WHITFIELD COUNTY
HAZARD MITIGATION PLAN 2022

Including the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta

Table of Contents

Chapter 1
Introduction

1.1 Purpose

The Disaster Mitigation Act of 2000 has helped to bring attention to the need for successful hazard mitigation planning throughout the United States. Section 322 of the Act emphasizes the importance of comprehensive multi-hazard planning at the local level, both natural and technological, and the necessity of effective coordination between State and local entities to promote an integrated, comprehensive approach to mitigation planning. The Hazard Mitigation Planning and Hazard Mitigation Grant Program (HMGP) interim final rule published on February 26, 2002, identifies these new local mitigation planning requirements. According to this rule, state and local governments are required to develop, submit, and obtain FEMA approval of a hazard mitigation plan (HMP). Completion of an HMP that meets the new Federal requirements will increase access to funds for local governments and allow them to remain eligible for Stafford Act assistance.

The HMP becomes part of the foundation for emergency management planning, exercises, training, preparedness and mitigation within the County. Such a plan sets the stage for long-term disaster resistance through identification of actions that will, over time, reduce the exposure of people and property to identifiable hazards. This plan provides an overview of the hazards that threaten the County, and what safeguards have been implemented, or may need to considered for implementation in the future.

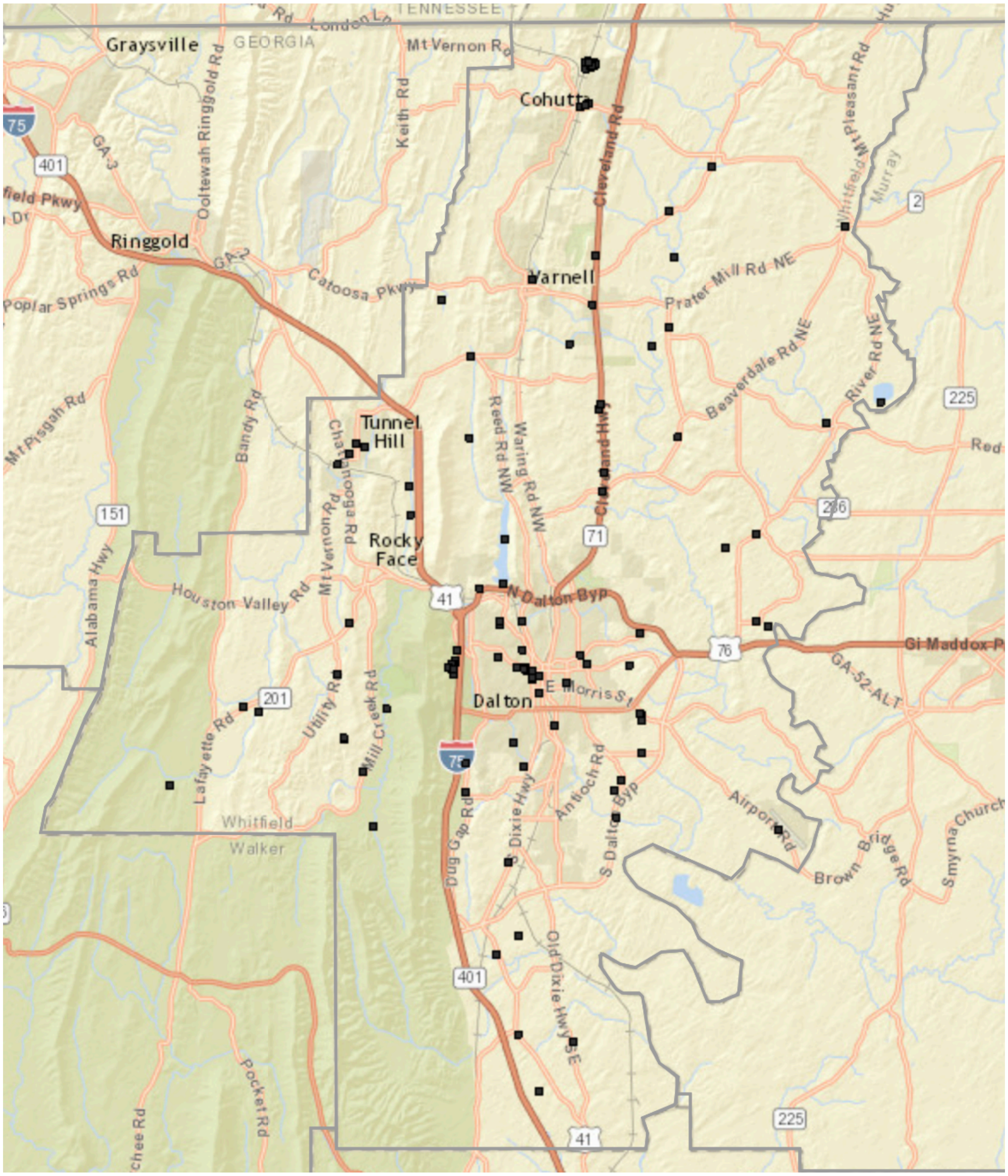
Hazards, for purposes of this plan, have been divided into two basic categories: natural and technological. Natural hazards include all hazards that are not caused either directly or indirectly by man and are frequently related to weather events, such as tornados and winter storms. Technological hazards include hazards that are directly or indirectly caused by man, including hazardous materials spills and weapons of mass destruction (WMD) events, although terrorism is not the particular focus of this Plan. This Plan also makes some recommendations that transcend this classification of natural and technological hazards. In other words, some of the recommendations contained within this Plan apply to many or all hazards. This is commonly referred to as an “all-hazards approach”. Most hazards throughout the United States could happen anytime and anywhere. However, the main focus of this plan is on those hazards that are most likely to affect Whitfield County and the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta in the future.

1.2 Organization of the Plan

The Hazard Mitigation Plan (HMP) consists of four main components: 1) the narrative plan, 2) the Hazard History Database, 3) the Hazard Frequency Table, and 4) a Critical Facilities Database. The narrative plan itself is the main component of the HMP. This part of the Plan includes an overview of the planning process, a summary of the County's hazard history, hazard frequency projections, a detailed discussion of proposed mitigation measures, and a description of how future reviews and updates to the Plan will be handled. The Hazard History Database is attached as a Microsoft Excel spreadsheet and includes relevant information on past hazards within the County. The Hazard Frequency Table is derived from the hazard history and provides frequency-related statistics for each discussed hazard. This table is also attached as a Microsoft Excel spreadsheet. Finally, the Critical Facilities Database is an online tool developed in part by UGA for GEMA that contains detailed information on critical facilities within the County. Critical facilities for the purposes of this plan are those facilities that are among the most important within a specific jurisdiction with regard to the security and welfare of the persons and property within that jurisdiction. Typical critical facilities include hospitals, fire stations, police stations, critical records storage locations, etc. These facilities will be given special consideration during mitigation planning. For instance, a critical facility should not be located in a floodplain if at all possible. Using the critical facilities information, including GPS coordinates and replacement values, along with different hazard maps from GEMA, this database becomes a valuable planning tool that can be used by Counties to help estimate losses and assess vulnerabilities. This interactive Critical Facilities Database will also help to integrate mitigation planning into their other planning processes.

The following GEMA map displays the location of critical facilities within Whitfield County and the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta. These facilities may be viewed in much greater detail within the Critical Facilities Database. Access to this database is limited and can only be viewed with the permission of the EMA Director due to the sensitive nature of some of the information.

Whitfield County Critical Facilities Map (GEMA)



A risk assessment, which is composed of elements from each of the four main HMP components, provides the factual basis for all mitigation activities proposed within this Plan.

Inventory of Critical Facilities: Critical facilities are defined as facilities that provide essential products and services to the public. Many of these facilities are government buildings that provide a multitude of services to the public, including most public safety disciplines such as emergency management, fire, police, and EMS. Other government buildings/facilities commonly classified as critical facilities are water distribution systems, wastewater treatment facilities, public works, public schools, administrative services, and post offices. For the purposes of this Plan, critical facilities have been identified by the HMPC and important information gathered for each one. This information is located in the Critical Facilities Database (Appendix A).

Hazard Identification: During the planning process, a hazard history was created based upon available records from the past fifty years. This hazard history includes the natural and technological hazards that are most likely to affect the County. Unfortunately, record keeping was not as accurate or detailed decades ago as it is now. Therefore, the most useful information relating to these hazard events is found within the last ten to fifteen years. This fact is obvious upon review of the Hazard History Database (Appendix B), and the Hazard Frequency Table (Appendix C).

Profile of Hazard Events: Each hazard identified was analyzed to determine likely causes and characteristics, and what portions of the County's population and infrastructure were most affected. However, each of the hazards discussed in this Plan has the potential to negatively impact any given point within the County. A profile of each hazard discussed in this plan is provided in Chapter 2.

Vulnerability Assessment: This step is accomplished with the Critical Facilities Database by comparing GEMA hazard maps with the inventory of affected critical facilities, other buildings, and population exposed to each hazard (see Worksheets 3a).

Estimating Losses: Using the best available data, this step involved estimating structural and other financial losses resulting from a specific hazard. This is also accomplished to some degree using the Critical Facilities Database. Describing vulnerability in terms of dollar amounts provides the County with a rough framework in which to estimate the potential effects of hazards on the built environment.

Based on information gathered, the Plan identifies some specific mitigation goals, objectives, and actions to reduce exposure or impact from hazards that have the most impact on each community. A framework for Plan implementation and maintenance is also presented within this document.

Planning grant funds from the Federal Emergency Management Agency, administered by GEMA, funded the HMP. The HMP was developed by the HMPC, with technical assistance from GEMA and North Georgia Consulting Group.

1.3 Participants in Planning Process

This Hazard Mitigation Plan (HMP) is designed to protect both the unincorporated areas of the County as well as the City. Though the County facilitated this planning process, the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta provided critical input into the process. Without this mutual cooperation, the Plan would not exist in its present comprehensive form. Note: Please keep in mind that throughout this Plan, the term "county" typically refers to all of Whitfield County, including the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta.

The process for updating Whitfield County's Hazard Mitigation Plan can be found in the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Planning's "How To" Guides. According to "Getting Started: Building Support for Mitigation Planning;" the suggested process for preparing a Hazard Mitigation Plan is to 1) Organize resources and identify stakeholders and those holding technical expertise; 2) Access risks to the community; 3) Develop a Mitigation Plan and lastly; 4) Implement and Monitor that plan once it is adopted. (FEMA 386-1)

The Whitfield County Hazard Mitigation Planning Committee (HMPC) is made up of a variety of members. The EMA Director is responsible for all decisions relating to the overall direction of the Plan, retrieval of data from various departments, and serving as a central point of contact for all matters relating to the Plan. The consultant, NGCG, is responsible for facilitation of HMPC meetings, integration of updated data into the Plan, grant administration, and other administrative functions. Local government officials including County and City employees, representatives from State government, and others from private businesses and other organizations participated in the Plan update. Each jurisdiction had representatives on the HMPC who provided critical data for consideration through meetings, email, an/or site visits. This diverse group provided valuable input into the planning process including identifying hazards and developing important mitigation measures to be considered in the future. The HMPC held its kickoff meeting on March 9, 2022. This was a more limited in-person meeting schedule than normal due to COVID-19. Other meetings and discussions were held throughout this planning process at various times between two or more HMPC members in order to accomplish smaller tasks. Two public meetings relating to this Plan are required by FEMA: one during the drafting stages of the Plan, and one after the final version of the Plan is completed. The first of these two meetings occurred on April 22, 2022 during the drafting stages of the Plan. Once necessary revisions were made to the Plan, a second public meeting was held on XXX where it was adopted by Whitfield County. A copy of the adoption resolution is included in the Appendices. All public meetings were advertised in the local newspaper and on the County website, and the draft Plan update was posted on the County website as shown on the following page. Prior to adoption at the final public meeting, the public was provided with an additional opportunity to review and comment on the Plan. This final version was then submitted to GEMA and FEMA for review and approval.

Whitfield County | Home | Government | Courts ▾ | Development ▾ | Public Safety ▾ | Employee Logon

Emergency Management

Our Mission

The mission of the Whitfield County Emergency Management Agency is to maintain a high level of preparedness, to protect the citizens of Whitfield County; to mitigate loss of life and assets prior to, during, and during the aftermath of a disaster; and to facilitate the recovery of Whitfield County in the mid and long term intervals following a disaster.

Office Description

Whitfield County's Emergency Management Agency (EMA) has the responsibility to coordinate all County emergency response plans. EMA's responsibilities are to identify vulnerabilities, effectively mitigate disasters, public education, plan for all-hazard emergency situations, ensure continuity of government and business, and to facilitate an effective recovery. Whitfield County EMA will coordinate with local, state, and federal agencies, as well as private entities to develop, maintain, and implement the Emergency Operations Plan. EMA will also support and manage the County's Emergency Operations Center.

WHITFIELD COUNTY CERT
COMMUNITY EMERGENCY RESPONSE TEAM

FEMA

Contact Information

David Metcalf, CMCP, GaCEM,
Director
dmetcalf@whitfieldcountyga.com

804 Professional Blvd
Dalton, Georgia, 30720
Office: 706-259-3730
ema@whitfieldcountyga.com

Jeff B. Ownby, GAPCEM,
Deputy Director
jownby@whitfieldcountyga.com

Christina Byrd, GaCEM,
Emergency Management Coordinator
cbyrd@whitfieldcountyga.com

Links

- GEMA
- Ready Georgia
- LEPC Local Emergency Planning Committee
- Whitfield County Pan-Flu Plan
- Emergency Operations Plan
- Whitfield County Draft Hazard Mitigation Plan
- Whitfield County CERT
- 2022 Whitfield County Hazard Mitigation Plan

WHITFIELD COUNTY EMERGENCY MANAGEMENT

LEPC ...safety in knowledge

CODERED weather WARNING

Follow us on:
Facebook
www.facebook.com/whitfieldema

Twitter
twitter.com/WhitfieldEMA

EMA on Instagram

Other Links and Information

CODERED weather WARNING

Whitfield County History

Be a fan on Facebook

Contact Information (Click here)

Whitfield County Board of Commissioners
201 S Hamilton St
Dalton, GA 30720
Ph: (706) 275-7500

The Plan is the result of a community-wide effort put forth over the past several months utilizing FEMA's Hazard Mitigation Plan "How To" Guides to aid in laying out the planning process described above. Stakeholders and persons with technical expertise were identified early in the process. Full participation was provided by Whitfield County and the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta. Each jurisdiction had representatives on the Hazard Mitigation Planning Committee and provided critical data to the HMPC for consideration either through in-person meetings, emails, phone conversations, or a combination of the above.

The public involvement elements of this Plan were reviewed by the HMPC. They were determined to have remained effective and were approved for use in the current Plan update process.

HMPC members are listed alphabetically in the following table:

Name	Affiliation	Title or Division/Dept
Darryl Camp	NGHD 1-2	Emergency Preparedness
Josh Cherry	Whitfield County E911	Deputy Director
Tom Dickson	City of Varnell	Mayor
Lana Duff	NGHD 1-2	Emergency Preparedness
Greg Fowler	Cohutta Police Dept	Chief of Police
Roger Gates	UGA Extension	ANR Agent
Kenny Gowin	City of Tunnel Hill	Mayor
Dewayne Hunt	Whitfield County Public Works	Director
Richard Knox	Whitfield County Schools	School Safety Coordinator
Michael Masters	Dalton State College	Director of Public Safety
David Metcalf	Whitfield County EMA	Director
Edward O'Brien	Whitfield County Fire Dept	Fire Chief
Sean O'Mahony	Whitfield County Sheriffs Office	Officer
Jeff Ownby	Whitfield County EMA	Deputy Director
David E. Pennington, III	City of Dalton	Mayor
Scott Radeker	Hamilton EMS	Director
Mike Russell	Dalton Fire Dept	Deputy Fire Chief
Jackson Sheppard	Dalton Public Works	Project Engineer
Ron Shinnick	Town of Cohutta	Mayor
Chad Townsend	Dalton Public Works	Director
Dirk Verhoeff	Dalton Water & Sewer Authority	Solid Waste Authority Director
Jeff Wells	Dalton Public Schools	Safety & Transportation

Various County and City departments, schools, and others participated in conversations with the EMA Director that directly contributed to the development of this Plan. Due to limited resources within the County, Cities, and Towns, attendance at HMPC meetings for many was not an option. Nevertheless, their direct input was utilized by the HMPC to develop this Plan.

The Plan was posted on the county's website during the planning process. This was done to allow the general public, including other nearby communities, as well as other agencies to review and comment on the Plan utilizing the contact information provided on the website. The Plan was also forwarded to surrounding jurisdictions with a request they review the plan and provide any feedback they deem necessary. This included Murray, Gilmer, Pickens, Cherokee, Bartow, Floyd, Chattooga, Walker and Whitfield Counties. A copy of the email is included in Appendix D. No feedback or comments have been received to date.

1.4 HRV summary/Mitigation goals

Whitfield County has experienced a number of hazard events throughout its history, most resulting in fairly localized damage. Flooding, tornados, winter storms, wildfire, drought, severe thunderstorms (including hail and lightning), earthquakes, landslides, dam failure and hazardous materials to varying degrees represent known threats to Whitfield County. The Whitfield County HMPC used information gathered throughout this planning process to identify mitigation goals and objectives as well as some recommended mitigation actions. Each potential mitigation measure identifies an organization or agency responsible for initiating the necessary action, as well as potential resources, which may include grant programs and human resources. An estimated timeline is also provided for each mitigation action.

1.5 Multi-Jurisdictional Special Considerations

The Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta were active participants and equal partner in the planning process as well as the previous planning process. As an active part of the HMPC, both jurisdictions contributed significantly to the identification of mitigation goals and objectives and potential mitigation measures contained within the HMP.

Participation in Mitigation Plan

Jurisdiction	2016 Plan	2022 Plan
Whitfield County	✓	✓
City of Dalton	✓	✓
City of Tunnel Hill	✓	✓
City of Varnell	✓	✓
Town of Cohutta	✓	✓

1.6 Adoption, Implementation, Monitoring, Evaluation

Upon completion of the Plan, it will be forwarded to GEMA for initial review. GEMA will then forward the Plan to FEMA for final review and approval. Once final FEMA approval has been received, Whitfield County and the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta will be responsible for initiating the appropriate courses of action related to this Plan. Actions taken may be in coordination with one another or may be pursued separately. The "Plan Update and Maintenance" section of this document details the formal process that will ensure that the Whitfield County HMP remains an active and relevant document. The HMP maintenance process includes monitoring and evaluating the Plan annually, and producing a complete Plan revision every five years. Additionally, procedures will ensure public participation throughout the plan maintenance process. This Plan will be considered for integration into various existing plans and programs, including the Whitfield County Comprehensive Plan at its next scheduled update. Mitigation actions within the HMP may be used by the County, Cities, and Towns as one of many tools to better protect the people and property of Whitfield County and the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta. Whitfield County and each of the municipalities are individually responsible for the processes necessary to formally adopt this Plan.

Adoption Status

Jurisdiction	***Date of Adoption***
Whitfield County	Upon GEMA & FEMA Approval
City of Dalton	Upon GEMA & FEMA Approval
City of Tunnel Hill	Upon GEMA & FEMA Approval
City of Varnell	Upon GEMA & FEMA Approval
Town of Cohutta	Upon GEMA & FEMA Approval

1.7 Review and Incorporation

The HMPC recognized the need to integrate other plans, codes, regulations, procedures and programs into this Hazard Mitigation Plan (HMP). Whitfield County did not have the opportunity to incorporate the original HMP's strategy into other planning mechanisms, but will now ensure that during the planning process for new and updated local planning documents such as a comprehensive plan or Local Emergency Operations Plan, the EMA Director will provide a copy of the HMP to the appropriate parties, so incorporation will be considered in future updates. All goals and strategies of new and updated local planning documents should be consistent with, and support the goals of, the HMP and not contribute to increased hazards in the affected jurisdiction(s).

Record of Review

Existing planning mechanisms	Reviewed? (Yes/No)	Method of use in Hazard Mitigation Plan
Comprehensive Plan (multi-jurisdictional)	Yes	Development trends
Local Emergency Operations Plan	Yes	Identifying hazards; Assessing vulnerabilities
Storm Water Management / Flood Damage Protection Ordinance	Yes	Mitigation strategies
Building and Zoning Codes and Ordinances	Yes	Development trends; Future growth
Mutual Aid Agreements	Yes	Assessing vulnerabilities
State Hazard Mitigation Plan	Yes	Risk assessment
Land Use Maps	Yes	Assessing vulnerabilities; Development trends; Future growth
Critical Facilities Maps	Yes	Locations
Community Wildfire Protection Plan	Yes	Mitigation strategies

As set forth in the plan maintenance section of this plan (Section 6.4), the Hazard Mitigation Planning Committee will meet during the plan approval anniversary date of every year to complete a review of the Hazard Mitigation Plan. It is during this review process that the mitigation strategy and other information contained within the Hazard Mitigation Plan are considered for incorporation into other planning mechanisms as appropriate. Opportunities to integrate the requirements of this HMP into other local planning mechanisms will continue to be identified through future meetings of the HMPC on an annual basis. The primary means for integrating mitigation strategies into other local planning mechanisms will be through the revision, update and implementation of each jurisdiction's individual action plans that require specific planning and administrative tasks (e.g., plan amendments and ordinance revisions).

