assessment shall include a] description of the jurisdiction’s vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

Requirement §201.6(c)(2)(ii)(A) :The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.

Requirement §201.6(c)(2)(ii)(B) :[The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

Requirement §201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

Requirement §201.6(c)(2)(ii): (As of October 1, 2008) [The risk assessment] must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged in floods.

Following the hazard profile for each hazard will be the vulnerability assessment. The vulnerability assessment further defines and quantifies populations, buildings, critical facilities, and other community assets at risk to damages from natural hazards. The vulnerability assessments will be based on the best available county-level data, which is in the Missouri Hazard Mitigation Plan (2013). The county-level assessments in the State Plan were based on the following sources:

- Statewide GIS data sets compiled by state and federal agencies; and
- FEMA’s HAZUS-MH loss estimation software.

The vulnerability assessments in the Dallas County plan will also be based on:

- Written descriptions of assets and risks provided by participating jurisdictions;
- Existing plans and reports;
- Personal interviews with planning committee members and other stakeholders; and
- Other sources as cited.

In the Vulnerability Assessment, the following sub-headings will be addressed:

Vulnerability Overview

Potential Losses to Existing Development: Includes the types and numbers of building and critical facilities.

Previous and Future Development: This section will include information on how changes in development have impacted the community's vulnerability to this hazard. It also includes a description of changes in development that occurred in known hazard prone areas since the previous plan have increased or decreased the community's vulnerability, and any anticipated future development in the county, and how that would impact hazard risk in Dallas County.

Hazard Summary by Jurisdiction: For hazard risks that vary by jurisdiction, this section will provide an overview of the variation and the factual basis for that variation. For example, a community that has adopted more recent building codes and constructed safe rooms would be less vulnerable to the impact of tornados.

Problem Statements

Each hazard analysis will conclude with a brief summary of the problems created by the hazard in Dallas County, and possible ways to resolve those problems. Jurisdiction-specific information in those cases where the risk varies across Dallas County is included.

3.4.1 Dam Failure

Some specific sources for this hazard are:

- Missouri Department of Natural Resources, Dam and Reservoir Safety, <http://dnr.mo.gov/env/wrc/dam-safety/statemap.htm>
- Stanford University's National Performance of Dams Program; <http://npdp.stanford.edu/>
- National Inventory of Dams
- MO DNR Dam & Reservoir Safety Program;
- National Resources Conservation Service <http://www.nrcs.usda.gov>
- DamSafetyAction.org, <http://www.damsafetyaction.org/MO/>

Hazard Profile

Hazard Description

A dam is defined as a barrier constructed across a watercourse for the purpose of storage, control, or diversion of water. Dams are typically constructed of earth, rock, concrete, or mine tailings. Dam failure is the uncontrolled release of impounded water resulting in downstream flooding, affecting both life and property. Flooding, earthquakes, blockages, landslides, lack of maintenance, improper operation and poor construction can all cause a dam to fail. When a dam failure occurs, an enormous amount of water is suddenly released, destroying infrastructure and flooding the area downstream of the dam. Dams can fail for many reasons and can be caused by any of the following:

1. **Overtopping** - inadequate spillway design, debris blockage of spillways or settlement of the dam crest.
2. **Piping** - internal erosion caused by embankment leakage, foundation leakage and deterioration of pertinent structures appended to the dam.

3. **Erosion** -inadequate spillway capacity causing overtopping of the dam, flow erosion, and inadequate slope protection.
4. **Structural Failure** -caused by an earthquake, slope instability or faulty construction.

According to the State Plan, Missouri had some 5,423 recorded dams in 2013, the largest number of man-made dams of any state in the country. Missouri’s topography allows lakes to be built easily and inexpensively, which accounts for the high number of dams. Despite the large number of dams, there are only 682 (about 13 percent) state regulated dams, with an additional 66 federally regulated dams. Federal dams in Missouri are primarily regulated by two federal agencies; the U.S. Army Corps of Engineers (USACE), and the U.S. Department of Agriculture Forest Service. The remaining 4,495 dams are unregulated.

Dams that fall under state regulation are non-federally regulated dams that are more than 35 feet in height. Most nonfederal dams are privately owned structures built either for agricultural, water supply or recreational use. The Department of Natural Resources (MDNR) Water Resources Center maintains the Dam and Reservoir Safety Program in Missouri. The program ensures that dams over 35 feet in height are safely constructed, operated, and maintained pursuant to Chapter 236 of Revised Statutes of Missouri.

The Department of Natural Resources provides information about regulated and unregulated dams in Missouri. The information includes details of the dam dimensions, date of construction, approximate reservoir volume, contributing drainage basin area and hazard classification. In addition, USACE maintains the National Inventory of Dams (NID). The information in the NID database matches the list from the MDNR website with some additional details for dams in Dallas County. Although both agencies provide a hazard classification for dams, the dam classification systems differ.

The Missouri Dam and Reservoir Safety Council Rules and Regulations uses three classes of downstream environmental zone used when considering permits. The downstream environment zone is the area below the dam that would become inundated should the dam fail. Inundation is defined as water two feet or more over the submerged ground outside of the stream channel. These classes are based on the number of structures and types of development contained within the inundation area as presented in **Table 3.16**. The downstream environment zone classification is also used to prescribe the frequency of inspection.

Table 3.16. MDNR Dam Hazard Classification Definitions

Hazard Class	Definition
Class I	The area downstream from the dam that would be affected by inundation contains ten (10) or more permanent dwellings or any public building. Inspection of these dams must occur every two years
Class II	The area downstream from the dam that would be affected by inundation contains one to nine permanent dwelling, or one (1) or more campgrounds with permanent water, sewer and electrical services or one (1) or more industrial buildings. Inspection of these dams must occur once every three years.
Class III	The area downstream from the dam that would be affected by inundation does not contain any of the structures identified for Class I or Class II dams. Inspection of these dams must occur once every five years

Source: Missouri Department of Natural Resources, http://dnr.mo.gov/env/wrc/docs/rules_reg_94.pdf

Dams in the NID are classified according to hazard potential, an indicator of the consequences of dam failure. A dam’s hazard potential classification, presented in **Table 3.17**, does not indicate its condition. Dams assigned the high hazard potential classification are those where failure will potentially result in loss of human life. Significant hazard potential are those dams where failure results in no probable loss of human life but can cause economic loss. Dams assigned the low hazard potential classification are those where failure or results in no probable loss of human life and low economic or environmental losses. Losses are principally limited to the owner’s property.

Table 3.17. NID Dam Hazard Classification Definitions

Hazard Class	Definition
Low Hazard	Failure results in only minimal property damage.
Significant Hazard	Failure could possibly result in the loss of life and appreciable property damage.
High Hazard	If the dam were to fail, lives would be lost and extensive property damage could result.

Source: National Inventory of Dams

There is not a direct correlation between the State Hazard classification and the NID classifications. However, most dams that are in the State’s Classes I and II are considered NID High Hazard Dams.

Geographic Location

Dams in Planning Area

There are four recorded dams in Dallas County. There is only one dam that is classified as high hazard, Thurman Lake Dam. The other three are low hazard dams. None of the dams are state regulated.

Information about all dams in Dallas County are presented in **Table 3.18**. The table indicates if there is an Emergency Action Plan (EAP) in place, year completed, height, drainage area, last inspection date, and dam owner. An acre foot is defined as the volume of one acre of surface area to the depth of one foot.

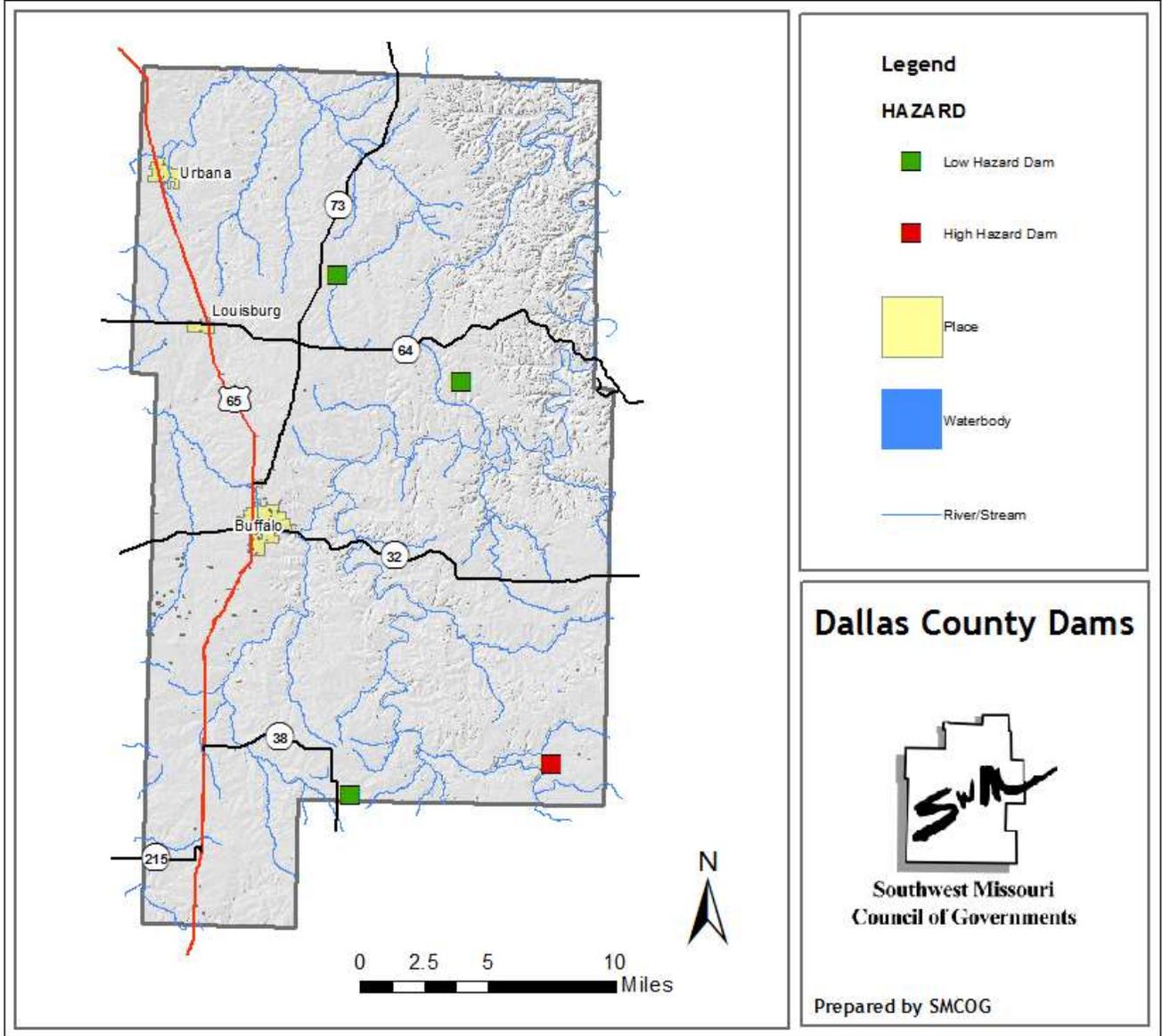
Table 3.18. Dams in the Dallas County Planning Area

Dam Name	Emergency Action Plan (EAP)	Year Completed	Dam Height (Ft)	Drainage Area (Acre-Ft)	Last Inspection Date	Dam Owner
Maddux Lake Dam	N/A	1959	25	1,384	N/A	Dale Maddux
Thurman Lake Dam	N/A	N/A	25	44	N/A	June Thurman
Hutton Lake Dam	NR	1972	26	93	N/A	D H Hutton
Hannon Lake Dam	N/A	1975	15	85	N/A	E G Hannon

Sources: Missouri Department of Natural Resources, <http://dnr.mo.gov/env/wrc/dam-safety/statemap.htm> and National Inventory of Dams,

Figure 3.5 provides the locations of dams located in Dallas County.

Figure 3.5. Low and High Hazard Dam Locations in Dallas County



Source: U.S. Army Corps of Engineers, Missouri Department of Natural Resources

Severity/Magnitude/Extent

The severity/magnitude of dam failure would be similar in some cases to the impacts associated with flood events (see the flood hazard vulnerability analysis and discussion). Based on the hazard class definitions, failure of any of the High Hazard/Class I dams could result in a serious threat of loss of human life, serious damage to residential, industrial or commercial areas, public utilities, public buildings, or major transportation facilities. Catastrophic failure of any high hazard dams has the potential to result in greater destruction due to the potential speed of onset and greater depth, extent, and velocity of flooding. Note that for this reason, dam failures could flood areas outside of mapped flood hazards.

The one high hazard dam could impact a few structures, but the dam is essentially for a livestock pond and any potential impacted structures would belong to the dam owner.

Previous Occurrences

Dam failure events in Missouri include dams in Lawrenceton in 1968, Washington County in 1975, Fredericktown in 1977, a near failure in Franklin County in 1978, and Lesterville in 2005. There has not been a reported incident of dam failure in Dallas County thus far.

The most recent example of a dam failure in Missouri happened in 2005, when the stone retaining wall around a huge mountaintop reservoir around the town of Lesterville collapsed before daybreak, releasing a billion-gallon torrent of water that swept away at least two homes and several vehicles and critically injured three children, according to authorities. After the breach opened up, within minutes the 50-acre reservoir had emptied itself out with terrifying effect, turning the surrounding area into a landscape of flattened trees and clay-covered grass and temporally evacuating the city of Lesterville. (National Weather Service)

Probability of Future Occurrence

Since there has been no recorded events in Dallas County in the past 20 years, a calculation of a probability percent would give a 0% probability of a dam failure.

According to information from the 2013 State Plan, Missouri's percentage of high hazard dams in the DNR inventory puts the State at about the national average for that category. Stanford University's National Performance of Dams Program, between 1975 and 2001 there were 17 dam failures in Missouri. These data translate into a 65% probability that there will be a dam failure in any given year statewide. However, with over 5,000 dams across the state the probability that a dam failure would occur at a Dallas County Dam is very low; therefore, it is unlikely that an event of this type will happen in the county.

The age and ownership of dams are the most significant factors affecting risk of dam failure. The likelihood of a dam failure is always possible, but the impact of the dams located in Dallas County would be relatively low.

Vulnerability

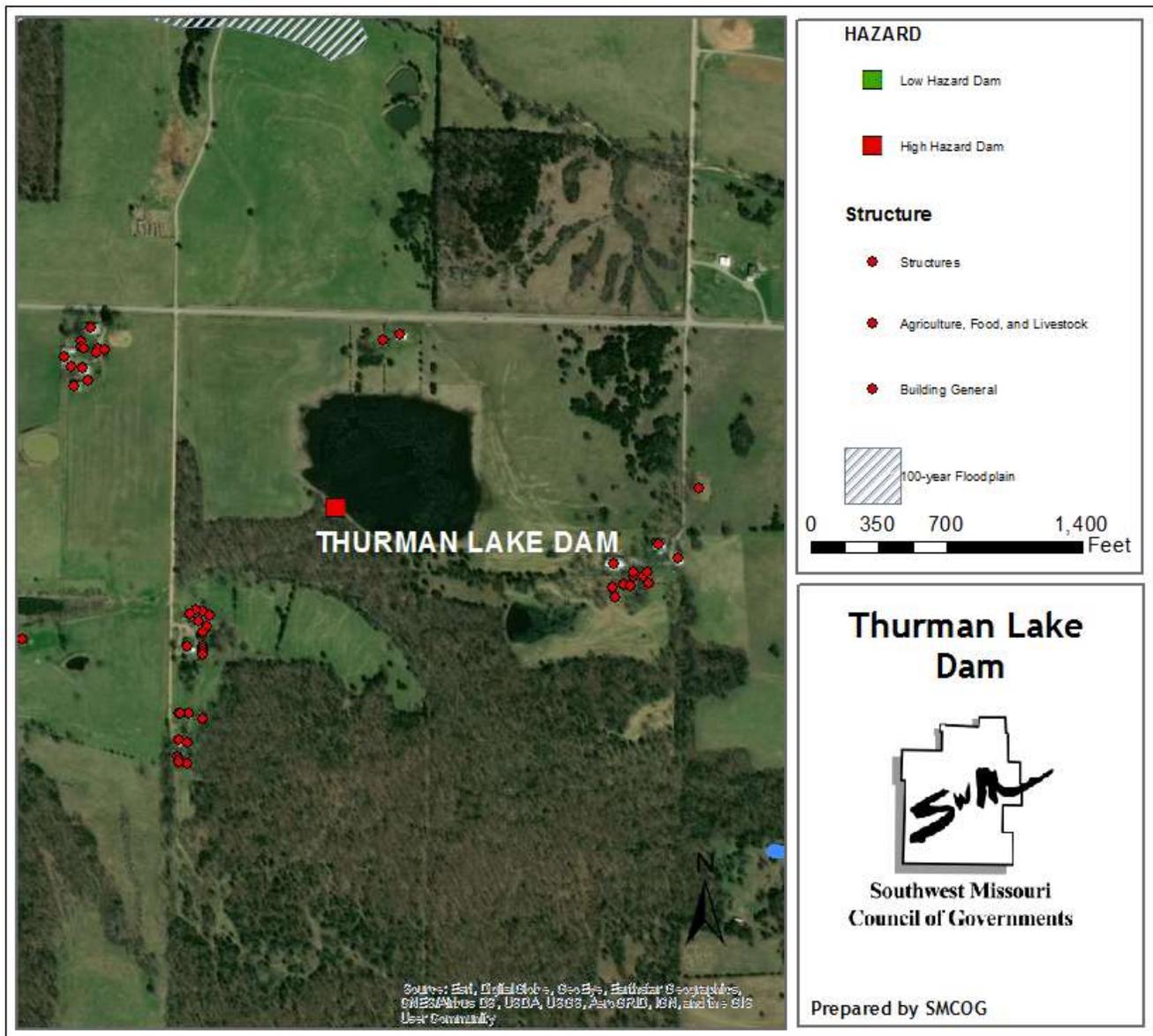
Vulnerability Overview

Vulnerability to dam failure in Dallas County is very small due to the limited number of dams in the county, and the small size of the waterbodies those dams contain. The one high hazard dam appears to serve as an agricultural use. If the dam were to fail, a few structures could be impacted, as well as a roadway. The majority of any structures impacted appear to be owned by the dam owner, but the drainage area would likely retain much of the water. The three low hazard dams would cause little to no damage in the event to a failure due to limited structures in potential impact areas.

Potential Losses to Existing Development: (including types and numbers, of buildings, critical facilities, etc.)

In the event of a failure of the high hazard dam in the County, losses would be minimal to none, because there are few structures downstream. If the dam were to fail, a few structures could be impacted, as well as a roadway. It can be assumed that the water in the event of a dam failure would follow the downstream topography. As shown in **Figure 3.6** there are few downstream structures within or near a floodplain, so it is unlikely that a failure of this dams would cause any significant damage to existing development. The majority of any structures impacted appear to be owned by the dam owner, but the drainage area would likely retain much of the water. There are no critical facilities downstream of a dam.

Figure 3.6. Thurman Lake Dam



Impact of Previous and Future Development

Any future development in Dallas County that occurs in low-lying areas downstream of dams would be impacted in the event of a dam failure. However, due to the rural locations of all dams in the county, substantial future development in potentially affected areas is not anticipated.

Hazard Summary by Jurisdiction

No jurisdictions or school districts would suffer damages in the event of a dam failure. All potential damages would occur in unincorporated parts of the county.

Problem Statement

Overall, dam failure is a relatively low risk to Dallas County and incorporated communities. There is only one dam in Dallas County that has been designated as having a high hazard potential, three low

hazard potential, and no high hazard dams upstream of Dallas County. Because none of the dams in the County are state regulated, there are no inundation maps for the County. Records do not indicate any inspections in recent years, even though it is required by law that low-hazard dams be inspected every five years. Due to the number of unregulated dams in Missouri and the lack of manpower, inspections of these dams is unlikely in the coming years.

Although the probability of dam failure in the county is very low, there is still a small potential for damage. All dams are earthen dams and are prone to erosion and damage from floods. To mitigate this problem, dam owners should be contacted to setup inspections to evaluate the state of dams. Any damages caused by unregulated dams becomes the responsibility of the dam owner.

3.4.2 Drought

Some specific sources for this hazard are:

- Maps of effects of drought, National Drought Mitigation Center (NDMC) located at the University of Nebraska in Lincoln; <http://www.drought.unl.edu/>.
- Historical drought impacts, National Drought Mitigation Center (NDMC) located at the University of Nebraska in Lincoln; at <http://droughtreporter.unl.edu/> .
- Recorded low precipitation, NOAA Regional Climate Center, (<http://www.hprcc.unl.edu>).
- Water shortages, Missouri's Drought Response Plan, Missouri Department of Natural Resources, <http://dnr.mo.gov/pubs/WR69.pdf>
- Populations served by groundwater by county, USGS-NWIS, <http://maps.waterdata.usgs.gov/mapper/index.html>
- Census of Agriculture, _
https://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/Missouri/index.asp and _
http://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/Missouri/
- USDA Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/data/cause>
- Natural Resources Defense Council, <http://www.nrdc.org/globalWarming/watersustainability/>

Hazard Profile

Hazard Description

Drought is generally defined as a condition of moisture levels significantly below normal for an extended period of time over a large area that adversely affects plants, animal life, and humans. A drought period can last for months, years, or even decades. There are four types of drought conditions relevant to Missouri, according to the State Plan, which are as follows.

- Meteorological drought is defined in terms of the basis of the degree of dryness (in comparison to some "normal" or average amount) and the duration of the dry period. A meteorological drought must be considered as region-specific since the atmospheric conditions that result in deficiencies of precipitation are highly variable from region to region.
- Hydrological drought is associated with the effects of periods of precipitation (including snowfall) shortfalls on surface or subsurface water supply (e.g., streamflow, reservoir and lake levels, ground water). The frequency and severity of hydrological drought is often defined on a watershed or river basin scale. Although all droughts originate with a deficiency of precipitation, hydrologists are more concerned with how this deficiency plays out through the hydrologic system. Hydrological droughts are usually out of phase with or lag the occurrence of meteorological and agricultural droughts. It takes longer for precipitation deficiencies to show up in components of the hydrological system such as soil moisture, streamflow, and ground water and reservoir levels. As a result, these impacts also are out of phase with impacts in other economic sectors.
- Agricultural drought focus is on soil moisture deficiencies, differences between actual and potential evaporation, reduced ground water or reservoir levels, etc. Plant demand for water depends on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil.

- Socioeconomic drought refers to when physical water shortage begins to affect people.

Geographic Location

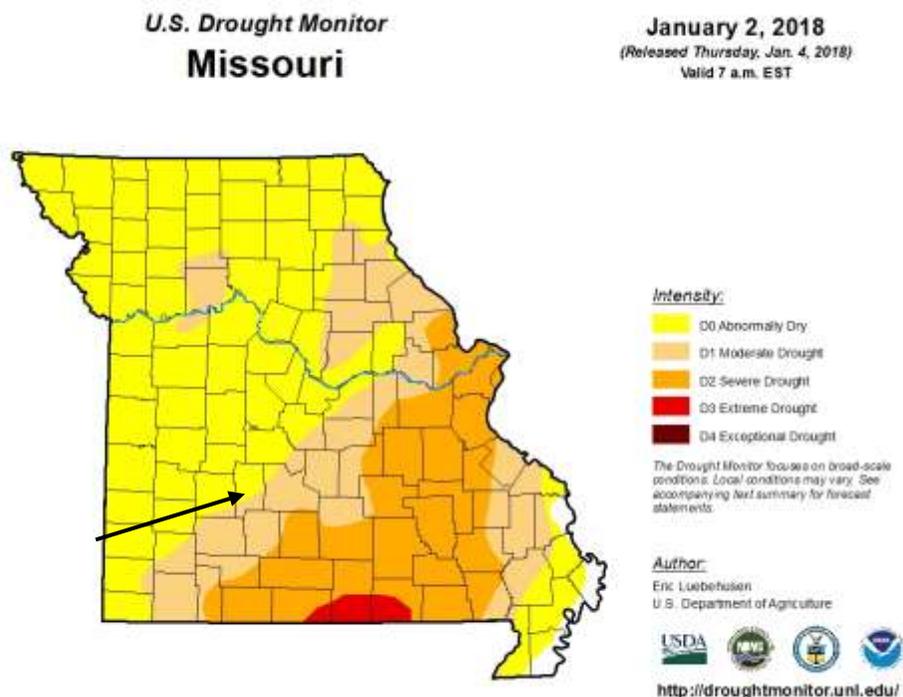
Droughts are a regional phenomenon and affect the entire county with little variability from place to place. However, drought most directly impacts the agricultural sector, so areas within the county where there is extensive agricultural land use can experience significant impacts. The major agricultural activity in the county is livestock which accounts for 88% of sales. Due to the density of livestock in the region, an extreme drought can have a devastating effect.

Severity/Magnitude/Extent

The National Drought Monitor Center at the University of Nebraska at Lincoln summarized the potential severity of drought as follows. Drought can create economic impacts on agriculture and related sectors, including forestry and fisheries, because of the reliance of these sectors on surface and subsurface water supplies. In addition to losses in yields in crop and livestock production, drought is associated with increases in insect infestations, plant disease, and wind erosion. Droughts also bring increased problems with insects and disease to forests and reduce growth. The incidence of forest and range fires increases substantially during extended droughts, which in turn place both human and wildlife populations at higher levels of risk. Income loss is another indicator used in assessing the impacts of drought because so many sectors are affected. Finally, while drought is rarely a direct cause of death, the associated heat, dust and stress can all contribute to increased mortality.

Figure 3. 7 is a recent map from the U.S. Drought Monitor and an example of the geographic area that could be in drought at any given moment in time. Remember that it is only a snapshot of conditions at a given moment in time. Dallas County is designated as DO Abnormally Dry, and D1 Moderate Drought.

Figure 3.7. U.S. Drought Monitor Map of Missouri on January 2, 2018



Source: U.S. Drought Monitor, <http://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?MO>

The USDA's Risk Management Agency Dallas County reported crop loss payments as a result of drought are shown in **Table 3.19** below.

Table 3.19. USDA Drought Crop Loss Payments for Dallas County 2008-2017

Year	Crop	Loss
2010	All other crops	\$27,043
2011	All other crops	\$168,111
2012	All other crops	\$494,200
2013	Corn	\$31,545
2013	Soybeans	\$7,086
2014	Corn	\$64,502
2014	Soybeans	\$10,292
2017	Corn	\$86,133
Total		\$888,912

The most commonly used indicator of drought and drought severity is the Palmer Drought Severity Index (PDSI), jointly published by the NOAA and the United States Department of Agriculture. The Palmer Drought Indices measure dryness based on recent precipitation and temperature. The indices are based on a "supply-and-demand model" of soil moisture. Calculation of supply is relatively straightforward, using temperature and the amount of moisture in the soil. However demand is more complicated as it depends on a variety of factors, such as evapotranspiration and recharge rates. These rates are harder to calculate. Palmer tried to overcome these difficulties by developing an algorithm that approximated these rates, and based the algorithm on the most readily available data — precipitation and temperature.

The Palmer Index has proven most effective in identifying long-term drought of more than several months. However, the Palmer Index has been less effective in determining conditions over a matter of weeks. It uses a "0" as normal, and drought is shown in terms of negative numbers; for example, negative 2 is moderate drought, negative 3 is severe drought, and negative 4 is extreme drought. Palmer's algorithm also is used to describe wet spells, using corresponding positive numbers.

According to the MDNR Missouri Drought Plan revised in 2002, Missouri's Drought Response System is divided into four phases based on Palmer index values:

- **Phase I: Advisory Phase** — Requires a drought monitoring and assessment system to provide enough lead time for state and local planners to take appropriate action;
- **Phase II: Drought Alert**— When the PDSI reads -1.0 to -2.0, and stream flows, reservoir levels, and groundwater levels are below normal over a several month period, or when the Drought Assessment Committee (DAC) determines that Phase II conditions exist based on other drought determination methods;
- **Phase III: Conservation Phase**— When the PDSI reads -2.0 to -4.0, and stream flows, reservoir levels, and groundwater levels continue to decline, along with forecasts indicating an extended period of below-normal precipitation, or when the DAC determines that Phase III conditions exist based on other drought determination models;
- **Phase IV: Drought Emergency**— When the PDSI is lower than -4.0, or when the DAC determines that Phase IV conditions exist based on other drought determination methods.

Palmer also developed a formula for standardizing drought calculations for each individual location

based on the variability of precipitation and temperature at that location. The Palmer index can therefore be applied to any site for which sufficient precipitation and temperature data is available.

Communities in Dallas County rely on both wells and surface water for water supply. Drought can easily have an impact on communities that rely on surface water. The impact of drought on deeper public wells would not be as significant unless the drought were to be so severe to reduce groundwater levels.

In addition to the impact on agriculture and drinking water, arid conditions created by drought pose an increased risk of fire. The danger is especially high for brush fires, grass fires, and in wooded areas, which can threaten homes and other structures in their path. Lack of water resources in rural areas can complicate firefighting efforts.

Previous Occurrences

The NCEI storm events database includes 14 events from 1998-2017. Many of these were multiple reports from persistent drought events that lasted several months. The NCEI reports indicate that there were four distinct drought periods during the twenty-year time frame. **Table 3.20** provides a summary of these events.

Table 3.20. Previous Drought Occurrences 1998-2017

Drought Year	Duration	Property Damage	Crop Damage
1999	October	\$0	\$20,000
2000	August-September	\$0	\$0
2006	January-March	\$0	\$0
2012-2013	July-January	\$0	\$8,680,000

Source: NOAA Storm Events Database <https://www.ncdc.noaa.gov/stormevents/>

Probability of Future Occurrence

Over the 20-year record period, Dallas County was in drought for 13 months. There are a total of 240 months in the record period. Based on the number of months of drought and the total number of months in the record period there is a 5.4% probability of drought occurrence in the county in any given month. Although drought is not predictable, long-range outlooks and predicted impacts of climate change could indicate an increased chance of drought persistence and severity.

Vulnerability

Vulnerability Overview

The agriculture sector is particularly vulnerable to drought. Periods of dry weather can reduce stock ponds and force the early sale of livestock. Crop production can be disrupted and vegetative diseases can spread reducing yields. Cities that operate water wells can experience water shortages during persistent drought periods like the six month drought period in 2012-2013. Those that rely on private wells are likely be impacted by reductions in the groundwater supply. Waste water treatment facilities may also be impacted, as it could limit the ability to discharge due to lower water levels and produce dangerous or unlawful levels of contaminants.

Potential Losses to Existing Development

According to data from the USDA Risk Management Agency, there was \$888,910 in insured crop loss payments in Dallas County in the years of 2008 through 2017. Therefore, it is probable that

future droughts will also result in crop losses. There are no anticipated structural losses, loss of life, or injuries directly associated with this hazard

Impact of Previous and Future Development

Increases in acreage planted with crops would add to exposure to drought-related agricultural losses. In addition, increases in population result in increased demand for treated water and increase waste water discharge, adding additional strain on water systems.