During the planning process for new and updated local planning documents such as a comprehensive plan or Local Emergency Operations Plan, the EMA Director will provide a copy of the HMP to the appropriate parties. It will be recommended that all goals and strategies of new and updated local planning documents be consistent with, and support the goals of, the HMP and will not contribute to increased hazards in the affected jurisdiction(s).

Although it is recognized that there are many benefits to integrating components of this plan into other local planning mechanisms, and that components are actively integrated into other planning mechanisms when appropriate, the development and maintenance of this stand-alone HMP is deemed by the committee to be the most effective method to ensure implementation of local hazard mitigation actions at this time. Therefore, the review and incorporation efforts made in this update and the last, which consisted of a simple review of the documents listed in the chart above by various members of the HMPC, are considered successful by the HMPC and will likely be utilized in future updates.

The County's EMA is committed to incorporating hazard mitigation planning into its Local Emergency Operations Plan and other public emergency management activities. As the EMA Director becomes aware of updates to other County or City plans, codes, regulations, procedures and programs, the Director will continue to look for opportunities to include hazard mitigation into these mechanisms.

1.8 Scope of Updates

Changes have been made to the HMP in this updated version. These changes are summarized in the following table.

Chapter or Section	Chapter or Section Description	Changes this Update
1.2	Organization of the Plan	Descriptions
1.3	Participants in Planning Process	Data
1.5	Multi-Jurisdictional Special Considerations	Data
1.6	Adoption, Implementation, Monitoring, Evaluation	Descriptions, Data
1.7	Review and Incorporation	Descriptions, Data
1.8	Scope of Updates	Descriptions, Data
1.9	Brief County Overview	Descriptions, Data
2	Introduction	Descriptions, Data
2.1	Tornado	Descriptions, Data, Visual Aids
2.2	Severe Thunderstorm	Descriptions, Data, Visual Aids
2.3	Flooding	Descriptions, Data, Visual Aids
2.4	Winter Storm	Descriptions, Data, Visual Aids
2.5	Wildfire	Descriptions, Data, Visual Aids
2.6	Drought	Descriptions, Data, Visual Aids
2.7	Earthquake	Descriptions, Data, Visual Aids
2.8	Landslides	Descriptions, Data, Visual Aids
3.1	Hazardous Materials Release	Descriptions, Data, Visual Aids
3.2	Dam Failure	Descriptions, Data, Visual Aids
3.3	Pandemic	Descriptions, Data, Visual Aids
4	Land Use and Development Trends	Descriptions, Data, Visual Aids

Chapter or Section	Chapter or Section Description	Changes this Update
5	Hazard Mitigation Goals Objectives and Actions	Descriptions, Data
6.1	Action Plan Implementation	Descriptions
6.2	Evaluation	Descriptions
6.3	Multi-Jurisdictional Strategy & Considerations	Descriptions
6.4	Plan Update and Maintenance	Descriptions, Data
7.2	References	Data
App. A	Critical Facilities Database	Data
App. B	Hazard History Database	Data
App. C	Hazard Frequency Table	Data
App. D	Other Planning Documents	Descriptions, Data, Visual Aids

1.9 Brief County Overview

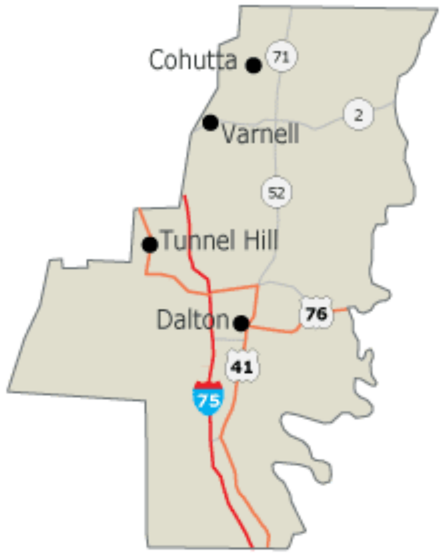
County Formed: December 30, 1851

County Seat: Dalton

Incorporated Municipalities: Cohutta, Dalton, Tunnel Hill and Varnell

Population Estimates	
Jurisdiction	Population
Whitfield County	102,848 (2021, US Census)
City of Dalton	34,285 (2021, US Census)
City of Tunnel Hill	963 (2021, GMA)
City of Varnell	2,179 (2021, GMA)
Town of Cohutta	764 (2021, GMA)

Total Area: 290 square miles



History:

Woodland Indians and Creek Nation held the area of present-day Dalton, Georgia until the mid 18th century, when the Cherokee pushed the Creek to the west and south. The Cherokee Indians called the mountains of north Georgia their "Enchanted Land" until their forced removal in 1838, the Trail of Tears.

By the time the last Cherokees had left, work was underway for a railroad, the Western and Atlantic, to join the Tennessee River with the Chattahoochee River. In 1847, the newly renamed railway was defined as a mile radius from the city center - the Western and Atlantic Depot. The final segment of this pivotal railway was completed in Tunnel Hill, Whitfield County, Ga. in 1850. A second railroad, the East Tennessee and Georgia was completed in 1852.

With the invention of the automobile, a cottage industry arose in the homes along "Peacock Alley", U.S. Highway 41. Running from Copper Harbor, Michigan, to Miami Beach, Florida, the route ran on paved state roads. It was designated in 1925 and signed in 1926. Women would sell quilts to drivers along this popular north-south route. From this early origin, the carpet tufting industry grew in Dalton. Today, Carpet Mills remain major area employers.

During the Civil War, Dalton saw its first action during the Great Locomotive Chase, on April 12, 1862. More than a year later, on September 19–20, 1863, massive Union and Confederate forces battled a few miles west of Dalton at Chickamauga, and later at Chattanooga. The war came to Whitfield County in the spring of 1864. The First Battle of Dalton included the battle of Rocky Face Ridge and Dug Gap began on May 7, 1864, and ended when General Johnston completed his withdrawal from Dalton on May 12. The

Second Battle of Dalton occurred August 14-15, 1864. The last campaign of the Confederacy, the John Bell Hood's Nashville Campaign attacked a Union blockhouse in Tilton before passing through Dalton and heading west. The U.S. government recently declared Dalton and Whitfield County to have more intact Civil War artifacts than any other place in the country. Also of interest is the site of the historic Western & Atlantic Railroad Station; one of the few still standing and restored to its original architectural state, this site is now the Dalton Depot Restaurant. The steel center marker for the original surveying of the City of Dalton is still inside the depot.

Dalton is often referred to as the "Carpet Capital of the World", home to 150+ carpet plants. The industry employs more than 30,000 people in the Whitfield County area. More than 90% of the functional carpet produced in the world today is made within a 65-mile radius of the city.

The agglomeration of the carpet industry in Dalton can be traced back to a wedding gift given in 1895 by a teenage girl, Catherine Evans Whitener, to her brother, Henry Alexander Evans, and his bride, Elizabeth Cramer. The gift was an unusual tufted bedspread. Copying a quilt pattern, she sewed thick cotton yarns with a running stitch into unbleached muslin, clipped the ends of the yarn so they would fluff out, and finally, washed the spread in hot water to hold the yarns by shrinking the fabric. Interest grew in young Catherine's bedspreads, and in 1900, she made the first sale of a spread for $2.50. Demand became so great for the spreads that by the 1930s, local women had "haulers", who would take the stamped sheeting and yarns to front porch workers. Often entire families worked to hand tuft the spreads for 10 to 25 cents per spread. Nearly 10,000 area cottage "tufters"--men, women, and children, were involved in the industry. Income generated by the bedspreads was instrumental in helping many area families survive the depression. Chenille bedspreads became amazingly popular all over the country and provided a new name for Dalton: the Bedspread Capital of the World.

When a form of mechanized carpet making was developed after World War II, Dalton became the center of the new industry due to the fact that specialized tufting skills were required and the city had a ready pool of workers with those skills.

By the 1970s manufacturers had begun to develop techniques to move from plain tufted carpet to sculpted carpet. Improved patterning, stain and wear resistance, and colors have made today's tufted carpet the choice for functional carpet for the vast majority of homes and moved woven carpet to a decorative role.

Chapter 2
Local Natural Hazard, Risk and Vulnerability (HRV) Summary

The Whitfield County Hazard Mitigation Planning Committee (HMPC) identified eight natural hazards the County is most vulnerable to based upon available data including scientific evidence, known past events, and future probability estimates. As a result of this planning process, which included an analysis of the risks associated with probable frequency and impact of each hazard, the HMPC determined that each of these natural hazards pose a threat significant enough to address within this Plan. These include tornados, severe thunderstorms (including hail & lightning), flooding, winter storms, wildfire, drought, earthquakes, and landslides. For this plan update, the HMPC reviewed the natural hazards listed in the 2019-2024 Georgia Hazard Mitigation Strategy Standard Plan Update to assess the applicability of these hazards to Whitfield County and the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta (See Table 2.1). Each of these natural hazards is addressed in this chapter of the Plan. An explanation and results of the vulnerability assessment are found in Tables 2-1 and 2-2.

The HMPC also discussed how changes in the climate may in some ways impact the County, Cities, and Towns. If this is the case, at this point there is insufficient data to calculate how and to what degree such changes may impact Whitfield County in the future. However, it seems likely that the impact of any changes in climate would be manifested in the form of the same hazards currently addressed within this Plan, even though frequency, probability and severity of those hazards might change.

Table 2.1 – Hazards Terminology Differences

Hazards Identified in Georgia Hazard Mitigation Strategy Plan (2019-2024)	Equivalent/Associated Hazards identified in the current Whitfield County Plan	Difference
Tornadoes	Tornados	Grammatical only.
Wind	Severe Thunderstorms	HMPC views as an associated hazard.
Severe Weather	Severe Thunderstorms	Difference in terminology.
Hailstorm	Severe Thunderstorms	HMPC views as an associated hazard.
Lightning	Severe Thunderstorms	HMPC views as an associated hazard.
Tropical Cyclonic Events	Severe Thunderstorms Flooding	Due to the County's inland location, not directly viewed as a threat. Tropical weather has limited effects within the County and is generally considered in terms of Severe Thunderstorms and Flooding, associated hazards.
Inland Flooding	Flooding	Difference in terminology.
Earthquake	Earthquake	None
Severe Winter Storms	Winter Storms	Difference in terminology.
Wildfire	Wildfire	None
Drought	Drought	None

Table 2.2 – Vulnerability Assessment Survey Results - Natural Hazards

(see Keys A, B, and C below)

Hazard	Whitfield County	Dalton	Tunnel Hill	Varnell	Cohutta
Tornado – Severity	H	H	H	M	H
Tornado – Frequency	M	M	L	M	M
Tornado – Probability	H	H	H	M	H
Severe Thunderstorm (incl. Hail/Lightning) - Severity	H	H	H	H	H
Severe Thunderstorm (incl. Hail/Lightning) – Frequency	H	H	H	H	H
Severe Thunderstorm (incl. Hail/Lightning) - Probability	H	H	H	H	H
Flooding – Severity	H	H	H	H	H
Flooding – Frequency	H	M	H	H	H
Flooding – Probability	H	M	H	H	H
Winter Storm – Severity	H	H	H	H	H
Winter Storm – Frequency	H	H	H	M	H
Winter Storm – Probability	H	H	H	M	H
Wildfire – Severity	H	M	M	M	H
Wildfire – Frequency	M	L	M	M	M

Hazard	Whitfield County	Dalton	Tunnel Hill	Varnell	Cohutta
Wildfire – Probability	M	L	M	M	M
Drought – Severity	H	H	H	H	H
Drought – Frequency	M	M	M	H	M
Drought – Probability	M	M	M	H	M
Earthquake – Severity	M	M	M	L	M
Earthquake – Frequency	L	L	L	L	L
Earthquake – Probability	L	L	L	L	L
Landslide – Severity	L	L	L	L	L
Landslide – Frequency	L	L	L	L	L
Landslide - Probability	L	L	L	L	L

Key A for Table 2.2 – Vulnerability Assessment Severity Definitions

Code	Definitions
L	Low Severity Average hazard event would typically result in relatively low damage. For example, a hazard that significantly affects less than 5% of the jurisdiction typically with no serious injuries. All data is compiled from the most recent vulnerability assessment survey responses.
M	Medium Severity Average hazard event would typically result in moderate damage. For example, a hazard that significantly affects up to 15% of the jurisdiction or results in multiple injuries. All data is compiled from the most recent vulnerability assessment survey responses.
H	High Severity Average hazard event would typically result in significant damage. For example, a hazard that significantly affects 25% of the jurisdiction or results in multiple injuries and/or deaths. All data is compiled from the most recent vulnerability assessment survey responses.

Key B for Table 2.2 – Vulnerability Assessment Frequency Definitions

Code	Definitions
L	Low Frequency The hazard has not occurred or has rarely occurred within the past five years. All data is compiled from the most recent vulnerability assessment survey responses and hazards history data.
M	Medium Frequency The hazard has occurred one or more times within the past five years. All data is compiled from the most recent vulnerability assessment survey responses and hazards history data.
H	High Frequency The hazard has occurred multiple times within the past five years, and at least once within the past year. All data is compiled from the most recent vulnerability assessment survey responses and hazards history data.

Key C for Table 2.2 – Vulnerability Assessment Probability Definitions

Code	Definitions
L	Low Probability The probability for the hazard to occur at least one time within the next five years is estimated to be between 1% and 30%. All data is compiled from the most recent vulnerability assessment survey responses.
M	Medium Probability The probability for the hazard to occur at least one time within the next five years is estimated to be between 31% and 70%. All data is compiled from the most recent vulnerability assessment survey responses.
H	High Probability The probability for the hazard to occur at least one time within the next five years is estimated to be between 71% and 100%. All data is compiled from the most recent vulnerability assessment survey responses.

2.1 Tornados

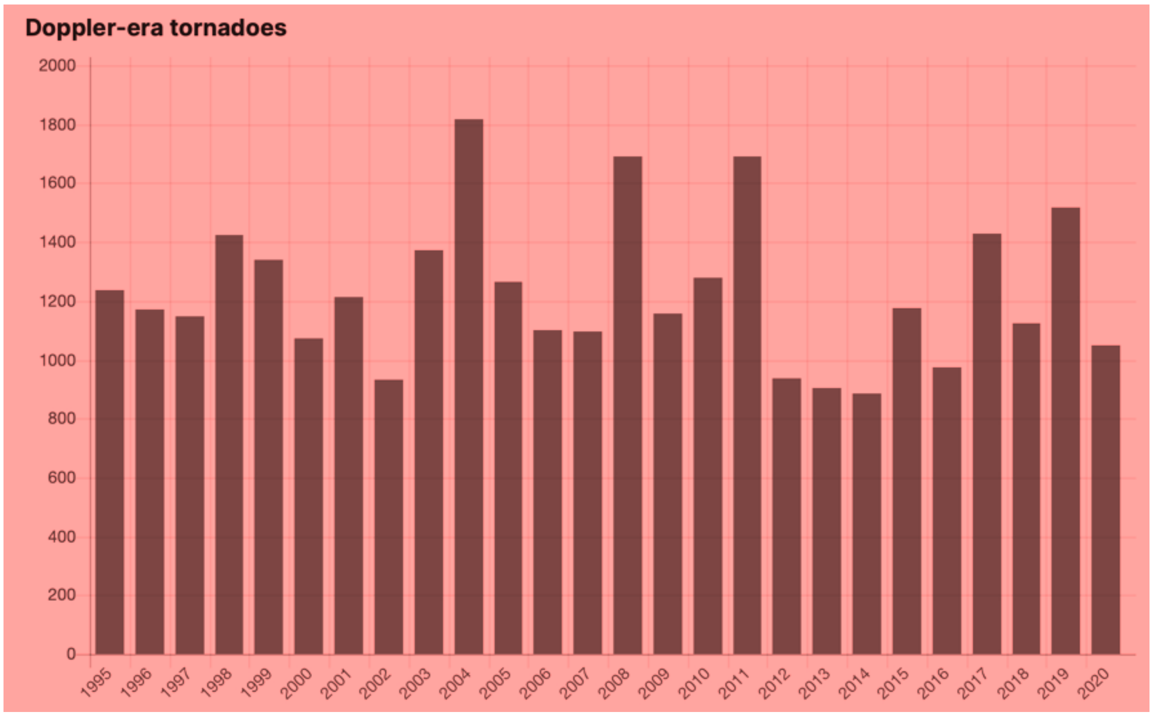
A. Hazard Identification – A tornado is a dark, funnel-shaped cloud containing violently rotating air that develops below a heavy cumulonimbus cloud mass and extends toward the earth. The funnel twists about, rises and falls, and where it reaches the earth causes great destruction. The diameter of a tornado varies from a few feet to a mile; the rotating winds attain velocities of 200 to 300 mph, and the updraft at the center may reach 200 mph. A tornado is usually accompanied by thunder, lightning, heavy rain, and a loud "freight train" noise. In comparison with a hurricane, a tornado covers a much smaller area but can be just as violent and destructive. The atmospheric conditions required for the formation of a tornado include great thermal instability, high humidity, and the convergence of warm, moist air at low levels with cooler, drier air aloft. A tornado travels in a generally northeasterly direction with a speed of 20 to 40 mph. The length of a tornado's path along the ground varies from less than one mile to several hundred.

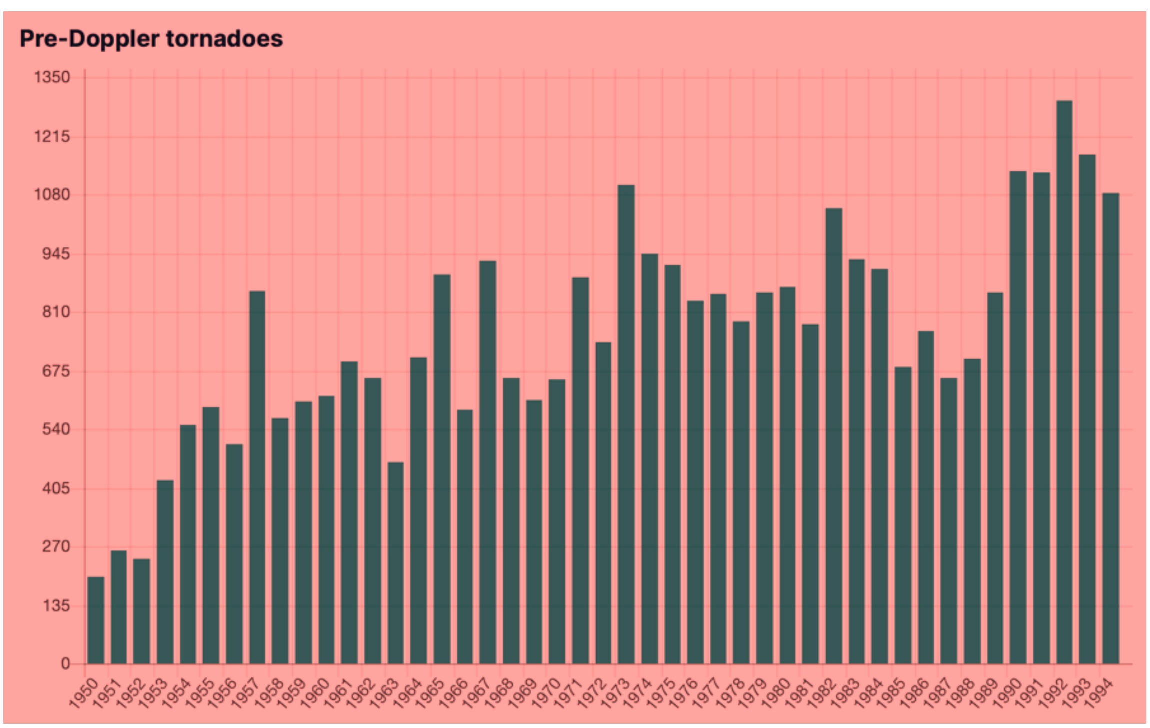
The Fujita Scale was the standard scale in the United States for rating the severity of a tornado as measured by the damage it causes from 1971 to 2007 (see table below).