Impact of Climate Change

A new analysis, performed for the Natural Resources Defense Council, examined the effects of climate change on water supply and demand in the contiguous United States. The study found that more than 1,100 counties will face higher risks of water shortages by mid-century as a result of climate change. Two of the principal reasons for the projected water constraints are shifts in precipitation and potential evapotranspiration (PET). Climate models project decreases in precipitation in many regions of the U.S., including areas that may currently be described as experiencing water shortages of some degree.

The Natural Resources Defense Council developed a new water supply sustainability index. The risk to water sustainability is based on the following criteria:

- Projected water demand as a share of available precipitation
- Groundwater use as a share of projected available precipitation
- Susceptibility to drought
- Projected increase in freshwater withdrawals
- Projected increase in summer water deficit

The risk to water sustainability for counties meeting two of the criteria are classified as “moderate,” while those meeting three of the criteria are classified as “high,” and those meeting four or more are classified as “extreme.” Counties meeting less than two criteria are considered to have low risk to water sustainability. According to the Natural Resources Defense Council, without climate change the water supply sustainability index for Dallas County is moderate. With climate change, the water supply sustainability index increases to high (NRDC).

Hazard Summary by Jurisdiction

Although the probability of drought is the same for the entire county, farming and livestock enterprises in the unincorporated parts of the county would feel the greatest impact. Although communities with wells are susceptible to water shortages due to groundwater reduction, other communities with no source are more at risk to extreme water shortages in the event of a drought. School districts would be the least impacted by drought; however, those districts in communities with single source wells or none at all may experience water shortages prior to those in larger communities. Communities with waste water treatment facilities, such as Buffalo, would be impacted by low water levels that could limit the amount of effluent that could be discharged.

Problem Statement

Although drought most likely will not cause structural damage, the impact is greatest on the agriculture sector and if persistent enough, could cause reductions in groundwater and water shortages in communities that provide potable water services. Potential actions to mitigate the impact of drought would be for communities to develop public information campaigns regarding water conservation techniques and measures, and provide notification mechanisms for community members to know when drought conditions may occur. Some methods may include restrict the use of public water resources

for non-essential usage, such as landscaping, washing cars, filling swimming pools, etc. during extreme drought periods. School and special districts can also implement water conservation measures at all district facilities as well.

3.4.3 Earthquakes

Some specific sources for this hazard are:

- U.S. Seismic Hazard Map, United States Geological Survey, https://earthquake.usgs.gov/hazards/hazmaps/conterminous/2014/images/HazardMap2014_lq.jpg;
- 6.5 Richter Magnitude Earthquake Scenario, New Madrid Fault Zone map, <http://www.igsb.uiowa.edu/Browse/quakes/quakes.htm>;

Hazard Profile

Hazard Description

An earthquake is a sudden motion or trembling that is caused by a release of energy accumulated within or along the edge of the earth's tectonic plates. Earthquakes occur primarily along fault zones and tears in the earth's crust. Along these faults and tears in the crust, stresses can build until one side of the fault slips, generating compressive and shear energy that produces the shaking and damage to the built environment. Heaviest damage generally occurs nearest the earthquake epicenter, which is that point on the earth's surface directly above the point of fault movement. The composition of geologic materials between these points is a major factor in transmitting the energy to buildings and other structures on the earth's surface.

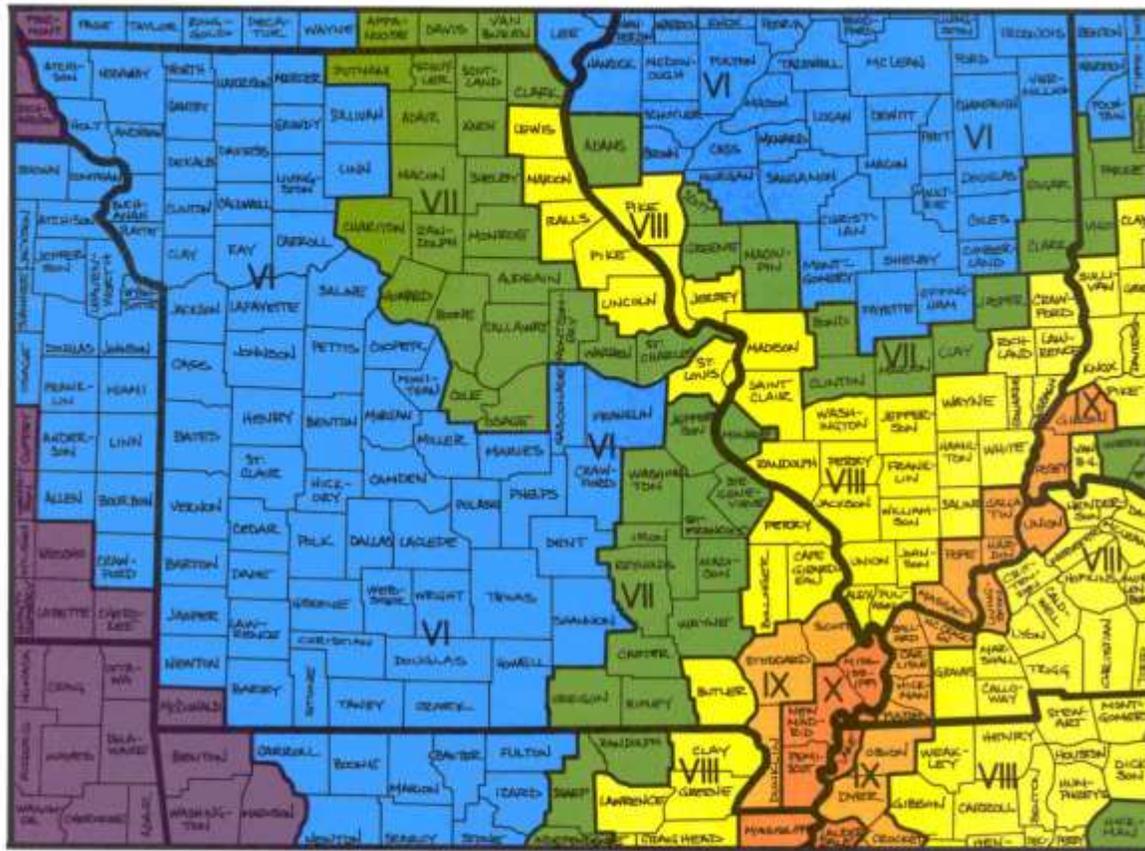
The subterranean faults were formed many millions of years ago on or near the surface of the earth. Subsequent to that time, these ancient faults subsided, while the areas adjacent were pushed up. As this fault zone (also known as a rift) lowered, sediments filled in the lower areas. Under pressure, the sediments hardened into limestones, sandstones, and shales – thus burying the rifts. The pressures on the North American plate and the movements along the San Andreas Fault by the Pacific plate have reactivated the buried rift(s) in the Mississippi embayment. This rift system is called the Reelfoot Rift and underlies the New Madrid Seismic Zone (Braile et al., 1986).

Geographic Location

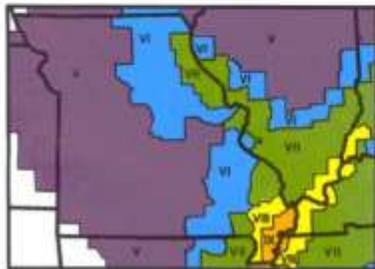
The greatest hazard from earthquakes in Dallas County comes from the New Madrid Seismic Zone situated in the boot heel area of southeast Missouri. The potential of high magnitude earthquakes occurring along the New Madrid fault presents risk that does not vary across Dallas County. The Nemaha uplift in central Kansas is also prone to seismic activity; however, the center of the Humbolt fault zone near the Nemaha Uplift is over 250 miles west of Dallas County and produces lower magnitude seismic events.

Figure 3.8 shows the highest projected Modified Mercalli intensities by county from a potential magnitude 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid Seismic Zone. The secondary maps in **Figure 3.8** on show the same regional intensities for 6.7 and 8.6 earthquakes, respectively. Dallas County is located in zone VI from a potential magnitude 7.6 earthquake along the New Madrid fault. Residents would feel movement, there could be minimal damage to structures, and dishes and glassware would likely be broken.

Figure 3.8. Impact Zones for Earthquake Along the New Madrid Fault

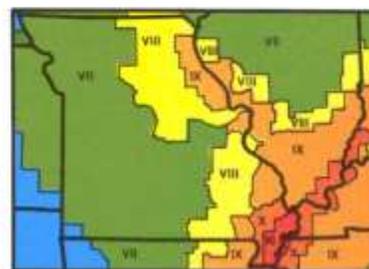


This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 7.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.



This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 6.7 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.

This map shows the highest projected Modified Mercalli intensities by county from a potential magnitude - 8.6 earthquake whose epicenter could be anywhere along the length of the New Madrid seismic zone.



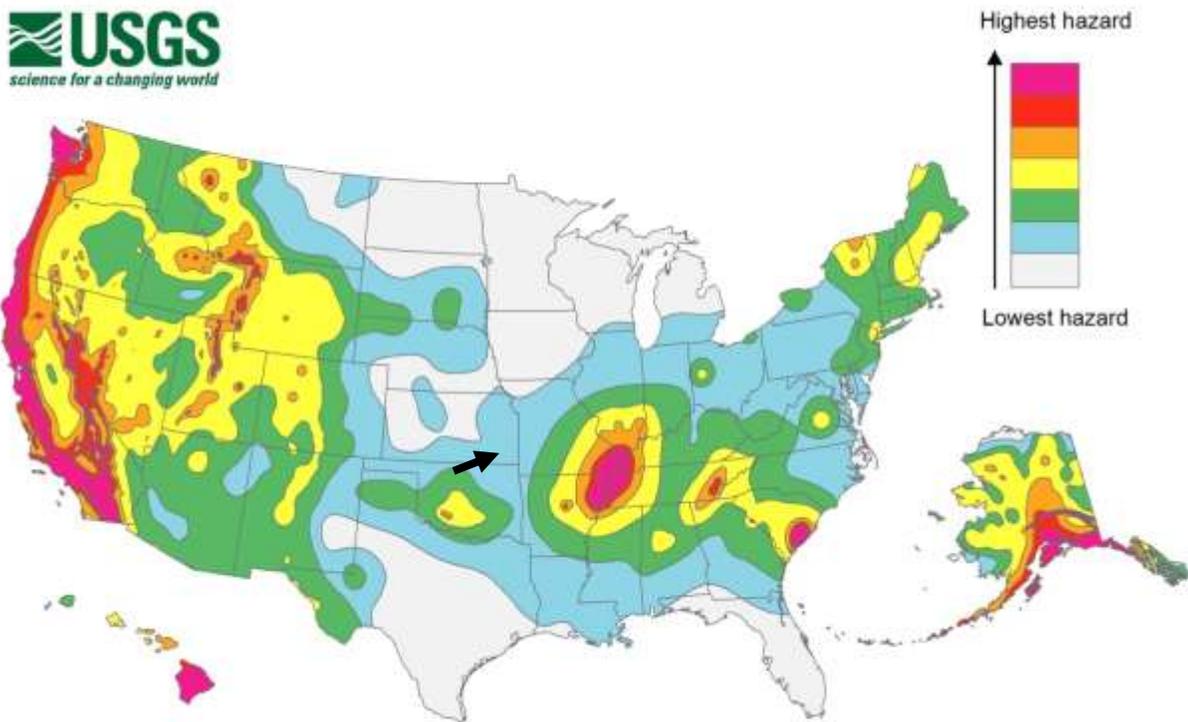
Source:

http://sema.dps.mo.gov/docs/programs/Planning,%20Disaster%20&%20Recovery/State%20of%20Missouri%20Hazard%20Analysis/2012-State-Hazard-Analysis/Annex_F_Earthquakes.pdf

The 2014 USGS National Seismic Hazard Maps display earthquake ground motions for various probability levels across the United States and are applied in seismic provisions of building codes, insurance rate structures, risk assessments, and other public policy. The updated maps represent an assessment of the best available science in earthquake hazards and incorporate new findings on earthquake ground shaking, faults, seismicity, and geodesy. The USGS National Seismic Hazard Mapping Project developed these maps by incorporating information on potential earthquakes and associated ground shaking obtained from interaction in science and engineering workshops involving hundreds of participants, review by several science organizations and State surveys, and advice from expert panels and a Steering Committee.

Figure 3.9 is a USGS map illustrating seismicity in the United States. An arrow showing the location of Dallas County has been inserted on the map.

Figure 3.9. United States Seismic Hazard Map



Source: United States Geological Survey at http://earthquake.usgs.gov/hazards/products/conterminous/2014/HazardMap2014_lg.jpg https://earthquake.usgs.gov/hazards/hazmaps/conterminous/2014/images/HazardMap2014_lg.jpg

Severity/Magnitude/Extent

The extent or severity of earthquakes is generally measured in two ways: 1) the Richter Magnitude Scale is a measure of earthquake magnitude; and 2) the Modified Mercalli Intensity Scale is a measure of earthquake severity. The two scales are defined as follows.

Richter Magnitude Scale

The Richter Magnitude Scale was developed in 1935 as a device to compare the size of earthquakes.

The magnitude of an earthquake is measured using a logarithm of the maximum extent of waves recorded by seismographs. Adjustments are made to reflect the variation in the distance between the various seismographs and the epicenter of the earthquakes. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, comparing a 5.3 and a 6.3 earthquake shows that the 6.3 quake is ten times bigger in magnitude. Each whole number increase in magnitude represents a tenfold increase in measured amplitude because of the logarithm. Each whole number step in the magnitude scale represents a release of approximately 31 times more energy.

Modified Mercalli Intensity Scale

The intensity of an earthquake is measured by the effect of the earthquake on the earth's surface. The intensity scale is based on the responses to the quake, such as people awakening, movement of furniture, damage to chimneys, etc. The intensity scale currently used in the United States is the Modified Mercalli (MM) Intensity Scale. It was developed in 1931 and is composed of 12 increasing levels of intensity. They range from imperceptible shaking to catastrophic destruction, and each of the twelve levels is denoted by a Roman numeral. The scale does not have a mathematical basis, but is based on observed effects. Its use gives the laymen a more meaningful idea of the severity.

Table 3.21. Modified Mercalli Intensity Scale

Intensity Level	Description
I	People do not feel any movement.
II	A few people might notice movement.
III	Many people indoors feel movement; Hanging objects swing.
IV	Most people indoors feel movement; Dishes, windows, and doors rattle; Walls, frames and structures creak; Liquids in open vessels are slightly disturbed; Parked cars rocked.
V	Almost everyone feels movement. Most people are awakened; Doors swing open or closed; Dishes are broken; Pictures on the wall move; Windows crack in some cases; Small objects move or are turned over; Liquids might spill out of open containers.
VI	Everyone feels movement; Poorly built buildings are damaged slightly; Considerable quantities of dishes, glassware and windows are broken; People have trouble walking; Pictures fall off walls; Objects fall from shelves; Plaster in walls might crack; Some furniture is overturned; Small bells in churches, chapels, and schools ring.
VII	People have difficulty standing; Considerable damage in poorly built or badly designed buildings, adobe houses, old walls, and spires; Damage is slight to moderate in well-built buildings; Numerous windows are broken; Weak chimneys break at rooflines; Cornices from towers and high buildings fall; Loose bricks fall from buildings; Heavy furniture is overturned and damaged; Some sand and gravel stream banks cave in.
VIII	Drivers have trouble steering; Poorly built structures suffer severe damage; Ordinary substantial buildings partially collapse; Damage slight in structures especially built to withstand earthquakes; Tree branches break; Houses not bolted down may shift on foundations; Tall structures such as towers and might chimneys twist and fall; Temporary or permanent changes in springs and wells; Sand and mud is ejected.
IX	Most buildings suffer damage; Houses not bolted down move off their foundations; Some underground pipes are broken; The ground cracks conspicuously; Reservoirs suffer damage.
X	Well-built wooden structures destroyed; most masonry and frame structures destroyed, including foundations; Rails bent; Dams seriously damaged; Cracks open in pavement.
XI	Few, if any masonry structures remain standing; Large well-built bridges destroyed; Rails bent greatly; Buried pipelines are rendered completely useless. Water mixed with sand and mud ejected in large amounts.
XII	Damage total, nearly all works of construction damaged greatly or destroyed; Objects thrown into the air; Large amounts of rock may move; The ground moves in waves or ripples.

Previous Occurrences

There is no historical record of an earthquake occurrence within Dallas County. The southeastern portion of Missouri is most susceptible to earthquakes because it overlies the New Madrid Seismic Zone. Earthquake hazards in the western part of the State also exist because of the historical earthquakes in eastern Kansas and Nebraska. No area of Missouri is immune from the danger of earthquakes. Minor, but potentially damaging, earthquakes can occur anywhere in the state (SEMA, 2013).

Participating jurisdictions noted during the planning process that some tremors or minor earthquakes have been felt in the past, but nothing of grand scale and not in a long time.

Probability of Future Occurrence

Without a definite historical record for earthquakes in Dallas County it is not possible to calculate a precise probability of earthquake occurrence. The Center for Earthquake Research and Information (CERI) at the University of Memphis has computed conditional probabilities of a magnitude 6.0 earthquake in the New Madrid seismic zone. According to a fact sheet prepared by SEMA in 2003, the probability for a magnitude 6.0 to 7.5 or greater earthquake along the New Madrid Fault is 25 to 40 percent over the next 50 years. At the 25% level, the likelihood of an earthquake happening in a given year is 1.0%. At the 40% level, the likelihood of an earthquake happening in a given year is 1.6%.

Figure 3.8 indicates the potential severity for Dallas County of a 6.7, 7.6, and 8.6 magnitude earthquake anywhere along the New Madrid fault. Based on verbal accounts of small scale tremors, it is likely that parts of Dallas County may experience some shaking or limited earthquake type events.

Vulnerability

Vulnerability Overview

Ground shaking is the most damaging effect from earthquakes. Ground shaking will impact all structures and critical infrastructure such as roads and electrical transmission systems. The greatest and most impactful earthquake risk to Dallas County is the New Madrid fault in the boot-heel region of Missouri. A 7.6 magnitude earthquake would result in poorly built buildings damaged slightly; considerable quantities of dishes, glassware and windows are broken; people having trouble walking; pictures falling off walls; objects falling from shelves; plaster in walls cracking; and furniture overturned. Damage to structures will occur but will vary on the quality of construction. In addition, some underground utilities may be damaged. Some injuries may occur but fatalities are unlikely.

Potential Losses to Existing Development

Potential losses to existing development include the total exposure for all communities listed in **Table 3.3 and Table 3.6** in the Assets at Risk section of this chapter. The total exposure of each jurisdiction was used to estimate losses due to a 7.6 earthquake along the New Madrid Fault. A damage factor of 0.5% was applied to each jurisdiction's total building and contents based on the expected impact for Zone VI on the modified Mercalli scale. **Table 3.22** depicts the estimated losses in each jurisdiction based on total exposure and a 0.5% damage factor.

Table 3.22. Estimated Potential Earthquake Losses

Jurisdiction	Potential Earthquake Losses
Unincorporated Dallas County	\$2,770,194
City of Buffalo	\$730,143
Village of Louisburg	\$19,746

Impact of Previous and Future Development

Previous development that may have been constructed without adherence to building codes may be at a greater risk of damage during an event. If future development follows building codes, it is not expected to increase the risk other than contributing to the overall exposure of what could become damaged as a result of an event. However, only the City of Buffalo enforces building codes.

Hazard Summary by Jurisdiction

Earthquake intensity is not likely to vary greatly throughout the county; the risk of occurrence is the same throughout. However, damages will differ where there are variations in the county based on percentage of structures built prior to 1939. For example, if one community has a higher percentage of residences built prior to 1939 than the other jurisdictions, that community is likely to experience higher damages. **Table 3.23** shows the number and percentage of housing units built in 1939 or earlier

Table 3.23. Percent of Housing Units Built in 1939 or Earlier

Jurisdiction	Built 1939 or earlier #	Built 1939 or earlier %
Dallas County	632	8.3%
City of Buffalo	59	4.5%
Village of Louisburg	29	35.8%

Source: U.S. Census Bureau; 2011-2015 American Community Survey 5-Year Estimates

Unincorporated Dallas County has the greatest number of structures built prior to 1939. The Village of Louisburg is at the highest overall percentage risk for damage from an earthquake with the highest percentage of total structures built before 1939. Louisburg and the County do not enforce building codes, so any new development would add to the exposure.

The City of Buffalo has 59 structures built prior to 1939. These are at higher risk for damage from an earthquake. As the community experiences a turnover in housing stock or substantial housing improvement, with new building codes used for renovation the older structures could become more resilient to a potential earthquake.

Problem Statement

Based on likely damage from a 7.6 magnitude earthquake along the New Madrid fault, older poorly built structures will suffer slight damage. The Village of Louisburg has the highest percentages of houses built before 1939 with 35.8% of the housing stock, and Dallas County has approximately 8.3% of structures built before 1939. These jurisdictions would likely experience the most damage to structures. Potential damages to future development can be mitigated by adopting and enforcing at least IBC 2012 building codes. Only the City of Buffalo has adopted building codes. Unincorporated Dallas County does not currently have building codes. Adopting, updating, and enforcing building codes throughout the County would mitigate the impact on future development from an earthquake event.

3.4.4 Extreme Heat

Hazard Profile

Some specific sources for this hazard are:

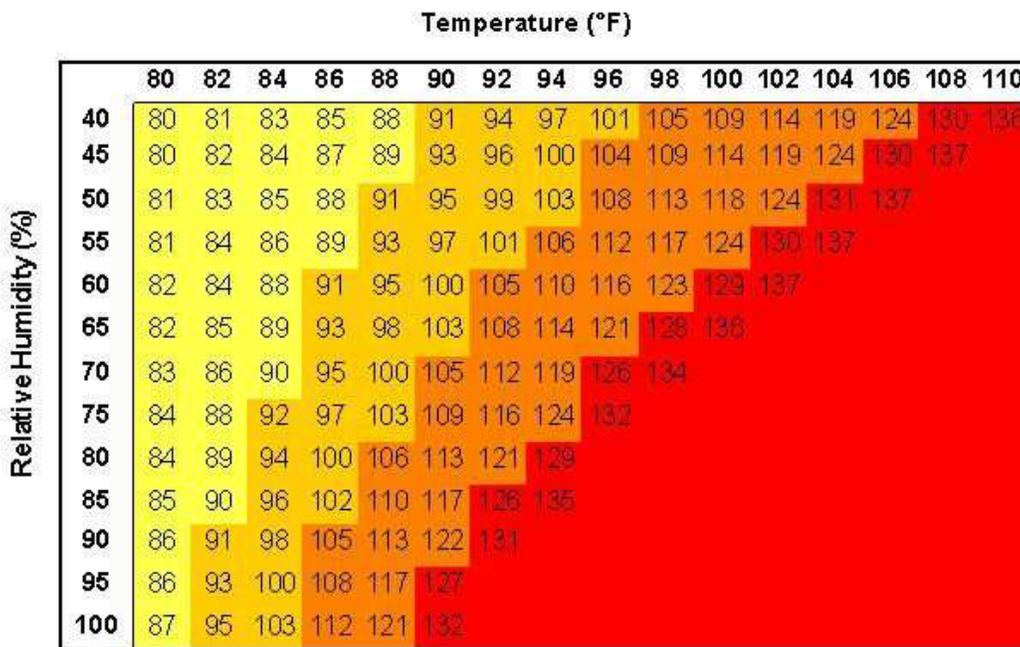
- Heat Index Chart & typical health impacts from heat, National Weather Service; National Weather Service Heat Index Program, www.weather.gov/os/heat/index.shtml ;
- Daily temperatures averages and extremes, High Plains Regional Climate Summary, <http://climod.unl.edu/> ;
- <http://health.mo.gov/living/healthcondiseases/hyperthermia/pdf/hyper2.pdf>;

Hazard Description

Extreme temperature events, both hot and cold, can impact human health and mortality, natural ecosystems, agriculture and other economic sectors. The remainder of this section profiles extreme heat. Extreme cold events are profiled in combination with Winter Storm in [Section 3.4.10](#).

According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Ambient air temperature is one component of heat conditions, with relative humidity being the other. The relationship of these factors creates what is known as the apparent temperature. The Heat Index chart shown in **Figure 3.10** uses both of these factors to produce a guide for the apparent temperature or relative intensity of heat conditions.

Figure 3.10. Heat Index (HI) Chart



Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution
 Extreme Caution
 Danger
 Extreme Danger

Source: National Weather Service (NWS)

Note: Exposure to direct sun can increase Heat Index values by as much as 15°F. The shaded zone above 105°F corresponds to a HI that may cause increasingly severe heat disorders with continued exposure and/or physical activity.

Geographic Location

Extreme heat is an area-wide hazard event, and the risk of extreme heat does not vary across Dallas County.

Severity/Magnitude/Extent

Extreme heat can cause stress to crops and animals. While the USDA Risk Management Agency does not have any crop loss payments for extreme heat for the past decade, it is likely that there have been some losses that have gone unreported. Extreme heat can also strain electricity delivery infrastructure overloaded during peak use of air conditioning during extreme heat events. Another type of infrastructure damage from extreme heat is road damage. When asphalt is exposed to prolonged extreme heat, it can cause buckling of asphalt-paved roads, driveways, and parking lots.

From 1988-2011, there were 3,496 fatalities in the U.S. attributed to summer heat. This translates to an annual national average of 146 deaths. During the same period, 0 deaths were recorded in Dallas County, according to NCEI data. The National Weather Service stated that among natural hazards, no other natural disaster—not lightning, hurricanes, tornadoes, floods, or earthquakes—causes more deaths.

Those at greatest risk for heat-related illness include infants and children up to five years of age, people 65 years of age and older, people who are overweight, and people who are ill or on certain medications. However, even young and healthy individuals are susceptible if they participate in strenuous physical activities during hot weather. In agricultural areas, the exposure of farm workers, as well as livestock, to extreme temperatures is a major concern.

Table 3.24 Lists typical symptoms and health impacts due to exposure to extreme heat.

Table 3.24. Typical Health Impacts of Extreme Heat

Heat Index (HI)	Disorder
80-90° F (HI)	Fatigue possible with prolonged exposure and/or physical activity
90-105° F (HI)	Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and/or physical activity
105-130° F (HI)	Heatstroke/sunstroke highly likely with continued exposure

Source: National Weather Service Heat Index Program, www.weather.gov/os/heat/index.shtml

The National Weather Service has an alert system in place (advisories or warnings) when the Heat Index is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. A common guideline for issuing excessive heat alerts is when for two or more consecutive days : (1) when the maximum daytime Heat Index is expected to equal or exceed 105 degrees Fahrenheit (°F); and the night time minimum Heat Index is 80°F or above. A heat advisory is issued when temperatures reach 105 degrees and a warning is issued at 115 degrees.

Previous Occurrences

There were nine (9) recorded extreme heat events recorded in the National Centers for Environmental Information (NCEI) database from 1998 to 2017 for Dallas County. There were zero deaths and no injuries or property and crop damage associated with these events in the NCEI data for Dallas County. The event narratives describe fatalities that occurred during regional multi-county heat events for other nearby counties. Extreme heat events in Dallas County were recorded in consecutive months in four separate years from 1998 to 2017. The months for each year are summarized as follows:

The events recorded in the NCEI database describe prolonged periods where temperatures rose above at least 90° for at least 12 consecutive days. Heat advisories and warnings are issued for shorter periods of extreme heat nearly every year and may not meet the threshold for consecutive days in the NCEI database. This data limitation indicates that the impact of extreme heat events could be underreported.

Vulnerability

Vulnerability Overview

High humidity, which often accompanies heat in Missouri, can make the effects of heat even more harmful. While heat-related illness and death can occur from exposure to intense heat in just one afternoon, heat stress on the body has a cumulative effect. Consequently, the persistence of a heat wave increases the threat to public health. The people most at risk are children under five years of age and adults over the age of 65, as well as people who work outdoors. The agriculture sector can also suffer crop loss during periods of extreme heat. Extreme heat may also cause buckling of roads.

Potential Losses to Existing Development

It may be estimated that there will be some crop or agriculture losses, but amounts are difficult to estimate. Additionally, it is possible that there will be at least one heat related death in Dallas County over the next decade due to the high number of residents in the at risk populations.

Impact of Previous and Future Development

Population growth can result in increases in the age-groups that are most vulnerable to extreme heat. Population growth also increases the strain on electricity infrastructure, as more electricity is needed to accommodate the growing population. Buffalo has the largest populations under 5 and over 65 years of age. Dallas County and the City of Buffalo anticipate some moderate growth over the next decade, and that may include several residents in the at-risk populations.

Impact of Climate Change

With rising global temperatures, it is likely that extreme heat events may become more frequent or more severe. This hazard should be monitored over the upcoming years and any new or increased impacts on Dallas County communities will be referenced in future plan updates.

Hazard Summary by Jurisdiction

Those at greatest risk for heat-related illness and deaths include children up to five years of age, people 65 years of age and older, people who are overweight, and people who are ill or on certain medications. To determine jurisdictions within Dallas County with populations more vulnerable to extreme heat, demographic data was obtained from the 2010 census on population percentages in each jurisdiction comprised of those under age 5 and over age 65. Data was not available for overweight individuals and those on medications vulnerable to extreme heat.

Table 3.25 below summarizes vulnerable populations in the participating jurisdictions. Note that school and special districts are not included in the table because students and those working for the special districts are not customarily in these age groups.

Table 3.25. Dallas County Population Under Age 5 and Over Age 65, 2010 Census Data

Jurisdiction	Population under 5 years	Population Under 5 years %	Population 65 years and over	Population 65 years and over %
Dallas County	1,145	6.1%	2,853	17.0%
City of Buffalo	275	8.9%	645	20.9%
Village of Louisburg	5	4.1%	28	23.0%

Source: U.S. Census Bureau, (*) includes entire population of each city or county

All schools in the planning area have proper air-conditioning and all follow proper procedures in the event of extreme heat. However, daycare and eldercare facilities may be at risk of heat related injuries if facilities are not properly cooled.

Problem Statement

Older and younger segments of the population are more vulnerable to the impact of extreme heat. In addition people living below the poverty level may be more vulnerable during periods of extreme heat due to a lack of air conditioning or utilities in their homes. Institutionalized populations, such as those living in nursing homes, become more vulnerable to extreme heat due to power outages. Buffalo has identified nursing homes and daycare centers as critical community facilities, which can increase the potential impact of extreme heat events.

To help reduce the risk of death, heating and cooling centers should be promoted and known to the public, especially to those who have young children or are over the age of 65. Partnering with local community organizations to continue to donate fans and offer weatherization programs would mitigate the impact on vulnerable populations in the county.

3.4.5 Wildfires

The specific sources for this hazard are:

- Missouri Department of Conservation Wildfire Data Search at <http://mdc7.mdc.mo.gov/applications/FireReporting/Report.aspx>
- Statistics, Missouri Division of Fire Safety;
- National Statistics, US Fire Administration;
- Forestry Division of the Missouri Dept of Conservation;
- National Fire Incident Reporting System (NFIRS), <http://dfs.dps.mo.gov/programs/resources/fire-incident-reporting-system.php> <http://www.dfs.dps.mo.gov/programs/resources/fire-incident-reporting-system.asp>
- Firewise, www.firewise.org
- University of Wisconsin Slivis Lab, <http://silvis.forest.wisc.edu/maps/wui/2010/download>

Hazard Profile

Hazard Description

The fire incident types for wildfires include: 1) natural vegetation fire, 2) outside rubbish fire, 3) special outside fire, and 4) cultivated vegetation, crop fire.

The Missouri Division of Fire Safety (MDFS) indicates that approximately 80 percent of the fire departments in Missouri are staffed with volunteers. Whether paid or volunteer, these departments are often limited by lack of resources and financial assistance. .

The Forestry Division of the Missouri Department of Conservation (MDC) is responsible for protecting privately owned and state-owned forests and grasslands from wildfires. To accomplish this task, eight forestry regions have been established in Missouri for fire suppression. The Forestry Division works closely with volunteer fire departments and federal partners to assist with fire suppression activities. Currently, more than 900 rural fire departments in Missouri have mutual aid agreements with the Forestry Division to obtain assistance in wildfire protection if needed.

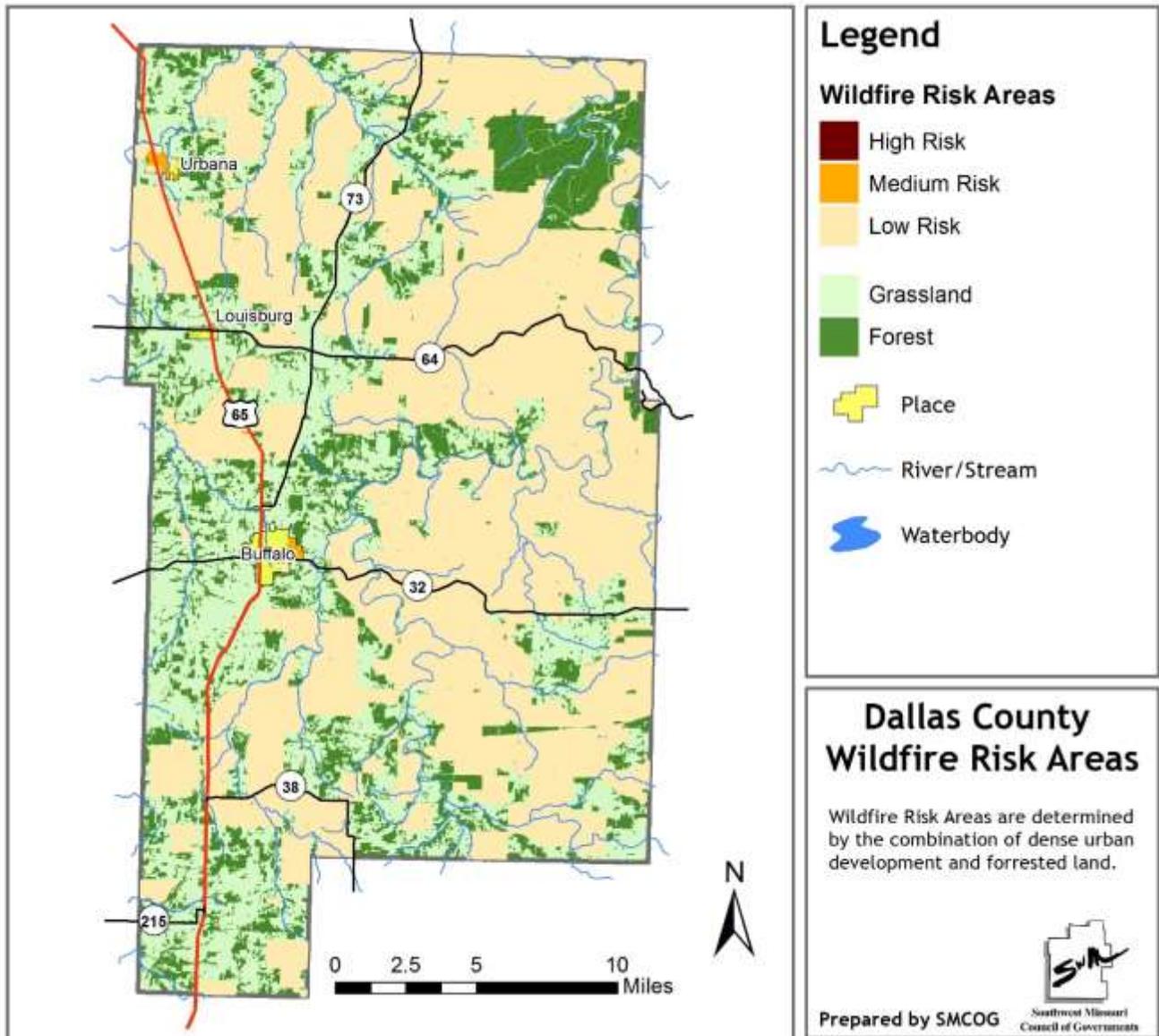
Most of Missouri fires occur during the spring season between February and May. The length and severity of both structural and wildland fires depend largely on weather conditions. Spring in Missouri is usually characterized by low humidity and high winds. These conditions result in higher fire danger. In addition, due to the recent lack of moisture throughout many areas of the state, conditions are likely to increase the risk of wildfires. Drought conditions can also hamper firefighting efforts, as decreasing water supplies may not prove adequate for firefighting. It is common for rural residents burn their garden spots, brush piles, and other areas in the spring. Some landowners also believe it is necessary to burn their forests in the spring to promote grass growth, kill ticks, and reduce brush. Therefore, spring months are the most dangerous for wildfires. The second most critical period of the year is fall. Depending on the weather conditions, a sizeable number of fires may occur between mid-October and late November.

Geographic Location

Damages due to wildfires would be higher in communities with more wildland–urban interface (WUI) areas. The term refers to the zone of transition between unoccupied land and human development and needs to be defined in the plan. Within the WUI, there are two specific areas identified: 1) Interface and

2) Intermix. The interface areas are those areas that abut wildland vegetation and the Intermix areas are those areas that intermingle with wildland areas. Each of the communities in Dallas County have some risk of wildfire; Urbana and then Buffalo have the largest areas of wildfire prone area. Members of the MPC noted that wildfires often occur in the northeast part of the county, in the forested area. There is less risk of fire and structure conflict, but fires in this area take a substantial amount of personnel and time due to limited access to the area. Firefighters often have to haul water on foot to put out the wildfires. **Figure 3.12** shows the Wildland/Urban Intermix areas in Dallas County.

Figure 3.12. Dallas County Wildland Intermix and Wildfire Prone Areas



Severity/Magnitude/Extent

Wildfires damage the environment, killing some plants and occasionally animals. Firefighters have been injured or killed, and structures can be damaged or destroyed. The loss of plants can heighten the risk of soil erosion and landslides. Although Missouri wildfires are not the size and intensity of those in the Western United States, they could impact recreation and tourism in and near the fires.

Wildland fires in Missouri have been mostly a result of human activity rather than lightning or some other natural event. Wildfires in Missouri are usually surface fires, burning the dead leaves on the ground or dried grasses. They do sometimes “torch” or “crown” out in certain dense evergreen stands like eastern red cedar and shortleaf pine. However, Missouri does not have the extensive stands of evergreens found in the western US that fuel the large fire storms seen on television news stories.

While very unusual, crown fires can and do occur in Missouri native hardwood forests during prolonged periods of drought combined with extreme heat, low relative humidity, and high wind. Tornadoes, high winds, wet snow and ice storms in recent years have placed a large amount of woody material on the forest floor that causes wildfires to burn hotter and longer. These conditions also make it more difficult for fire fighters suppress fires safely.

Often wildfires in Missouri go unnoticed by the general public because the sensational fire behavior that captures the attention of television viewers is rare in the state. Yet, from the standpoint of destroying homes and other property, Missouri wildfires can be quite destructive.

The most significant wildfire in Dallas County in the past decade was in 2010 when 2,855 acres near Lead Mine Conservation Area were burned on March 31. The primary responder was a road patrol. Eighteen hand crews, 1 dozer, 5 water units, and 1 airplane were used to fight the blaze. There was one threatened residence. No damaged properties, injuries, or fatalities occurred.

Previous Occurrences

According to MDC wildfire data, there have been 649 wildfires reported in Dallas County from 2008 – 2017. A total of 32,427 acres were burned as a result of these reported wildfires. In addition, 32 buildings were destroyed which include residential, commercial, and outbuildings. Twenty-three buildings have been damages and 1,095 building threatened by wildfires. **Table 3.26** contains MDC wildfire statistics by year. No schools or special districts reported any fire incidents that impacted their facilities.

Table 3.26. Dallas County Wildfires 2008 – 2017

Year	Number of Wildfires	Buildings Destroyed	Buildings Damaged	Buildings Threatened	Acres Burned
2008	45	1	1	24	952
2009	52	7	6	130	2,571.2
2010	50	2	0	55	4,540.13
2011	78	2	2	106	3,148.2
2012	121	14	7	451	11,579.67
2013	27	2	0	44	247.11
2014	118	3	1	149	5,496.01
2015	59	0	3	60	395.25
2016	52	1	2	45	2,923
2017	47	0	1	31	575
Total	649	32	23	1,095	32,427.57

Source: <https://mdc6.mdc.mo.gov/Applications/MDCFireReporting/Home/FireReportSearch>

Probability of Future Occurrence

There were a total of 649 reported wildfires from 2008-2017, with several events in each year. This equates to a 100% probability of wildfire in Dallas County in any given year, with an average of 64.9 events per year.

Vulnerability

Vulnerability Overview

Wildfires occur throughout wooded and open vegetation areas of Missouri. They can occur any time of the year, but mostly occur during long, dry hot spells. Any small fire, if not quickly detected and suppressed, can get out of control. Most wildfires are caused by human carelessness or negligence. However, some are precipitated by lightning strikes and in rare instances, spontaneous combustion. Structures and people in WUI areas in the county and cities are more vulnerable to the impact of wildfires due to the level of fuel mixed with structures.

Potential Losses to Existing Development

On average, 3.2 structures are destroyed and 2.3 structures are damaged by wildfires annually in Dallas County. Approximately, 109 structures are threatened and 3,242 acres of land are burned on average, annually.

Impact of Previous and Future Development

It is anticipated that there will be future development in WUI areas throughout unincorporated areas of the county. Future growth in WUI areas of the county will increase the risk and exposure to wildfires. It is expected that WUI development in cities will be mitigated by development regulations reducing the risk to wildfire hazard.

Impact of Climate Change

As stated in section 3.4.2, an analysis by the Natural Resources Defense Council found that climate change may increase the risk for water shortage, thus increasing the difficulty in extinguishing wildfires. Climate change may also increase the number of extreme heat and drought days, which may increase the probability of wildfire events.

Hazard Summary by Jurisdiction

Table 3.27 summarized the structure exposure for Dallas County and jurisdictions. Structure counts and exposure values were derived from overlaying parcel data from the Dallas County assessor with the WUI data. The exposure amounts indicates the dollar amount of assets at risk and the variability of vulnerability from place to place.

Table 3.27. Wildfire Structure Exposure by Jurisdiction

Jurisdiction	Residential	Commercial	Agriculture	Exposure (\$)
Buffalo	\$964,380	\$3,900	\$16,820	\$985,100
Village of Louisburg	\$101,390	\$72,130	\$3,060	\$176,580
Unincorporated County	\$13,745,110	\$576,000	\$1,685,620	\$16,006,730
Non-Participating Jurisdictions	\$1,159,560	\$752,410	\$34,170	\$1,946,140
Dallas County Total	\$15,970,440	\$1,404,440	\$1,739,670	\$19,114,550

Problem Statement

Wildfire occurrences are very frequent within Dallas County. These events can destroy, damage, and threaten structures in hazard prone areas. Populations and structures in WUI areas of the county have an increased risk to wildfires due to the level of fuel mixed with structures. Table 3.27 indicates that of the participating incorporated jurisdictions of Dallas County, Buffalo has the highest risk of wildfires. Cities that have adopted landscape ordinances can include fire safe landscape design requirements in these areas. Cities that have building codes or design requirements may also encourage noncombustible materials for new construction.

The unincorporated part of the county has the highest risk and exposure to wildfires. County officials and rural fire districts can promote fire resistant construction materials and landscape design techniques to mitigate the risk to wildfire in future development. Information about these materials and techniques are included in the MDC publication, *Living with Wildfire*. Including this information in education and awareness programs for the public may potentially mitigate wildfire damage in the county.

3.4.6 Flooding (Flash and River)

Some specific sources for this hazard are:

- Watershed map, Environmental Protection Agency, <https://cfpub.epa.gov/surf/locate/index.cfm>
- FEMA Map Service Center, Digital Flood Insurance Rate Maps (DFIRM) for all jurisdictions, if available, msc.fema.gov/portal
- NFIP Community Status Book, <http://www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-status-book>
- NFIP claims status, BureauNet, <http://bsa.nfipstat.fema.gov/reports/reports.html>
- Flood Insurance Administration—Repetitive Loss List (this must be requested from the State Floodplain Management agency or FEMA)
- National Climatic Data Center, Storm Events Database, <http://www.ncdc.noaa.gov/stormevents/>
- USDA Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/data/cause>

Hazard Profile

Hazard Description

A flood is partial or complete inundation of normally dry land areas. Riverine flooding is defined as the overflow of rivers, streams, drains, and lakes due to excessive rainfall, rapid snowmelt, or ice. There are several types of riverine floods, including headwater, backwater, interior drainage, and flash flooding. Riverine flooding is defined as the overflow of rivers, streams, drains, and lakes due to excessive rainfall, rapid snowmelt or ice melt. The areas adjacent to rivers and stream banks that carry excess floodwater during rapid runoff are called floodplains. A floodplain is defined as the lowland and relatively flat area adjoining a river or stream. The terms “base flood” and “100- year flood” refer to the area in the floodplain that is subject to a one percent or greater chance of flooding in any given year. Floodplains are part of a larger entity called a basin, which is defined as all the land drained by a river and its branches.

Flooding caused by dam is discussed in Section 3.4.1. It will not be addressed in this section.

A flash flood occurs when water levels rise at an extremely fast rate as a result of intense rainfall over a brief period, sometimes combined with rapid snowmelt, ice jam release, frozen ground, saturated soil, or impermeable surfaces. Flash flooding can happen in Special Flood Hazard Areas (SFHAs) as delineated by the National Flood Insurance Program (NFIP), and can also happen in areas not associated with floodplains.

Ice jam flooding is a form of flash flooding that occurs when ice breaks up in moving waterways, and then stacks on itself where channels narrow. This creates a natural dam, often causing flooding within minutes of the dam formation.

In some cases, flooding may not be directly attributable to a river, stream, or lake overflowing its banks. Rather, it may simply be the combination of excessive rainfall or snowmelt, saturated ground, and inadequate drainage. With no place to go, the water will find the lowest elevations – areas that are often not in a floodplain. This type of flooding, often referred to as sheet flooding, is becoming increasingly prevalent as development outstrips the ability of the drainage infrastructure to properly carry and disburse the water flow.

Most flash flooding is caused by slow-moving thunderstorms or thunderstorms repeatedly moving over

the same area. Flash flooding is a dangerous form of flooding which can reach full peak in only a few minutes. Rapid onset allows little or no time for protective measures. Flash flood waters move at very fast speeds and can move boulders, tear out trees, scour channels, destroy buildings, and obliterate bridges. Flash flooding can result in higher loss of life, both human and animal, than slower developing river and stream flooding.

In certain areas, aging storm sewer systems are not designed to carry the capacity currently needed to handle the increased storm runoff. Typically, the result is water backing into basements, which damages mechanical systems and can create serious public health and safety concerns. This combined with rainfall trends and rainfall extremes all demonstrate the high probability, yet generally unpredictable nature of flash flooding in Dallas County.

Although flash floods are somewhat unpredictable, there are factors that can point to the likelihood of flash floods occurring. Weather surveillance radar is being used to improve monitoring capabilities of intense rainfall. This, along with knowledge of the watershed characteristics, modeling techniques, monitoring, and advanced warning systems has increased the warning time for flash floods.

Geographic Location

Riverine flooding is most likely to occur in Special Flood Hazard Areas (SFHAs) where the 100-year floodplain has been mapped. Areas along the Niangua River and Brush Creek, primarily in unincorporated Dallas County have the greatest impact to riverine and flash floods. According to the NCEI storm event data from 1998-2017, there were 29 riverine flood events and 70 flash flood events recorded in the county. These events are typically regional in nature; however, flash floods can be contained to one area, specifically portions of highways or roads. **Figures 3.13 through 3.15** are mapped SFHAs for participating communities and unincorporated areas in Dallas County.

Figure 3.13. Dallas County SFHAs with Critical Facilities

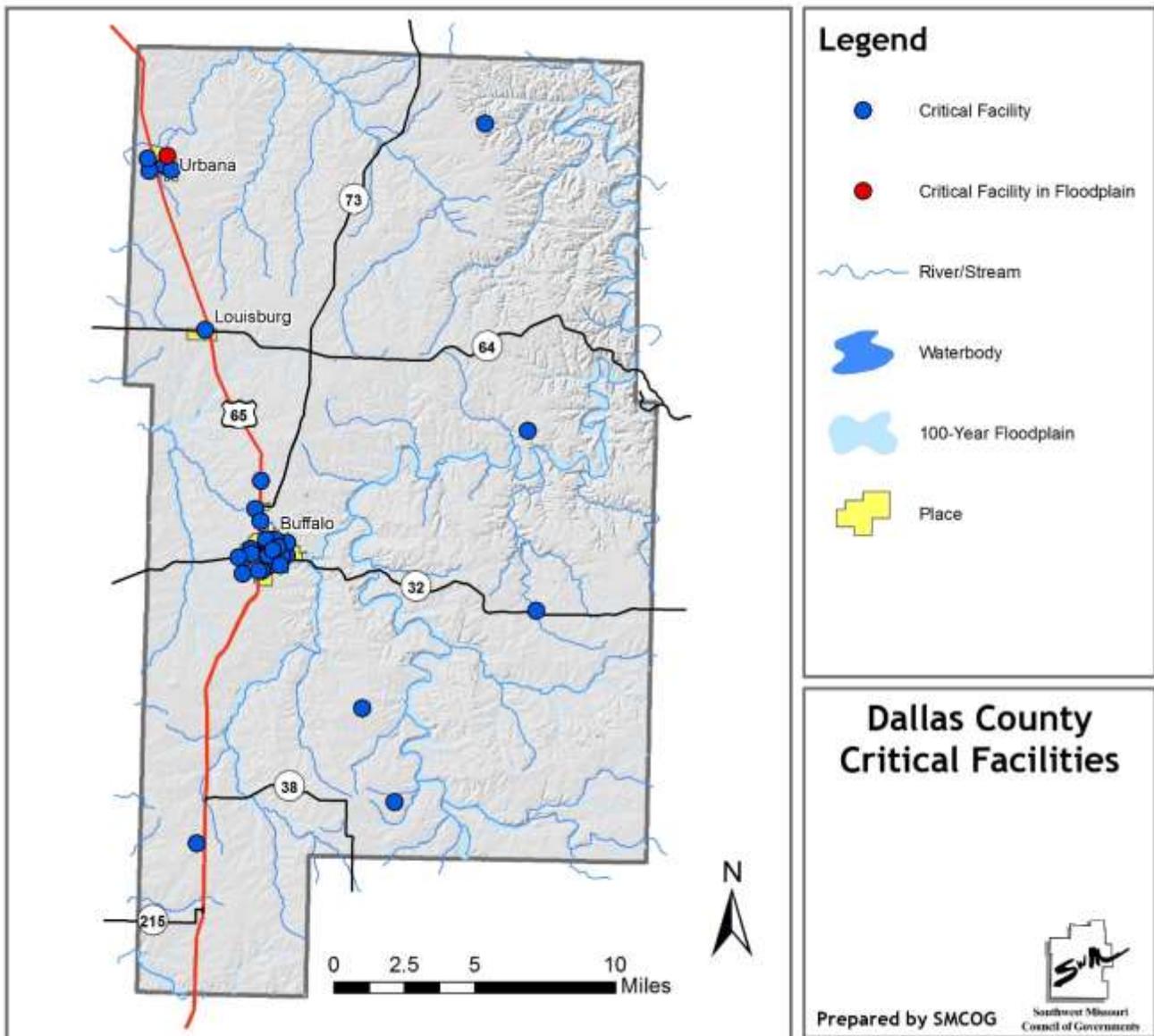


Figure 3.14. City of Buffalo SFHAs with Critical Facilities

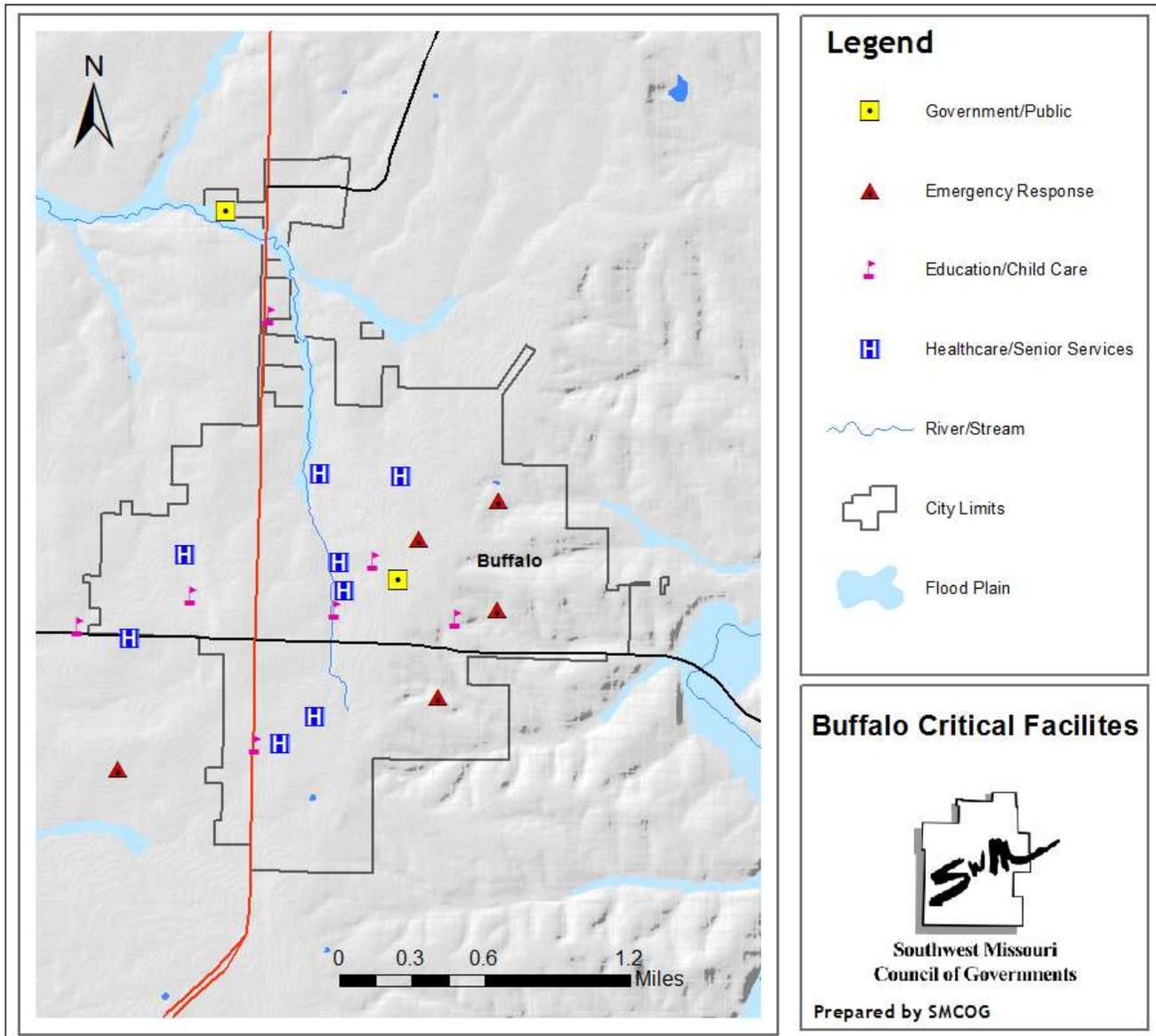
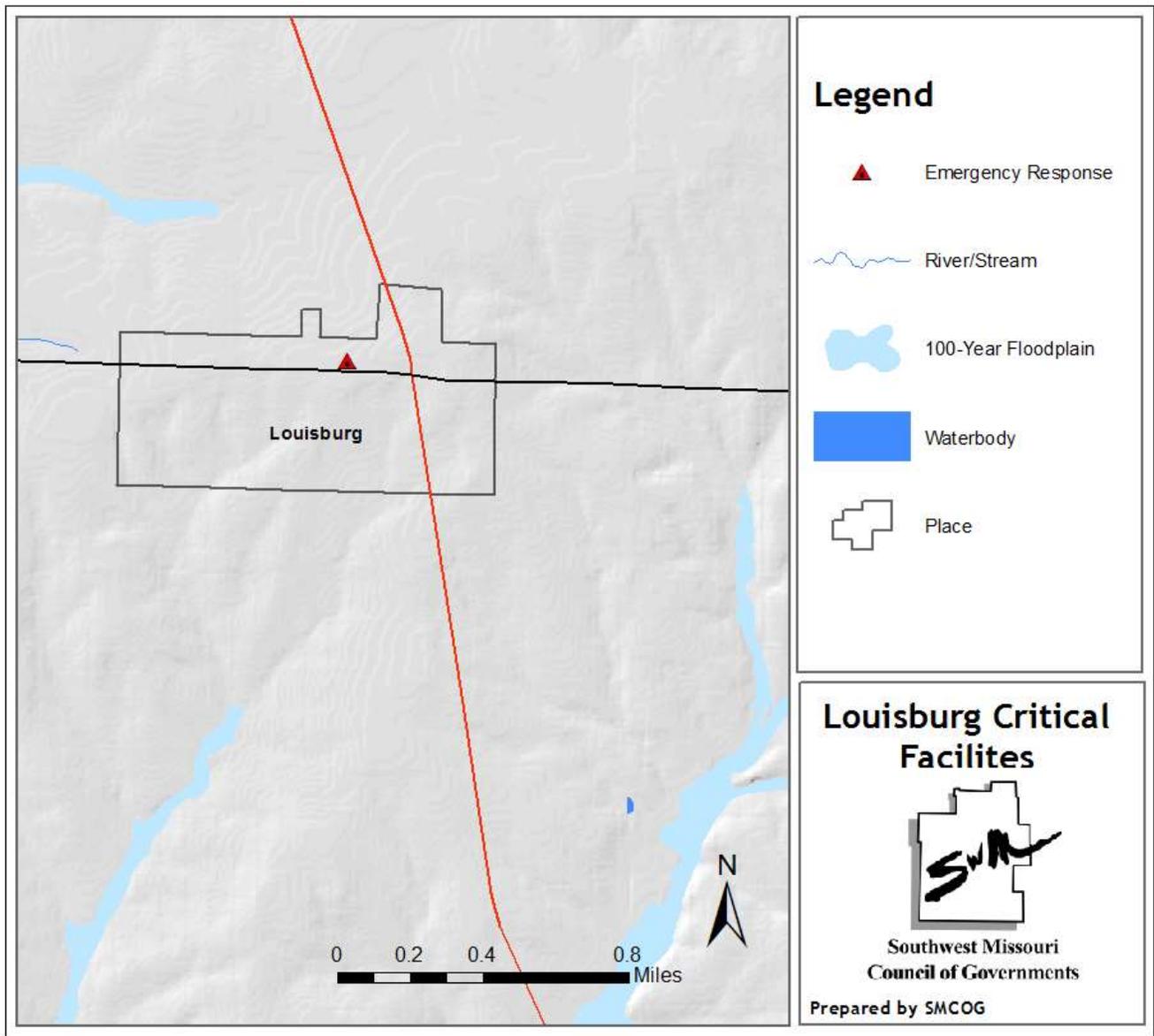


Figure 3.15. Village of Louisburg SFHAs with Critical Facilities



Flash flooding events pose the most pervasive hazard of the two flood types in the county due to permeability of soils, slopes, increasing urban development and extensive network of streams and rivers. Sustained rainfall or downpours at the rate of one inch per hour have caused street flooding in incorporated areas and made a significant number of low water crossings impassible. Flash flooding occurs in the floodplain while low-lying areas in all jurisdictions are susceptible to flash floods outside the 100-year floodplain. They also occur in areas without adequate drainage to carry away the amount of water that falls during intense rainfall events. A review of the NCEI storm event database determined which jurisdictions are most prone to flooding and flash flooding from 1998 to 2017 are listed in **Table 3.28** and **Table 3.29**.

Table 3.28. Dallas County NCEI Flood Events by Location, 1998-2017

Location	#of Events
Unincorporated Dallas County	12
Low water crossings, rivers, streams countywide: 05/08/2002, 05/12/2002, 01/05/2005, 01/12/2005, 11/25/2010, 07/04/2016	
Near Route OO/Niangua River: 3/22/2010	
Near Hayes Road along Greasy Creek: 04/25/2011	
Near Route 32 and Niangua River: 08/10/2013	
Near State Highway E: 05/03/2017	
Near State Highway P: 05/03/2017	
City of Buffalo	8
General Flooding: 06/02/2007, 03/14/2011, 05/19/2011	
Route C flooding: 01/24/2010, 03/25/2010, 05/20/2010, 05/20/2011	
Severe Storms and Tornados: 05/14/2010	
Village of Louisburg	5
General Flooding: Near Highway C 03/03/2008, 03/26/2010, 03/26/2010	
Near Huckaby Road: 07/03/2016, 07/03/2016	

Source: National Centers for Environmental Information, <https://www.ncdc.noaa.gov/stormevents>

The NCEI storm event data lists flash flood events according to the nearest community or place. Most of these events cover larger areas than the smaller geographic areas reported in the data. Some specific locations are listed with the narratives for flash flood events. Where specific roads and located are listed they are provided in the table. Although some events may not be inside the corporate limits of the community identified in the narrative, they are in such proximity that the community named would be the most affected by impassible roads. It is safe to assume that numerous low water crossings would be impacted by heavy rains that exacerbate flash flooding across the county. In addition, multiple records are related to the same event and vice versa.