The Fujita Scale of Tornado Intensity			
F-Scale Number	**Intensity Phrase**	**Wind Speed**	**Type of Damage Done**
F0	Gale tornado	40-72 mph	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.
F1	Moderate tornado	73-112 mph	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	Significant tornado	113-157 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
F3	Severe tornado	158-206 mph	Roof and some walls torn off well constructed houses; trains overturned; most trees in forest uprooted
F4	Devastating tornado	207-260 mph	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	Incredible tornado	261-318 mph	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel reinforced concrete structures badly damaged.

The Enhanced Fujita (EF) Scale for Tornado Damage is an update to the original Fujita Scale by a team of meteorologists and wind engineers that was implemented in the United States in 2007. The EF Scale is still a set of wind estimates (not measurements) based on damage. It uses three-second gusts estimated at the point of damage based on a judgment of 8 levels of damage to 28 indicators. These estimates vary with height and exposure. The three-second gust is not the same wind as in standard surface observations. Standard measurements are taken by weather stations in open exposures, using a directly measured, "one-minute mile" speed.

The adoption of Doppler radar, along with other technical advancements and increased storm observation, has led to the ability to detect weaker and/or short-lived tornados that would often have gone unreported. The 1995-2019 U.S. average was 1,239 tornadoes per year. The 1955-1994 average was much lower at 813 tornadoes per year. Source: ustornadoes.com

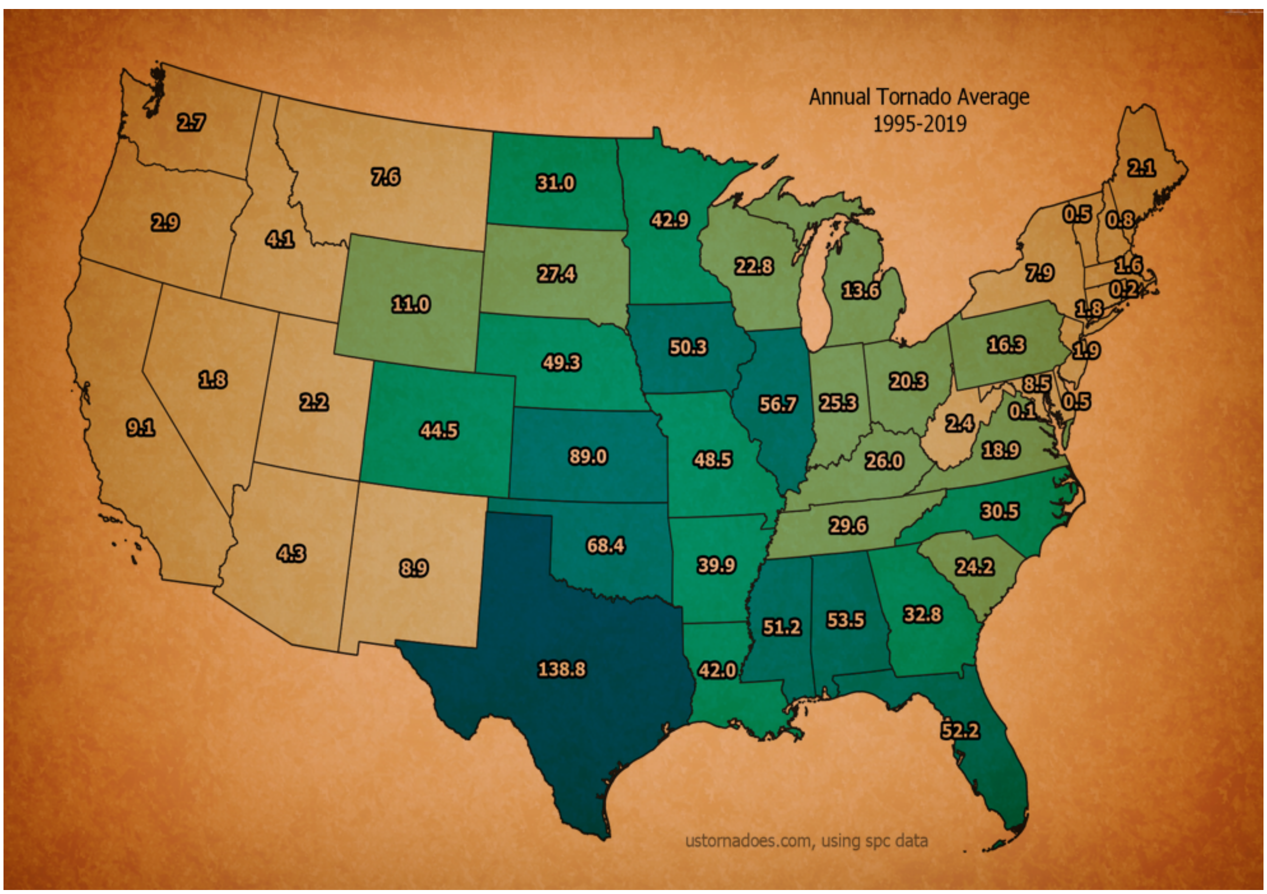




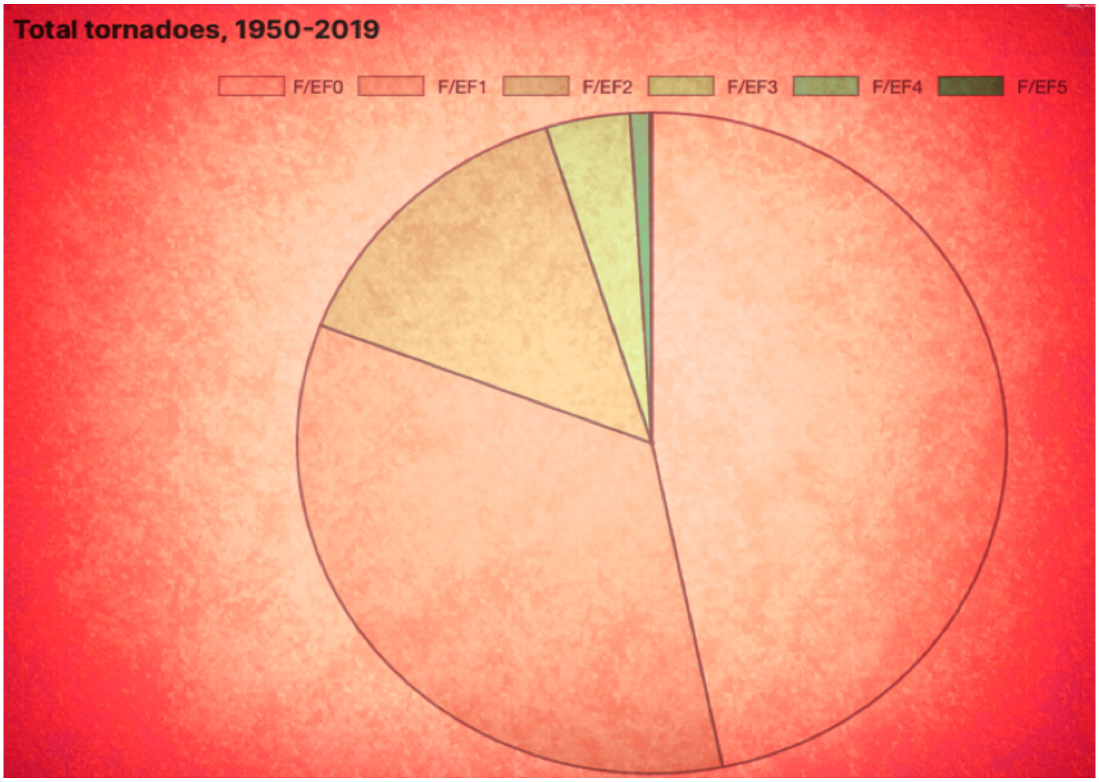
B. Hazard Profile – All areas within Whitfield County are vulnerable to the threat of a tornado. There is simply no method to determine exactly when or where a tornado will occur. The Whitfield County Hazard Mitigation Planning Committee (HMPC) reviewed historical data from the Georgia Tornado Database, the National Climatic Data Center, the National Weather Service and various other resources in researching the past effects of tornados within the County. With most of the County's recorded tornado events, only basic information was available. However, many dozens of tornado watches have been recorded during this period, and certainly some tornados go undetected or unreported. Therefore, any conclusions reached based upon available information on tornados within Whitfield County should be treated as the minimal possible threat. Whitfield County is located in both a state and a region known for high tornado activity.

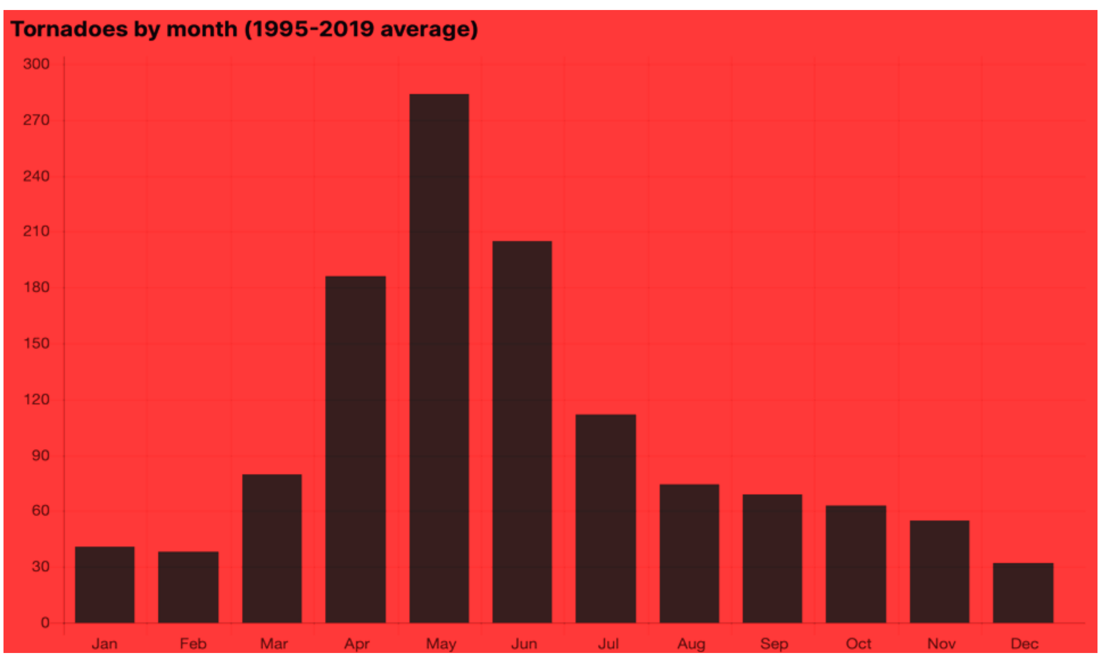
National overview:

The following map demonstrates the average number of tornados each year by state for the period 1995-2019.

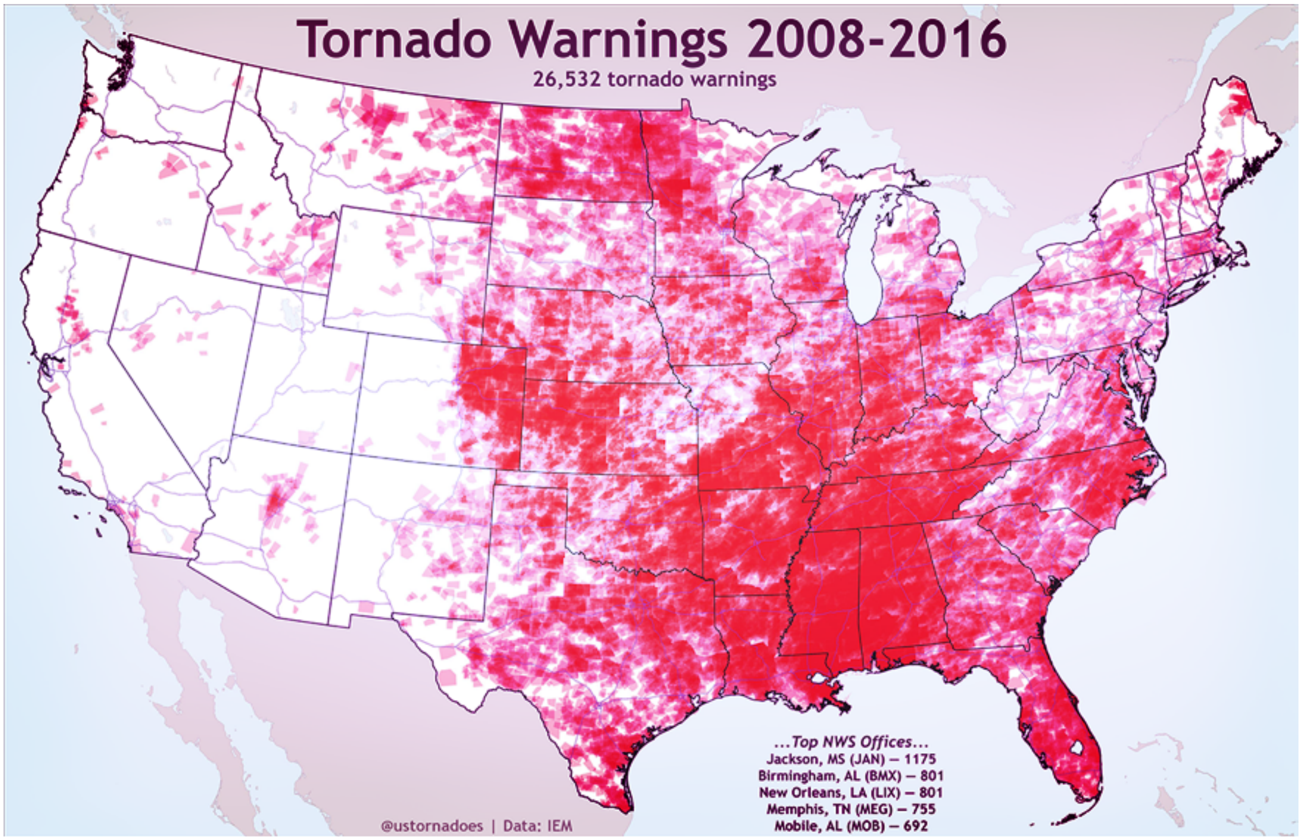


The first chart below, which includes data from 1950-2019, shows weak F/EF0 and F/EF1 tornadoes have comprised about 80 percent of all tornados. F/EF2 make up about 14%, F/EF3 roughly 4%, F/EF4 nearly 1%, and F/EF5 a mere 0.1%. Yet 63% of all fatalities have been caused by that one percent of F/EF4 and F/EF5 events. The second chart below demonstrates average tornados by month. Source: ustornadoes.com

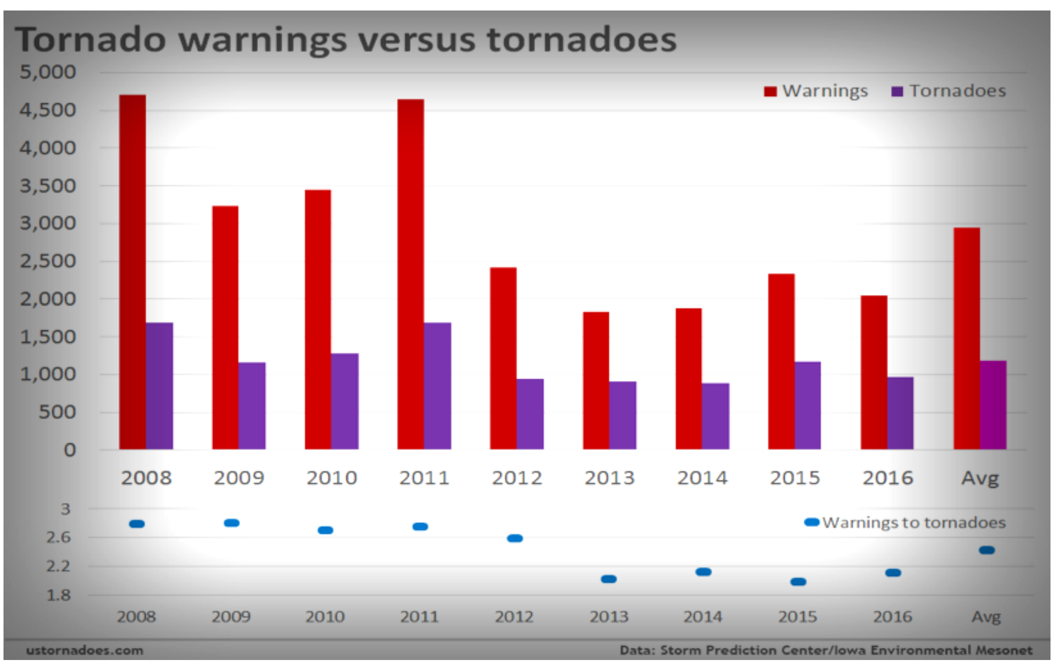




The following shapefile map, based off of National Weather Service data, demonstrates tornado warnings issued from 2008-2016 by state.

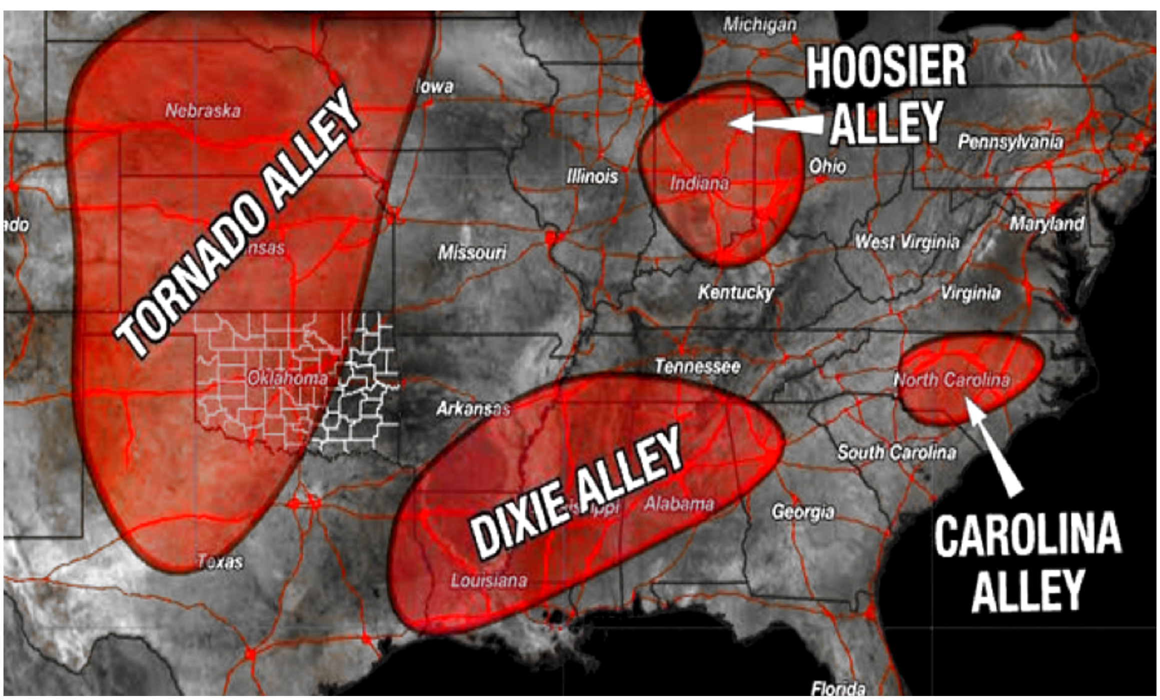


However, as shown in the chart below, tornado warnings don't always result in tornados.