Table 3.29. Dallas County NCEI Flash Flood Events by Location, 1998-2017

Location	# of Events
Unincorporated Dallas County	33
General Flash Flooding County Wide: 03/19/1998, 10/05/1998, 05/04/1999, 07/12/2000, 05/29/2006, 06/01/2007, 11/15/2009, 06/16/2013, 06/19/2015, 07/01/2015, 12/26/2015	
Bennett Spring State Park: 12/26/2015	
Niangua River: 07/01/2015	
Route E: 08/05/2013, 07/01/2015, 09/16/2016, 04/29/2017	
Highway AA: 06/28/2008	
Highway B: 08/10/2013, 07/01/2015, 07/14/2016	
Route P: 07/01/2015, 07/14/2016	
Highway PP: 05/29/2006	
Highway UU: 09/16/2016	
Highway 32: 07/01/2015	

Highway 65: 09/16/2016	
Highway 215: 06/01/2007, 09/21/2009	
Highway 171: 06/11/2007	
Bannon Road: 12/26/2015	
Hackberry Road: 07/01/2015	
Steelman Road: 07/02/2015	
County Road 73-32: 08/05/2008	
City of Buffalo	24
General Flash Flooding: 05/12/2002, 08/02/2003, 08/20/2007, 06/15/2008, 06/16/2013	
Highway 65: 11/01/2004, 07/10/2006, 07/01/2015	
Highway 32: 01/05/2005, 08/21/2005, 09/10/2007	
Spruce Street and Jefferson Street: 06/16/2013, 06/16/2013	
Autoscope Road and Hickory Street: 07/01/2015	
Kelley Road: 02/05/2008	
Highway C: 05/07/2008, 06/02/2008, 06/02/2008, 09/14/2008, 10/29/2009, 03/20/2010, 05/14/2010, 09/01/2010, 09/16/2010	
Village of Louisburg	6
General Flash Flooding: 03/18/2008, 03/31/2008	
Highway B: 01/12/2005	
Highway C: 04/22/2008, 11/15/2009, 12/23/2009	

Source: National Centers for Environmental Information, <https://www.ncdc.noaa.gov/stormevents>

As shown in the tables above, there are some specific areas that are more prone to flooding. Low water crossings across the county are at a high risk to flooding, but Routes E and B in unincorporated Dallas County have a high occurrence of flash flooding. Highways 65, 32, and C have located that flood frequently within the city limits of Buffalo. Highway C also floods in the Village of Louisburg boundaries. Additionally, the County noted that the west side of a low water bridge on Thomasville Road goes under water nearly every time it rains.

Severity/Magnitude/Extent

Missouri has a long and active history of flooding over the past century, according to the 2010 State Hazard Mitigation Plan. Flooding along Missouri’s major rivers generally results in slow-moving disasters. River crest levels are forecast several days in advance, allowing communities downstream sufficient time to take protective measures, such as sandbagging and evacuations. Nevertheless, floods exact a heavy toll in terms of human suffering and losses to public and private property. By contrast, flash flood events in recent years have caused a higher number of deaths and major property damage in many areas of Missouri.

Flooding presents a danger to life and property, often resulting in injuries, and in some cases, fatalities. Floodwaters themselves can interact with hazardous materials. Hazardous materials stored in large containers could break loose or puncture as a result of flood activity. Examples are bulk propane tanks. When this happens, evacuation of citizens is necessary.

Public health concerns may result from flooding, requiring disease and injury surveillance. Community sanitation to evaluate flood-affected food supplies may also be necessary. Private water and sewage sanitation could be impacted, and vector control (for mosquitoes and other entomology concerns) may be necessary.

When roads and bridges are inundated by water, damage can occur as the water scours materials around bridge abutments and gravel roads. Floodwaters can also cause erosion undermining road beds. In some instances, steep slopes that are saturated with water may cause mud or rock slides onto roadways. These damages can cause costly repairs for state, county, and city road and bridge maintenance departments. When sewer back-up occurs, this can result in costly clean-up for home and business owners as well as present a health hazard.

National Flood Insurance Program (NFIP) Participation

Table 3.30 provides details on NFIP participation for the participating communities in Dallas County. **Table 3.31** shows the number of policies in force, amount of insurance in force, number of closed losses, and total payments for Dallas County. Buffalo is an NFIP participant but due to NFIP ordinance enforcement, there are no structures in the floodplain thus no NFIP policies in place. The Village of Louisburg is not an NFIP participate, and the City of Urbana is an NFIP participate, but did not participate in this plan update. No Dallas County jurisdictions have been NFIP sanctioned or rescinded.

Table 3.30. NFIP Participation in Dallas County

Community ID #	Community Name	NFIP Participant (Y/N)	Current Effective Map Date	Regular- Emergency Program Entry Date
290797	Dallas County	Y	4/19/10	6/30/11
290739	City of Buffalo	Y	4/19/10	11/14/07

Source: NFIP Community Status Book, 9/26/2013; BureauNet, <http://www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-status-book>; M= No elevation determined – all Zone A, C, and X; NSFHA = No Special Flood Hazard Area; E=Emergency Program

Table 3.31. NFIP Policy and Claim Statistics as of 2017

Community Name	Policies in Force	Insurance in Force	Closed Losses	Total Payments
Dallas County	9	\$2,380,000	2	\$27,937.62

Source: NFIP Community Status Book, 2017; BureauNet, <http://bsa.nfipstat.fema.gov/reports/reports.html>; *Closed Losses are those flood insurance claims that resulted in payment. Loss statistics are for the period from [date] to [date].

Repetitive Loss/Severe Repetitive Loss Properties

Repetitive Loss Properties are those properties with at least two flood insurance payments of \$5,000 or more in a 10-year period.

Severe Repetitive Loss (SRL): A SRL property is defined it as a single family property (consisting of one-to-four residences) that is covered under flood insurance by the NFIP; and has (1) incurred flood-related damage for which four or more separate claims payments have been paid under flood insurance coverage with the amount of each claim payment exceeding \$5,000 and with cumulative amounts of such claims payments exceeding \$20,000; or (2) for which at least two separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

According to the Flood Insurance Administration, there are no repetitive or severe repetitive loss properties in Dallas County.

Previous Occurrences

According to the NCEI storm event data, there were 29 riverine flood and 70 flash flood events recorded in Dallas County from 1998-2017. Five riverine flood events resulted in damage and nine flash flood events were damaging. The most recent damaging event occurred in April of 2017 when several rounds of severe thunderstorms occurred across southwest Missouri, resulting in disaster declaration 4317. Dallas County was also included in the presidential disaster declaration 4250 during major flooding across the state in December 2015. Numerous roads, bridges, and low water crossings were damaged. **Table 3.32** summarizes flash flood events by year from 1998-2017 in Dallas County.

Table 3.32. NCEI Dallas County Flash Flood Events Summary, 1998 to 2017

Year	# of Events	# of Deaths	# of Injuries	Property Damages	Crop Damages
1998	2	0	0	\$0	\$0
1999	1	0	0	\$0	\$0
2000	1	0	0	\$0	\$0
2001	0	0	0	\$0	\$0
2002	1	0	0	\$0	\$0
2003	1	0	0	\$0	\$0
2004	1	0	0	\$0	\$0
2005	3	0	0	\$0	\$0
2006	2	0	0	\$0	\$0
2007	4	0	0	\$50,000	\$0
2008	16	0	0	\$1,000	\$0
2009	7	1	0	\$5,000	\$0
2010	4	0	0	\$0	\$0
2011	0	0	0	\$0	\$0
2012	0	0	0	\$0	\$0
2013	6	0	0	\$275,000	\$0
2014	0	0	0	\$0	\$0
2015	14	1	0	\$525,000	\$0
2016	5	0	0	\$10,000	\$0
2017	2	0	0	\$100,000	\$0
Total	70	2	0	\$966,000	\$0

Source: NCEI, <https://www.ncdc.noaa.gov/stormevents>; data accessed January 2018

Table 3.33 summarized riverine flood events by year from 1998-2017 in Dallas County.

Table 3.33. NCEI Dallas County Riverine Flood Events Summary, 1998 to 2017

Year	# of Events	# of Deaths	# of Injuries	Property Damages	Crop Damages
1998	0	0	0	\$0	\$0
1999	0	0	0	\$0	\$0
2000	0	0	0	\$0	\$0
2001	0	0	0	\$0	\$0
2002	2	0	0	\$3,520,000	\$0
2003	0	0	0	\$0	\$0
2004	0	0	0	\$0	\$0
2005	2	0	0	\$0	\$0
2006	0	0	0	\$0	\$0
2007	1	0	0	\$0	\$0
2008	2	0	0	\$0	\$0
2009	0	0	0	\$0	\$0
2010	9	0	0	\$0	\$0
2011	5	0	0	\$0	\$0
2012	0	0	0	\$0	\$0
2013	1	0	0	\$130,000	\$0
2014	0	0	0	\$0	\$0
2015	1	0	0	\$0	\$0
2016	3	0	0	\$20,000	\$0
2017	3	0	0	\$0	\$0
Total	29	0	0	\$3,670,000	\$0

Source: NCDC, <https://www.ncdc.noaa.gov/stormevents>; data accessed January 2018

Probability of Future Occurrence

There have been a total of 99 reported flood events in Dallas County from 1998 to 2017 in the NCEI storm event database. Of those, 70 were flash floods. In this 20 year period, there were four years without any flash flood events, and seven years with damaging events. This equates to an 80% probability that there will be a flash flood event in any given year and a 35% probability of a damaging event in any given year. From 1998-2017 flash floods resulted in \$966,000 in property damage, or \$107,333 per damaging event. During the same time period there were 29 riverine flood events reported in Dallas County. These were spread out over 10 years, giving a 50% probability for a riverine flood in any given year and 1.45 events on average per year. Five of the 29 events resulted in \$3,670,000 in damage, or \$734,000 per damaging event, this equates to a 15% probability of a damaging riverine flood event in any given year.

Vulnerability

Vulnerability Overview

Flooding has been included in 13 of the 14 presidential disaster declarations that have included Dallas County. Periods of heavy rain falling at the rate of one inch per hour floods low water crossings throughout the county, making many roads impassable. This creates a severe threat to motorists that attempt to drive through flood waters over the roadway. Riverine flooding occurs less frequently than flash flooding. Although Dallas County has no SRL properties, property damage is still likely to occur to non-SRL properties. Low lying areas outside of the floodplain may also be frequently flooded. Flooding of streets has been reported in several of the communities and many highways are frequently covered with water during heavy rain events. Highway C has experienced substantial flooding across many communities. None of the participating communities have critical facilities in the floodplain, but Buffalo’s wastewater treatment plan is very close to the SFHA.

Potential Losses to Existing Development

Flood loss estimates were developed by selecting all parcels located within 100 feet of the 100-year floodplain to compile building counts by type for each participating municipality and the unincorporated parts of Dallas County. It is important to note that this method created building counts for areas outside of the 100-year floodplain, but in an effort to depict potential losses from flash flooding, those parcels were included. The summed valuations for all parcels within 100 feet of the 100-year floodplain would be more prone to flash flooding due to the proximity to the natural drainage features in the area.

Potential flood losses by building type by jurisdiction are presented in **Table 3.34**.

Table 3.34. Potential Flood Losses for Building Types by Jurisdiction

Jurisdiction	Residential	Commercial	Agricultural	Other	Total
Buffalo	3	0	2	5	10
Village of Louisburg	0	0	0	0	0
Unincorporated County	99	2	174	231	506
Dallas County Total	102	2	176	236	516

Source: Dallas County Parcel Data

Table 3.35 provides the total exposure for structures and contents by building type and jurisdiction. Losses were estimated by applying a 5% damage factor to total exposure.

Table 3.35. Total Flood Exposure and Estimated Losses by Jurisdiction

Jurisdiction	Residential	Commercial	Agricultural	Other	Total
Buffalo	\$100,601.75	\$0.00	\$1,306.47	\$1,953.38	\$103,861.60
Village of Louisburg	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Unincorporated County	\$496,524.28	\$52,066.49	\$904,726.53	\$53,608.61	\$1,506,925.91
Dallas County Total	\$597,126.03	\$52,066.49	\$906,033.00	\$55,561.99	\$1,610,787.51

Source: Dallas County Parcel Data

None of the participating communities have critical facilities in the floodplain, but Buffalo's wastewater treatment plan is very close to the SFHA.

Table 3.36 provides a summary of estimated damages and losses for Dallas County from the 2013 State Hazard Mitigation Plan.

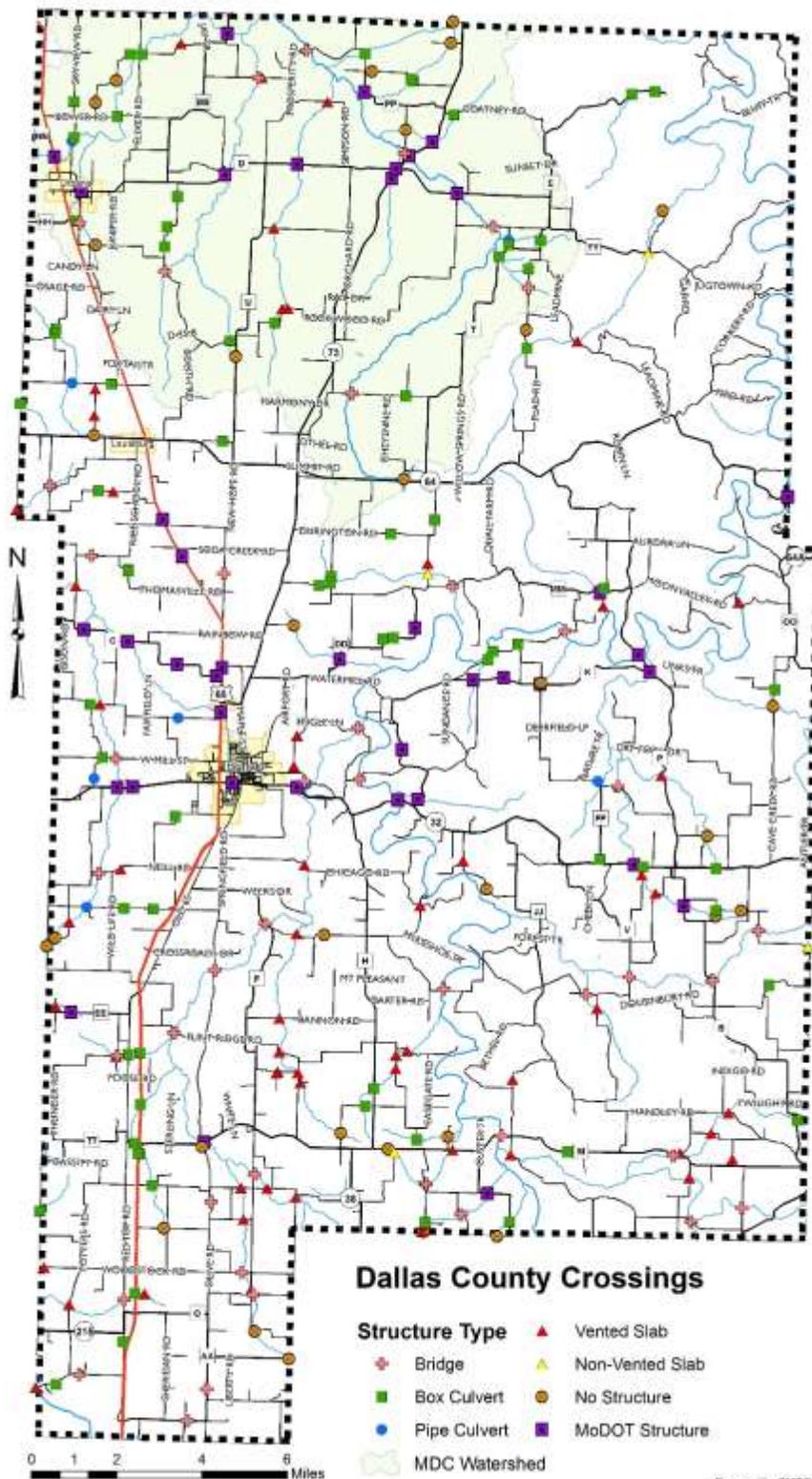
Table 3.36. Total Flood Potential Damage from 2013 State Plan

Jurisdiction	Structural Damage	Contents Damage	Inventory Loss	Total Direct Loss	Total Income loss	Total Direct and Income Loss	Calc. Loss Ratio
Dallas County	\$8,149,073.43	\$5,650,895.54	\$112,482.28	\$13,912,451.25	\$117,838.58	\$14,030,289.83	2.0

Low Water Crossings

Damage to low water crossings due to flooding is a significant fiscal problem for communities. In the fall of 2017, an inventory of all low water crossings in Dallas County was conducted. Data gathered included condition, type of structure, measurements, and flooding risk. The inventory showed that there are 206 county-maintained water crossings of all types in Dallas County. At the time of the inventory, there were 56 in good condition, 130 in fair condition, and 28 in poor condition. **Figure 3.16** shows the locations and conditions of all crossings in Dallas County.

Figure 3.16. Dallas County Low Water Crossings

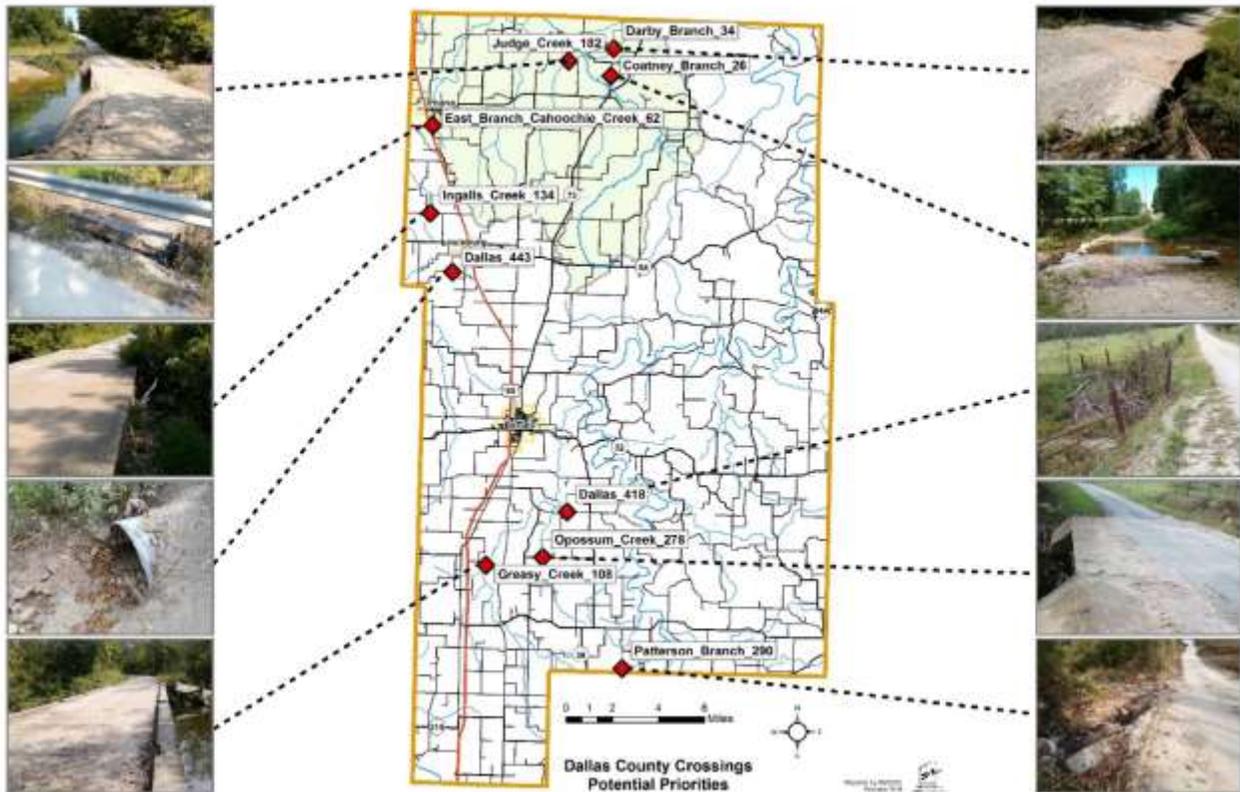


Prepared by SMCOG
February 2013



The data from the inventory was used to determine the top ten priority crossings for replacement and/or upgrading in Dallas County based on several factors. **Figure 3.17** shows the location of the ten priority crossings and includes a picture of each crossing. Many of these crossings are repeatedly damaged during heavy rain events and need substantial improvements or upgrades in order to increase resiliency towards flooding.

Figure 3.17. Dallas County Low Water Crossings Priorities



Impact of Previous and Future Development

Future development could impact flash and riverine flooding in Dallas County. Development in low-lying areas near rivers and streams or where interior drainage systems are not adequate to provide drainage during heavy rainfall events will be at risk to flash flooding. Future development would also increase impervious surfaces causing additional water run-off and drainage problems during heavy rainfall events.

Hazard Summary by Jurisdiction

All local jurisdictions in the county are at risk to flood hazards; however, as demonstrated in Table 3.35 exposure of assets near SFHAs varies among jurisdictions. It should be noted that all of these communities can be impacted by flooding of major roads and low water crossings in the areas proximate to their corporate limits. Several incorporated areas in the county are susceptible to street flooding during periods of heavy rain as evidenced by the previous occurrences by location in Table 3.28 and 3.29. Due to previous flood events, some county bridges have had to be replaced. The greatest impact of flooding is in the unincorporated part of the county. Often one of the largest issues is the amount of debris left over after a flood event. Due to the topography and many streams in the

county, numerous low water crossings are damaged and create a significant hazard to public safety during flood events.

Community Comments

Nineteen survey respondents stated that flooding was likely or highly likely to occur and impact their jurisdiction. The impact of flooding (flash and river) was in the top five threats felt by residents in all jurisdictions. Three respondents felt that flooding could have a catastrophic impact and eight felt it would be of critical impact. Residents were in general supportive of flood mitigation techniques, including structure elevation, minor localized flood reduction projects, and flood prone property acquisition and structure demolition.

Problem Statement

Floods are frequent events and have been listed in all but one of the presidential disaster declarations that have included Dallas County. Dallas County and the City of Buffalo have passed floodplain management ordinances and have the ability to substantially regulate development in the floodplain. Participation in the NFIP enables residents to purchase flood insurance. Street flooding in incorporated areas can be addressed through storm water management projects and enforcing storm water management regulations.

Several million dollars in property damage has resulted in the numerous flood events in the past two decades. The most significant impacts have been to the unincorporated county. To reduce the damage of floods to infrastructure and human life, several strategies can be implemented, such as hazard awareness programs and waterway maintenance. Projects involving the improvements to river/stream embankments and debris removal can also reduce flooding to surrounding areas. The enforcement of NFIP ordinances, and the purchase and demolition, elevation, or flood proofing of structures in the floodplain would also minimize the impact of flooding.

3.4.7 Land Subsidence/Sinkholes

Some specific sources for this hazard are:

- <http://www.dnr.mo.gov/geology/geosrv/envgeo/sinkholes.htm>
<http://strangesounds.org/2013/07/us-sinkhole-map-these-maps-show-that-around-40-of-the-u-s-lies-in-areas-prone-to-sinkholes.html>
- <http://www.businessinsider.com/where-youll-be-swallowed-by-a-sinkhole-2013-3>
- <http://water.usgs.gov/edu/sinkholes.html>
- <http://pubs.usgs.gov/fs/2007/3060/>

Hazard Profile

Hazard Description

Sinkholes are common where the rock below the land surface is limestone, carbonate rock, salt beds, or rocks that naturally can be dissolved by ground water circulating through them. As the rock dissolves, spaces and caverns develop underground. The sudden collapse of the land surface above them can be dramatic and range in size from broad, regional lowering of the land surface to localized collapse. However, the primary causes of most subsidence are human activities: underground mining of coal, groundwater or petroleum withdrawal, and drainage of organic soils. In addition, sinkholes can develop as a result of subsurface void spaces created over time due to the erosion of subsurface limestone (karst).

Land subsidence occurs slowly and continuously over time, as a general rule. On occasion, it can occur abruptly, as in the sudden formation of sinkholes. Sinkhole formation can be aggravated by flooding.

In the case of sinkholes, the rock below the surface is rock that has been dissolving by circulating groundwater. As the rock dissolves, spaces and caverns form, and ultimately the land above the spaces collapse. In Missouri, sinkhole problems are usually a result of surface materials above openings into bedrock caves eroding and collapsing into the cave opening. These collapses are called "cover collapses" and geologic information can be applied to predict the general regions where collapse will occur. Sinkholes range in size from several square yards to hundreds of acres and may be quite shallow or hundreds of feet deep.

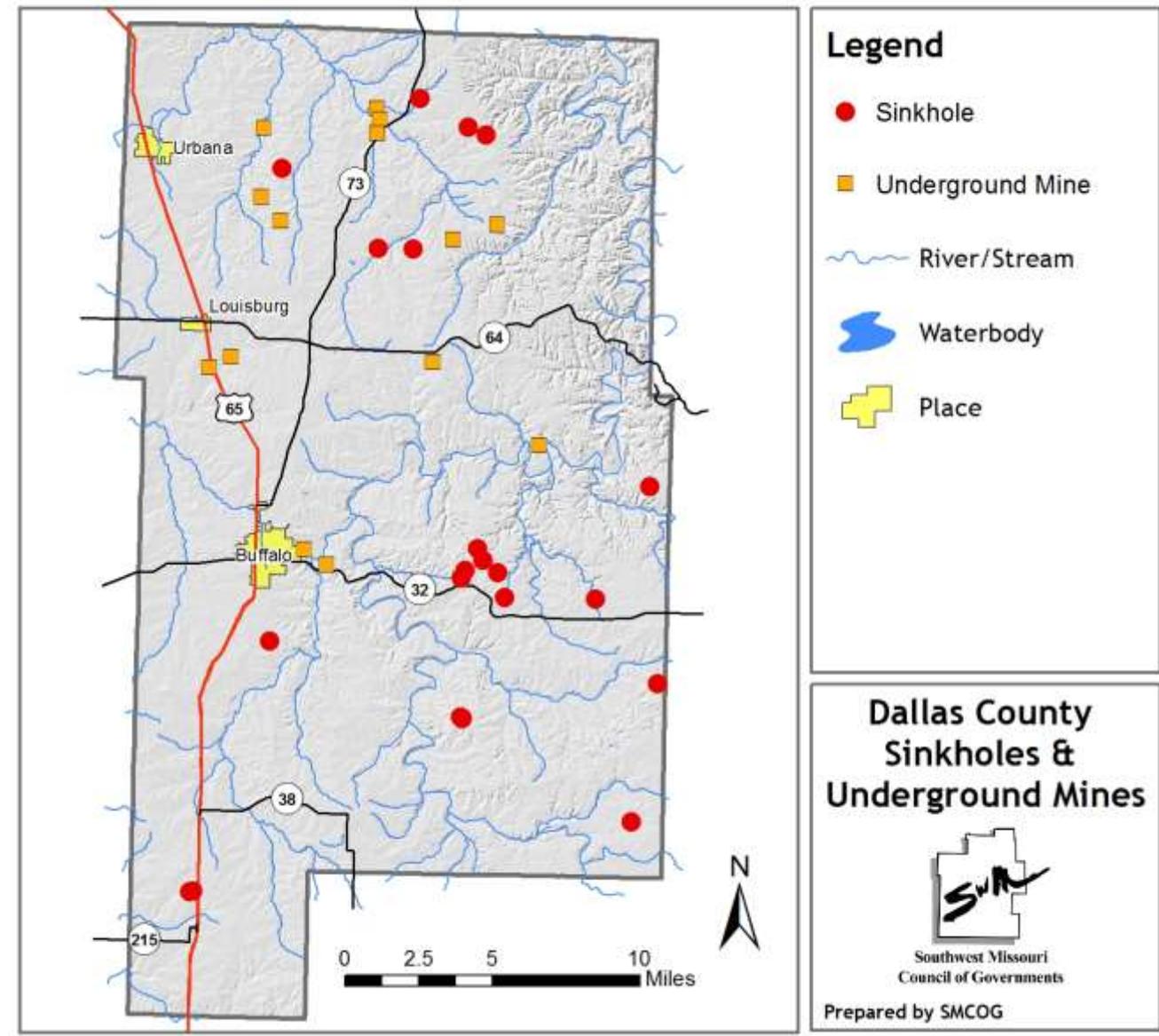
According to the U.S. Geological Survey (USGS), the most damage from sinkholes tends to occur in Florida, Texas, Alabama, Missouri, Kentucky, Tennessee, and Pennsylvania. Fifty-nine percent of Missouri is underlain by thick, carbonate rock that makes Missouri vulnerable to sinkholes. Sinkholes occur in Missouri on a fairly frequent basis. Most of Missouri's sinkholes occur naturally in the State's karst regions (areas with soluble bedrock). They are a common geologic hazard in southern Missouri, but also occur in the central and northeastern parts of the State. Missouri sinkholes have varied from a few feet to hundreds of acres and from less than one to more than 100 feet deep. The largest known sinkhole in Missouri encompasses about 700 acres in western Boone County southeast of where Interstate 70 crosses the Missouri River. Sinkholes can also vary in shape like shallow bowls or saucers whereas other have vertical walls. Some hold water and form natural ponds.

According to Missouri Department of Natural Resources, Inventory of Mines, Occurrences, and Prospects database, there are 15 mines in Dallas County. Fourteen are past producers and are no longer in use. Lead, limestone, coal, zinc, sand, and gravel have been historically the most common commodity mined; however, the 1 mine currently in operation extracts limestone.

Geographic Location

There seems to be a trend of sinkholes around the Little Niangua River in the northern part of the county, and there is a cluster of sinkholes between the Niangua River and Fourmile Creek in eastern-central Dallas County. The greatest concentrations of sinkholes in Dallas County include central Dallas County just north of highway 32 and in the north on the eastern side of highway 73. Urbana, Louisburg, and Buffalo have no sinkholes in them. **Figure 3.18** shows the location of sinkholes and underground mines in Dallas County.

Figure 3.18. Sinkholes and Underground mines in Dallas County, MO



Severity/Magnitude/Extent

Sinkholes vary in size and location, and these variances will determine the impact of the hazard. A sinkhole could result in the loss of a personal vehicle, a building collapse, or damage to infrastructure such as roads, water, or sewer lines. Groundwater contamination is also possible from a sinkhole.

Because of the relationship of sinkholes to groundwater, pollutants captured or dumped in sinkholes could affect a community's groundwater system. Sinkhole collapse could be triggered by large earthquakes. Sinkholes located in floodplains can absorb floodwaters but make detailed flood hazard studies difficult to model.

The 2013 State Plan included only seven documented sinkhole "notable events". The plan stated that sinkholes are common to Missouri and the probability is high that they will occur in the future. To date, Missouri sinkholes have historically not had major impacts on development nor have they caused serious damage. Thus, the severity of future events is likely to be low.

Previous Occurrences

There are 23 identified sinkholes in Dallas County. The most recently reported sinkhole occurred in March 2008. The collapse event occurred in a horse pasture south of Buffalo. It measured approximately 10 feet in diameter and was between 20 to 30 feet in depth. MPC members also noted a relatively recent sinkhole on the east side of Urbana, but no data could be found for details.

Probability of Future Occurrence

Sinkhole incidents are not tracked by the NCEI, and MDNR data was unavailable, so it is difficult to calculate a future probability of occurrence. However, using the one, maybe two, reported sinkholes in the last ten years, there is a moderate probability, approximately 10% in any given year, that there may be a new sinkhole in Dallas County in the next decade.

Vulnerability

Vulnerability Overview

The risk of sinkhole formation in Dallas County is moderate based on the carbonate bedrock in the area and the number of existing sinkholes reported throughout the county. While some sinkholes may be considered a slow changing nuisance; other more sudden, catastrophic collapses can destroy property, delay construction projects, contaminate ground water resources, and damage underground utilities. Unincorporated Dallas County has the highest vulnerability to sinkholes based on the known locations of existing sinkholes.

Potential Losses to Existing Development

Sinkhole loss estimates were established using GIS processes and appraised valuations. A sinkhole point shapefile acquired from MDNR was used to generate a half-mile buffer around each feature. The buffer layer was designated as the hazard prone areas for sinkholes. The map layer of the sinkhole hazard prone areas was used as an overlay on the parcel data to generate the loss estimates from this hazard by jurisdiction. Table 3.37 provides the building count by type and by jurisdiction based on the results of the sinkhole analysis. Table 3.38 provides a dollar amount for total exposure by jurisdiction and estimated losses. To calculate the potential losses, a damage factor of 0.5% was applied to the total exposure. The small damage factor of 0.5% was used because damage from a sinkhole is unlikely, and damage from a sinkhole is unlikely to be catastrophic.

Table 3.37. Sinkhole Exposure by Building Type by Jurisdiction

Jurisdiction	Residential	Commercial	Agriculture	Building Other	Building Count
Buffalo	0	0	0	0	0
Louisburg	0	0	0	0	0
Unincorporated County	473	3	324	1	801
Dallas County Total	473	3	324	1	801

Source: Missouri GIS Database

Table 3.38. Total Sinkhole Exposure and Estimated Losses by Jurisdiction

Jurisdiction	Residential	Commercial	Agriculture	Estimated Exposure	Estimated Loss
Buffalo	0	0	0	0	0
Louisburg	0	0	0	0	0
Unincorporated County	\$2,364,290	\$215,740	\$483,510	\$3,063,540	\$153,170
Dallas County Total	\$2,364,290	\$215,740	\$497,630	\$3,077,660	\$1,538,830

Source: Missouri GIS Database, Dallas County Parcel Data

None of the participating jurisdictions have a sinkhole within a half mile of the municipal limits.

Impact of Previous and Future Development

Future development over abandoned mines and in areas of known risk to sinkhole formation in Dallas County will increase vulnerability to this hazard. Population and development in these areas will increase exposure to sinkhole occurrence. There are currently no regulations prohibiting construction over or near known sinkholes. Future development may also change storm runoff patterns and cause expansion or formation of sinkholes.

Hazard Summary by Jurisdiction

The risk of sinkhole damage for individual communities and school districts is limited to the amount of exposure of buildings and infrastructure. Some parts of the county are more at risk for potential sinkhole formations such as areas around the Little Niangua River in the northern part of the county, and between the Niangua River and Fourmile Creek. None of the participating jurisdictions have structures at risk of sinkholes, but much of the unincorporated county is at risk.

Problem Statement

Sinkhole formation in urban areas compared to rural areas has the potential to be expedited due to human interaction with the subsurface through construction of facilities and infrastructure. Natural drainage patterns are altered, which can increase water volume and flow to areas more susceptible to sinkhole formation, thus increasing the potential for mobilization of sediment in the subsurface or increasing amount of dissolution of the underlying bedrock. A secondary problem that can arise once sinkhole formation has already occurred is flooding. During periods of excessive rainfall in the watershed of an existing sinkhole can cause water levels to rise faster than it can infiltrate into the ground through the soil of the sinkhole. When this happens, water can temporarily “back-up” to fill the sinkhole and may even “spill-over” into surrounding low-lying areas. In some cases, homes with “walk-out” basements are built along the sides of a sinkhole and, in those cases, the walk-out basement may become the low-lying “spill-over” area.

It is likely that more sinkholes will occur as development increases within the county. Sinkholes can be

remediated with fill material. Once a sinkhole has been remediated, building should be prohibited at the site. Existing sinkholes can expand if surface runoff erodes the edges of the sinkhole. Storm water runoff should be diverted away from known sinkholes. Jurisdictions may adopt regulations prohibiting construction at least 30 feet from known sinkholes. Information about identifying potential sinkhole formation and promoting Missouri FAIR plan sinkhole insurance can be included in public outreach and hazard awareness programs. Undeveloped land that is in a sinkhole risk area can be used for park space or other recreational purposes.

3.4.8 Thunderstorm/High Winds/Lightning/Hail

Some Specific Sources for this hazard are:

- FEMA 320, Taking Shelter from the Storm, 3rd edition, http://www.weather.gov/media/bis/FEMA_SafeRoom.pdf
- Lightning Map, National Weather Service, <http://www.vaisala.com/en/products/thunderstormandlightningdetectionsystems/Pages/NLDN.aspx>
- Death and injury statistics from lightning strikes, National Weather Service.
- Wind Zones in the U.S. map, FEMA, https://www.fema.gov/pdf/library/ism2_s1.pdf ;
- Annual Windstorm Probability (65+knots) map U.S. 1980-1994, NSSL, http://www.nssl.noaa.gov/users/brooks/public_html/bigwind.gif
- Hailstorm intensity scale, The Tornado and Storm Research Organization (TORRO), <http://www.torro.org.uk/site/hscale.php>;
- USDA Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/data/cause>
- National Severe Storms Laboratory – hail map, http://www.nssl.noaa.gov/users/brooks/public_html/bighail.gif

Hazard Profile

Hazard Description

Thunderstorms

A thunderstorm is defined as a storm that contains lightning and thunder which is caused by unstable atmospheric conditions. When cold upper air sinks and warm moist air rises, storm clouds or 'thunderheads' develop resulting in thunderstorms. This can occur singularly, as well as in clusters or lines. The National Weather Service defines a thunderstorm as "severe" if it includes hail that is one inch or more, or wind gusts that are at 58 miles per hour or higher. At any given moment across the world, there are about 1,800 thunderstorms occurring. Severe thunderstorms most often occur in Missouri in the spring and summer, during the afternoon and evenings, but can occur at any time. Other hazards associated with thunderstorms are heavy rains resulting in flooding (discussed separately in **Section 3.4.6**) and tornadoes (discussed separately in **Section 3.4.9**).

High Winds

A severe thunderstorm can produce winds causing as much damage as a weak tornado. The damaging winds of thunderstorms include downbursts, microbursts, and straight-line winds. Downbursts are localized currents of air blasting down from a thunderstorm, which induce an outward burst of damaging wind on or near the ground. Microbursts are minimized downbursts covering an area of less than 2.5 miles across. They include a strong wind shear (a rapid change in the direction of wind over a short distance) near the surface. Microbursts may or may not include precipitation and can produce winds at speeds of more than 150 miles per hour. Damaging straight-line winds are high winds across a wide area that can reach speeds of 140 miles per hour.

Lightning

All thunderstorms produce lightning which can strike outside of the area where it is raining and is has been known to fall more than 10 miles away from the rainfall area. Thunder is simply the sound that

lightning makes. Lightning is a huge discharge of electricity that shoots through the air causing vibrations and creating the sound of thunder.

Hail

According to the National Oceanic and Atmospheric Administration (NOAA), hail is precipitation that is formed when thunderstorm updrafts carry raindrops upward into extremely cold atmosphere causing them to freeze. The raindrops form into small frozen droplets. They continue to grow as they come into contact with super-cooled water which will freeze on contact with the frozen rain droplet. This frozen droplet can continue to grow and form hail. As long as the updraft forces can support or suspend the weight of the hailstone, hail can continue to grow before it hits the earth.

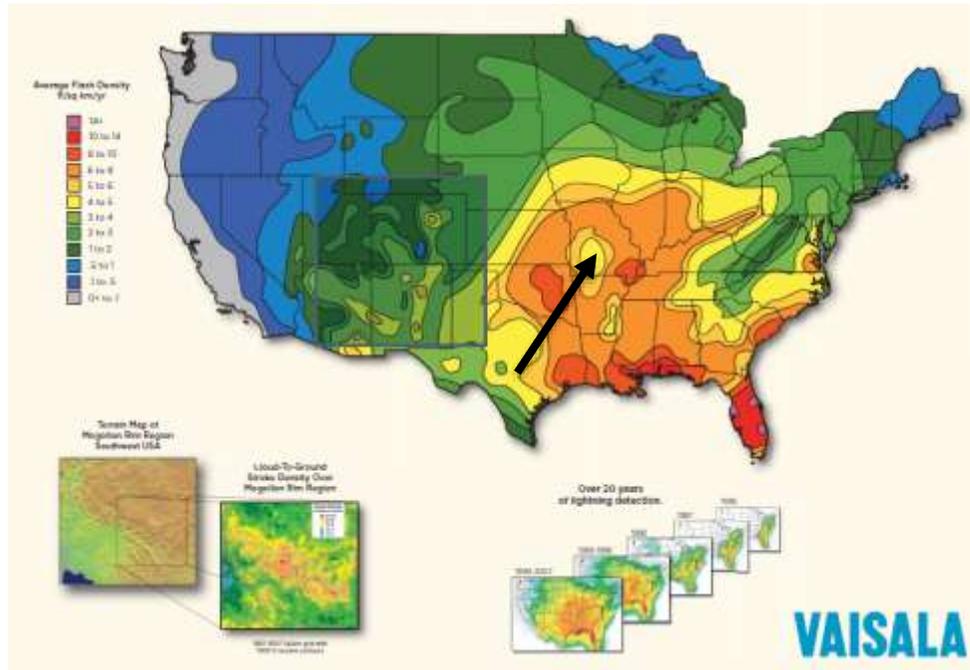
At the time when the updraft can no longer support the hailstone, it will fall down to the earth. For example, a ¼" diameter or pea sized hail requires updrafts of 24 miles per hour, while a 2 ¾" diameter or baseball sized hail requires an updraft of 81 miles per hour. According to the NOAA, the largest hailstone in diameter recorded in the United States was found in Vivian, South Dakota on July 23, 2010. It was eight inches in diameter, almost the size of a soccer ball. Soccer-ball-sized hail is the exception, but even small pea-sized hail can do damage.

Geographic Location

Thunderstorms/high winds/hail/lightning events are an area-wide hazard that can happen anywhere in the county. Although these events occur similarly throughout Dallas County, they are more frequently reported in the urbanized areas. In addition, damages are more likely to occur in more densely developed urban areas, such as Buffalo.

Figure 3.19 showing lightning frequency in the state. Dallas County lies in the 4-5 flash density zone in the map.

Figure 3.19. Location and Frequency of Lightning in Missouri



Source: National Weather Service, <http://www.vaisala.com/en/products/thunderstormandlightningdetectionsystems/Pages/NLDN.aspx>. Note: indicate location of planning area with a colored square or arrow.

Figure 3.20 shows wind zones in the United States, Dallas County is located in Zone IV, which can experience wind speeds of up to 250 mph.

Figure 3.20. Wind Zones in the United States



Source: FEMA 320, Taking Shelter from the Storm, 3rd edition, https://www.fema.gov/pdf/library/ism2_s1.pdf

Severity/Magnitude/Extent

Severe thunderstorm losses are usually attributed to the associated hazards of hail, downburst winds, lightning and heavy rains. Losses due to hail and high wind are typically insured losses that are localized and do not result in presidential disaster declarations. However, in some cases, impacts are severe and widespread and assistance outside state capabilities is necessary. Hail and wind also can have devastating impacts on crops. Severe thunderstorms/heavy rains that lead to flooding are discussed in the flooding hazard profile. Hailstorms cause damage to property, crops, and the environment, and can injure and even kill livestock. In the United States, hail causes more than \$1 billion in damage to property and crops each year. Even relatively small hail can shred plants to ribbons in a matter of minutes. Vehicles, roofs of buildings and homes, and landscaping are also commonly damaged by hail. Hail has been known to cause injury to humans, occasionally fatal injury.

In general, assets in the county vulnerable to thunderstorms with lightning, high winds, and hail include people, crops, vehicles, and built structures. Although this hazard results in high annual losses, private property insurance and crop insurance usually cover the majority of losses. Considering insurance coverage as a recovery capability, the overall impact on jurisdictions is reduced.

Most lightning damages occur to electronic equipment located inside buildings. But structural damage can also occur when a lightning strike causes a building fire. In addition, lightning strikes can cause damages to crops if fields or forested lands are set on fire. Communications equipment and warning transmitters and receivers can also be knocked out by lightning strikes.

Based on information provided by the Tornado and Storm Research Organization (TORRO), **Table 3.399** below describes typical damage impacts of the various sizes of hail.

Table 3.39. Tornado and Storm Research Organization Hailstorm Intensity Scale

Intensity Category	Diameter (mm)	Diameter (inches)	Size Description	Typical Damage Impacts
Hard Hail	5-9	0.2-0.4	Pea	No damage
Potentially Damaging	10-15	0.4-0.6	Mothball	Slight general damage to plants, crops
Significant	16-20	0.6-0.8	Marble, grape	Significant damage to fruit, crops, vegetation
Severe	21-30	0.8-1.2	Walnut	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
Severe	31-40	1.2-1.6	Pigeon's egg > squash ball	Widespread glass damage, vehicle bodywork damage
Destructive	41-50	1.6-2.0	Golf ball > Pullet's egg	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
Destructive	51-60	2.0-2.4	Hen's egg	Bodywork of grounded aircraft dented, brick walls pitted
Destructive	61-75	2.4-3.0	Tennis ball > cricket ball	Severe roof damage, risk of serious injuries
Destructive	76-90	3.0-3.5	Large orange > Soft ball	Severe damage to aircraft bodywork
Super Hailstorms	91-100	3.6-3.9	Grapefruit	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
Super Hailstorms	>100	4.0+	Melon	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Source: Tornado and Storm Research Organization (TORRO), Department of Geography, Oxford Brookes University

Notes: In addition to hail diameter, factors including number and density of hailstones, hail fall speed and surface wind speeds affect severity. <http://www.torro.org.uk/site/hscale.php>

Straight-line winds are defined as any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 miles per hour, which represent the most common type of severe weather. They are responsible for most wind damage related to thunderstorms. Since

thunderstorms do not have narrow tracks like tornadoes, the associated wind damage can be extensive and affect entire (and multiple) counties. Objects like trees, barns, outbuildings, high-profile vehicles, and power lines/poles can be toppled or destroyed, and roofs, windows, and homes can be damaged as wind speeds increase.

Table 3.40 below summarizes past crop damages as indicated by the crop insurance claims between 2007 and 2017. The table illustrates the magnitude of the impact on Dallas County. There were no recorded crop insurance claims caused by high winds, hail, or lightning in the same time period.

Table 3.40. Crop Insurance Claims Paid in Dallas County from Thunderstorms, 2007-2017

Crop Year	Crop Name	Cause of Loss Description	Insurance Paid
2017	Corn/Soybeans	Excess Moisture/Precip/Rain	\$ 100,173.85
2015	Corn/Soybeans	Excess Moisture/Precip/Rain	\$ 48,406.00
2014	Soybeans	Excess Moisture/Precip/Rain	\$ 5,314.00
2013	Corn/Soybeans	Excess Moisture/Precip/Rain	\$ 86, 536.63
2011	All Other Crops	Excess Moisture/Precip/Rain/ Cold Wet Weather	\$ 3,361.00
2009	All Other Crops	Excess Moisture/Precip/Rain	\$ 9,692.00
2007	All Other Crops	Excess Moisture/Precip/Rain	\$ 1,132.60
Total			\$ 254,616.08

The onset of thunderstorms with lightning, high wind, and hail is generally rapid. Duration is less than six hours and warning time is generally six to twelve hours. Nationwide, lightning kills 75 to 100 people each year. Lightning strikes can also start structural and wildland fires, as well as damage electrical systems and equipment.

Previous Occurrences

Thunderstorm Winds

There were 91 thunderstorm wind events reported to the NCEI from 1998-2017 for Dallas County. There were 27 events with reported damages. The total damages from these events include one injury and \$3,446,000 in property damages, with the average loss per damaging event totaling \$127,630.

Table 3.41 provides information about thunderstorm wind events in the county.

Table 3.41. NCEI Reported Events with Damages from Thunderstorm Winds, 1998-2017

Location	# of Events	Deaths	Injuries	Property Damage	Crop Damage
Buffalo	25	0	0	\$343,000	\$0
Louisburg	4	0	0	\$25,000	\$0
Dallas Unincorporated	57	0	1	\$3,078,000	\$0
Total	91	0	1	\$3,446,000	\$0

Source: NCEI Storm Events Database, <https://www.ncdc.noaa.gov/stormevents>

Hail

There were 110 reported hail events in the NCEI database from 1998-2017 in Dallas County. One event recorded the highest magnitude hailstones at 2.75 inches in diameter. Three events resulted in damages totaling \$115,000. The most significant event occurred in June of 2008 which resulted

in \$100,000 in property damage in the city of Buffalo.

Table 3.42 provides information about damaging hail events in the county.

Table 3.42. NCEI Reported Damages from Hail, 1998-2017

Location	Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Buffalo	6/18/1998	1.75 in	0	0	\$5,000	\$0
Buffalo	6/30/2005	2.75 in	0	0	\$10,000	\$0
Buffalo	6/15/2008	2.75 in	0	0	\$100,000	\$0
Total			0	0	\$115,000	\$0

Source: NCEI Storm Events Database, <https://www.ncdc.noaa.gov/stormevents>

High Winds

There were three high wind events reported in Dallas County from 1998-2017, but no event resulted in damage. These are wind events not associated with a thunderstorm.

Table 3.43 provides information about high wind events in the county.

Table 3.43. NCEI Reported Events and Damages from High Winds, 1998-2017

Location	Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Unincorporated Dallas County	2/25/2001	n/a	0	0	\$0	\$0
Unincorporated Dallas County	5/13/2003	60 kts.	0	0	\$0	\$0
Unincorporated Dallas County	5/8/2009	61 kts.	0	0	\$0	\$0
Total			0	0	\$0	\$0

Source: NCEI Storm Events Database, <https://www.ncdc.noaa.gov/stormevents>

Lightning

Limitations to the use of NCEI reported lightning events include the fact that only lightning events that result in fatality, injury and/or property and crop damage are in the NCEI. With this in mind, there were two recorded lightning events in the NCEI database from 1998-2017. MPC members noted that the event in 2008 was when lightning struck a tree near the school in Buffalo and caused 14 students to have minor injuries. The 2015 damaging event struck the Buffalo fire station and communications tower.

Table 3.44 provides information about damaging lightning events in the county.

Table 3.44. NCEI Reported Events and Damages from Lightning, 1998-2017

Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Buffalo	10/31/2008	0	14	\$0	\$0
Buffalo	7/1/2015	0	0	\$2,000	\$0
Total		0	14	\$2,000	\$0

Source: NCEI Storm Events Database, <https://www.ncdc.noaa.gov/stormevents>

Probability of Future Occurrence

Thunderstorm Winds

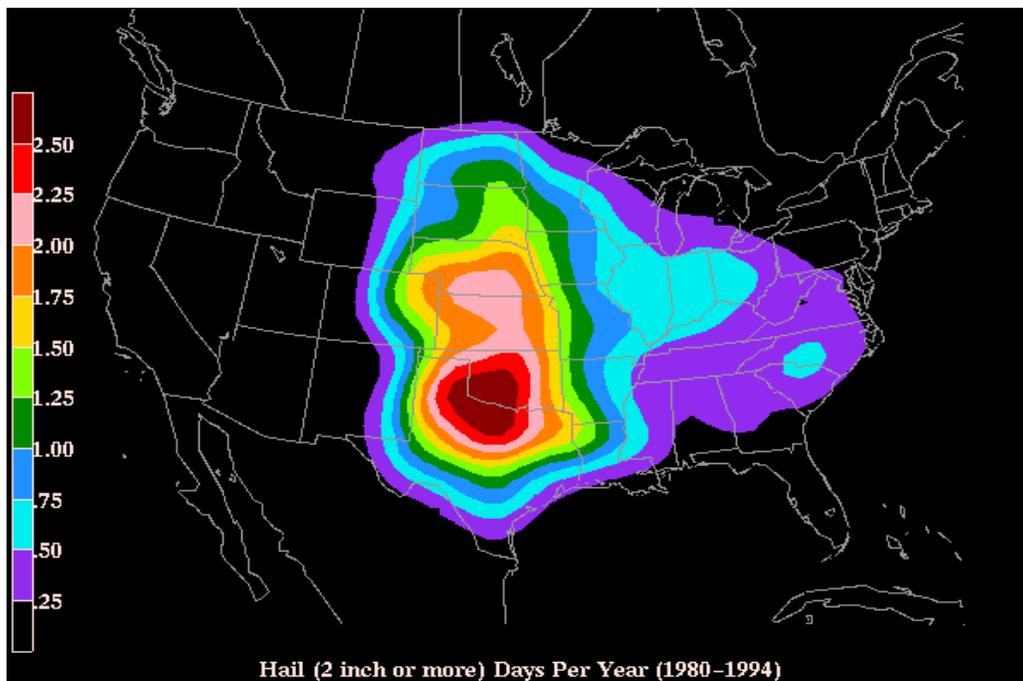
There were 91 thunderstorm wind events in Dallas County over the 20 year period reported to the NCEI from 1998-2017. This is an average of 4.5 thunderstorm wind occurrences each year. There were 27 events that results in one injury and \$3,446,000 in property damage. There were five years with no damaging events. Historical data equates to a 75% probability of a damaging event in any given year with average losses of \$127,630 per event.

Hail

There were 110 reported hail events over the 20 year period from 1998-2017. This is an average of 5.5 hail events in any given year. There were three (3) events that resulted in \$115,000 in in property damage. This equates to a 15% probability of a damaging event in any given year, with averages losses of \$38,333 per event.

Figure 3.21 is a map based on hailstorm data from 1980-1994. It shows the probability of hailstorm occurrence (2" diameter or larger) based on number of days per year. Dallas County is in the green zone on the map meaning that the county should experience hail greater than 2" in diameter one day per year.

Figure 3.21. Annual Hailstorm Probability (2" diameter or larger), 1980-1994



Source: NSSL, http://www.nssl.noaa.gov/users/brooks/public_html/bighail.gif

High Winds

There were three reported high wind events in the NCEI database for the 20 year period from 1998-2017. This means there is a 15% probability of a high wind event in any given year. There was no reported damage from any events, so the average damage based on past events is \$0.

Lightning

There were two lightning events reported to the NCEI from 1998-2017 with \$2,000 in property damage and 14 injuries. The probability of a damaging event is 10% in any given year with an average loss of \$1,000 and 7 injuries per event.

Vulnerability

Vulnerability Overview

Thunderstorms, high wind, hail, and lightning pose varying risk for jurisdictions in Dallas County. Downbursts resulting from thunderstorms can be just as damaging as an EF-1 tornado. Thunderstorm winds have resulted in one injury and zero deaths in Dallas County along with \$3,446,000 in property damage. Poorly built structures, barns, outbuildings are more vulnerable to the impact of high winds during thunderstorms. Both high winds and hail can damage roofs. Hail can also damage crops and dent cars and trucks. Total hail damage recorded in the NCEI database from 1998 – 2017 was \$115,000, with one hail event accounted for \$100,000 in damages. Lightning can cause wildfires and structural fires, damage electrical utilities causing power outages, death to livestock, and sometimes human fatalities.

Potential Losses to Existing Development

The average annual loss determined from historical losses for thunderstorms, high wind, hail and lightning are indicators of the potential losses to existing development. Thunderstorm wind events in the county have damaged critical facilities, schools, local governments, and private property. Potential losses are difficult to calculate, but should be expected to occur and cause damages in the future.

The 2013 State Plan estimates Dallas County's building exposure as \$1,297,333,000 and crop exposure as \$3,048,000 to severe thunderstorms.

Previous and Future Development

Growth in Dallas County is occurring at a slow rate, with Buffalo expecting the most growth in terms of population and housing. Additional development results in the exposure of more households and businesses vulnerable to damages from high winds, hail, and lightning.

Hazard Summary by Jurisdiction

Although thunderstorms/high winds/lightning/hail events are area-wide, communities with a greater percentage of structures built prior to 1939 are considered to be more vulnerable to the impact of high wind and hail damage. The Village of Louisburg has the highest percentage (35.8%) of structures built prior to 1939, but unincorporated Dallas County has the highest number (632) overall. New construction and population growth would increase the exposure and risk to this hazard; however, the city of Buffalo will have a decreased risk due to the enforcement of building codes.

Community Comments on Hazard

Over 85% (30) of the online survey respondents answered that severe thunderstorms and similar weather such as high winds, lightning, and hail held the highest threat or impact to their jurisdictions. Eleven survey respondents were supportive of retrofitting existing buildings to protect from wind damage.

Problem Statement

Poorly built structures, barns, and outbuildings are more vulnerable to the impact of high winds during thunderstorms. High winds can topple utility poles and lead to power outages. Both high winds and hail can damage roofs. Hail can also damage crops and dent cars and trucks. People are also at risk to injury and death during high wind events. Crop insurance mitigates the risk to farmers and the agriculture sector within the county. Lightning events have caused structural fires and can strike electrical utilities leading to power outages.

The community of Buffalo is at the highest risk for impact due to the amount of development and population. Historical data shows that Buffalo has experienced significant financial impact due to thunderstorms, winds, hail, and lightning. Additionally, unincorporated Dallas County is at risk due to the amount of agricultural uses and the number of structures built without adherence to building codes.

The risk of property damage, injury, and death in the county can be mitigated by identifying safe refuge areas in public buildings, nursing homes and other facilities that house vulnerable populations that do not have a safe room. The purchasing and installation of NOAA weather radios in schools, government buildings and public areas may assist in providing early warning to allow for public to seek shelter during high wind events. Education and hazard awareness programs in public schools would also increase public safety in the event of severe thunderstorm events.

3.4.9 Tornado

Some specific sources for this hazard are:

- Enhanced F Scale for Tornado Damage, NWS, www.spc.noaa.gov/faq/tornado/ef-scale.html;
- Enhanced Fujita Scale's damage indicators and degrees of damage table, NOAA Storm Prediction Center, www.spc.noaa.gov/efscale/ef-scale.html;
- Tornado Activity in the U.S. map (1950-2006), FEMA 320, Taking Shelter from the Storm, 3rd edition;
- Tornado Alley in the U.S. map, <http://www.tornadochaser.net/tornalley.html>
- Enhanced Fujita Scale, www.spc.noaa.gov/efscale/ef-scale.html
- National Climatic Data Center, <http://www.ncdc.noaa.gov/stormevents/>
- Tornado History Project, map of tornado events, <http://www.tornadohistoryproject.com/tornado/Missouri>

Hazard Profile

Hazard Description

The NWS defines a tornado as “a violently rotating column of air extending from a thunderstorm to the ground.” It is usually spawned by a thunderstorm and produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. Often, vortices remain suspended in the atmosphere as funnel clouds. When the lower tip of a vortex touches the ground, it becomes a tornado.

High winds not associated with tornadoes are profiled separately in this document in **Section 3.4.8** Thunderstorm/High Wind/Hail/Lightning.

Essentially, tornadoes are a vortex storm with two components of winds. The first is the rotational winds that can measure up to 500 miles per hour, and the second is an uplifting current of great strength. The dynamic strength of both these currents can cause vacuums that can overpressure structures from the inside.

Although tornadoes have been documented in all 50 states, most of them occur in the central United States due to its unique geography and presence of the jet stream. The jet stream is a high-velocity stream of air that separates the cold air of the north from the warm air of the south. During the winter, the jet stream flows west to east from Texas to the Carolina coast. As the sun moves north, so does the jet stream, which at summer solstice flows from Canada across Lake Superior to Maine. During its move northward in the spring and its recession south during the fall, the jet stream crosses Missouri, causing the large thunderstorms that breed tornadoes.

A typical tornado can be described as a funnel-shaped cloud in contact with the earth's surface that is “anchored” to a cloud, usually a cumulonimbus. This contact on average lasts 30 minutes and covers an average distance of 15 miles. The width of the tornado (and its path of destruction) is usually about 300 yards. However, tornadoes can stay on the ground for upward of 300 miles and can be up to a mile wide. The National Weather Service, in reviewing tornadoes occurring in Missouri between 1950 and 1996, calculated the mean path length at 2.27 miles and the mean path area at 0.14 square mile.

The average forward speed of a tornado is 30 miles per hour but may vary from nearly stationary to 70 miles per hour. The average tornado moves from southwest to northeast, but tornadoes have been known to move in any direction. Tornadoes are most likely to occur in the afternoon and evening, but have been known to occur at all hours of the day and night.

Geographic Location

There are no specific likely locations for future occurrences as the threat from this hazard is countywide.

Severity/Magnitude/Extent

Tornadoes are the most violent of all atmospheric storms and are capable of tremendous destruction. Wind speeds can exceed 250 miles per hour and damage paths can be more than one mile wide and 50 miles long. Tornadoes have been known to lift and move objects weighing more than 300 tons a distance of 30 feet, toss homes more than 300 feet from their foundations, and siphon millions of tons of water from water bodies. Tornadoes also can generate a tremendous amount of flying debris or “missiles,” which often become airborne shrapnel that causes additional damage. If wind speeds are high enough, missiles can be thrown at a building with enough force to penetrate windows, roofs, and walls. However, the less spectacular damage is much more common.

Tornado magnitude is classified according to the EF- Scale (or the Enhance Fujita Scale, based on the original Fujita Scale developed by Dr. Theodore Fujita, a renowned severe storm researcher). The EF-Scale (see **Table 3.455**) attempts to rank tornadoes according to wind speed based on the damage caused. This update to the original F Scale was implemented in the U.S. on February 1, 2007.

Table 3.45. Enhanced F Scale for Tornado Damage

FUJITA SCALE			DERIVED EF SCALE		OPERATIONAL EF SCALE	
F Number	Fastest ¼-mile (mph)	3 Second Gust (mph)	EF Nu	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

Source: The National Weather Service, www.spc.noaa.gov/faq/tornado/ef-scale.html

The wind speeds for the EF scale and damage descriptions are based on information on the NOAA Storm Prediction Center as listed in **Table 3.466**. The damage descriptions are summaries. For the actual EF scale it is necessary to look up the damage indicator (type of structure damaged) and refer to the degrees of damage associated with that indicator. Information on the Enhanced Fujita Scale’s damage indicators and degrees of damage is located online at www.spc.noaa.gov/efscale/ef-scale.html.