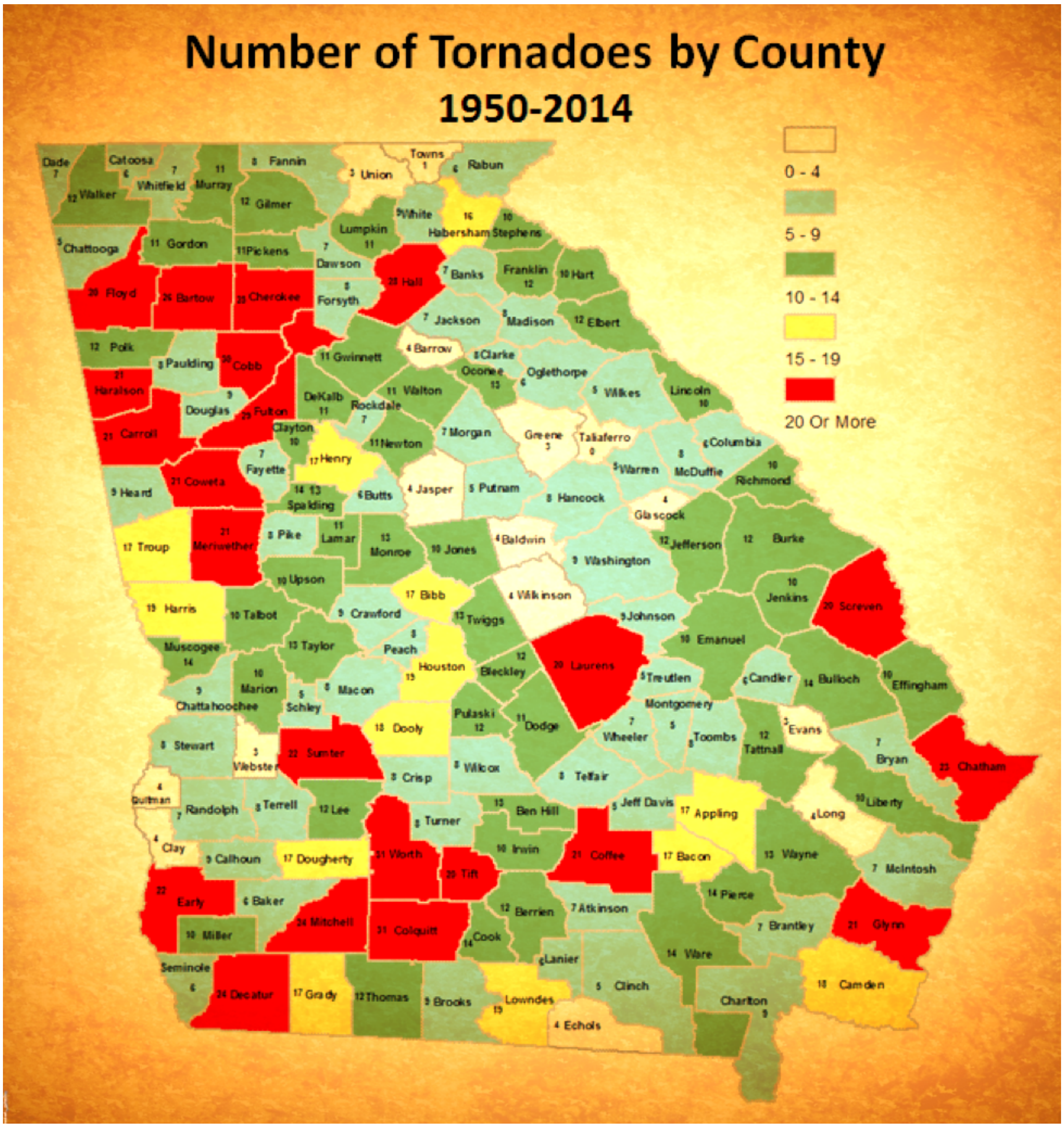
Regional overview:

Dixie Alley is the nickname given to the areas of the southern United States with a particularly high frequency of strong, long-track and violent tornadoes. The Dixie Alley region includes areas of the lower Mississippi Valley, and spans from eastern Texas and Arkansas across Louisiana, Mississippi, Tennessee, Alabama, Georgia, and to upstate South Carolina and western North Carolina. The term Dixie Alley was first used in 1971 by Allen Pearson, a director of the Storm Prediction Center after witnessing a violent and deadly tornado outbreak on February 21, 1971. Although tornadoes are less frequent than in the more well-known Tornado Alley, Dixie Alley experiences more deaths because of relatively higher numbers of strong long tracked tornadoes and higher population density of this region. New research indicates that Dixie Alley is essentially an extension of Tornado Alley. Tornadoes in this area are long-tracked and deadly and often occur during the night and early morning. Tornadoes in the Dixie Alley are often partially or fully wrapped in rain making it hard for storm spotters and chasers, law enforcement, and the public to spot. They often occur in early spring and late autumn, but can continue throughout the winter and into late spring. Some notable tornado outbreaks in the region includes: Great Natchez Tornado, the 1884 Enigma tornado outbreak, the April 1924 tornado outbreak, the 1932 Deep South tornado outbreak, the 1936 Tupelo-Gainesville tornado outbreak, the April 1957 Southeastern tornado outbreak, the 1984 Carolinas tornado outbreak, and the November 1992 tornado outbreak. See the map below of Dixie Alley.

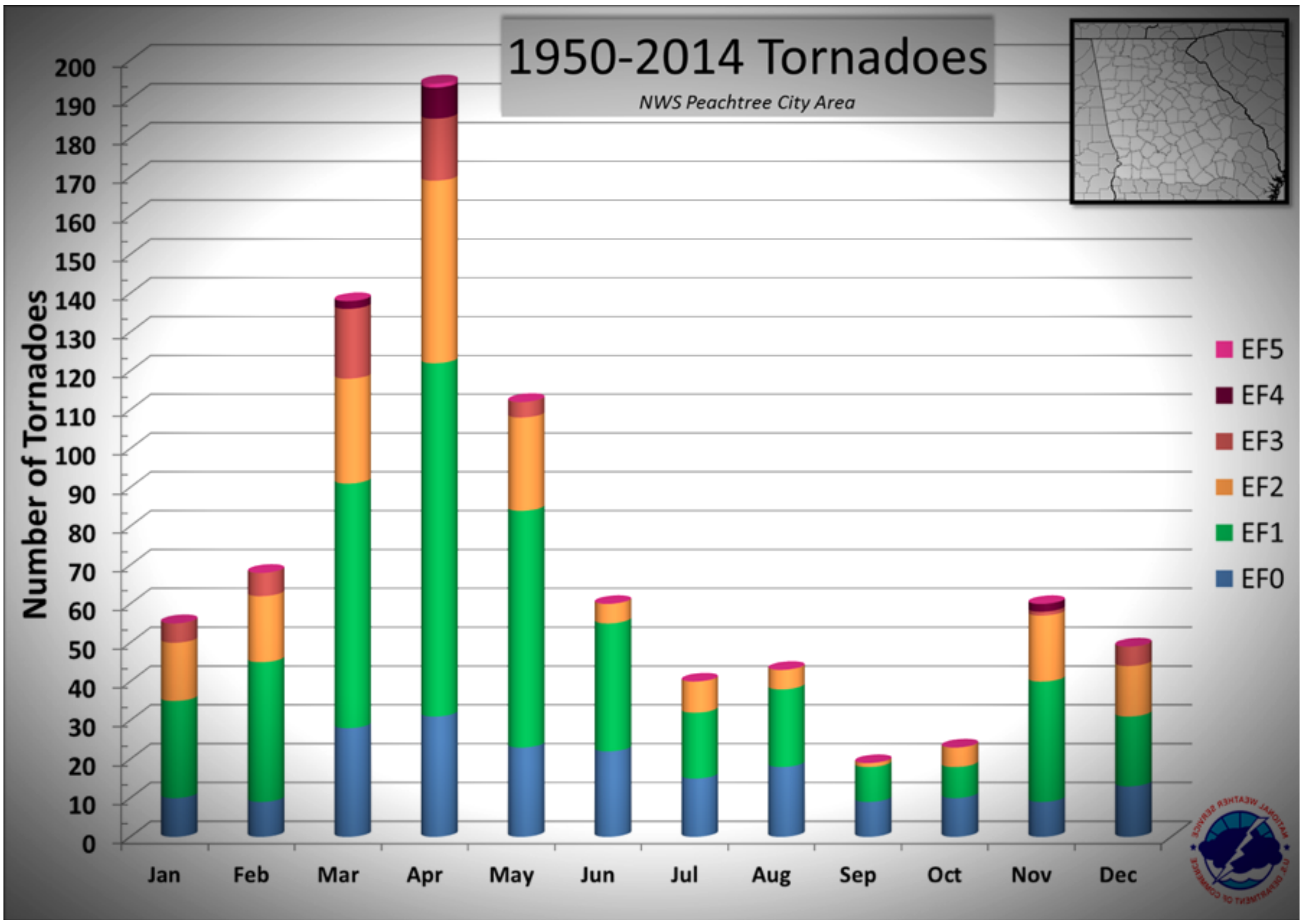


State overview:

The state of Georgia is also known for its relatively high historical level of tornado activity. The most recent version of this National Weather Service map below covers the period from 1950-2014. It demonstrates historic tornado activity of the County in relationship to surrounding counties, and the entire state. The map shows seven Whitfield County tornados on record from the specific time period, however, a total of six tornados have actually been recorded over the past fifty years (1972-2021).



Tornados are considered to be the most unpredictable and destructive of weather events in Georgia, even though they are not the most frequently occurring natural hazard within Whitfield County. Tornado season in Georgia is ordinarily said to run from March through August, with the peak activity being in April. However, tornados can strike at any time of the year when certain atmospheric conditions are met, including during the coldest months of the year. See the National Weather Service graph below, which covers the NWS Peachtree City County Warning Area (CWA).



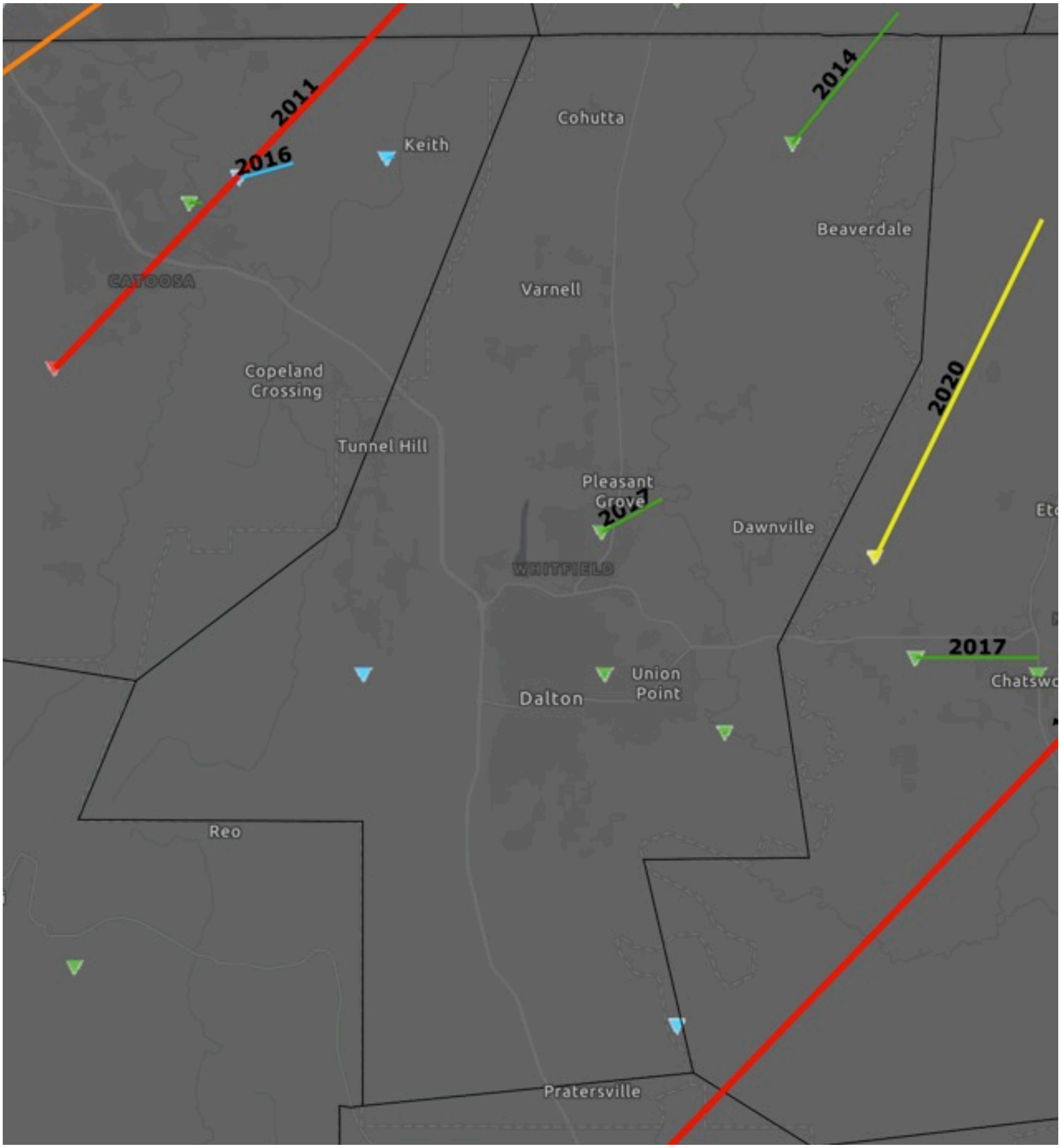
In the Peachtree City County Warning Area (CWA), which includes Whitfield County, the average number of tornado days per year is six, according to the National Weather Service. While tornadoes have been reported in all months of the year, most occur in the months of March, April, and May. During this "tornado season" the most likely time of occurrence is from mid-afternoon through early evening. Tornado intensities of F2 or greater are involved in 37% of the events when the data is broken down into a county-by-county basis. These strong tornados are more likely to occur during the month of April than in any other month.

Local overview:

A total of six tornados have been recorded to have occurred in Whitfield County over the past fifty years (1972-2021). See the following chart which shows all six recorded tornados.

Whitfield County - Recorded tornados 1972 to present		
Date	**Time**	**Intensity**
1/11/1974	4:45am	F1
4/3/1974	4:50pm	F4
5/19/1983	6:00pm	F1
4/24/1992	6:40pm	F0
4/28/2014	10:05pm	EF1
5/24/2017	8:45am	EF1

There are seven recorded tornado events in Whitfield County for the 50-year period from 1972 to 2021. The following Midwestern Regional Climate Center (MRCC) map shows most of the estimated paths and intensities of those tornados in Whitfield County. Source: MRCC



The two most recent tornados recorded in Whitfield County are discussed in more detail below:

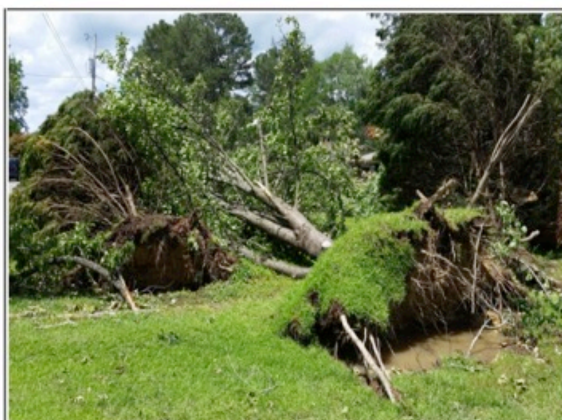
May 24, 2017 EF-1 Tornado

A brief tornado touched down northeast of Dalton along Highway 71 (Cleveland Highway), snapping and uprooting several trees between 3rd Street and West Hill View Drive. The tornado continued northeast and created the most significant damage along the south end of Lynn Drive where numerous large trees were snapped or uprooted in an approximate 200-yard wide path. In this location, a couple of trees were snapped near the base which resulted in the rating of a low-end EF-1 with estimated maximum winds around 90 mph. A camper was also rolled about 20 yards away from its original location near Lynn Drive. Several more trees were found snapped near Creekwood Lane Northeast just before the tornado lifted.

Damage Path - Whitfield County

County	Rating	# of Injuries	KML
Whitfield	EF-1	0	

Rating:	EF-1
Peak Wind:	90 MPH
Path Length:	1.6 miles
Path Width:	200 yards
Fatalities:	0
Injuries:	0
Start Date:	May 24, 2017
Start Time:	9:45 AM EDT
Start Lat/Lon:	34.8186 / -84.9512
End Date:	May 24, 2017
End Time:	9:49 AM EDT
End Lat/Lon:	34.8299 / -84.9263



A number of trees were uprooted on this property by the tornado.

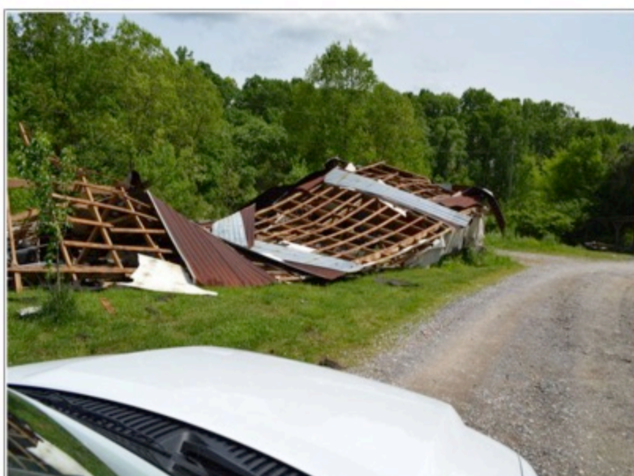
Several trees were snapped and uprooted near this home.

April 28, 2014 EF-1 Tornado

A National Weather Service survey team determined that a short-lived EF-1 tornado touched down in northern Whitfield County. Numerous trees were downed, one on a truck. A chicken house collapsed and another outbuilding was destroyed. Minor roof damage was also noted along the path. The tornado continued into Bradley County, Tennessee, before lifting.

County	Rating	# of Injuries	KML
Whitfield	EF-1	0	

Rating:	**EF-1**
Peak Wind:	**97 MPH**
Path Length:	**3.4 MILES**
Path Width:	**100 YARDS**
Fatalities:	**0**
Injuries:	**0**
Start Date:	**APRIL 28, 2014**
Start Time:	**11:05 PM EDT**
Start Location:	**5 Miles E of Cohutta**
Start Lat/Lon:	**34.9510/-84.8718**
End Date:	**APRIL 28, 2014**
End Time:	**11:10 PM EDT**
End Location:	**4 Miles WNW of Gregory**
End Lat/Lon:	**34.9876/-84.8321**

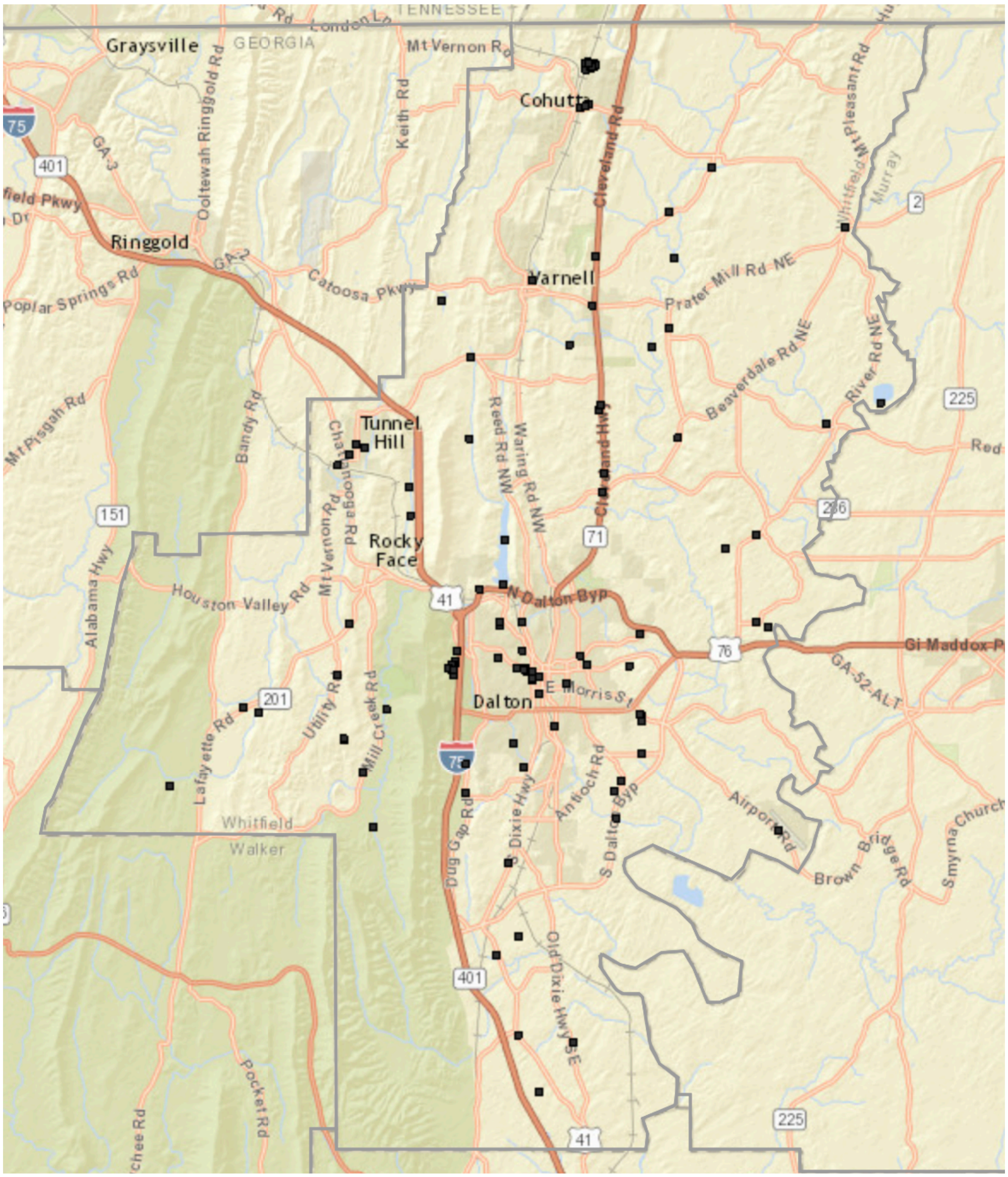

Tornado Damage


Tornado Damage

(National Climatic Data Center) NCDC and other records show that six tornados occurred within the County over the past fifty years, which equates to a 12% annual frequency of reported events. However, in the past ten years the County has averaged a 20% annual frequency. It would appear that tornado activity has increased over time within the County. This may be the case or it may simply be that record keeping and technology have improved significantly over the course of time, reflecting the higher numbers. It may also be a combination of these factors. The following chart provides annual frequency of reported events over the past five, ten, twenty, and fifty-year periods. The most recent five-year period, covering the span of time since the last update to this Plan, is highlighted in gold.