Table 3.46. Enhanced Fujita Scale with Potential Damage

Enhanced Fujita Scale			
Scale	Wind Speed (mph)	Relative Frequency	Potential Damage
EF0	65-85	53.5%	Light. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e. those that remain in open fields) are always rated EF0).
EF1	86-110	31.6%	Moderate. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	10.7%	Considerable. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes complete destroyed; large trees snapped or uprooted; light object missiles generated; cars lifted off ground.
EF3	136-165	3.4%	Severe. Entire stores of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	0.7%	Devastating. Well-constructed houses and whole frame houses completely levelled; cars thrown and small missiles generated.
EF5	>200	<0.1%	Explosive. Strong frame houses levelled off foundations and swept away; automobile-sized missiles fly through the air in excess of 300 ft.; steel reinforced concrete structure badly damaged; high rise buildings have significant structural deformation; incredible phenomena will occur.

Source: NOAA Storm Prediction Center, <http://www.spc.noaa.gov/efscale/ef-scale.html>

Enhanced weather forecasting has provided the ability to predict severe weather likely to produce tornadoes days in advance. Tornado watches can be delivered to those in the path of these storms several hours in advance. Lead time for actual tornado warnings is about 30 minutes. Tornadoes have been known to change paths very rapidly, thus limiting the time in which to take shelter. Tornadoes may not be visible on the ground if they occur after sundown or due to blowing dust or driving rain and hail.

Previous Occurrences

In the 20 year period from 1998 to 2017, there were nine (9) tornadoes recorded in Dallas County with EF/F Scale ratings ranging from EF0 to EF3 in magnitude. EF0/F0 has been the most frequent EF/F scale magnitude, with five events. Collectively, the nine tornadoes accounted for \$7,480,000 in property damage and \$0 in NCEI reported crop damage.

Three EF2/F2 tornados have occurred in Dallas County in the last 20 years. The earliest occurred in Foose and traveled to Buffalo for 4.67 miles. This event caused \$1,000,000 in property damage and injured three people. Approximately 40 homes were destroyed or heavily damaged. The tornado path extended over the Buffalo industrial park and flipped airplanes at the Buffalo airport.

The most severe tornado occurred in 2003, beginning near Louisburg and traveling 14 miles towards Leadmine. This was a continuation of a tornado that began in Polk County near the Polk, Hickory, Dallas county lines. The storm destroyed approximately 48 homes and outbuildings resulting in \$3,800,000 in property damage, and killing two Dallas County residents.

There are limitations to the use of NCEI tornado data that must be noted. For example, one tornado may contain multiple segments as it moves geographically. A tornado that crosses a county line or state line is considered a separate segment for the purposes of reporting to the NCEI. Also, a tornado that

lifts off the ground for less than 5 minutes or 2.5 miles is considered a separate segment. If the tornado lifts off the ground for greater than 5 minutes or 2.5 miles, it is considered a separate tornado. Tornadoes reported in Storm Data and the Storm Events Database are in segments. **Table 3.46** includes NCEI reported tornado events and damages from 1998-2017 in Dallas County.

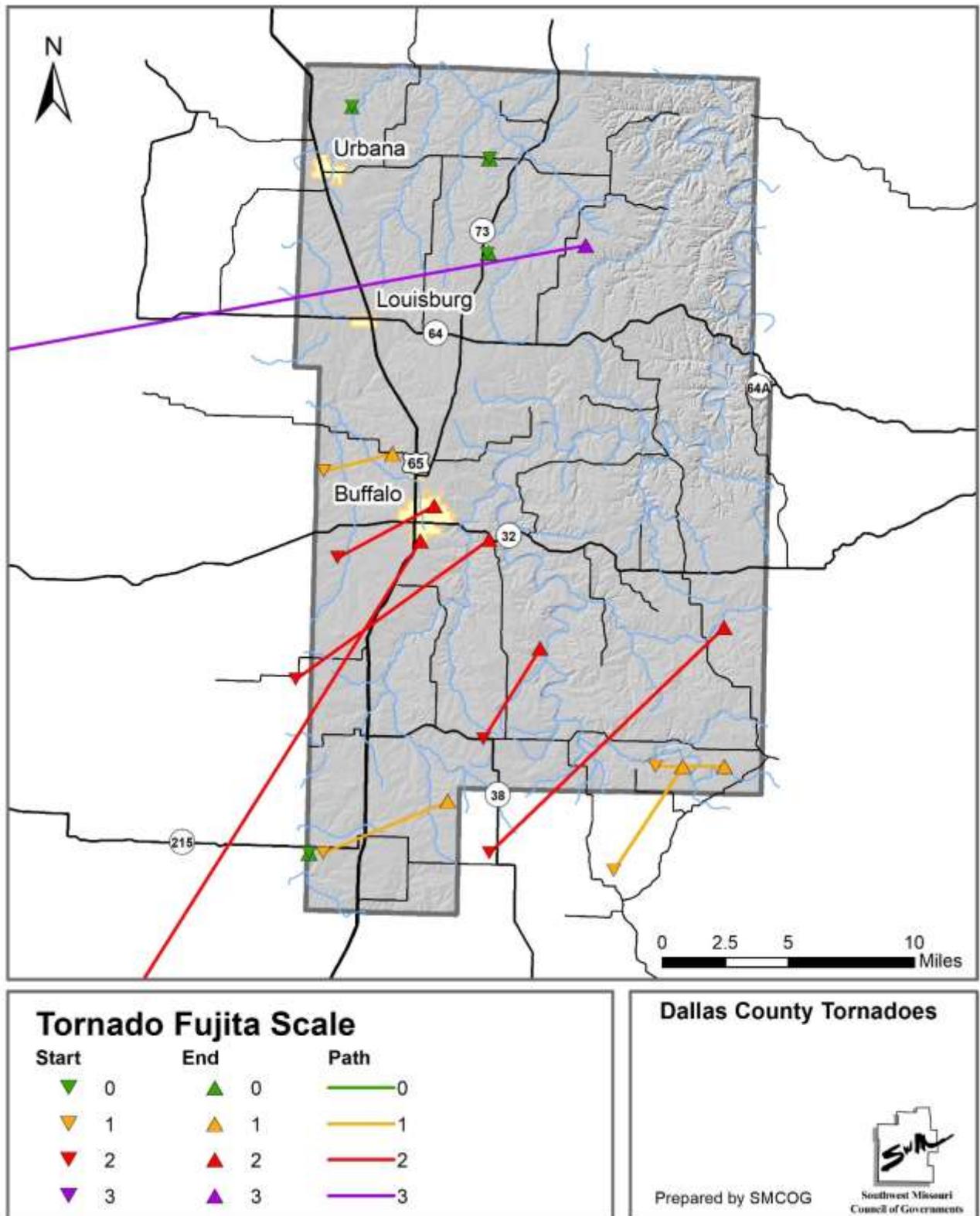
Table 3.46. Recorded Tornadoes in Dallas County, 1998 – 2017

Date	Beginning Location	Ending Location	Length (miles)	Width (yards)	F/EF Rating	Death	Injury	Property Damage	Crop Damages
5/4/2003	Louisburg	Leadmine	14	880	F3	2	10	\$3,800,000	\$0
5/4/2003	Tunas	Tunas	0.2	20	F0	0	0	\$0	\$0
5/6/2003	Olive	Olive	0.2	25	F0	0	0	\$0	\$0
1/7/2008	Handley	Handley	1.33	150	EF0	0	0	\$0	\$0
3/31/2008	Foose	Buffalo	4.67	300	EF2	0	3	\$1,000,000	\$0
5/8/2009	March	Spring Grove	4.25	400	EF2	0	2	\$2,000,000	\$0
2/28/2012	Foose	Cloverdale	9	100	EF2	1	12	\$650,000	\$0
5/17/2015	Wood Hill	Wood Hill	0.1	40	EF0	0	0	\$5,000	\$0
3/1/2017	Buffalo	Buffalo	1	100	EF0	0	0	\$25,000	\$0
Total						3	27	\$7,480,000	\$0

Source: National Centers for Environmental Information, <http://www.ncdc.noaa.gov/stormevents/>

Figure 3.22 show a historic tornado paths in Dallas County.

Figure 3.22. Dallas County Map of Historic Tornado Events



Source: Missouri Tornado History Project, <http://www.tornadohistoryproject.com/tornado/Missouri>

There has been no recorded data in the USDA Risk Management Agency Database that refers to crop damages as a result of tornadoes in the past 10 years.

Probability of Future Occurrence

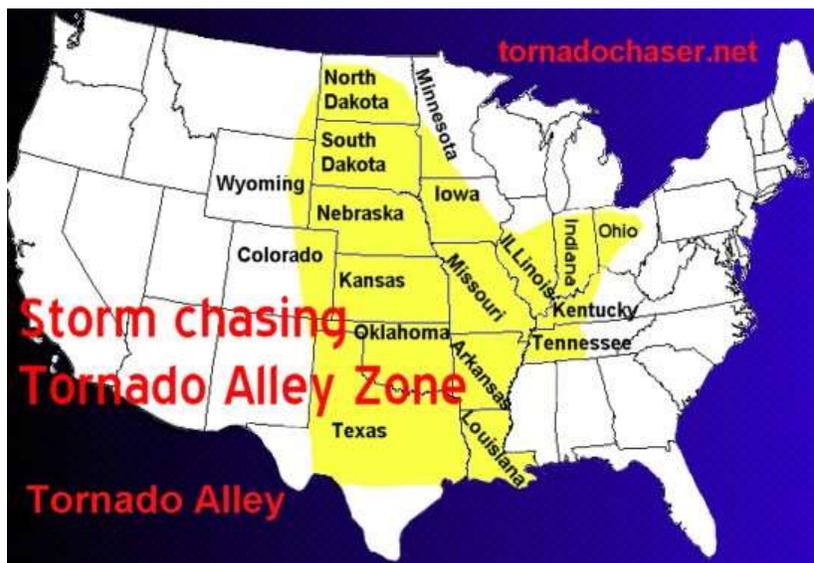
According to the NCEI database, from 1998-2017, a period of 20 years, there have been nine tornado events which equates to a 45% annual probability of a tornado event. Six of the nine events that have resulted in damages, this is equivalent to a 30% probability of a damaging event in any given year.

Vulnerability

Vulnerability Overview

Dallas County is located in a region in the U.S. with high frequency of dangerous and destructive tornadoes referred to as “Tornado Alley”, as is the entire state of Missouri. **Figure 3.23** illustrates the area where dangerous tornadoes historically have occurred.

Figure 3.23. Tornado Alley in the U.S.



Source: <http://www.tornadochaser.net/tornalley.html>

The 2013 State Plan used a methodology to the vulnerability of each county in the state to determine each county’s vulnerability to tornadoes. While this approach attempts to prioritize tornado vulnerable counties, it does not identify any particular geographic patterns to tornado risk. The state’s analysis combined annualized losses and frequency of occurrence to determine the greatest likelihood of being impacted by a tornado. The state’s vulnerability rating ranged from very high, high, and moderate. The vulnerability rating for Dallas County was moderate.

Potential Losses to Existing Development

During the 20 year period from 1998 to 2017, a total of \$7,480,000 in property losses equates to \$374,000 in average annual losses. The most common tornado events recorded in the county are F0 magnitude events. Five of the nine tornado events on record have been F0 magnitude. There were also three F2 and one F3 magnitude tornadoes recorded in the NCEI data. Potential losses for each jurisdiction were estimated based on the total exposure with applied damage factor of 1%, an estimate

of the average damage a tornado could cause in a community. **Tables 3.47** and **3.48** provide estimates for total losses by jurisdiction.

Table 3.47 Estimated Potential Tornado Losses by Jurisdiction

Jurisdiction	Total Exposure	Estimated Losses
City of Buffalo	\$88,719,000	\$887,190
Village of Louisburg	\$2,533,500	\$25,335
Unincorporated Dallas County	\$372,411,500	\$3,724,115
Totals	\$420,298,900	\$4,636,640

Source: Dallas County Assessor

Table 3.48. Estimated Potential Tornado Losses for Dallas County R-I

Dallas County Schools	Total Exposure	Estimated Losses
Dallas County R-I	\$56,945,150	\$569,451

Source: Dallas County R-I

Previous and Future Development

Development across the county and within incorporated jurisdictions increases the potential for losses. During the 20 year period, the average annual losses countywide were \$374,000. This indicates the potential future losses if the current development were to remain, with no additional development. Future development and population increases will increase exposure to damage. It is anticipated that Buffalo will experience additional new development, but with building code enforcement the risk of building damages may be reduced.

Hazard Summary by Jurisdiction

Although tornado events are area-wide hazard, communities with a greater percentage of structures built prior to 1939 are considered to be more vulnerable to the impact of high wind and hail damage. Section 3.4.8 for discusses jurisdictions at a higher risk due to the number of homes built before 1939.

Community Comments on Hazard

Nineteen, or 54.5%, of survey respondents stated that a tornado was highly likely to impact their jurisdiction. Seventeen (48.6%) respondents believe that a tornado would have a catastrophic impact on their community, and an additional 15 respondents felt it would be a critical impact. Twenty-five respondents identified the construction of a new tornado safe room as a mitigation action they would support.

Problem Statement

Tornadoes are the most violent of all atmospheric storms and are capable of tremendous destruction. Wind speeds can exceed 250 miles per hour and damage paths can be more than one mile wide and 50 miles long. Significant tornado events in Dallas County have resulted in three deaths, 27 injuries, and \$7,480,000 in property damage over the last 20 years. Information in the 2013 State Plan indicates that Dallas County has a moderate vulnerability to tornados based on frequency of occurrence and previous damages.

The risk of property damage, injury, and death in the county can be mitigated by constructing FEMA saferooms in facilities that house vulnerable populations such as nursing homes, government buildings, and schools. Additionally, identifying safe refuge areas in public buildings, nursing homes and other facilities that house vulnerable populations that do not have a safe room. Retrofitting school district

facilities with protective filming of windows and installation of blast proof doors will provide more protection for students and staff at school facilities. Promoting the installation of NOAA weather radios, and additional warnings and alerts systems, such as Swift 911, will also provide the public and schools more time to take cover during tornado. Cities can adopt or update and enforce IBC 2012 building codes that include construction techniques such as roof tie down straps to mitigate damage to future development.

3.4.10 Winter Weather/Snow/Ice/Severe Cold

Some specific sources for this hazard are:

- Wind chill chart, National Weather Service, http://www.nws.noaa.gov/om/cold/wind_chill.shtml;
- Average Number of House per year with Freezing Rain, American Meteorological Society. “Freezing Rain Events in the United States.” <http://ams.confex.com/ams/pdfpapers/71872.pdf>;
- USDA Risk Management Agency, Insurance Claims, <https://www.rma.usda.gov/data/cause>
- Any local Road Department data on the cost of winter storm response efforts.
- National Climatic Data Center, Storm Events Database, <http://www.ncdc.noaa.gov/stormevents/>

Hazard Profile

Hazard Description

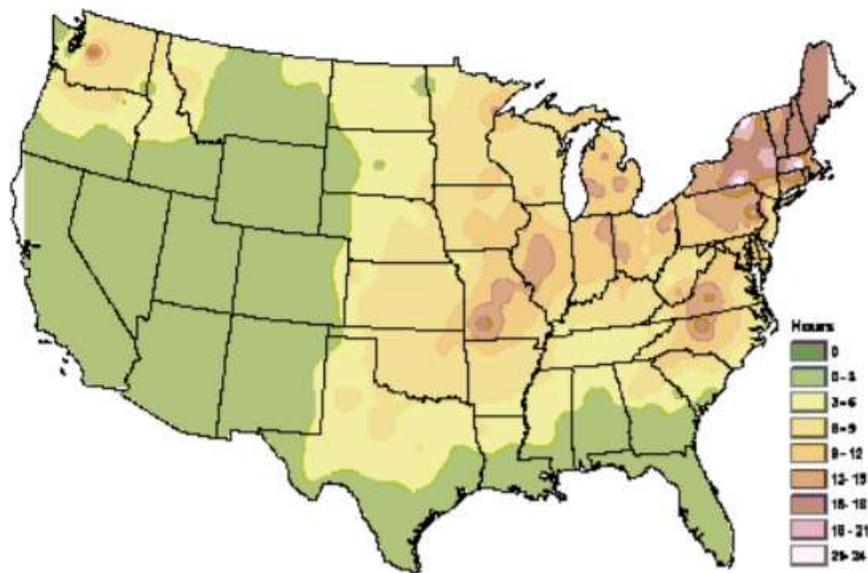
A major winter storm can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall, and cold temperatures. The National Weather Service describes different types of winter storm events as follows.

- **Blizzard**—Winds of 35 miles per hour or more with snow and blowing snow reducing visibility to less than $\frac{1}{4}$ mile for at least three hours.
- **Blowing Snow**—Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.
- **Snow Squalls**—Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant.
- **Snow Showers**—Snow falling at varying intensities for brief periods of time. Some accumulation is possible.
- **Freezing Rain**—Measurable rain that falls onto a surface with a temperature below freezing. This causes it to freeze to surfaces, such as trees, cars, and roads, forming a coating or glaze of ice. Most freezing-rain events are short lived and occur near sunrise between the months of December and March.
- **Sleet**—Rain drops that freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects.

Geographic Location

The entire county is vulnerable to heavy snow, ice, extreme cold temperatures and freezing rain. **Figure 3.24** depicts the average number of hours per year with freezing rain. Dallas County is located in a zone that can expect 18 – 21 hours of freezing rain per year.

Figure 3.24. NWS Statewide Average Number of Hours per Year with Freezing Rain



Source: American Meteorological Society. "Freezing Rain Events in the United States." <http://ams.confex.com/ams/pdfpapers/71872.pdf>

Severity/Magnitude/Extent

Severe winter storms include extreme cold, heavy snowfall, ice, and strong winds which can push the wind chill well below zero degrees in Dallas County. Heavy snow can bring a community to a standstill by inhibiting transportation (in whiteout conditions), weighing down utility lines, and by causing structural collapse in buildings not designed to withstand the weight of the snow. Repair and snow removal costs can be significant. Ice buildup can collapse utility lines and communication towers, as well as make transportation difficult and hazardous. Ice can also become a problem on roadways if the air temperature is high enough that precipitation falls as freezing rain rather than snow.

Extreme cold often accompanies severe winter storms and can lead to hypothermia and frostbite in people without adequate clothing protection. Cold can cause fuel to congeal in storage tanks and supply lines, stopping electric generators. Cold temperatures can also overpower a building's heating system and cause water and sewer pipes to freeze and rupture. Extreme cold also increases the likelihood for ice jams on flat rivers or streams. When combined with high winds from winter storms, extreme cold becomes extreme wind chill, which is hazardous to health and safety.

The National Institute on Aging estimates that more than 2.5 million Americans are elderly and especially vulnerable to hypothermia, with the isolated elders being most at risk. About 10 percent of people over the age of 65 have some kind of bodily temperature-regulating defect, and 3-4 percent of all hospital patients over 65 are hypothermic.

Also at risk are those without shelter, those who are stranded, or who live in a home that is poorly insulated or without heat. Other impacts of extreme cold include asphyxiation (unconsciousness or death from a lack of oxygen) from toxic fumes from emergency heaters; household fires, which can be caused by fireplaces and emergency heaters; and frozen/burst pipes.

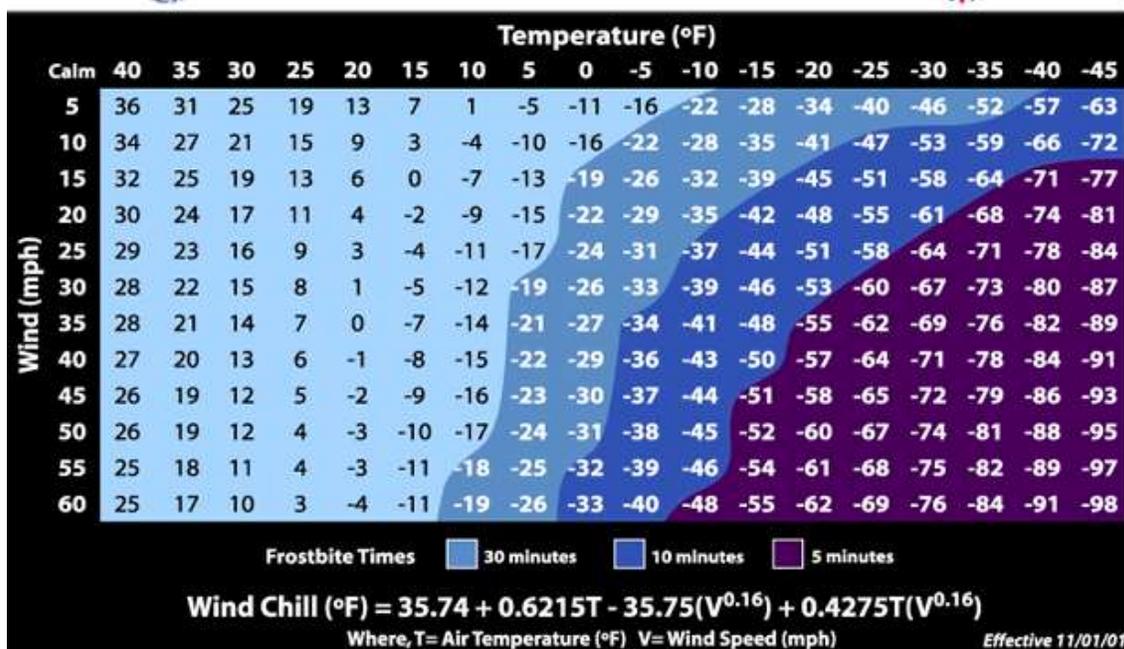
Buildings with overhanging tree limbs are more vulnerable to damage during winter storms when limbs fall. Businesses experience loss of income as a result of closure during power outages. In general heavy winter storms increase wear and tear on roadways though the cost of such damages is difficult to determine. Businesses can experience loss of income as a result of closure during winter storms.

Overhead power lines and infrastructure are also vulnerable to damages from winter storms. In particular ice accumulation during winter storm events damage to power lines due to the ice weight on the lines and equipment. Damages also occur to lines and equipment from falling trees and tree limbs weighted down by ice. Potential losses could include cost of repair or replacement of damaged facilities, and lost economic opportunities for businesses.

Secondary effects from loss of power could include burst water pipes in homes without electricity during winter storms. Public safety hazards include risk of electrocution from downed power lines. Specific amounts of estimated losses are not available due to the complexity and multiple variables associated with this hazard. Standard values for loss of service for utilities reported in FEMA’s 2009 BCA Reference Guide, the economic impact as a result of loss of power is \$126 per person per day of lost service.

Wind can greatly amplify the impact of cold ambient air temperatures. Provided by the National Weather Service, **Figure 3.25** below shows the relationship of wind speed to apparent temperature and typical time periods for the onset of frostbite.

Figure 3.25. Wind Chill Chart



Source: National Weather Service, http://www.nws.noaa.gov/om/cold/wind_chill.shtml

Although, the NCEI database has records of crop loss due to freeze, the USDA Risk Management Agency had no records of crop insurance claims paid in Dallas county as a result of cold conditions and snow from 1998-2017.

Previous Occurrences

There were 33 recorded events in the NCEI database for Blizzard, Extreme Cold/Wind Chill, Frost/Freeze, Heavy Snow, Ice Storm, Sleet, and Winter Storm in Dallas County from 1998 - 2017. **Table 3.49** includes the number of occurrences of these Winter Weather events. **Table 3.50** includes the five weather events that caused damage, with event narratives listed following the table.

Table 3.49. NCEI Dallas County Winter Weather Events Summary, 1998-2017

Type of Event	Number of Occurrences	# of Deaths	# of Injuries	Property Damages	Crop Damages
Severe Cold	2	0	0	\$0	\$0
Frost/Freeze	1	0	0	\$0	\$2,840,000
Heavy Snow	3	0	0	\$0	\$0
Ice Storm	7	0	0	\$105,000,000	\$0
Winter Storm	20	0	0	\$75,000	\$0

Source: National Centers for Environmental Information, data accessed January 2018

Table 3.50. NCEI Dallas County Winter Weather Damaging Events, 1998-2017

Type of Event	Date	# of Deaths	# of Injuries	Property Damages	Crop Damages
Winter Storm	1/1/1999	0	0	\$50,000	\$0
Winter Storm	11/30/2006	0	0	\$25,000	\$0
Ice Storm	1/12/2007	0	0	\$100,000,000	\$0
Frost/freeze	4/7/2007	0	0	\$0	\$2,840,000
Ice Storm	12/9/2007	0	0	\$5,000,000	\$0
Total	-	0	0	\$105,075,000	\$2,840,000

Source: National Centers for Environmental Information, data accessed January 2018

Winter Storm – January 1999

A band of snow and sleet (in addition to the ice) fell from southwest to central Missouri. Three to six inch amounts occurred in southwest Missouri in the Springfield, Galena, Ozark, and Buffalo areas. Heavier amounts of 5 to 10 inches occurred in central Missouri near the Lake of the Ozarks. Several electric service providers lost power leaving thousands without power for up to six days.

Winter Storm – November 2006

A major winter storm caused a combination of freezing rain, sleet, and heavy snow to fall over sections of southwest and central Missouri. The frozen precipitation began on the 30th, the precipitation type was freezing rain and sleet, with ice accumulations up to four inches in some areas. The second wave of precipitation occurred overnight causing large amount of snow to accumulate over the ice. Storm total accumulations ranging from 13 to 17 inches occurred from the Lake of the Ozarks Region, over to Vernon and Cedar counties. Meanwhile other areas north of the Interstate 44 corridor experienced storm totals ranging from seven to 12 inches. The combination of the ice and snow weighted down all exposed objects. As a matter of fact, some areas experienced disaster as many roofs on businesses, barns, outbuildings, and schools collapsed due to the weight of the accumulated precipitation. On Lake of the Ozarks and Pomme De Terre Lake, numerous docks collapsed destroying a large number of boats and causing many of them to sink.

Ice Storm – January 2007

One of the greatest disasters to ever impact southwest Missouri, including the Springfield metro area, occurred in the form of an ice storm. Several counties, mainly along and north of the interstate 44

corridor, experienced ice accumulations up to two and a half inches. Power outages and catastrophic tree damage were the main impacts resulting from this historic event. Power outages occurred for over three weeks in many areas. Several indirect fatalities due to the extreme elements were documented. Carbon monoxide poisoning occurred within a few homes as gas generators were being used in garages, which allowed for dangerous levels of carbon monoxide to seep into houses.

Frost/ Freeze – April 2007

Unusually warm conditions during the month of March caused early season growth in vegetation across the Missouri Ozarks. Hay along with the wheat crop had begun to mature. During the nights of April 7th through the 9th, temperatures dropped into the upper teens to mid-20s, causing a hard freeze on matured vegetation. The wheat crop suffered approximately 90% damage. Hay crops along with fescue seed also sustained major damage. Total crop losses for 34 counties across the southwestern quadrant of Missouri were estimated at \$147,905,541.

Ice Storm – December 2007

A major ice storm impacted portions of southwest Missouri during the early morning hours of 9 December. A southwest to northeast narrow band of convection developed from northeast Oklahoma into central Missouri, which became the heaviest axis of ice accumulation. Ice accumulations of up to an inch were observed across sections of Dallas County. Power outages were common as significant tree and power line damage occurred. Intermittent periods of light freezing rain occurred through the morning of 10 December, which provided an additional coating of ice on exposed surfaces.

Probability of Future Occurrence

The probability for all of the different types of winter weather are included as one probability, since one storm generally includes multiple types of events. There were 33 severe winter weather events in Dallas County from 1997 to 2017. This equates to a 100% probability of occurrence in any given year.

Vulnerability

Vulnerability Overview

Severe winter storms include extreme cold, heavy snowfall, ice, and strong winds which can push the wind chill well below zero degrees in the planning area. Heavy snow can bring a community to a standstill by inhibiting transportation (in whiteout conditions), weighing down utility lines, and by causing structural collapse in buildings not designed to withstand the weight of the snow. Repair and snow removal costs can be significant. Ice buildup can collapse utility lines and communication towers, as well as make transportation difficult and hazardous. People over 65 and those living in poverty have an increased risk of hypothermia and frostbite due to extreme cold and wind chill.

In the 2013 State Plan, seven factors were considered in determining overall severe winter storm vulnerability as follows: housing density, likelihood of occurrence, building exposure, crop exposure, average annual property loss ratio, average annual crop insurance claims and social vulnerability. The state ranked each of these criteria using a scale from one to five, one being lowest and five being the highest, to rank each county's vulnerability to severe winter weather. Dallas County received a vulnerability rating for each criteria as follows: Housing Density Rating: low, Likelihood rating: low, Property Loss Ratio Rating: medium, Crop Exposure Rating: low, Social Vulnerability Index: medium. This equates to an overall vulnerability rating of low.

Potential Losses to Existing Development

During the 20 year period from 1998-2017, a total of \$105,075,000 in property damage equates to \$5,253,750 in average annual losses countywide.

Previous and Future Development

Increased development and any resulting increase in population will increase exposure to damage from severe winter weather. Future commercial development can expect functional downtime and decreased revenues during periods of severe winter weather. Future construction of facilities that will serve vulnerable populations will need to be prepared for extreme weather conditions. Road construction in the county will increase the need for snow removal and salt to keep transportation lifelines open during periods of severe winter weather. Any increase in agriculture crop production will also increase the risk of exposure.

Hazard Summary by Jurisdiction

Severe winter weather can cause power outages and put structures at risk to fires when individuals in homes resort to fuel heaters. The risk of extreme cold deaths and frostbite varies among segments of the populations. People over 65 and those living below the poverty level have an increased vulnerability to severe winter weather. **Table 3.51** includes information on populations over 65 and the percent living below the poverty level by jurisdiction. Buffalo has a high risk due to the number of families living below poverty level and a high percentage of persons over 65. As the largest incorporated community in Dallas County, Buffalo will likely be the primary impacted jurisdiction for severe winter weather events.

Table 3.51. Population over 65 and Percent Living Below the Poverty Level by Jurisdiction

Jurisdiction	% of Families Living Below Poverty Level	Population over 65	Population over 65 Percent
Dallas County	15.8%	1,332	17.0%
City of Buffalo	31.3%	645	20.9%
Village of Louisburg	24.0%	28	23.0%

Source: Census.gov; 2011-2015 ACS 5-year Estimates

Community Comments on Hazard

County residents who responded to the online survey indicated that winter weather was highly likely to impact their communities with 25 respondents or 71%. Respondents stated this was the second highest hazard threat after severe thunderstorms. While an ice storm has been the greatest cause of monetary damage in the county, residents did not feel that severe winter weather would have the highest impact, tornadoes were rated to have the largest impact. Twenty-three respondents stated that severe winter weather would have either a critical or catastrophic impact.