Whitfield County – Tornado Frequency (based on Reported Events)				
Time Period	**5yrs (2017-2021)**	**10yrs (2012-2021)**	**20yrs (2002-2021)**	**50yrs (1972-2021)**
Number of Reported Events	**1**	**2**	**2**	**6**
Frequency Average per Year	**0.20**	**0.20**	**0.10**	**0.12**
Frequency Percent per Year	**20%**	**20%**	**10%**	**12%**

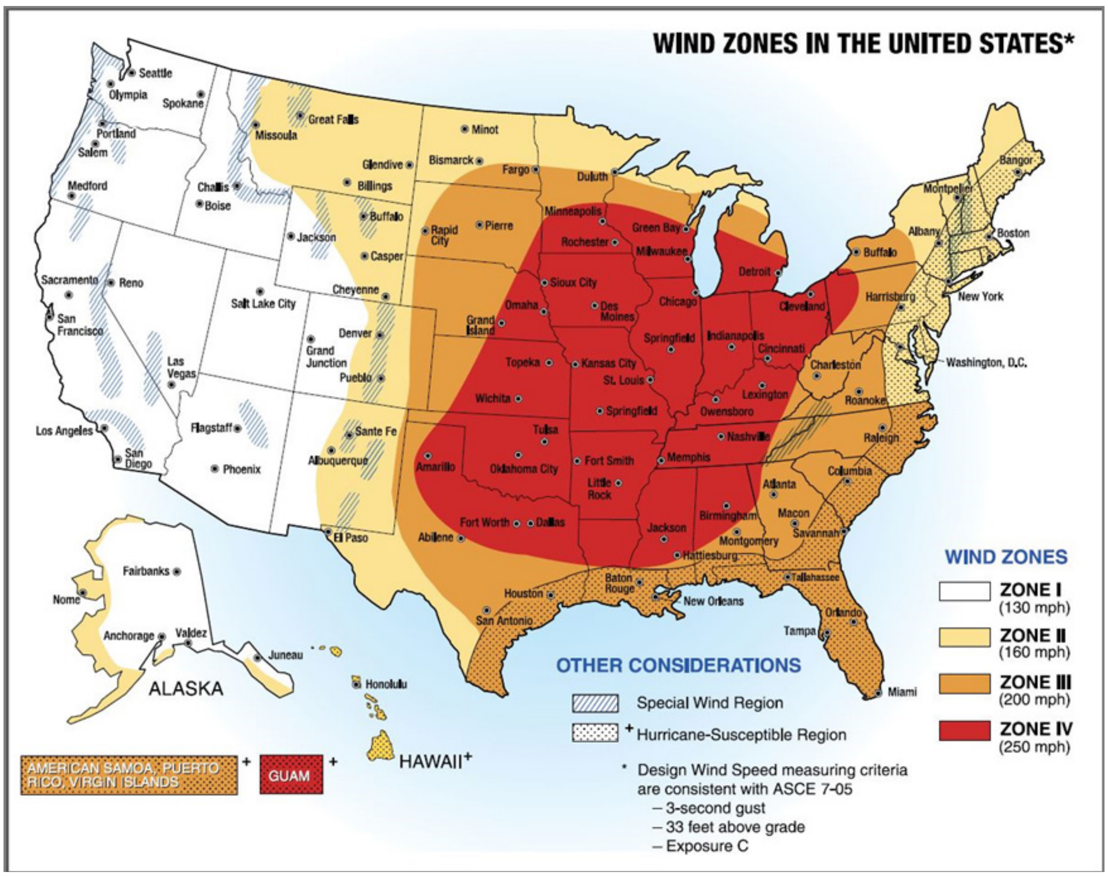
C. Assets Exposed to Hazard - Tornados are unpredictable and are indiscriminate as to when or where they strike. All public and private property including critical facilities are susceptible to tornados since this hazard is not spatially defined. The GEMA map below identifies critical facilities located within the hazard area, which in the case of tornados includes all areas within the County, Cities, and Towns.

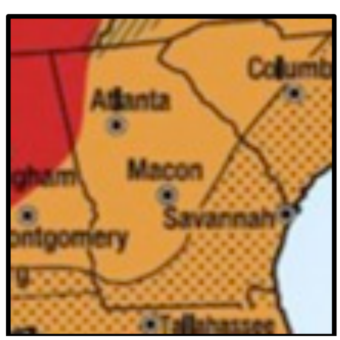


D. Estimate of Potential Losses – For loss estimate information, please refer to the Critical Facilities Database (Appendix A).

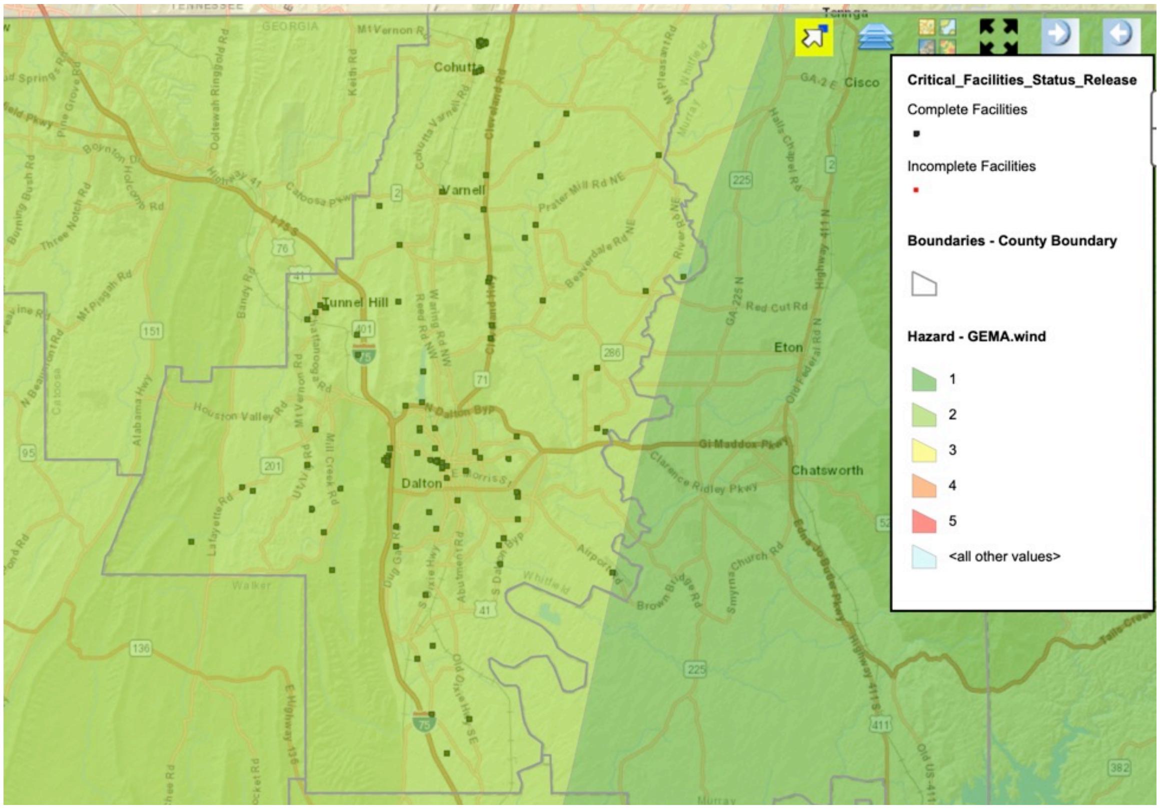
E. Multi-Jurisdictional Concerns - Whitfield County and the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta have a design wind speed of 250 mph as determined by the American Society of Civil Engineers (ASCE). Since no part of the County is immune from tornados, any mitigation steps taken related to tornados will be undertaken on a countywide basis, including the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta. See the following ASCE design wind speed map, and GMIS wind hazard map.

<u>ASCE Design Wind Speed Map</u>





GMIS Wind Hazard Map



The Wind Hazard Scores are based on the 2000 International Building Code, figure 1609 contours showing 3 second gust wind speeds with a 50-year return interval. The Northwest portion of the state scored an additional point for the 250mph community tornado shelter design zone according to FEMA publications.

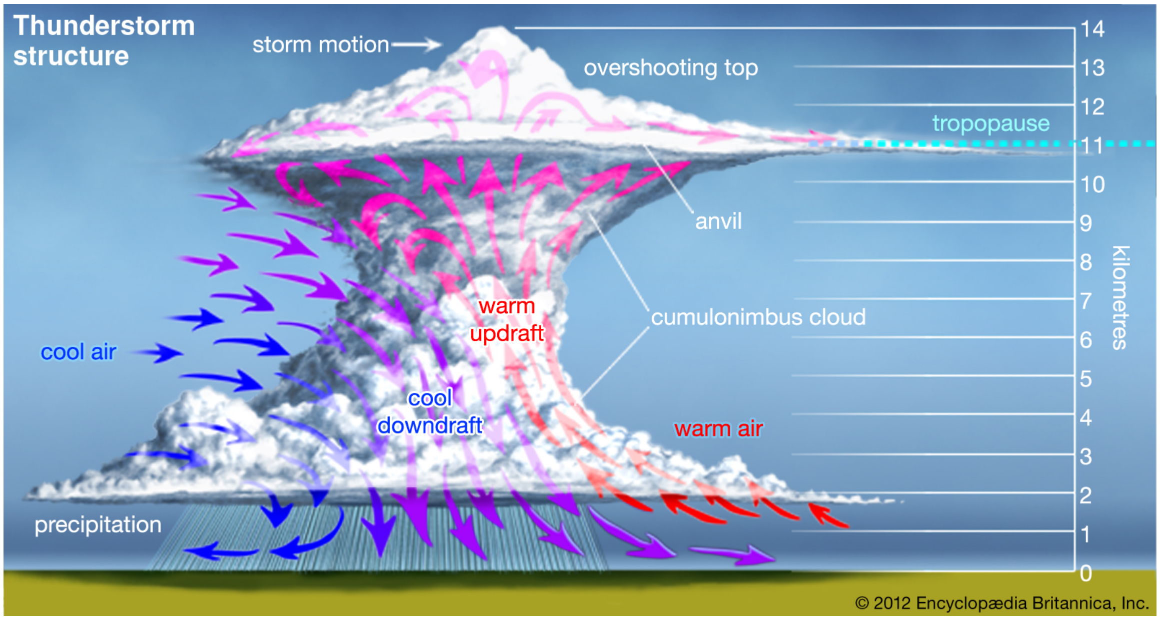
Score	Original Value	Description
5	> 120 mph	3 second gust greater than 120 mph
4	110 to 119 mph	
3	100 to 109 mph	
2	90 to 99 mph (or ZONE IV)	This score is also given to an area with Zone IV of the "Design Wind Speed Map for Community Shelters," representing an area exposed to 250 mph winds. This area is the Northwestern corner of the state.
1	< 90 mph	

F. Hazard Summary – Based on its history, Whitfield County has a high exposure to potential damage from tornados. Should a tornado strike residential areas or critical facilities, significant damage and loss of life could occur. Due to the destructive power of tornados it is essential that the mitigation measures identified in this plan receive full consideration. Specific mitigation recommendations related to tornados are identified in *Chapter 5*.

2.2 Severe Thunderstorms (including Hail & Lightning)

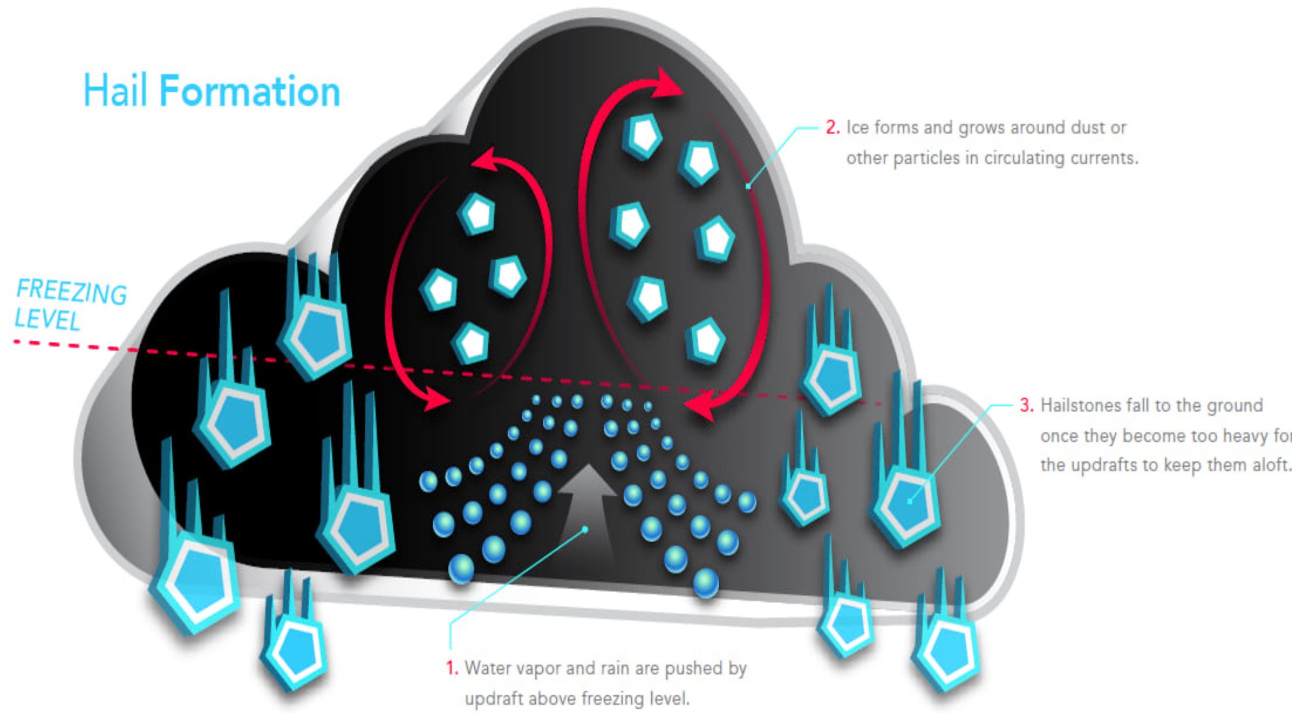
A. Hazard Identification – A Severe Thunderstorm is defined as a thunderstorm producing wind at or above 58 mph and/or hail ¾ of an inch in diameter or larger. This threshold is met by approximately 10% of all thunderstorms. These storms can strike any time of year, but similar to tornados, are most frequent in the spring and summer months. They are nature's way of providing badly needed rainfall, dispersing excessive atmospheric heat buildup and cleansing the air of harmful pollutants. Not only can severe thunderstorms produce injury and damage from violent straight-line winds, hail, and lightning, but these storms can produce tornados very rapidly and without warning. Note: For the purposes of this Plan, severe thunderstorms that result from tropical storms and hurricanes are included in this section.

Thunderstorms are violent short-lived weather disturbances that are almost always associated with lightning, thunder, dense clouds, heavy rain or hail, and strong gusty winds. Thunderstorms arise when layers of warm, moist air rise in a large, swift updraft to cooler regions of the atmosphere. There the moisture contained in the updraft condenses to form towering cumulonimbus clouds and eventually precipitation. Columns of cooled air then sink earthward, striking the ground with strong downdrafts and horizontal winds. At the same time, electrical charges accumulate on cloud particles (water droplets and ice). Lightning discharges occur when the accumulated electric charge becomes sufficiently large. Lightning heats the air it passes through so intensely and quickly that shock waves are produced; these shock waves are heard as claps and rolls of thunder. On occasion, severe thunderstorms are accompanied by swirling vortices of air that become concentrated and powerful enough to form tornadoes. See structure of a thunderstorm in the following diagram. Source: Encyclopedia Britannica



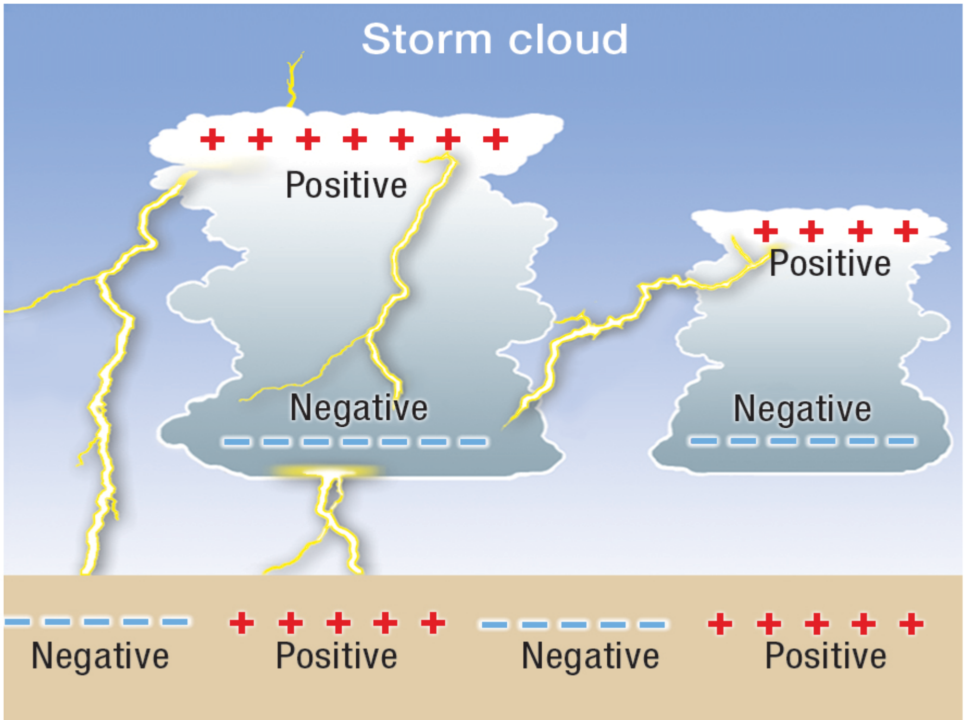
The most damaging phenomena associated with thunderstorms, excluding tornado activity, are thunderstorm winds. These winds are generally short in duration involving straight-line winds and/or gusts in excess of 50 mph. However, these winds can gust to more than 100 miles an hour, overturning trailers, unroofing homes, and toppling trees and power lines. Such winds tend to affect areas of the County with significant tree stands, as well as areas with exposed property, infrastructure, and above-ground utilities. Resulting damage often includes power outages, transportation and economic disruptions, and significant property damage. Severe thunderstorms can ultimately leave a population with injuries and loss of life. Thunderstorms produce two types of wind. Tornados are characterized by rotational winds. The other more predominant winds from a thunderstorm, downbursts, are small areas of rapidly descending air beneath a thunderstorm that strike the ground producing isolated areas of significant damage. Every thunderstorm produces a downburst. The typical downburst consists of only a 25mph gusty breeze, accompanied by a temperature drop of as much as 20 degrees within a few minutes. However, severe downburst winds can reach from 58 to 100 mph, or more, significantly increasing the potential for damage to structures. Downbursts develop quickly with little or no advance warning and come from thunderstorms whose radar signatures appear non-severe. There is no sure method of detecting these events, but atmospheric conditions have been identified which favor the development of downbursts. Severe downburst winds have been measured in excess of 120 miles per hour, or the equivalent of an F2 tornado, on the Fujita Scale. Such winds have the potential to produce both a loud “roaring” sound and the widespread damage typical of a tornado. This is why downbursts are often mistaken for tornados.

Hail can also be a destructive aspect of severe thunderstorms. Hail causes more monetary loss than any other type of thunderstorm-spawned severe weather. Annually, the United States suffers about one billion dollars in crop damage from hail. Storms that produce hailstones only the size of a dime can produce dents in the tops of vehicles, damage roofs, break windows and cause significant injury or even death. Unfortunately, hail is often much larger than a dime and can fall at speeds in excess of 100 mph. Hailstones are created when strong rising currents of air called updrafts carry water droplets high into the upper reaches of thunderstorms where they freeze. These frozen water droplets fall back toward the earth in downdrafts. In their descent, these frozen droplets bump into and coalesce with unfrozen water droplets and are then carried back up high within the storm where they refreeze into larger frozen drops. This cycle may repeat itself several times until the frozen water droplets become so large and heavy that the updraft can no longer support their weight. Eventually, the frozen water droplets fall back to earth as hailstones. See the diagram below.



Finally, one of the most frightening aspects of thunderstorms is lightning. Lightning kills nearly one hundred people every year in the United States and injures hundreds of others. A possible contributing reason for this is that lightning victims frequently are struck before or just after the occurrence of precipitation at their location. Many people apparently feel safe from lightning when they are not experiencing rain. Lightning tends to travel the path of least resistance and often seeks out tall or metal objects. With lightning however, it's all relative. A 'tall' object can be an office tower, a home, or a child standing on a soccer field. Lightning can and does strike just about any object in its path. Some of the most dangerous and intense lightning may occur with severe thunderstorms during the summer months, when outdoor activities are at their peak.

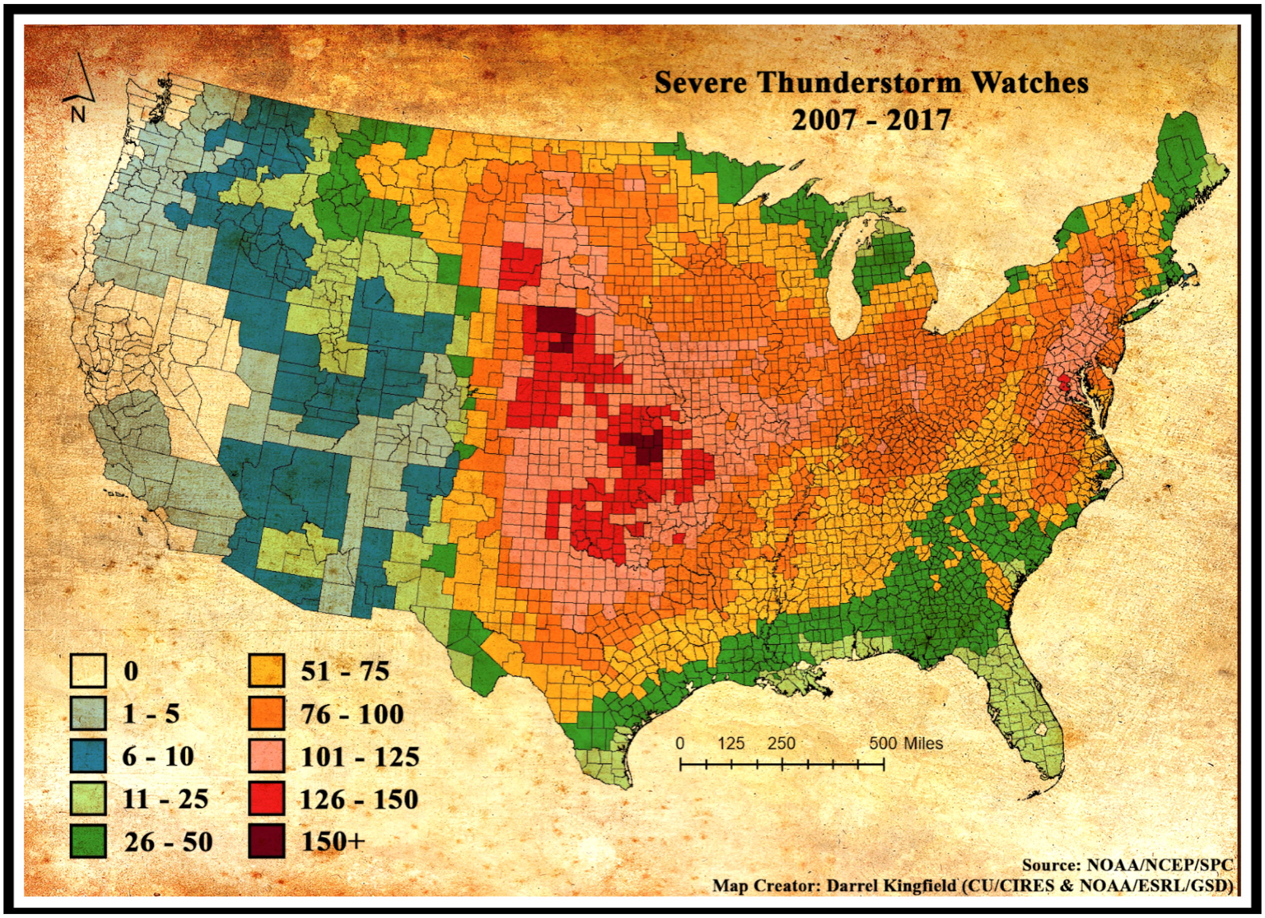
Lightning is produced as a result of charge separation within the atmosphere. Lightning (a spark discharge between centers of positive and negative charge) can occur within clouds, between clouds and between clouds and the ground. See diagram below.

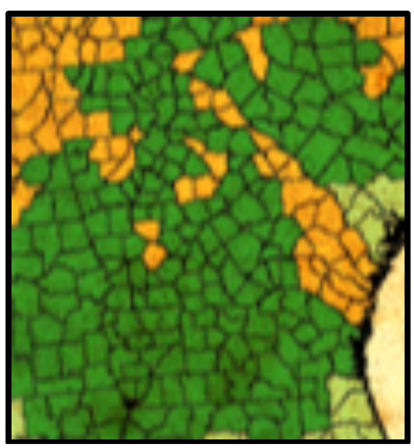


B. Hazard Profile – Severe thunderstorms, hail, and lightning are serious threats to the residents of Whitfield County. Over the course of a year, the County experiences dozens of thunderstorms, with about one in ten being severe. Severe thunderstorms occur more frequently than any other natural hazard event within Whitfield County. Many of these storms include lightning and/or hail.

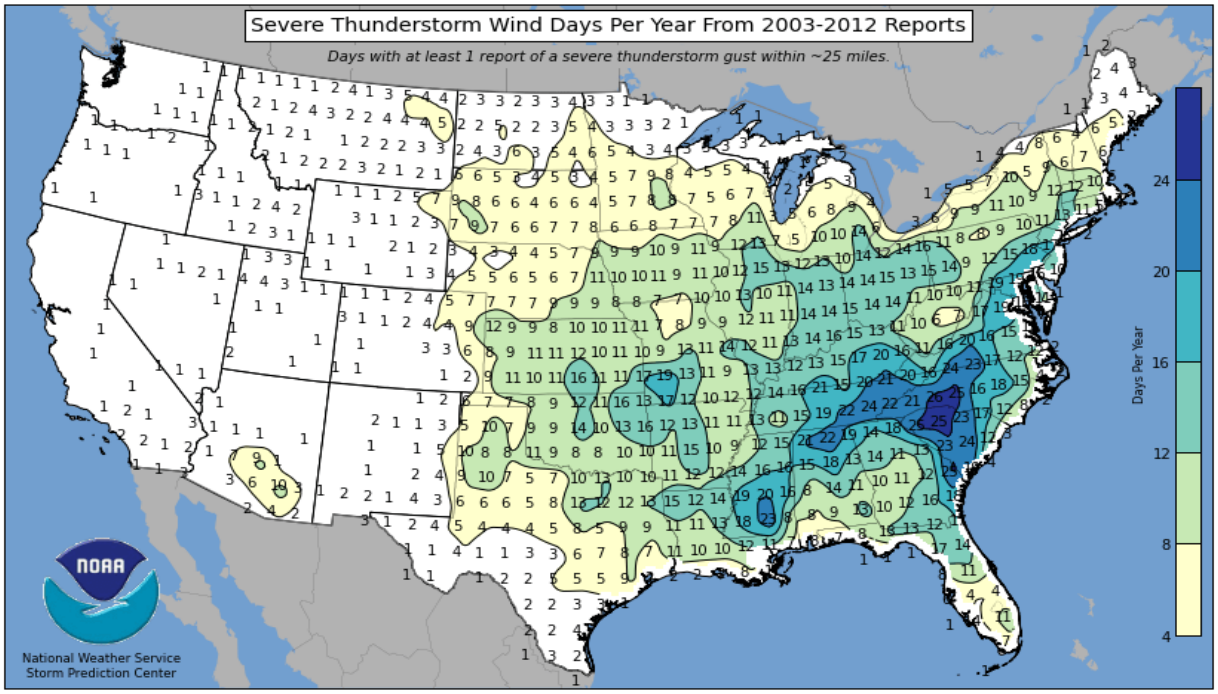
Most of the available information relating to severe thunderstorms, hail, and lightning occurrences within Whitfield County fails to describe damage estimates in great detail. However, with each thunderstorm event it is likely there are unreported costs related to infrastructure and utilities repair and public safety costs, at a minimum. Severe thunderstorms have occurred in all parts of the day and night within Whitfield County. They have also taken place in every single month of the year.

Whitfield County is located in one of the more active areas of the United States as it relates to severe thunderstorms. The following map based upon NOAA data shows the average number of severe thunderstorm watches in the U.S. per county from 2007-2017, which for Whitfield County was between 26 and 50.

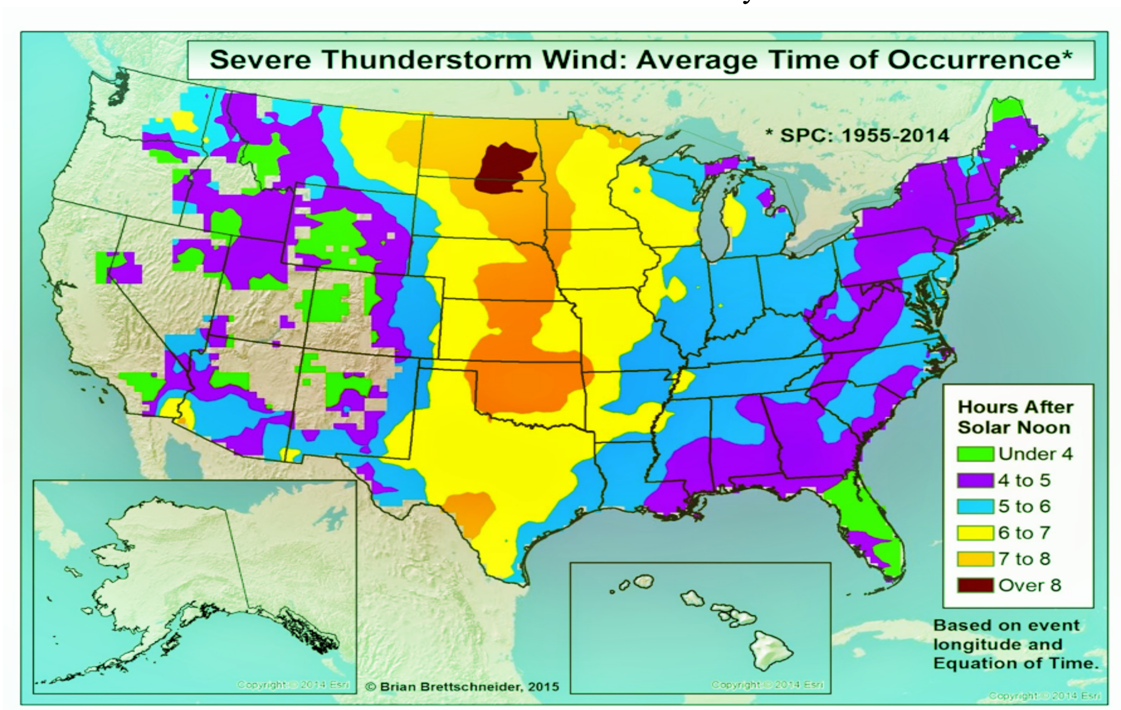




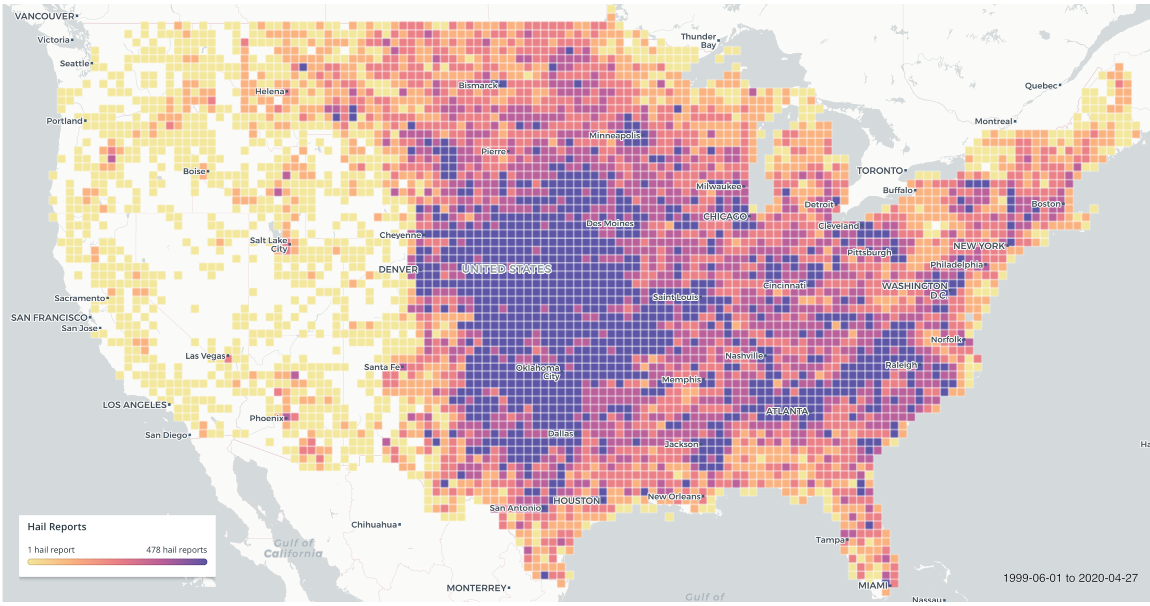
Although a little outdated, the most recent version of the following NOAA map demonstrates the average number of severe thunderstorm wind days per year. For this particular time period, Whitfield County averaged 14 days per year.

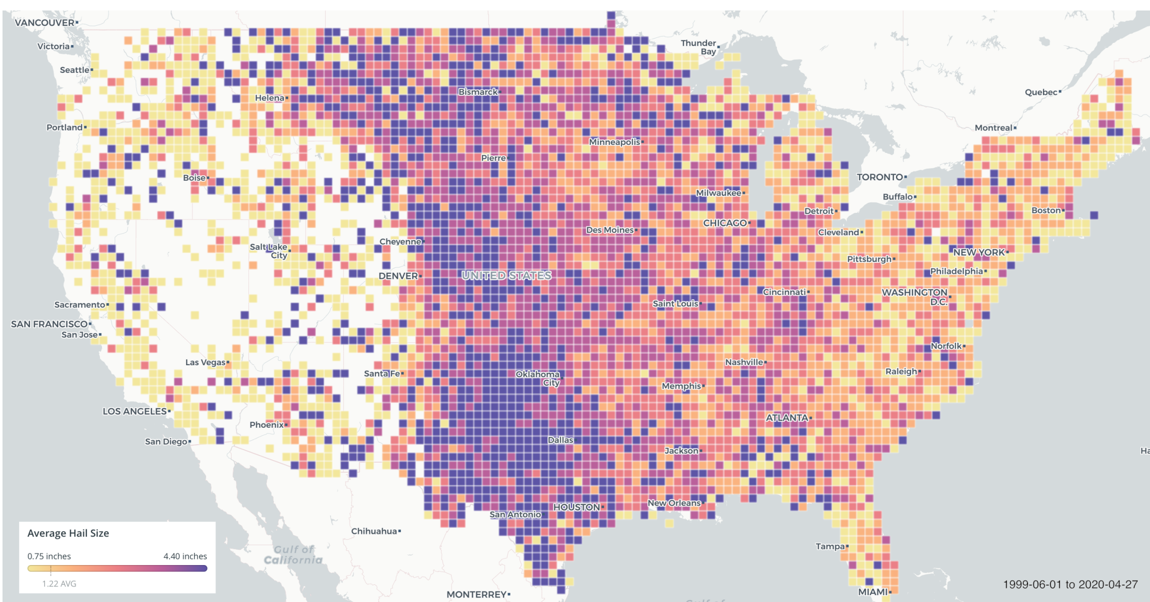


Severe thunderstorms can occur at any time of day. In Whitfield County they tend to occur in the late afternoon/early evening. The following map demonstrates the average time of occurrence of severe thunderstorm winds across the country.

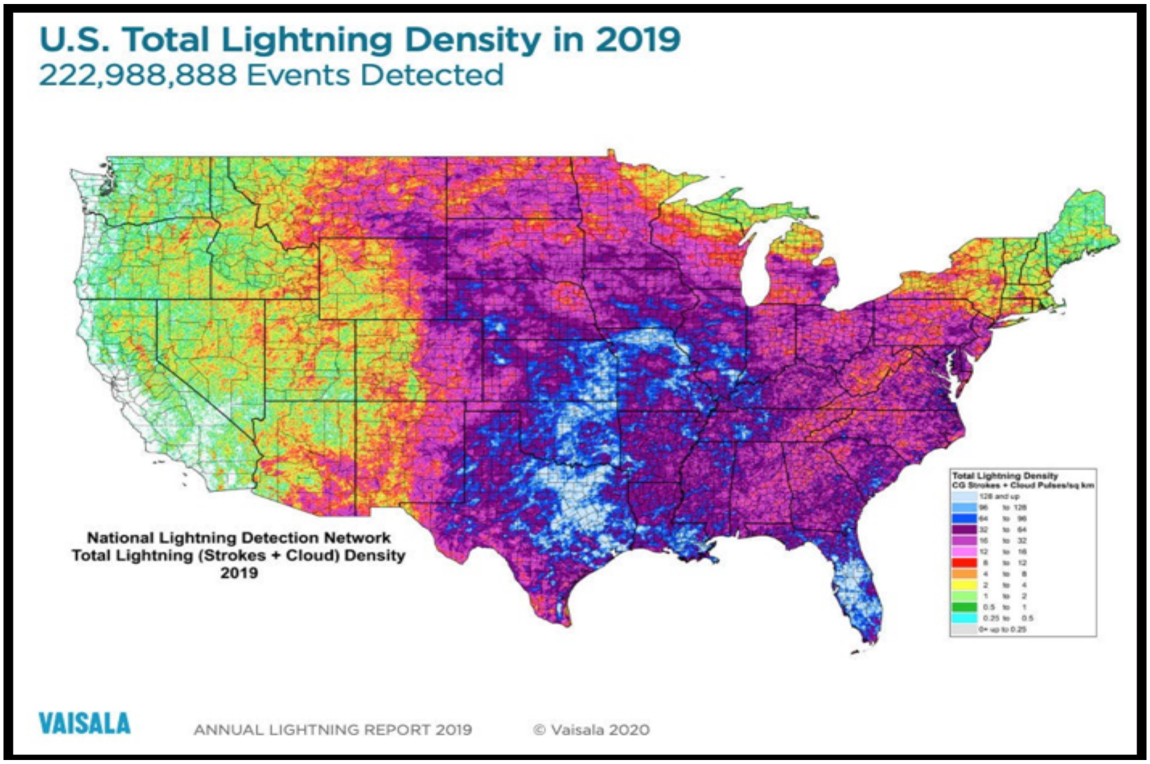


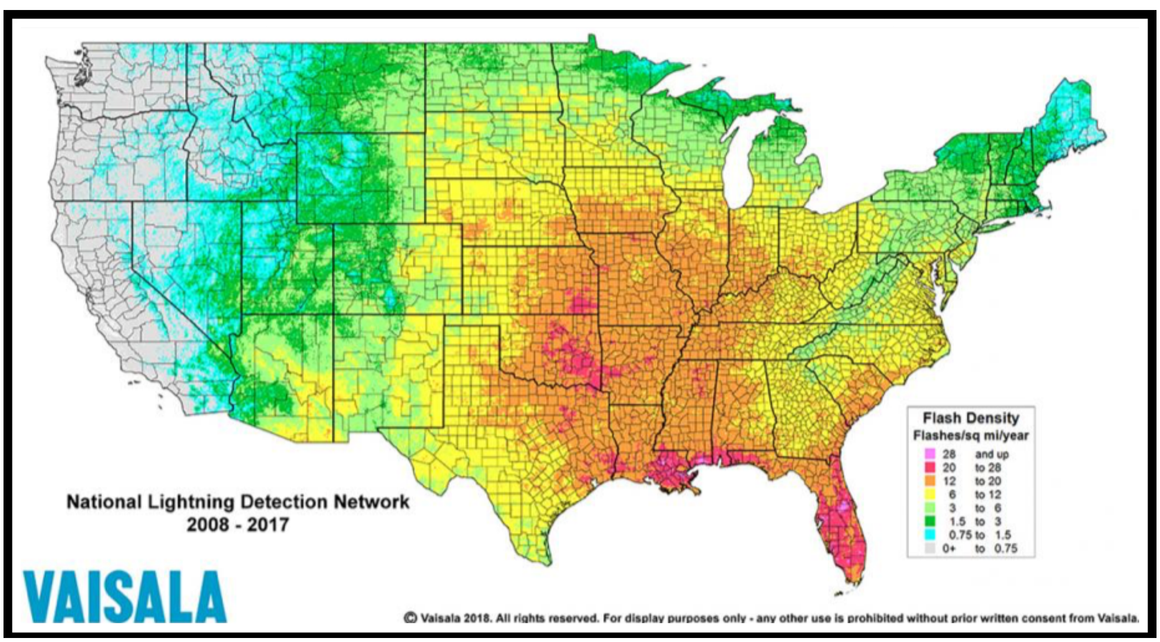
In the two maps below, NOAA Storm Prediction Center data shows both the number of reported hail events and the average hail size for the period 1999 to 2020. According to the data, Whitfield County is on the high end of the spectrum with regard to number of hail reports (first map) and near mid-range with regard to average hail size (second map).