Problem Statement

Heavy snow can bring a community to a standstill by inhibiting transportation (in whiteout conditions), weighing down utility lines, and by causing structural collapse in buildings not designed to withstand the weight of the snow. Repair and snow removal costs can be significant. Ice buildup can collapse utility lines and communication towers, as well as make transportation difficult and hazardous. People over 65 and those living in poverty have an increased risk of hypothermia and frostbite due to extreme cold and wind chill.

Organizing outreach to at-risk populations, including establishing and promoting accessible heating and cooling centers can help reduce the potential exposure to harsh winter weather. Additionally, identifying debris disposal and burning locations can assist in facilitating recovery efforts after a significant winter storm or ice incident.

4 MITIGATION STRATEGY

4	MITIGATION STRATEGY	4.1
4.1	<i>Goals.....</i>	4.1
4.2	<i>Identification and Analysis of Mitigation Actions.....</i>	4.2
4.3	<i>Implementation of Mitigation Actions</i>	4.4

44 CFR Requirement §201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction’s blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

This section presents the mitigation strategy updated by the Mitigation Planning Committee (MPC) based on the risk assessment. The mitigation strategy was developed through a collaborative group process. The process included review of general goal statements to guide the jurisdictions in lessening disaster impacts as well as specific mitigation actions to directly reduce vulnerability to hazards and losses. The following definitions are taken from FEMA’s *Local Hazard Mitigation Review Guide (October 1, 2012)*.

- **Mitigation Goals** are general guidelines that explain what you want to achieve. Goals are long-term policy statements and global visions that support the mitigation strategy. The goals address the risk of hazards identified in the plan.
- **Mitigation Actions** are specific actions, projects, activities, or processes taken to reduce or eliminate long-term risk to people and property from hazards and their impacts. Implementing mitigation actions helps achieve the plan’s mission and goals.

4.1 Goals

44 CFR Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

This planning effort is an update to Dallas County’s existing hazard mitigation plan approved by FEMA on December 12, 2013. Therefore, the goals from the 2013 Dallas County Hazard Mitigation Plan were reviewed to see if they were still valid, feasible, practical, and applicable to the defined hazard impacts. The MPC conducted a discussion session during their third meeting to review and update the plan goals. To ensure that the goals developed for this update were comprehensive and supported State goals, the 2013 State Hazard Mitigation Plan goals were reviewed. The MPC also reviewed the goals from current surrounding county plans.

Discussion of the previously approved goals involved determining the application of the goals to today and validity of the language used. It was determined that the goals still applied and so, were unchanged for this plan update. In the 2013 Plan, the organization of the actions included broad goals and a set of objectives linking the actions to the goals. The MPC opted to keep the goals from the 2013 Plan and eliminate the objective statements, moving forward with broad goals and specific mitigation actions. Objectives seemed to add a layer of complication and potential confusion. During

this update process, the intent was to provide a usable set of actions that each jurisdiction was able to work towards partial or full implementation, and objectives seemed unnecessary.

The Plan update goals and objectives are as follows:

Goal 1 – Protect lives and minimize injury to citizens.

Goal 2 – Preserve and protect property, infrastructure and the local economy from the negative impacts of natural hazards.

Goal 3 – Ensure the continued operation of government, emergency services.

4.2 Identification and Analysis of Mitigation Actions

44 CFR Requirement §201.6(c)(3)(ii): The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

During the second MPC meeting, the results of the risk assessment update were provided to the MPC members for review and the key issues were identified for specific hazards. Changes in risk since adoption of the previously approved plan were discussed.

The MPC determined to include problem statements in the plan update at the end of each hazard profile, which had not been done in the previously approved plan. The problem statements summarize the risk to the planning area presented by each hazard, and include possible methods to reduce that risk. Use of the problem statements allowed the MPC to recognize new and innovative strategies to mitigate risks in the planning area.

Jurisdiction representatives on the MPC were encouraged to review the details of the risk assessment vulnerability analysis specific to their jurisdiction, and the previously identified mitigation actions prior to Meeting #3. Representatives were provided a link to the FEMA's publication, Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (January 2013). This document was developed by FEMA as a resource for identification of a range of potential mitigation actions for reducing risk to natural hazards and disasters.

The focus of meetings #3 and #4 was to update the mitigation strategy. For a comprehensive range of mitigation actions to consider, the MPC reviewed the following information during Meeting #3:

- A list of actions proposed in the previous mitigation plan and discussing each individually regarding progress made and continued relevance
- Input during meetings
- Responses to Data Collection Questionnaires- where jurisdictions had reported progress made on previous actions

During Meeting #3, few new actions were proposed by the committee, but numerous actions were reworded. Much of the discussion surrounded making actions SMART: specific, measurable, achievable, relevant, and time-bound. SMCOG staff provided some recommended altered language for some items, and general discussion by the MPC provided some significant changes to many actions and to which jurisdictions actions were relevant. MPC members were encouraged to use the STAPLEE scoring to determine which actions applied to their jurisdiction.

The MPC members reviewed the actions from the previously approved plan for progress made since the plan had been adopted. This was done as part of the data collection questionnaire process.

Each jurisdiction was instructed to provide information regarding the “Action Status” with one of the following status choices:

- Completed, with a description of the progress,
- Not Started/Continue in Plan Update, with a discussion of the reasons for lack of progress,
- In Progress/Continue in Plan Update, with a description of the progress made to date or
- Deleted, with a discussion of the reasons for deletion.

Based on the status updates, there were 1 completed actions, 0 deleted actions, and 35 continuing actions.

Table 4.1 provides a summary of the action status for each jurisdiction:

Table 4.1. Action Status Summary

Jurisdiction	Completed Actions	Deleted Actions	Continuing Actions
Dallas County			1.1.1, 1.1.2, 1.2.1, 1.2.2, 1.2.3, 1.2.4, 2.1.2, 2.1.4, 2.2.3, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6
Buffalo	2.1.1		1.1.1, 1.1.2, 1.2.2, 1.2.3, 1.3.2, 1.3.3, 2.1.3, 2.1.4, 2.2.2, 2.2.4, 3.1.1, 3.1.6
Louisburg			1.1.1, 1.1.2, 1.2.3, 1.2.1, 1.2.2, 1.3.3, 2.1.4, 3.1.3

Table 4.2 provides a summary of the completed and deleted actions from the previous plan.

Table 4.2. Summary of Completed and Deleted Actions from the Previous Plan

Completed Actions	Action Description	Completion Details (date, amount, funding source)
Buffalo 2.1.1	Promote installation of back-up generators in all communities for critical infrastructure, such as water towers and wastewater treatment facilities, and in critical/vulnerable facilities including schools, medical facilities, storm shelters, and critical government buildings.	City has completed prior to plan update
Deleted Actions	Action Description	Completion Details (date, amount, funding source)
None	None	None

Source: Previously approved County Hazard Mitigation Plan; Data Collection Questionnaires.

Many jurisdictions found that actions were still relevant and would be ongoing. Many of the continuing actions were re-worded for the update and are noted as “revised, continuing” on the action sheets.

The actions listed in Tables 4.1 and 4.2 are numbered according to the 2013 Plan and are not consistent with the new numbering in this plan.

4.3 Implementation of Mitigation Actions

44 CFR Requirement §201.6(c)(3)(ii): The mitigation strategy shall include an action strategy describing how the actions identified in paragraph (c)(2)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefits review of the proposed projects and their associated costs.

Jurisdictional MPC members were encouraged to gather community feedback on proposed actions. The Disaster Mitigation Act requires benefit-cost review as the primary method by which mitigation projects should be prioritized. Implementation may be pursued according to when and where damage occurs, available funding, political will, jurisdictional priority, and priorities identified in the Missouri State Hazard Mitigation Plan. The benefit/cost review at the planning stage primarily consisted of a qualitative analysis, and was not the detailed process required grant funding application. For each action, the plan sets forth a narrative describing the types of benefits that could be realized from action implementation. The cost was estimated as closely as possible, with further refinement to be supplied as project development occurs.

FEMA's STAPLEE methodology was used to assess the costs and benefits, overall feasibility of mitigation actions, and other issues impacting project. During the prioritization process, the MPC used worksheets to assign scores. The worksheets posed questions based on the STAPLEE elements as well as the potential mitigation effectiveness of each action. Scores were based on the responses to the questions as follows:

Definitely yes = 3 points
Maybe yes = 2 points
Probably no = 1
Definitely no = 0

The following questions were asked for each proposed action.

S: Is the action socially acceptable?

T: Is the action technically feasible and potentially successful?

A: Does the jurisdiction have the administrative capability to successfully implement this action?

P: Is the action politically acceptable?

L: Does the jurisdiction have the legal authority to implement the action?

E: Is the action economically beneficial?

E: Will the project have an environmental impact that is either beneficial or neutral? (score "3" if positive and "2" if neutral)

Will the implemented action result in lives saved?

Will the implanted action result in a reduction of disaster damage?

The final scores are listed below in the analysis of each action. The worksheets are attached to this plan as part of Appendix B. The STAPLEE final score for each action, absent other considerations, such as a localized need for a project, determined the priority. Low priority action items were those that had a total score of between 0 and 24. Moderate priority actions were those scoring between 25 and 29. High priority actions scored 30 or above. A blank STAPLEE worksheet is shown in **Figure 4.1**

Figure 4.1. Blank STAPLEE Worksheet

**XXXXXX COUNTY
MULTI-JURISDICTIONAL
LOCAL HAZARD MITIGATION PLAN**

Action Title:		Jurisdiction:	
Action ID:			
STAPLEE Criteria	Evaluation Rating Definitely YES = 3 Maybe YES = 2 Probably NO = 1 Definitely NO = 0	Score	
S: Is it Socially acceptable?			
T: Is it Technically feasible and potentially successful?			
A: Does the jurisdiction have the administrative capacity to execute this action?			
P: Is it Politically acceptable?			
L: Is there Legal authority to implement?			
E: Is it Economically beneficial?			
E: Will the project have either a neutral or positive impact on the natural environment? (score a 3 if positive impact, 2 if neutral impact)			
Will historic structures be saved or protected?			
Could it be implemented quickly?			
STAPLEE Score			

Mitigation Effectiveness Criteria	Evaluation Rating	Score
Will the implemented action result in lives saved?	Assign from 5-10 points based on the likelihood that lives would be saved.	
Will the implemented action result in a reduction of disaster damages?	Assign from 5-10 points based on the relative reduction of disaster damages.	
Mitigation Effectiveness Score		

Total Score (STAPLEE Score + Mitigation Effectiveness Score): _____

Priority Level: High (30+ points) Medium (25-29 points) Low (less than 25 points)

Completed by (name/title/phone #): _____

In addition to the STAPLEE cost benefit review prioritization, at the fourth MPC meeting, an implementation plan for each action was discussed. An action worksheet was used to develop the implementation plan. The action worksheet format is shown in **Table 4.3**.

Table 4.3. Table 4.3 Mitigation Action Worksheet

Action Worksheet	
Name of Jurisdiction:	
Risk / Vulnerability	
Problem being Mitigated:	Provide a brief description of the problem that the action will address
Hazard(s) Addressed:	List the hazard or hazards that will be addressed by this action
Action or Project	
Action/Project Number:	Insert a unique action number for this action for future tracking purposes. This can be a combination of the jurisdiction name, followed by the goal number and action number (i.e. Joplin1.1)
Name of Action or Project:	
Action or Project Description:	Describe the action or project.
Applicable Goal Statement:	Choose the goal statement that applies to this action
Estimated Cost:	Provide an estimate of the cost to implement this action. This can be accomplished with a range of estimated costs.
Benefits:	Provide a narrative describing the losses that will be avoided by implementing this action. If dollar amounts of avoided losses are known, include them as well.
Plan for Implementation	
Responsible Organization/Department:	Which organization will be responsible for tracking this action? Be specific to include the specific department or position within a department.
Action/Project Priority:	Include the STAPLEE score and Priority (H, M, L)
Timeline for Completion:	How many months/years to complete.
Potential Fund Sources:	List specific funding sources that may be used to pay for the implementation of the action.
Local Planning Mechanisms to be Used in Implementation, if any:	
Progress Report	
Action Status	Indicate status as New, Continuing Not Started, or Continuing in Progress)
Report of Progress	

The following section organizes the actions for each jurisdiction participating in the Plan, the goal statement that each action falls under, and the completed worksheet for each new and continuing mitigation action.

Goal 1: Protect the lives and minimize injury of citizens.

Action Worksheet	
Name of Jurisdiction:	Dallas County
Risk / Vulnerability	
Problem being Mitigated:	Public awareness of hazard vulnerability and mitigation measures.
Hazard(s) Addressed:	Tornado, Severe Storm, Winter Weather, Flooding, Drought, Extreme Heat, Earthquake, Wildlife, Sinkhole.
Action or Project	
Action/Project Number:	1.1
Name of Action or Project:	Public Awareness
Action or Project Description:	Distribute informational material to citizens, businesses, and vulnerable population groups on natural hazards and ways to reduce risks.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$0
Benefits:	Reduction in loss of life, injury, and property during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management, Administration, Health Department
Action/Project Priority:	32, High
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continuing
Report of Progress	N/A

Action Worksheet	
Name of Jurisdiction:	Dallas County
Risk / Vulnerability	
Problem being Mitigated:	Public and private awareness of hazard vulnerability and mitigation measures.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Drought, Heat Wave, Earthquake, Wildlife, Sinkhole.
Action or Project	
Action/Project Number:	1.2
Name of Action or Project:	Natural Hazard Awareness
Action or Project Description:	Work with private sector business organizations and community service organizations to distribute information to the public on natural hazards and resources available to reduce risk.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$0 - \$500
Benefits:	Reduction in loss of life, injury, and property during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management, Administration, Health Department
Action/Project Priority:	31, High
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	Dallas County
Risk / Vulnerability	
Problem being Mitigated:	Loss of life and preparedness in the event of severe storms, tornado, flood, and other hazards.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Drought, Heat Wave, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	1.4
Name of Action or Project:	Alert Systems
Action or Project Description:	Promote the use of NOAA radios and/or automated alert systems in businesses, homes, and vulnerable facilities such as schools, nursing homes, medical clinics, and day care centers.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$2,925/year
Benefits:	Reduction of injury and loss of life for citizens.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management, Administration
Action/Project Priority:	34, High
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Emergency Operations Plan, Budget process
Progress Report	
Action Status	Continuing
Report of Progress	N/A

Action Worksheet	
Name of Jurisdiction:	Dallas County
Risk / Vulnerability	
Problem being Mitigated:	Loss of life or injury during fire events.
Hazard(s) Addressed:	Wildfire
Action or Project	
Action/Project Number:	1.5
Name of Action or Project:	Citizen Preparedness
Action or Project Description:	Promote the use of smoke alarms in homes, businesses, and places of public congregation.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	Up to \$1,000
Benefits:	Reduction of injury and loss of life for citizens.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management; County volunteer fire departments
Action/Project Priority:	33, High
Timeline for Completion:	5 years
Potential Fund Sources:	Grants through house building supply businesses and local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Emergency Operations Plan, Budget Process
Progress Report	
Action Status	Continuing
Report of Progress	N/A

Action Worksheet	
Name of Jurisdiction:	Dallas County
Risk / Vulnerability	
Problem being Mitigated:	Unawareness of flooded roadways
Hazard(s) Addressed:	Floods
Action or Project	
Action/Project Number:	1.6
Name of Action or Project:	Procedure for Flooded Roadways
Action or Project Description:	Create a procedure for notification of flooded roadways.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$2,925/ year
Benefits:	Improves communication during hazard events and reduces injury to citizens.
Plan for Implementation	
Responsible Organization/Department:	Dallas County Commissioners, Emergency Management
Action/Project Priority:	34, High
Timeline for Completion:	Immediately. 0 months to 1 year.
Potential Fund Sources:	Local Taxes
Local Planning Mechanisms to be Used in Implementation, if any:	Emergency Operations Plan, Budget process
Progress Report	
Action Status	New
Report of Progress	Plan to purchase Swift 911

Action Worksheet	
Name of Jurisdiction:	Dallas County
Risk / Vulnerability	
Problem being Mitigated:	Unsafe environments during severe weather events.
Hazard(s) Addressed:	Tornado, Severe Thunderstorm
Action or Project	
Action/Project Number:	1.7
Name of Action or Project:	Safe environments during severe weather
Action or Project Description:	Where feasible, retrofit existing critical and vulnerable facilities to provide a safer environment during severe weather events.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$100,000
Benefits:	Lessens risks and injury to citizens during severe weather events.
Plan for Implementation	
Responsible Organization/Department:	Administration, Dallas County Sheriff's Department
Action/Project Priority:	28, Medium
Timeline for Completion:	5 years
Potential Fund Sources:	HMGP, PDM, USDA, Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Emergency Operations Plan, Budget process
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing

Goal 2: Preserve and protect property, infrastructure, and the local economy from the negative impacts of natural hazards.

Action Worksheet	
Name of Jurisdiction:	Dallas County
Risk / Vulnerability	
Problem being Mitigated:	Lack of backup power in critical facilities.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Heat Wave, and Earthquake
Action or Project	
Action/Project Number:	2.1
Name of Action or Project:	Back-up generators
Action or Project Description:	Promote installation of back-up generators in all communities for critical infrastructure, such as water towers and wastewater treatment facilities, and in critical/vulnerable facilities including schools, medical facilities, storm shelters, and critical government buildings.
Applicable Goal Statement:	Preserve and protect property, infrastructure, and the local economy from the negative impacts of natural hazards.
Estimated Cost:	\$50,000-\$100,000
Benefits:	Improved public safety during hazard events and preservation of critical infrastructure during hazardous events.
Plan for Implementation	
Responsible Organization/Department:	Dallas County Commissioners, Emergency Management
Action/Project Priority:	33, High
Timeline for Completion:	5 Years
Potential Fund Sources:	HMGP, PDM, local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continuing
Report of Progress	N/A

Action Worksheet	
Name of Jurisdiction:	Dallas County
Risk / Vulnerability	
Problem being Mitigated:	Flooding of low water crossings
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.2
Name of Action or Project:	Low water crossing upgrades
Action or Project Description:	Upgrade low water crossings where feasible.
Applicable Goal Statement:	Preserve and protect property, infrastructure, and the local economy from the negative impacts of natural hazards
Estimated Cost:	\$100,000 - 2 Million
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Dallas County Commission, Disaster Coordinator, Road and Bridge
Action/Project Priority:	36, High
Timeline for Completion:	0 to 5 Years
Potential Fund Sources:	HMGP, PDM, local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continuing
Report of Progress	

Action Worksheet	
Name of Jurisdiction:	Dallas County
Risk / Vulnerability	
Problem being Mitigated:	Buildup of debris in flood areas
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.4
Name of Action or Project:	Storm Water Impact
Action or Project Description:	Clean debris from drainage channels and under bridges to improve capacities of storm drainage systems.
Applicable Goal Statement:	Preserve and protect property, infrastructure, and the local economy from the negative impacts of natural hazards
Estimated Cost:	\$500 to \$5,000
Benefits:	Improved public safety during hazard events; mitigate future damage.
Plan for Implementation	
Responsible Organization/Department:	Road and Bridge
Action/Project Priority:	32, High
Timeline for Completion:	3 Years
Potential Fund Sources:	HMGP, Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continuing
Report of Progress	County R&B is always checking to see what and where this needs to be done. This is an ongoing practice with every hard rain or flood.

Action Worksheet	
Name of Jurisdiction:	Dallas County
Risk / Vulnerability	
Problem being Mitigated:	Out of date or nonexistent building codes
Hazard(s) Addressed:	Earthquake, Severe Winter Weather, Tornado, Severe Storm
Action or Project	
Action/Project Number:	2.5
Name of Action or Project:	Building Codes
Action or Project Description:	Adopt building codes for new construction
Applicable Goal Statement:	Preserve and protect property, infrastructure, and the local economy from the negative impacts of natural hazards
Estimated Cost:	\$0-0\$1,000
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Dallas County Commission
Action/Project Priority:	31, High
Timeline for Completion:	5 Years
Potential Fund Sources:	Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Revised, Continuing
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	Dallas County
Risk / Vulnerability	
Problem being Mitigated:	Storm and wind damage to structures
Hazard(s) Addressed:	Tornado, Severe Storm
Action or Project	
Action/Project Number:	2.6
Name of Action or Project:	Construction Technique Awareness
Action or Project Description:	Promote an educational campaign for homebuyers and builders on installing construction techniques such as, hurricane straps in new construction.
Applicable Goal Statement:	Preserve and protect property, infrastructure, and the local economy from the negative impacts of natural hazards
Estimated Cost:	\$200 - \$500
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Dallas County Commissioners, Emergency Management
Action/Project Priority:	31, High
Timeline for Completion:	5 Years
Potential Fund Sources:	Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continued
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	Dallas County
Risk / Vulnerability	
Problem being Mitigated:	Severe flash flooding and infrastructure damage due to stream and drainage ways being clogged with debris.
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.9
Name of Action or Project:	Stream and River Clean Up
Action or Project Description:	Clean debris from county rivers and streams to increase capacity of water bodies and mitigate floods.
Applicable Goal Statement:	Preserve and protect property, infrastructure, and the local economy from the negative impacts of natural hazards
Estimated Cost:	\$5,000 - \$20,000
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Dallas County Commission, Road and Bridge
Action/Project Priority:	26, Medium
Timeline for Completion:	5 Years
Potential Fund Sources:	EPA/ DNR grants, HMGP, local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget Process
Progress Report	
Action Status	Continued
Report of Progress	Ongoing

Goal 3: Ensure the continued operation of government and emergency services.

Action Worksheet	
Name of Jurisdiction:	Dallas County
Risk / Vulnerability	
Problem being Mitigated:	Lack of information regarding mitigation resources.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Drought, Heat Wave, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	3.1
Name of Action or Project:	Database Resources
Action or Project Description:	Establish and maintain a database on available mitigation resources and programs that can be shared with local governments, response and preparedness agencies, and emergency care providers.
Applicable Goal Statement:	Ensure the continued operation of government and emergency services
Estimated Cost:	\$0-\$15,000 year
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management
Action/Project Priority:	29, Medium
Timeline for Completion:	5 years
Potential Fund Sources:	DHS Grants, local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continued
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	Dallas County
Risk / Vulnerability	
Problem being Mitigated:	Lack of emergency equipment to necessary personnel.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Drought, Heat Wave, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	3.2
Name of Action or Project:	Communications Equipment
Action or Project Description:	Provide adequate communications equipment for essential emergency personnel.
Applicable Goal Statement:	Ensure the continued operation of government and emergency services
Estimated Cost:	\$2,000 to \$5,000
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management
Action/Project Priority:	32, High
Timeline for Completion:	5 Years
Potential Fund Sources:	DHS grants, USDA, local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continued
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	Dallas County
Risk / Vulnerability	
Problem being Mitigated:	Potential loss of information during hazard events.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	3.3
Name of Action or Project:	Data Backup
Action or Project Description:	Establish a records management and data backup systems for jurisdictions.
Applicable Goal Statement:	Ensure the continued operation of government and emergency services
Estimated Cost:	\$1,000 to \$5,000
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	County Clerk, Emergency Management
Action/Project Priority:	25, Medium
Timeline for Completion:	3 Years
Potential Fund Sources:	Federal grants, local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Annual budget process
Progress Report	
Action Status	Continued
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	Dallas County
Risk / Vulnerability	
Problem being Mitigated:	Infrastructure down time during hazard events.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Drought, Heat Wave, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	3.4
Name of Action or Project:	Redundancy Plans
Action or Project Description:	Support development of redundancy plans for utility and telecommunication service providers in the county.
Applicable Goal Statement:	Ensure the continued operation of government and emergency services
Estimated Cost:	\$0-4150
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Dallas County Commission
Action/Project Priority:	29, Medium
Timeline for Completion:	2 Years
Potential Fund Sources:	Local funds, utility company funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Revised, Continuing
Report of Progress	N/A

Action Worksheet	
Name of Jurisdiction:	Dallas County
Risk / Vulnerability	
Problem being Mitigated:	Lack of data for decision making and facilities management
Hazard(s) Addressed:	All Hazards
Action or Project	
Action/Project Number:	3.5
Name of Action or Project:	County GIS
Action or Project Description:	Utilize and enhance the countywide multi-jurisdictional GIS system.
Applicable Goal Statement:	Ensure the continued operation of government and emergency services
Estimated Cost:	\$0 - \$20,000
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Dallas County Commission
Action/Project Priority:	28, Medium
Timeline for Completion:	Ongoing
Potential Fund Sources:	Federal grants, local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continued
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	Dallas County
Risk / Vulnerability	
Problem being Mitigated:	Reduced communication during hazard events.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Sever Winter, Drought, Heat Wave, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	3.6
Name of Action or Project:	Communication Cooperation
Action or Project Description:	Ensure communication channels and cooperation with surrounding jurisdictions.
Applicable Goal Statement:	Ensure the continued operation of government and emergency services
Estimated Cost:	\$0-\$200
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management
Action/Project Priority:	28, Medium
Timeline for Completion:	2 Years
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continued
Report of Progress	Ongoing

Goal 1: Protect the lives and minimize injury of citizens.

Action Worksheet	
Name of Jurisdiction:	City of Buffalo
Risk / Vulnerability	
Problem being Mitigated:	Public awareness of hazard vulnerability and mitigation measures.
Hazard(s) Addressed:	Tornado, Severe Storm, Winter Weather, Flooding, Drought, Extreme Heat, Earthquake, Wildlife, Sinkhole.
Action or Project	
Action/Project Number:	1.1
Name of Action or Project:	Public Awareness
Action or Project Description:	Distribute informational material to citizens, businesses, and vulnerable population groups on natural hazards and ways to reduce risks.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$0-\$500
Benefits:	Reduction in loss of life, injury, and property during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Administration, Emergency Management
Action/Project Priority:	36, High
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continuing
Report of Progress	Ongoing processes, will continue to distribute.

Action Worksheet	
Name of Jurisdiction:	City of Buffalo
Risk / Vulnerability	
Problem being Mitigated:	Public and private awareness of hazard vulnerability and mitigation measures.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Drought, Heat Wave, Earthquake, Wildlife, Sinkhole.
Action or Project	
Action/Project Number:	1.2
Name of Action or Project:	Natural Hazard Awareness
Action or Project Description:	Work with private sector business organizations and community service organizations to distribute information to the public on natural hazards and resources available to reduce risk.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$200
Benefits:	Reduction in loss of life, injury, and property during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Administration, Emergency Management, Fire Department
Action/Project Priority:	36, High
Timeline for Completion:	2-3 Months
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Attending meeting of local organizations, Budget process
Progress Report	
Action Status	Continuing
Report of Progress	Continuing

Action Worksheet	
Name of Jurisdiction:	City of Buffalo
Risk / Vulnerability	
Problem being Mitigated:	Public hazards, damage, and loss of life from severe storms and tornados
Hazard(s) Addressed:	Tornado, Severe Thunderstorm
Action or Project	
Action/Project Number:	1.3
Name of Action or Project:	Storm Sirens
Action or Project Description:	Maintain storm sirens in all population centers in the county.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$0-\$3,000
Benefits:	Reduction in loss of life, injury, and property during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Administration, Emergency Management, Fire Department;
Action/Project Priority:	41, High
Timeline for Completion:	Ongoing
Potential Fund Sources:	USDA, Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Revised
Report of Progress	Updated systems added additional sirens in 2017

Action Worksheet	
Name of Jurisdiction:	City of Buffalo
Risk / Vulnerability	
Problem being Mitigated:	Loss of life and preparedness in the event of severe storms, tornado, flood, and other hazards.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Drought, Heat Wave, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	1.4
Name of Action or Project:	Alert systems
Action or Project Description:	Promote the use of NOAA radios and/or automated alert systems in businesses, homes, and vulnerable facilities such as schools, nursing homes, medical clinics, and day care centers.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	0-\$600 Swift 911
Benefits:	Reduction of injury and loss of life for citizens.
Plan for Implementation	
Responsible Organization/Department:	Administration, Emergency Management
Action/Project Priority:	47, High
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Swift 911 - Reverse 911 type system. Social media reports, public service announcements, additional siren in place. Budget process
Progress Report	
Action Status	Continued
Report of Progress	Continuing

Action Worksheet	
Name of Jurisdiction:	City of Buffalo
Risk / Vulnerability	
Problem being Mitigated:	Loss of life or injury during fire events.
Hazard(s) Addressed:	Wildfire
Action or Project	
Action/Project Number:	1.5
Name of Action or Project:	Citizen Preparedness
Action or Project Description:	Promote the use of smoke alarms in homes, businesses, and places of public congregation.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	0-\$500-flyers w/water bill
Benefits:	Reduction of injury and loss of life for citizens.
Plan for Implementation	
Responsible Organization/Department:	Fire Department
Action/Project Priority:	47, High
Timeline for Completion:	1-3 months, ongoing
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continuing
Report of Progress	Continuing

Action Worksheet	
Name of Jurisdiction:	City of Buffalo
Risk / Vulnerability	
Problem being Mitigated:	Unawareness of flooded roadways
Hazard(s) Addressed:	Floods
Action or Project	
Action/Project Number:	1.6
Name of Action or Project:	Procedure for flooded roadways
Action or Project Description:	Create a procedure for notification of flooded roadways.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$5,850-\$10,000
Benefits:	Improves communication during hazard events and reduces injury to citizens.
Plan for Implementation	
Responsible Organization/Department:	Police, Emergency Management
Action/Project Priority:	38, High
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local funds – city/county partnership
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process, Swift 911
Progress Report	
Action Status	New
Report of Progress	

Action Worksheet	
Name of Jurisdiction:	City of Buffalo
Risk / Vulnerability	
Problem being Mitigated:	Unsafe environments during severe weather events.
Hazard(s) Addressed:	Tornado, Severe thunderstorm
Action or Project	
Action/Project Number:	1.7
Name of Action or Project:	Safe environments during severe weather
Action or Project Description:	Where feasible, retrofit existing critical and vulnerable facilities to provide a safer environment during severe weather events.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$50,000 +
Benefits:	Lessens risks and injury to citizens during severe weather events.
Plan for Implementation	
Responsible Organization/Department:	Administration, Emergency Management,
Action/Project Priority:	35, High
Timeline for Completion:	2-5 years
Potential Fund Sources:	HMGP, PDM, Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Comprehensive Plan, Budget process
Progress Report	
Action Status	Continuing
Report of Progress	City police station has a system in place. City PD, EOC w/ less of power

Goal 2: Preserve and protect property, infrastructure, and the local economy from the negative impacts of natural hazards.

Action Worksheet	
Name of Jurisdiction:	City of Buffalo
Risk / Vulnerability	
Problem being Mitigated:	Lack of backup power in critical facilities.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Heat Wave, and Earthquake
Action or Project	
Action/Project Number:	2.1
Name of Action or Project:	Back-up generators
Action or Project Description:	Promote installation of back-up generators in all communities for critical infrastructure, such as water towers and wastewater treatment facilities, and in critical/vulnerable facilities including schools, medical facilities, storm shelters, and critical government buildings.
Applicable Goal Statement:	Preserve and protect property, infrastructure, and the local economy from the negative impacts of natural hazards.
Estimated Cost:	\$0-\$50,000
Benefits:	Improved public safety during hazard events and preservation of critical infrastructure during hazardous events.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management, Police Department, Fire Department
Action/Project Priority:	32, High
Timeline for Completion:	1 Year
Potential Fund Sources:	HMGP, PDM, USDA, Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Comprehensive Plan, Emergency Operations Plan, Budget process
Progress Report	
Action Status	Continuing
Report of Progress	Continuing - City PD, City FD, EOC/ 2 nd at FD, Public works

Action Worksheet	
Name of Jurisdiction:	City of Buffalo
Risk / Vulnerability	
Problem being Mitigated:	Flooding of low water crossings
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.2
Name of Action or Project:	Low water crossing upgrades
Action or Project Description:	Upgrade low water crossings where feasible.
Applicable Goal Statement:	Preserve and protect property, infrastructure, and the local economy from the negative impacts of natural hazards
Estimated Cost:	\$300,000
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	City Engineering, Administration
Action/Project Priority:	27, Medium
Timeline for Completion:	5 Years
Potential Fund Sources:	HMGP, PDM, Local transportation funds
Local Planning Mechanisms to be Used in Implementation, if any:	Comprehensive Plan, Budget process
Progress Report	
Action Status	Continuing
Report of Progress	Attempting to get mitigation funds from FEMA to assist.

Action Worksheet	
Name of Jurisdiction:	City of Buffalo
Risk / Vulnerability	
Problem being Mitigated:	Flood damage to waste water treatment facilities and collection systems.
Hazard(s) Addressed:	Flood.
Action or Project	
Action/Project Number:	2.3
Name of Action or Project:	Storm Water Impact
Action or Project Description:	Utilize appropriate structural improvements to eliminate or reduce the impacts of storm water on wastewater treatment facilities and collection systems.
Applicable Goal Statement:	Preserve and protect property, infrastructure, and the local economy from the negative impacts of natural hazards
Estimated Cost:	\$100,000+
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Administration, public works
Action/Project Priority:	25, Medium
Timeline for Completion:	Ongoing project, install new drains.
Potential Fund Sources:	HMGP, PDM, Local funds - Sewer Revenue w/rate raise
Local Planning Mechanisms to be Used in Implementation, if any:	Comprehensive plan, Budget process
Progress Report	
Action Status	Revised
Report of Progress	Expensive project, need better direction. Engineering study done to assist.

Action Worksheet	
Name of Jurisdiction:	City of Buffalo
Risk / Vulnerability	
Problem being Mitigated:	Buildup of debris in flood areas
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.4
Name of Action or Project:	Storm Water Impact
Action or Project Description:	Clean debris from drainage channels and under bridges to improve capacities of storm drainage systems.
Applicable Goal Statement:	Preserve and protect property, infrastructure, and the local economy from the negative impacts of natural hazards
Estimated Cost:	\$1,000
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Street Department
Action/Project Priority:	28, Medium
Timeline for Completion:	6 Months; ongoing
Potential Fund Sources:	HMGP, local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continuing
Report of Progress	Currently several times a year. Street department does this on public lands/easements

Action Worksheet	
Name of Jurisdiction:	City of Buffalo
Risk / Vulnerability	
Problem being Mitigated:	Storm and wind damage to structures
Hazard(s) Addressed:	Tornado, Severe Storm
Action or Project	
Action/Project Number:	2.6
Name of Action or Project:	Construction Technique Awareness
Action or Project Description:	Promote an educational campaign for home buyers and builders on installing construction techniques such as, hurricane straps in new construction.
Applicable Goal Statement:	Preserve and protect property, infrastructure, and the local economy from the negative impacts of natural hazards
Estimated Cost:	\$0-\$500 Handouts/Flyers
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management, Building inspector
Action/Project Priority:	35, M
Timeline for Completion:	4-6 Months; ongoing
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process, Building Codes
Progress Report	
Action Status	Continued
Report of Progress	Continuing

Goal 3: Ensure the continued operation of government and emergency services.

Action Worksheet	
Name of Jurisdiction:	City of Buffalo
Risk / Vulnerability	
Problem being Mitigated:	Lack of emergency equipment to necessary personnel.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Drought, Heat Wave, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	3.2
Name of Action or Project:	Communications Equipment
Action or Project Description:	Provide adequate communications equipment for essential emergency personnel.
Applicable Goal Statement:	Ensure the continued operation of government and emergency services
Estimated Cost:	0-\$100,000
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management, Administration, Fire Department, Police Department, Public works
Action/Project Priority:	47, High
Timeline for Completion:	1 year
Potential Fund Sources:	HMGP, PDM, USDA, Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process, LEPC, Emergency Operations Plan
Progress Report	
Action Status	Continued
Report of Progress	Continuing

Action Worksheet	
Name of Jurisdiction:	City of Buffalo
Risk / Vulnerability	
Problem being Mitigated:	Potential loss of information during hazard events.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	3.3
Name of Action or Project:	Data Backup
Action or Project Description:	Establish a records management and data backup systems for jurisdictions.
Applicable Goal Statement:	Ensure the continued operation of government and emergency services
Estimated Cost:	None
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management, Administration
Action/Project Priority:	47, High
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget Process
Progress Report	
Action Status	Continued
Report of Progress	Continuing

Action Worksheet	
Name of Jurisdiction:	City of Buffalo
Risk / Vulnerability	
Problem being Mitigated:	Infrastructure down time during hazard events.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Drought, Heat Wave, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	3.4
Name of Action or Project:	Redundancy Plans
Action or Project Description:	Support development of redundancy plans for utility and telecommunication service providers in the county.
Applicable Goal Statement:	Ensure the continued operation of government and emergency services
Estimated Cost:	\$0
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management, Administration (in coordination with utility providers)
Action/Project Priority:	43, High
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Revised
Report of Progress	Ongoing

Action Worksheet	
Name of Jurisdiction:	City of Buffalo
Risk / Vulnerability	
Problem being Mitigated:	Reduced communication during hazard events.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Sever Winter, Drought, Heat Wave, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	3.6
Name of Action or Project:	Communication Channels
Action or Project Description:	Ensure communication channels and cooperation with surrounding jurisdictions.
Applicable Goal Statement:	Ensure the continued operation of government and emergency services
Estimated Cost:	\$0
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Emergency Management, Fire Department, Police Department
Action/Project Priority:	47, High
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continued
Report of Progress	Ongoing

Goal 1: Protect the lives and minimize injury of citizens.

Action Worksheet	
Name of Jurisdiction:	Village of Louisburg
Risk / Vulnerability	
Problem being Mitigated:	Public awareness of hazard vulnerability and mitigation measures.
Hazard(s) Addressed:	Tornado, Severe Storm, Winter Weather, Flooding, Drought, Extreme Heat, Earthquake, Wildlife, Sinkhole.
Action or Project	
Action/Project Number:	1.1
Name of Action or Project:	Public Awareness
Action or Project Description:	Distribute informational material to citizens, businesses, and vulnerable population groups on natural hazards and ways to reduce risks.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$100-\$200 to send out packets
Benefits:	Reduction in loss of life, injury, and property during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Village Clerk
Action/Project Priority:	36, High
Timeline for Completion:	1 year, Ongoing
Potential Fund Sources:	Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continuing
Report of Progress	N/A

Action Worksheet	
Name of Jurisdiction:	Village of Louisburg
Risk / Vulnerability	
Problem being Mitigated:	Public and private awareness of hazard vulnerability and mitigation measures.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Drought, Heat Wave, Earthquake, Wildlife, Sinkhole.
Action or Project	
Action/Project Number:	1.2
Name of Action or Project:	Natural Hazard Awareness
Action or Project Description:	Work with private sector business organizations and community service organizations to distribute information to the public on natural hazards and resources available to reduce risk.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$50-\$100
Benefits:	Reduction in loss of life, injury, and property during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Village Clerk
Action/Project Priority:	36, High
Timeline for Completion:	1 Year
Potential Fund Sources:	General Fund
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continuing
Report of Progress	Preparing, continuing

Action Worksheet	
Name of Jurisdiction:	Village of Louisburg
Risk / Vulnerability	
Problem being Mitigated:	Loss of life and preparedness in the event of severe storms, tornado, flood, and other hazards.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Drought, Heat Wave, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	1.4
Name of Action or Project:	Alert systems
Action or Project Description:	Promote the use of NOAA radios and/or automated alert systems in businesses, homes, and vulnerable facilities such as schools, nursing homes, medical clinics, and day care centers.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$0
Benefits:	Reduction of injury and loss of life for citizens.
Plan for Implementation	
Responsible Organization/Department:	Village Board, Village Clerk
Action/Project Priority:	41, High
Timeline for Completion:	1 Year ; ongoing
Potential Fund Sources:	General fund
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continued
Report of Progress	Not started

Action Worksheet	
Name of Jurisdiction:	Village of Louisburg
Risk / Vulnerability	
Problem being Mitigated:	Loss of life or injury during fire events.
Hazard(s) Addressed:	Wildfire
Action or Project	
Action/Project Number:	1.5
Name of Action or Project:	Citizen Preparedness
Action or Project Description:	Promote the use of smoke alarms in homes, businesses, and places of public congregation.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$0
Benefits:	Increase citizen awareness of mitigation activities
Plan for Implementation	
Responsible Organization/Department:	Village Board, Village Clerk, Louisburg Volunteer fire
Action/Project Priority:	41, High
Timeline for Completion:	1 Year; ongoing
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process, Plan to work with fire department.
Progress Report	
Action Status	Continuing
Report of Progress	Information to be included in packets to residents

Goal 2: Preserve and protect property, infrastructure, and the local economy from the negative impacts of natural hazards.

Action Worksheet	
Name of Jurisdiction:	Village of Louisburg
Risk / Vulnerability	
Problem being Mitigated:	Buildup of debris in flood areas
Hazard(s) Addressed:	Flood
Action or Project	
Action/Project Number:	2.4
Name of Action or Project:	Storm Water Impact
Action or Project Description:	Clean debris from drainage channels and under bridges to improve capacities of storm drainage systems.
Applicable Goal Statement:	Preserve and protect property, infrastructure, and the local economy from the negative impacts of natural hazards
Estimated Cost:	\$0-\$1,000
Benefits:	Improved public safety during hazard events
Plan for Implementation	
Responsible Organization/Department:	Village Administration
Action/Project Priority:	29, Medium
Timeline for Completion:	1 Year; ongoing
Potential Fund Sources:	HMGP, Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continuing
Report of Progress	

Action Worksheet	
Name of Jurisdiction:	Village of Louisburg
Risk / Vulnerability	
Problem being Mitigated:	Storm and wind damage to structures
Hazard(s) Addressed:	Tornado, Severe Storm
Action or Project	
Action/Project Number:	2.6
Name of Action or Project:	Construction Technique Awareness
Action or Project Description:	Promote an educational campaign for home buyers and builders on installing construction techniques such as, hurricane straps in new construction.
Applicable Goal Statement:	Preserve and protect property, infrastructure, and the local economy from the negative impacts of natural hazards
Estimated Cost:	\$0
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Village Administration, Village Clerk
Action/Project Priority:	33, High
Timeline for Completion:	5 Years; ongoing
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continued
Report of Progress	

Goal 3: Ensure the continued operation of government and emergency services.

Action Worksheet	
Name of Jurisdiction:	Village of Louisburg
Risk / Vulnerability	
Problem being Mitigated:	Lack of emergency equipment to necessary personnel.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Drought, Heat Wave, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	3.2
Name of Action or Project:	Communications Equipment
Action or Project Description:	Provide adequate communications equipment for essential emergency personnel.
Applicable Goal Statement:	Ensure the continued operation of government and emergency services
Estimated Cost:	\$120 annually
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Village Administration - Currently use IRIS dispatch
Action/Project Priority:	36, High
Timeline for Completion:	Ongoing
Potential Fund Sources:	General Fund
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continued
Report of Progress	Already completed, but will continue

Goal 1: Protect the lives and minimize injury of citizens.

Action Worksheet	
Name of Jurisdiction:	Dallas County R-I
Risk / Vulnerability	
Problem being Mitigated:	Public awareness of hazard vulnerability and mitigation measures.
Hazard(s) Addressed:	Tornado, Severe Storm, Winter Weather, Flooding, Drought, Extreme Heat, Earthquake, Wildlife, Sinkhole.
Action or Project	
Action/Project Number:	1.1
Name of Action or Project:	Public Awareness
Action or Project Description:	Distribute informational material to citizens, businesses, and vulnerable population groups on natural hazards and ways to reduce risks.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	~ \$10,000 for automated calling and website.
Benefits:	Reduction in loss of life, injury, and property during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Assistant Superintendent – Communication
Action/Project Priority:	42, High
Timeline for Completion:	1-6 months; Ongoing
Potential Fund Sources:	District Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process, School Emergency plan,
Progress Report	
Action Status	Continuing
Report of Progress	Will be purchasing system

Action Worksheet	
Name of Jurisdiction:	Dallas County R-I
Risk / Vulnerability	
Problem being Mitigated:	Public and private awareness of hazard vulnerability and mitigation measures.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Drought, Heat Wave, Earthquake, Wildlife, Sinkhole.
Action or Project	
Action/Project Number:	1.2
Name of Action or Project:	Natural Hazard Awareness
Action or Project Description:	Work with private sector business organizations and community service organizations to distribute information to the public on natural hazards and resources available to reduce risk.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$0-\$10,000
Benefits:	Reduction in loss of life, injury, and property during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Assistant Superintendent
Action/Project Priority:	42, High
Timeline for Completion:	Ongoing
Potential Fund Sources:	District funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process, School Emergency plan
Progress Report	
Action Status	Continuing
Report of Progress	Will be purchasing system

Action Worksheet	
Name of Jurisdiction:	Dallas County R-I
Risk / Vulnerability	
Problem being Mitigated:	Loss of life and preparedness in the event of severe storms, tornado, flood, and other hazards.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Drought, Heat Wave, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	1.4
Name of Action or Project:	Alert systems
Action or Project Description:	Promote the use of NOAA radios and/or automated alert systems in businesses, homes, and vulnerable facilities such as schools, nursing homes, medical clinics, and day care centers.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$0-\$10,000
Benefits:	Reduction of injury and loss of life for citizens.
Plan for Implementation	
Responsible Organization/Department:	Assistant Superintendent – Communication
Action/Project Priority:	42, High
Timeline for Completion:	6 Months
Potential Fund Sources:	District Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget Process
Progress Report	
Action Status	Continued
Report of Progress	No barriers to begin

Action Worksheet	
Name of Jurisdiction:	Dallas County R-I
Risk / Vulnerability	
Problem being Mitigated:	Loss of life or injury during fire events.
Hazard(s) Addressed:	Wildfire
Action or Project	
Action/Project Number:	1.5
Name of Action or Project:	Citizen Preparedness
Action or Project Description:	Promote the use of smoke alarms in homes, businesses, and places of public congregation.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$0-\$10,000
Benefits:	Increase citizen awareness of mitigation activities
Plan for Implementation	
Responsible Organization/Department:	Assistant Superintendent- Communication
Action/Project Priority:	42, High
Timeline for Completion:	6 Months
Potential Fund Sources:	District Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continuing
Report of Progress	

Action Worksheet	
Name of Jurisdiction:	Dallas County R-I
Risk / Vulnerability	
Problem being Mitigated:	Unsafe environments during severe weather events.
Hazard(s) Addressed:	Tornado, Severe thunderstorm
Action or Project	
Action/Project Number:	1.7
Name of Action or Project:	Safe environments during severe weather
Action or Project Description:	Where feasible, retrofit existing critical and vulnerable facilities to provide a safer environment during severe weather events.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$20,000-\$500,000
Benefits:	Lessens risks and injury to citizens during severe weather events.
Plan for Implementation	
Responsible Organization/Department:	School Board, Superintendent, Maintenance Director
Action/Project Priority:	44, High
Timeline for Completion:	5 years
Potential Fund Sources:	HMGP, PDM, District funds, tax dollars
Local Planning Mechanisms to be Used in Implementation, if any:	Master Plan, Capital Improvement Plan, School Emergency Plan, Budget process
Progress Report	
Action Status	Continuing
Report of Progress	

Goal 3: Ensure the continued operation of government and emergency services.

Action Worksheet	
Name of Jurisdiction:	Dallas County R-I
Risk / Vulnerability	
Problem being Mitigated:	Lack of information regarding mitigation resources.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Drought, Heat Wave, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	3.1
Name of Action or Project:	Database Resources
Action or Project Description:	Establish and maintain a database on available mitigation resources and programs that can be shared with local governments, response and preparedness agencies, and emergency care providers.
Applicable Goal Statement:	Ensure the continued operation of government and emergency services
Estimated Cost:	\$0-\$10,000
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Assistant Superintendent
Action/Project Priority:	44, High
Timeline for Completion:	3 months
Potential Fund Sources:	District Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continued
Report of Progress	

Action Worksheet	
Name of Jurisdiction:	Dallas County R-I
Risk / Vulnerability	
Problem being Mitigated:	Infrastructure down time during hazard events.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Drought, Heat Wave, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	3.4
Name of Action or Project:	Redundancy Plans
Action or Project Description:	Support development of redundancy plans for utility and telecommunication service providers in the county.
Applicable Goal Statement:	Ensure the continued operation of government and emergency services
Estimated Cost:	\$100
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Maintenance and Tech Directors (in coordination with utility providers)
Action/Project Priority:	44, High
Timeline for Completion:	12 Months
Potential Fund Sources:	None
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Revised
Report of Progress	

Action Worksheet	
Name of Jurisdiction:	Dallas County R-I
Risk / Vulnerability	
Problem being Mitigated:	Reduced communication during hazard events.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Drought, Heat Wave, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	3.6
Name of Action or Project:	Communication Cooperation
Action or Project Description:	Ensure communication channels and cooperation with surrounding jurisdictions.
Applicable Goal Statement:	Ensure the continued operation of government and emergency services
Estimated Cost:	\$100
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Assistant Superintendent
Action/Project Priority:	44; High
Timeline for Completion:	12 months ; ongoing
Potential Fund Sources:	District Funds
Local Planning Mechanisms to be Used in Implementation, if any:	
Progress Report	
Action Status	Continued
Report of Progress	

Goal 1: Protect the lives and minimize injury of citizens.

Action Worksheet	
Name of Jurisdiction:	Urbana Rural Fire Department
Risk / Vulnerability	
Problem being Mitigated:	Public awareness of hazard vulnerability and mitigation measures.
Hazard(s) Addressed:	Tornado, Severe Storm, Winter Weather, Flooding, Drought, Extreme Heat, Earthquake, Wildlife, Sinkhole.
Action or Project	
Action/Project Number:	1.1
Name of Action or Project:	Public Awareness
Action or Project Description:	Distribute informational material to citizens, businesses, and vulnerable population groups on natural hazards and ways to reduce risks.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$0-\$500
Benefits:	Reduction in loss of life, injury, and property during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Fire fighters
Action/Project Priority:	25, Medium
Timeline for Completion:	6 months, ongoing
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continuing
Report of Progress	Work in progress

Action Worksheet	
Name of Jurisdiction:	Urbana Rural Fire Department
Risk / Vulnerability	
Problem being Mitigated:	Public and private awareness of hazard vulnerability and mitigation measures.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Drought, Heat Wave, Earthquake, Wildlife, Sinkhole.
Action or Project	
Action/Project Number:	1.2
Name of Action or Project:	Natural Hazard Awareness
Action or Project Description:	Work with private sector business organizations and community service organizations to distribute information to the public on natural hazards and resources available to reduce risk.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$0
Benefits:	Reduction in loss of life, injury, and property during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Fire Chief, Fire Fighters
Action/Project Priority:	25, Medium
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continuing
Report of Progress	Work in progress

Action Worksheet	
Name of Jurisdiction:	Urbana Rural Fire Development
Risk / Vulnerability	
Problem being Mitigated:	Loss of life or injury during fire events.
Hazard(s) Addressed:	Wildfire
Action or Project	
Action/Project Number:	1.5
Name of Action or Project:	Citizen Preparedness
Action or Project Description:	Promote the use of smoke alarms in homes, businesses, and places of public congregation.
Applicable Goal Statement:	Protect lives and minimize injury of citizens.
Estimated Cost:	\$0-\$150
Benefits:	Reduction of injury and loss of life for citizens.
Plan for Implementation	
Responsible Organization/Department:	Fire Chief, Fire Fighters
Action/Project Priority:	25, Medium
Timeline for Completion:	Continuous, never ending
Potential Fund Sources:	Local Funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continuing
Report of Progress	Work in progress

Goal 3: Ensure the continued operation of government and emergency services.

Action Worksheet	
Name of Jurisdiction:	Urbana Rural Fire Department
Risk / Vulnerability	
Problem being Mitigated:	Lack of emergency equipment to necessary personnel.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Drought, Heat Wave, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	3.2
Name of Action or Project:	Communications Equipment
Action or Project Description:	Provide adequate communications equipment for essential emergency personnel.
Applicable Goal Statement:	Ensure the continued operation of government and emergency services
Estimated Cost:	\$3,000
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Board of Directors
Action/Project Priority:	28, Medium
Timeline for Completion:	5 Years; ongoing
Potential Fund Sources:	USDA, grants, local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continued
Report of Progress	Renew in a few years.

Action Worksheet	
Name of Jurisdiction:	Urbana Rural Fire Department
Risk / Vulnerability	
Problem being Mitigated:	Potential loss of information during hazard events.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Severe Winter, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	3.3
Name of Action or Project:	Data Backup
Action or Project Description:	Establish a records management and data backup systems for jurisdictions.
Applicable Goal Statement:	Ensure the continued operation of government and emergency services
Estimated Cost:	\$100
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Fire Chief
Action/Project Priority:	27, Medium
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continued
Report of Progress	Done; ongoing to maintain

Action Worksheet	
Name of Jurisdiction:	Urbana Rural Fire Department
Risk / Vulnerability	
Problem being Mitigated:	Reduced communication during hazard events.
Hazard(s) Addressed:	Tornado, Severe Storm, Flood, Sever Winter, Drought, Heat Wave, Earthquake, Wildfire, Sinkhole.
Action or Project	
Action/Project Number:	3.6
Name of Action or Project:	Communication Cooperation
Action or Project Description:	Ensure communication channels and cooperation with surrounding jurisdictions.
Applicable Goal Statement:	Ensure the continued operation of government and emergency services
Estimated Cost:	\$0
Benefits:	Improved public safety during hazard events.
Plan for Implementation	
Responsible Organization/Department:	Board of Directors, Fire Chief
Action/Project Priority:	30, High
Timeline for Completion:	Ongoing
Potential Fund Sources:	Local funds
Local Planning Mechanisms to be Used in Implementation, if any:	Budget process
Progress Report	
Action Status	Continued
Report of Progress	

5 PLAN MAINTENANCE PROCESS

5 PLAN MAINTENANCE PROCESS	5.1
<i>5.1 Monitoring, Evaluating, and Updating the Plan.....</i>	<i>5.1</i>
5.1.1 Responsibility for Plan Maintenance	5.1
5.1.2 Plan Maintenance Schedule	5.2
5.1.3 Plan Maintenance Process.....	5.2
<i>5.2 Incorporation into Existing Planning Mechanisms</i>	<i>5.3</i>
<i>5.3 Continued Public Involvement</i>	<i>5.5</i>

This chapter provides an overview of the overall strategy for plan maintenance and outlines the method and schedule for monitoring, updating and evaluating the plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

5.1 Monitoring, Evaluating, and Updating the Plan

44 CFR Requirement 201.6(c)(4): The plan maintenance process shall include a section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

5.1.1 Responsibility for Plan Maintenance

The Mitigation Planning Committee (MPC) has served as an advisory body during the plan update process, but is not a standing committee. Many MPC representatives and stakeholders are also represented by the Local Emergency Planning Committee (LEPC), as well as several other committees and groups in Dallas County. The LEPC is overseen by the County Emergency Management Director, thus this group will be responsible for overseeing the plan monitoring, evaluation and maintenance of the Plan. However, it will be up to the County Commission, Office of Emergency Management, and the local jurisdictions to carry out the goals and actions outlined. Maintenance will involve agreement of the participating jurisdictions, including schools and special districts, to:

- Meet annually, and after a disaster event, to monitor and evaluate the implementation of the plan;
- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high priority, low- or no-cost recommended actions;
- Maintain vigilant monitoring of multi-objective, cost-share, and other funding opportunities to help the community implement the plan’s recommended actions for which no current funding exists;
- Monitor and assist in implementation and update of this plan;
- Keep the concept of mitigation in the forefront of community decision making by identifying plan recommendations when other community goals, plans, and activities overlap, influence, or directly affect increased community vulnerability to disasters;

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- Report on plan progress and recommended changes to the County Board of Commissioners and governing bodies of participating jurisdictions; and
 - Inform and solicit input from the public.

5.1.2 Plan Maintenance Schedule

The EMD will facilitate annual meetings and after a state or federally declared hazard event as appropriate to monitor progress and update the mitigation strategy. The Dallas County EMD will be responsible for initiating the plan reviews, which may occur during a regularly scheduled LEPC meeting, and will invite additional members of the MPC to attend.

In coordination with all participating jurisdictions, a five-year written update of the plan will be submitted to the Missouri State Emergency Management Agency (SEMA) and FEMA Region VII per Requirement §201.6(c)(4)(i) of the Disaster Mitigation Act of 2000, unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule.

5.1.3 Plan Maintenance Process

Progress on the proposed actions can be monitored by evaluating changes in vulnerabilities identified in the plan. During the annual meeting, members of the MPC or expanded LEPC group will review changes in vulnerability identified as follows:

- Decreased vulnerability as a result of implementing recommended actions,
- Increased vulnerability as a result of failed or ineffective mitigation actions,
- Increased vulnerability due to hazard events, and/or
- Increased vulnerability as a result of new development (and/or annexation).

Future 5-year updates to this plan will include the following activities:

- Consideration of changes in vulnerability due to action implementation,
- Documentation of success stories where mitigation efforts have proven effective,
- Documentation of unsuccessful mitigation actions and why the actions were not effective,
- Documentation of previously overlooked hazard events that may have occurred since the previous plan approval,
- Incorporation of new data or studies with information on hazard risks,
- Incorporation of new capabilities or changes in capabilities,
- Incorporation of growth data and changes to inventories, and
- Incorporation of ideas for new actions and changes in action prioritization.

In order to best evaluate any changes in vulnerability as a result of plan implementation, the participating jurisdictions will adopt the following process:

- Each proposed action in the plan identified an individual, office, or agency responsible for action implementation. This entity will track and report on an annual basis to the jurisdictional committee member on action status. The entity will provide input on whether the action as implemented meets the defined objectives and is likely to be successful in reducing risk.
- If the action does not meet identified objectives, the jurisdictional member will determine necessary remedial action, making any required modifications to the plan.

Changes will be made to the plan to remedy actions that have failed or are not considered feasible. Feasibility will be determined after a review of action consistency with established criteria, time frame, community priorities, and/or funding resources. Actions that were not ranked high but were identified as potential mitigation activities will be reviewed as well during the monitoring of this plan. Updating of the plan will be accomplished by written changes and submissions, as the EMD and LEPC group deems appropriate and necessary. Changes will be approved by the Dallas County Commission and the governing boards of the other participating jurisdictions.

5.2 Incorporation into Existing Planning Mechanisms

44 CFR Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

Where possible, plan participants, including school and special districts, will use existing plans and/or programs to implement hazard mitigation actions. Those existing plans and programs were described in Section 2.2 of this plan. Based on the capability assessments of the participating jurisdictions, communities in Dallas County will continue to plan and implement programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through the following plans:

- General or master plans of participating jurisdictions;
- Ordinances of participating jurisdictions;
- Dallas County Emergency Operations Plan;
- Capital improvement plans and budgets;
- School and Special District Plans and budgets; and
- Other plans and policies outlined in the capability assessment sections for each jurisdiction in Chapter 2 of this plan.

Jurisdictional representatives involved in updating these existing planning mechanisms will be responsible for integrating the findings and actions of the mitigation plan, as appropriate. The EMD and any expanded LEPC is also responsible for monitoring the integration and incorporation of the appropriate information into the next five-year update of the multi-jurisdictional hazard mitigation plan.

Additionally, after the annual review of the Hazard Mitigation Plan, the Dallas County Emergency Management Director will provide the updated Mitigation Strategy with current status of each mitigation action to the County Commission, as well as all Mayors, City Clerks, and School District Superintendents. The Emergency Management Director will request that the mitigation strategy be incorporated, where appropriate, in other planning mechanisms.

Table 5.1 below lists the planning mechanisms by jurisdiction into which the Hazard Mitigation Plan will be integrated.

Table 5.1 Planning Mechanisms Identified for Integration of Hazard Mitigation Plan

Jurisdiction	Planning Mechanisms	Integration Process for Previous Plan	Integration Process for Current Plan
Dallas County	County Mitigation Plan Floodplain Ordinance Economic Development Program, Mutual Aid Agreements, Emergency Operations Plan	N/A	Budget process Emergency Operations Plan
City of Buffalo	Comprehensive Plan County Mitigation Plan Zoning Ordinance Building Ordinance Floodplain Ordinance	N/A	Budget process Swift 911 - Reverse 911 type system Comprehensive Plan Emergency Operations Plan Building Codes LEPC
Village of Louisburg	Budget process	N/A	Budget process
Dallas R-I	Master Plan, Capital Improvement Plan, School Emergency Plan, Weapons Policy, Full-Time Building Official, Emergency Manager, Grant Writer, Public Information Officer, Public Education Programs, Local Funds, General Obligation Bonds, Special tax bonds, Private Activates Donations, State and Federal Funds/Grants, Tornado Sheltering Exercises, Public Address/Emergency Alert System, NOAA Weather Radios, Lock-Down Security Training, Mitigation Programs, Tornado Safe room, Campus Police.	N/A	Budget process, School Emergency plan

5.3 Continued Public Involvement

44 CFR Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.

The hazard mitigation plan update process provides an opportunity to publicize success stories resulting from the plan's implementation and seek additional public comment. Information about the annual reviews will be posted in the local newspaper as well as participating jurisdiction's websites and social media following each annual review of the mitigation plan.

When reconvening for the next five-year update, the EMD will coordinate with all stakeholders participating in the planning process and reconvene the MPC. Included in this group will be those who joined the MPC after the initial effort, to update and revise the plan. Public notice will be posted and public participating solicited, at a minimum, through available website postings and press releases to local media outlets.