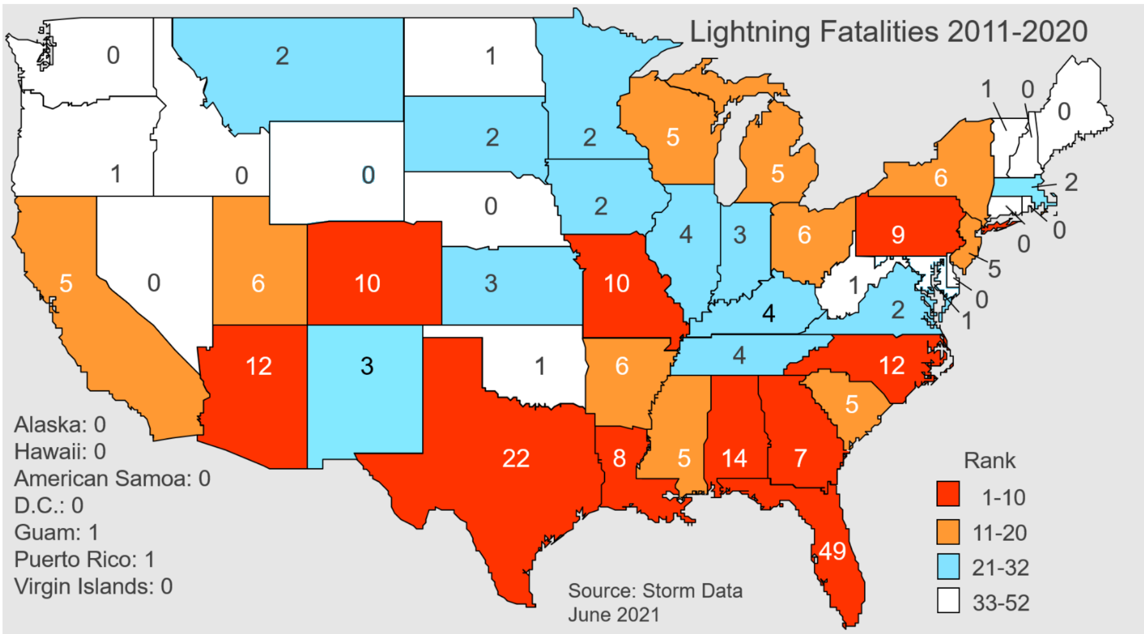


Lightning is another aspect of severe thunderstorms that can cause great devastation. The maps below show lightning activity nationwide. According to the data in the first map, Whitfield County experienced between 12 and 16 flashes of lightning per square mile in 2019. Similarly, the second map shows between 6 and 20 lightning flashes per square mile for the period 2008-2017 for Whitfield County. Source: Vaisala





Lightning can be a deadly phenomenon. As shown in the map below, Georgia has experienced seven reported lightning fatalities from 2011-2020. Source: Storm Data, June 2021



The table below shows the frequency of lightning fatalities by month nationwide from 2011-2020. It is clear that the second half of the year is drastically more dangerous than the first half with regard to lightning fatalities. Source: National Lightning Safety Council

Average Number of Lightning Fatalities Through Each Day of the Year

10-Year Average (2011-2020)

Day	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1	0	0	0	0	1	4	9	17	22	24	25	25
2	0	0	0	0	1	4	9	17	22	24	25	25
3	0	0	0	0	1	4	9	17	22	24	25	25
4	0	0	0	0	2	4	9	17	22	24	25	25
5	0	0	0	0	2	4	9	18	22	24	25	25
6	0	0	0	0	2	4	10	18	23	24	25	25
7	0	0	0	1	2	4	10	18	23	24	25	25
8	0	0	0	1	2	5	10	18	23	24	25	25
9	0	0	0	1	2	5	10	18	23	24	25	25
10	0	0	0	1	2	5	11	18	23	24	25	25
11	0	0	0	1	2	5	11	18	23	24	25	25
12	0	0	0	1	2	5	12	19	23	24	25	25
13	0	0	0	1	2	6	12	19	23	24	25	25
14	0	0	0	1	2	6	12	19	23	24	25	25
15	0	0	0	1	2	6	13	19	24	24	25	25
16	0	0	0	1	3	6	13	19	24	24	25	25
17	0	0	0	1	3	6	13	19	24	24	25	25
18	0	0	0	1	3	6	13	20	24	24	25	25
19	0	0	0	1	3	6	14	20	24	24	25	25
20	0	0	0	1	3	6	14	20	24	24	25	25
21	0	0	0	1	3	6	14	20	24	25	25	25
22	0	0	0	1	3	6	14	20	24	25	25	25
23	0	0	0	1	3	7	15	20	24	25	25	25
24	0	0	0	1	3	7	15	20	24	25	25	25
25	0	0	0	1	3	7	15	20	24	25	25	25
26	0	0	0	1	3	7	16	21	24	25	25	25
27	0	0	0	1	3	8	16	21	24	25	25	25
28	0	0	0	1	4	8	16	21	24	25	25	25
29	0	0	0	1	4	8	16	21	24	25	25	25
30	0		0	1	4	8	16	21	24	25	25	25
31	0		0		4		16	22		25		25

Compiled by John Jensenius
National Lightning Safety Council

The specific list of lightning fatalities in Georgia from 2006-2020 is shown below. While only one of these unfortunate events occurred in Whitfield County, in the City of Dalton, the threat is significant. Source: National Lightning Safety Council

Georgia Lightning Fatalities 2006-2020

Date	Day of Week	State	City	Age	Sex	Location	Activity	Name
7/3/2020	Friday	GA	Moultrie	9	F	Wooden shelter near tree	Walking	Nicol Mateo Pedro
7/4/2018	Wednesday	GA	Dalton	37	M	Pond	Fishing	Egan Stanley
9/7/2014	Sunday	GA	Lowndes County	57	M	Under pole barn	Sheltering from storm	Larry Dasher
7/11/2014	Friday	GA	Dawsonville	48	F	Back yard	Trimming hedges	Mary Jo Fortune Kinney
7/22/2013	Monday	GA	Bainbridge	21	M	Road	Had been working on farm	Mauselio Gomes
8/9/2012	Thursday	GA	Atlanta	35	M	Outside under roof of building	Building Maintenance	
7/13/2012	Friday	GA	Peachtree City	52	M	Under tree by boat ramp	Fishing	Burnette Hayes
7/13/2010	Tuesday	GA	Austell	16	F	Under tree	Walking home	Chaquille Hunter
7/13/2010	Tuesday	GA	Austell	14	F	Under tree	Walking home	Theresa Seabrum
6/29/2010	Tuesday	GA	McDonough	14	M	Outside home	Sheltering under tree	Eric Jarrell West
8/26/2007	Sunday	GA	Alpharetta	15	M	Parking lot	Riding bicycle	Kevin Avalar
6/30/2007	Saturday	GA	Tifton	23	M	Under tree	Taking shelter	Pablo Figueroa
6/25/2007	Monday	GA	Cummings, Forsyth County	27	M	Unfinished house	Taking shelter	Jose DeJesus-Cruz
6/21/2006	Wednesday	GA	Columbus	24	M	Under Tree	Mowing lawn, riding lawn mower	Adam White
5/13/2006	Saturday	GA	Tifton	31	M	Yard	Getting to Car	Max Hancock

The NCDC table below contains information on the costliest hail event on record for Whitfield County. The event occurred on May 7, 1998 and had estimated property damage of $25,000. Hail was reported to have been as large as 2.75 inches in diameter, or more.

Storm Events Database

Search Results / Next

Event Details:

Event	**Hail**
Magnitude	**2.75 in.**
State	**GEORGIA**
County/Area	**WHITFIELD**
WFO	**FFC**
NCEI Data Source	**PDC**
Begin Date	**1998-05-07 17:45 EST**
Begin Location	**5S ROCKY FACE**
Begin Lat/Lon	**34.73/-85.03**
End Date	**1998-05-07 18:00 EST**
End Location	**TILTON**
End Lat/Lon	**34.67/-84.93**
Deaths Direct/Indirect	**0/0** (fatality details below, when available...)
Injuries Direct/Indirect	**0/0**
Property Damage	**25K**
Crop Damage	
Event Narrative	**Several public reports indicated hail ranged from golf ball to baseball size. Lots of damage to cars and house roofs occurred.**

The NCDC table below contains information on the costliest thunderstorm wind event on record for Whitfield County. The event occurred on June 18, 2011 and had estimated property damage at $1.25 million, and wind gusts approximated between 65 and 70mph.

Storm Events Database

Search Results / Next

Event Details:

Event	**Thunderstorm Wind**
Magnitude	**61 kts.**
State	**GEORGIA**
County/Area	**WHITFIELD**
WFO	**FFC**
Report Source	**Amateur Radio**
NCEI Data Source	**CSV**
Begin Date	**2011-06-18 15:35:00.0 EST-5**
Begin Location	**6WSW ROCKY FACE**
Begin Lat/Lon	**34.7668/-85.1277**
End Date	**2011-06-18 15:55:00.0 EST-5**
End Location	**0WSW DAWNVILLE**
End Lat/Lon	**34.82/-84.87**
Deaths Direct/Indirect	**0/0** (fatality details below, when available...)
Injuries Direct/Indirect	**0/0**
Property Damage	**1.25M**
Crop Damage	**0.00K**
Episode Narrative	**A series of strong short waves were moving across the U.S. These short waves were ejecting from a large upper trough in the western U.S. These vigorous short waves encountered a hot, moist, unstable air mass across the U.S. However, dry mid-level atmosphere air and west to west-northwest flow aloft promoted the development of organized lines of thunderstorms, which produced extensive strong outflow boundaries supporting wind gusts of 50 to 60 mph, even greater in some cases. During the afternoon of the 18th, such thunderstorm gust fronts affected northwest Georgia in particular with widespread damaging wind gusts, likely in excess of 70 mph, blowing down hundreds of trees, dozens of power lines, and causing damage to some structures. This area of thunderstorms progressed southeast toward Atlanta, before dissipating during the mid-evening. Considerable wind damage was noted in the northern and northwestern suburbs of Atlanta from this activity.**
Event Narrative	**Amateur radio operators and the public reported that hundreds of trees were down across the county from west of Rocky Face to Dalton. Wind gusts were estimated at 65 to 70 mph. At least 40 homes across the county sustained minor to moderate damage from fallen trees. Four homes in Dalton and two homes in Rocky Face suffered extensive damage from trees which fell on the structures. Multiple trees and several power lines were down on Cleveland Highway north of Dalton. A number of power lines were down throughout the city of Dalton.**

The NCDC table below contains information on the costliest lightning event on record for Whitfield County. The storm occurred on June 24, 2011 and had estimated property damage at $100,000 due largely to the loss of a commercial structure on Beaverdale Rd.

Storm Events Database

Search Results / Next

Event Details:

Event	**Lightning**
State	**GEORGIA**
County/Area	**WHITFIELD**
WFO	**FFC**
Report Source	**Emergency Manager**
NCEI Data Source	**CSV**
Begin Date	**2011-06-24 15:32:00.0 EST-5**
Begin Location	**0W TOONNERVILLE**
Begin Lat/Lon	**34.8705/-84.8872**
End Date	**2011-06-24 15:32:00.0 EST-5**
End Location	**0W TOONNERVILLE**
End Lat/Lon	**34.8705/-84.8872**
Deaths Direct/Indirect	**0/0** (fatality details below, when available...)
Injuries Direct/Indirect	**0/0**
Property Damage	**100.00K**
Crop Damage	**0.00K**
Episode Narrative	**A persistent and strong subtropical ridge centered across the Southern Plains continued to provide Georgia with an unstable northwest flow aloft. A series of upper-level disturbances were embedded within the flow, each generating rounds of thunderstorms across the Tennessee Valley which progressively moved southeast into Georgia. This pattern remained in place through much of June and into early July, for that matter. A quasi-stationary front extended westward from the Carolinas and Tennessee westward into Oklahoma. Numerous convective outflow boundaries were noted throughout the Tennessee Valley and the Carolinas. A complex of thunderstorms moved into north Georgia during the mid-afternoon and steadily propagated southward into central Georgia during the evening before diminishing. Many reports of damaging wind and some hail were reported during this event.**
Event Narrative	**The Whitfield County Emergency Management Director reported that a commercial structure on Beaverdale Road was set on fire by lightning. No specific details regarding damages were provided.**

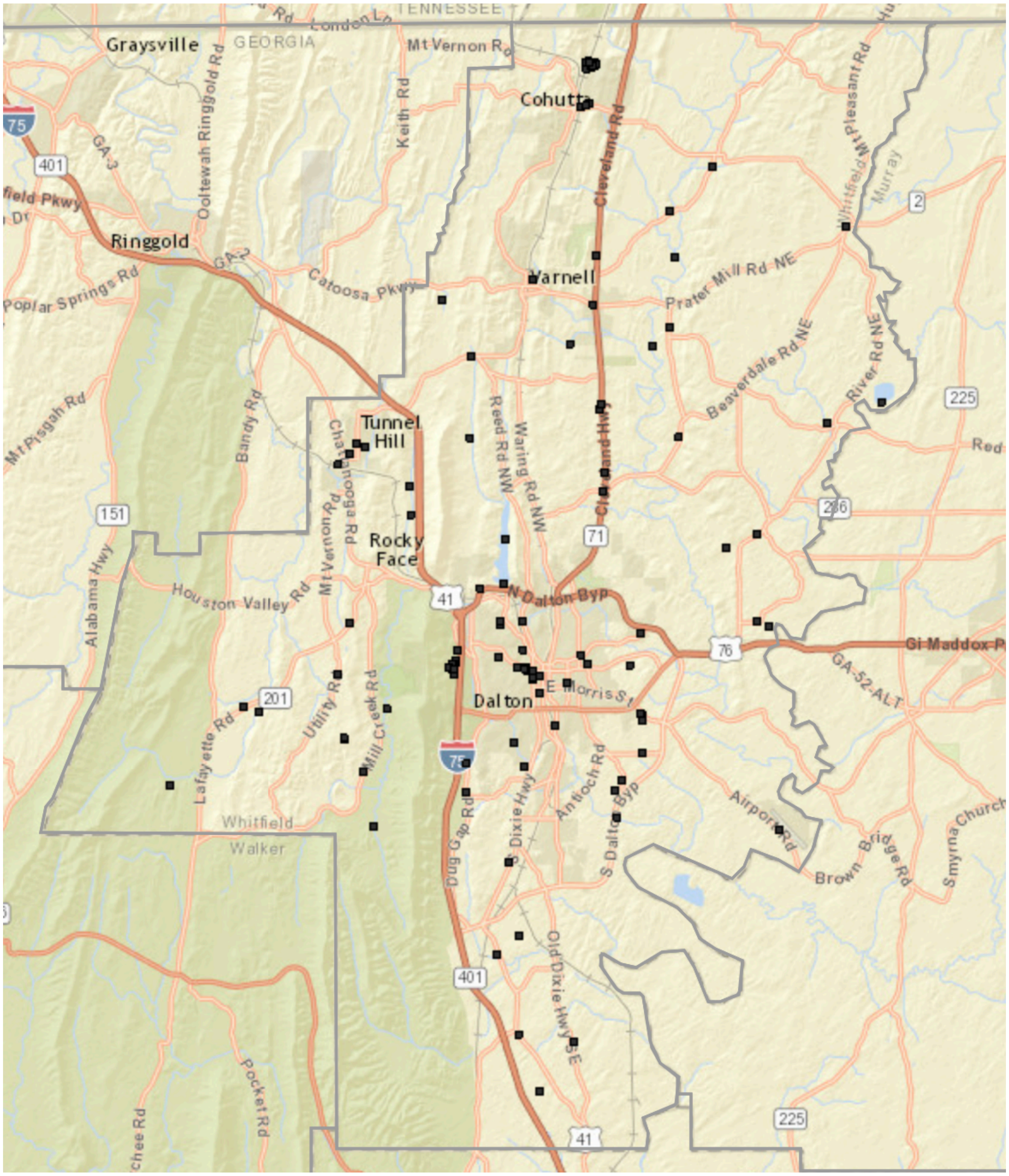
The Whitfield County HMPC utilized data from the National Climatic Data Center, the National Weather Service, numerous weather-related news articles and various online resources, and the Whitfield County Emergency Operations Plan in researching severe thunderstorms and their impact on the County. With most of the County's recorded severe thunderstorm events, only basic information was available. It is also likely that some severe thunderstorm events have gone unrecorded. Therefore, any conclusions reached based upon available information on severe thunderstorms within Whitfield County should be treated as the minimal possible threat.

NCDC records show that 223 severe thunderstorms occurred within the County over the past fifty years, which equates to a 446% annual frequency based upon reported events. Over the past twenty years that frequency has increased to 800%. It would appear that severe thunderstorm activity has increased over time within the County. This may be the case or it may simply be that record keeping and technology have improved significantly over the course of time, reflecting the higher numbers. It may also be a combination of these two factors. The following chart provides annual frequency of reported events over the past five, ten, twenty, and fifty-year periods. The most recent five-year period, covering the span of time since the last update to this Plan, is highlighted in gold.

Whitfield County – Severe Thunderstorm Frequency including Hail & Lightning (based on Reported Events)

Time Period	5yrs (2017-2021)	10yrs (2012-2021)	20yrs (2002-2021)	50yrs (1972-2021)
Number of Reported Events	40	68	153	223
Frequency Average per Year	8.00	6.80	7.65	4.46
Frequency Percent per Year	800%	680%	765%	446%

C. Assets Exposed to Hazard – All public and private property including critical facilities are susceptible to severe thunderstorms, hail, and lightning since this hazard is not spatially defined. The GEMA map below identifies critical facilities located within the hazard area, which in the case of severe thunderstorms includes all areas within the County, Cities, and Towns.



D. Estimate of Potential Losses – For loss estimate information, please refer to the Critical Facilities Database (Appendix A).

E. Multi-Jurisdictional Concerns – Any portion of Whitfield County can be negatively impacted by severe thunderstorms, hail, and lightning. Therefore, any mitigation steps taken related to these weather events will be pursued on a countywide basis and include the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta.

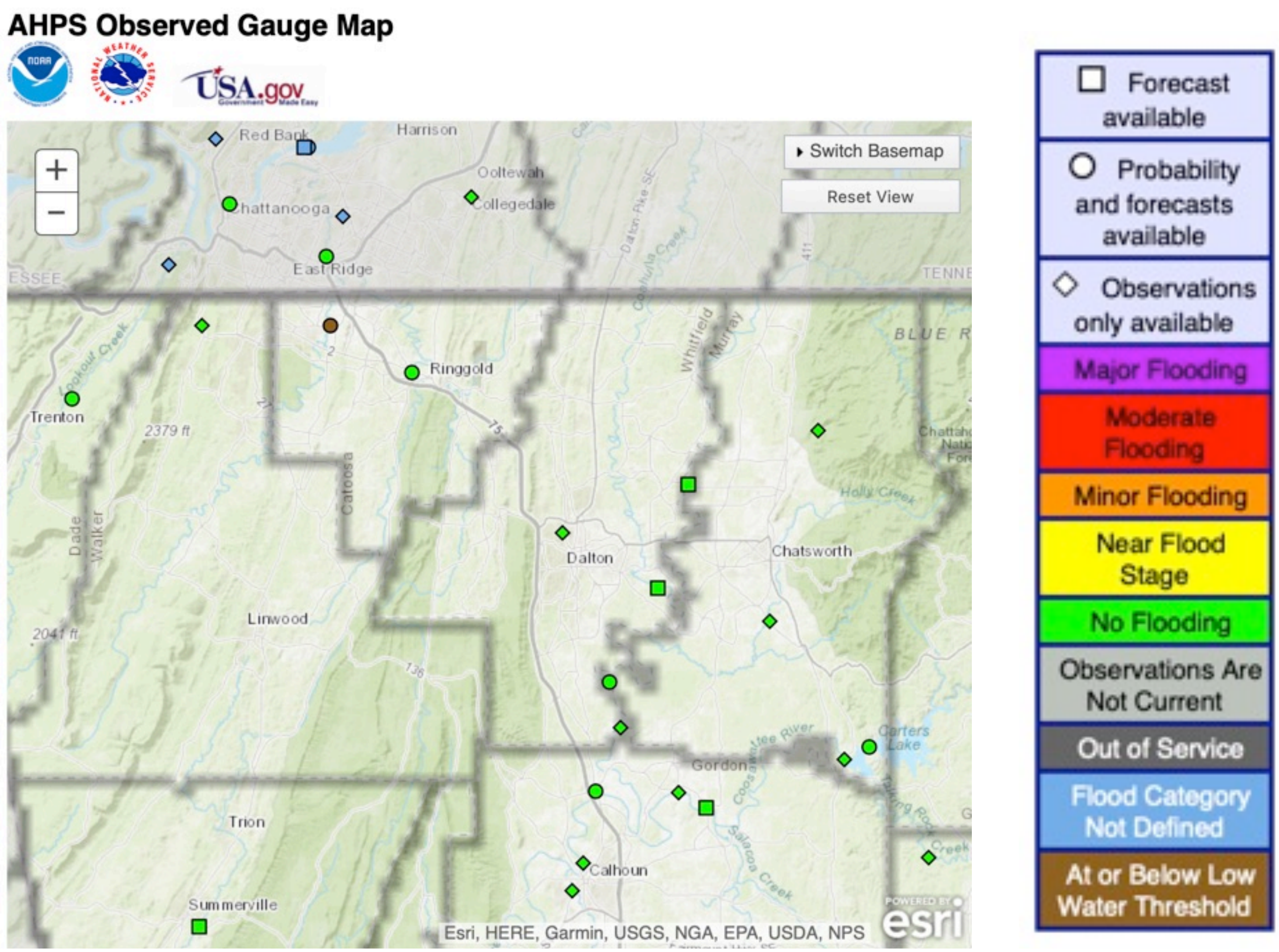
F. Hazard Summary – Overall, severe thunderstorm, hail, and lightning events pose one of the greatest threats to Whitfield County in terms of property damage, injuries and loss of life. These weather events represent the most frequently occurring natural hazard within Whitfield County and have a great potential to negatively impact the County each year. Based on the frequency of this hazard, as well as its ability to negatively impact any part of the County, the HMPC recommends that the mitigation measures identified in this plan for severe thunderstorm, hail, and lightning be aggressively pursued. Specific mitigation actions related to these weather events are identified in *Chapter 5*.

2.3 Flooding

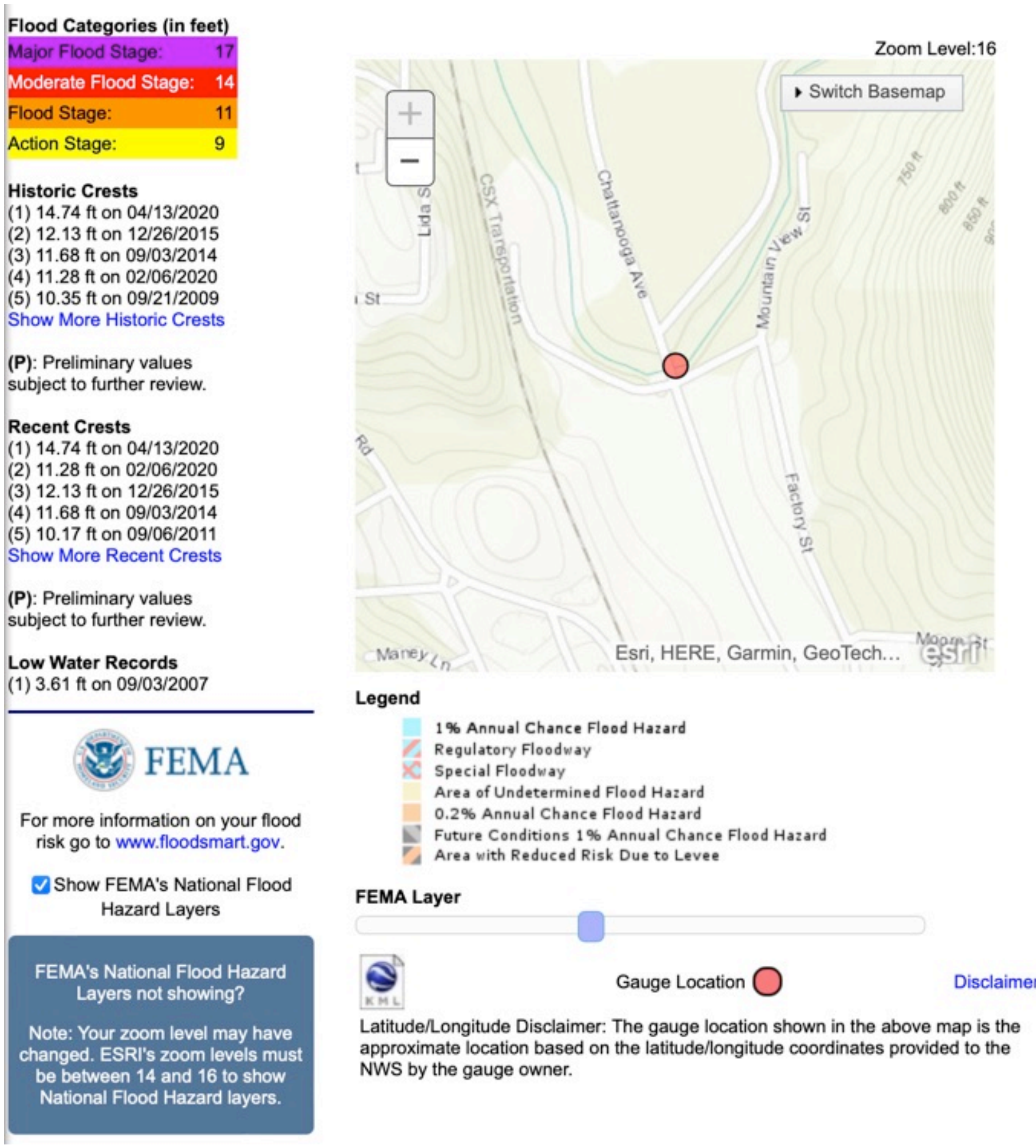
A. Hazard Identification: The vulnerability of a river or stream to flooding depends upon several variables. Among these are topography, ground saturation, rainfall intensity and duration, soil types, drainage, drainage patterns of streams, and vegetative cover. A large amount of rainfall over a short time span can result in flash flood conditions. Nationally, the total number of flash flood deaths has exceeded tornado fatalities during the last several decades. Two factors seem to be responsible for this: public apathy regarding the flash flood threat and increased urbanization. A small amount of rain can also result in floods in locations where the soil is saturated from a previous wet period or if the rain is concentrated in an area of impermeable surfaces such as large parking lots, paved roadways, etc. Topography and ground cover are also contributing factors for floods in that water runoff is greater in areas with steep slopes and little or no vegetation.

B. Hazard Profile: Over the past fifty years, flood events on record in Whitfield County have usually been associated with areas in the vicinity of the County's many creeks and lakes. The areas most affected or potentially most affected include locations in the vicinity of Dee St, Old Grade Rd at Admiral Mack Gaston Pkwy, Old Dixie Hwy at South Bypass, Hickory Flats Rd, Brock Dr, Susan Dr, Hunter Cr, 1710 Cleveland Hwy, Needham Dr, Mill Creek at Underwood Rd/Underwood St, Mill Creek at Environs Ln, Mill Creek at SR 71 (Cleveland Hwy), Mill Creek at I-75, and Mill Creek from US 41 at Willowdale Rd to US 41 at Shugart Rd. Other areas affected by flooding were associated with storm drain systems within the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta. Relatively little information on flooding damage estimates, in terms of dollars, is available. However, with each of these events there were certainly significant costs related to road repair, infrastructure repair, and public safety, at a minimum. Most of the flood damage that has occurred historically within the County appears to be "public" flood damage. More specifically, roads and culverts washing out have been the most common flooding problem.

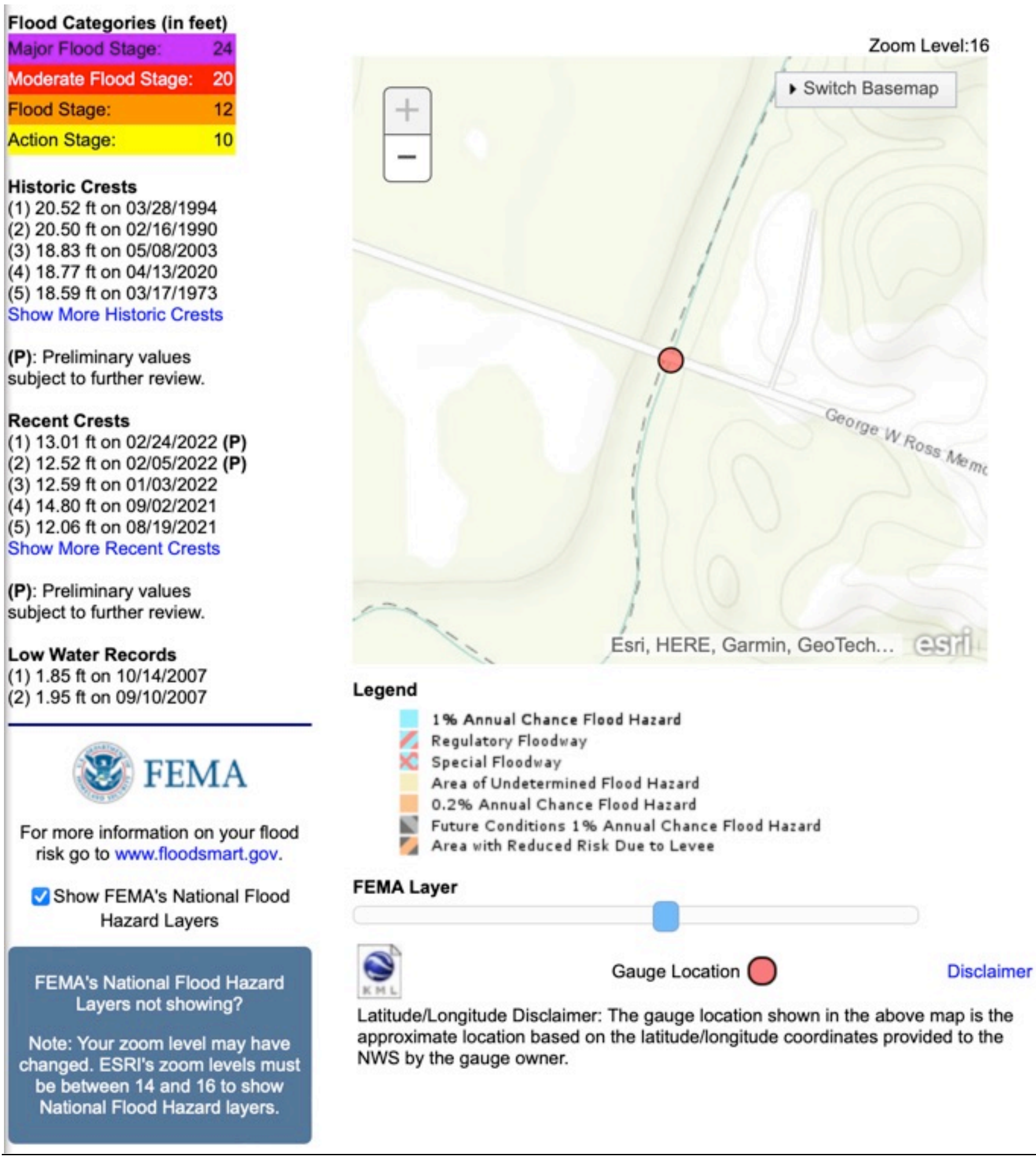
There are five flood gauges tracked by the National Weather Service in Whitfield County. These locations represent some of the most significant flooding events on record within the County. A description and map of each follows.



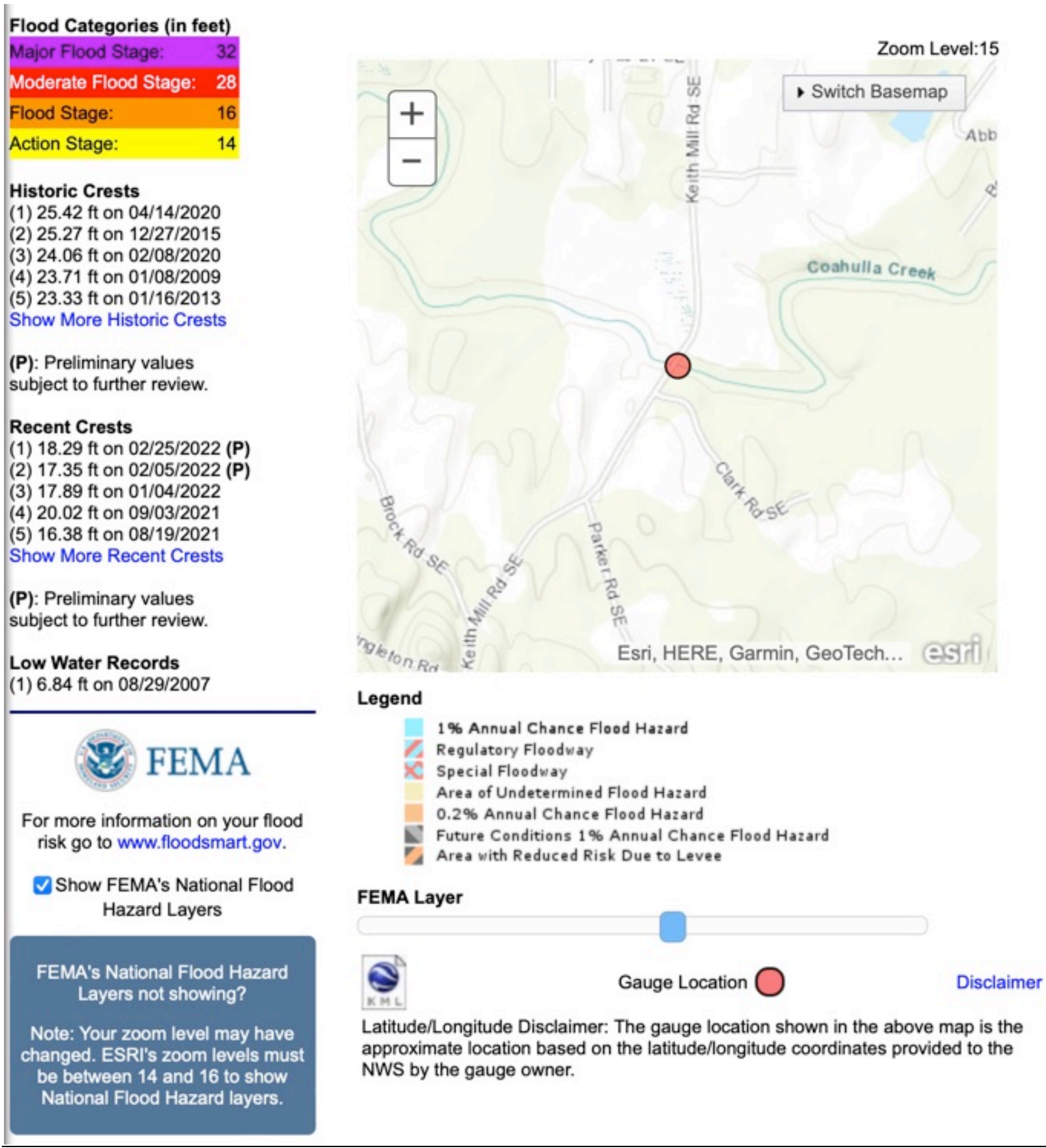
Below is a National Weather Service graphic illustrating both the historical and recent crests of the Mill Creek at Dalton, GA, as well as flood categories (in feet). The record historic crest was 14.74ft on April 13, 2020. This fell within the category of "Moderate Flood Stage".



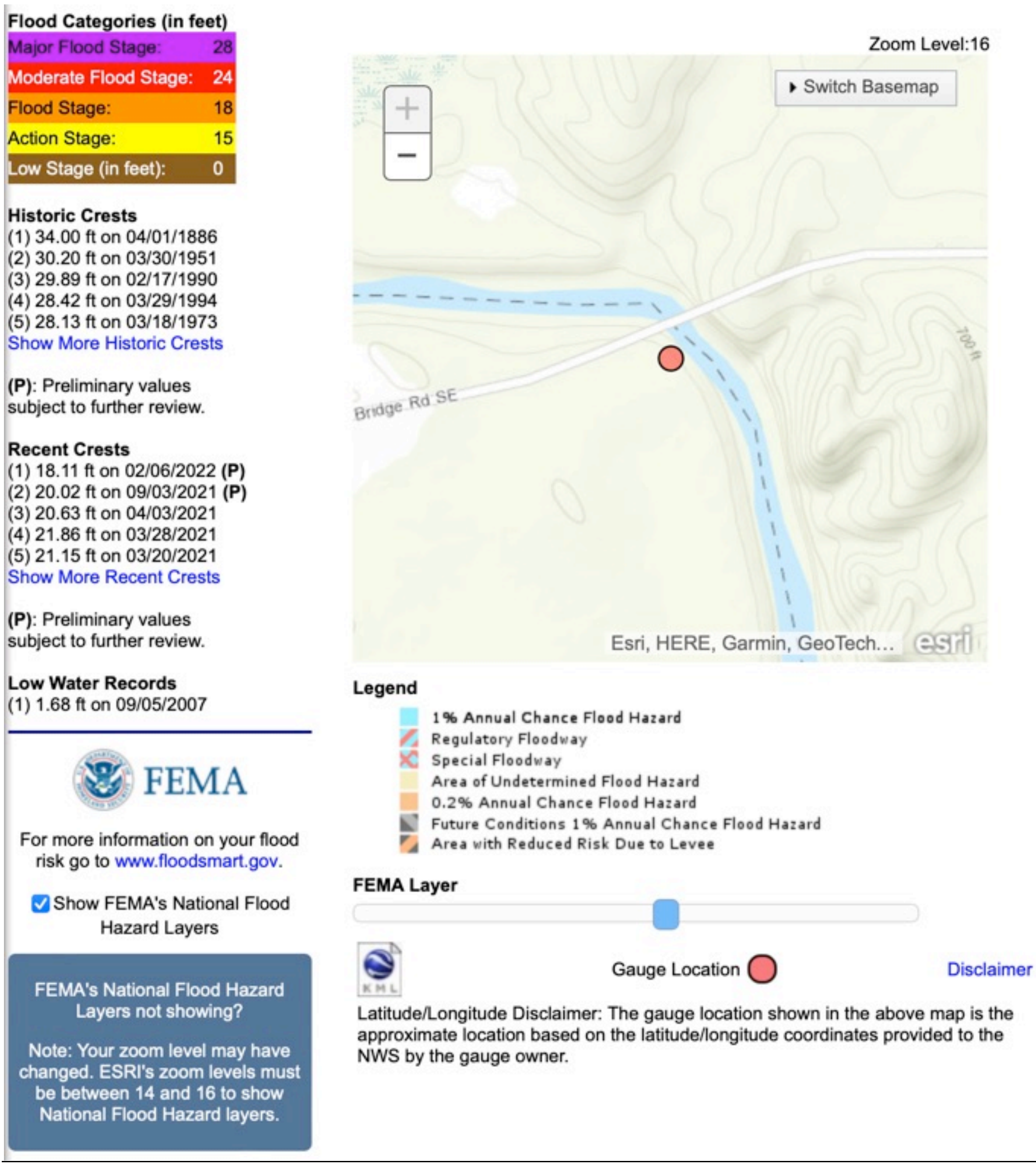
Below is a National Weather Service graphic illustrating both the historical and recent crests of the Conasauga River at GA 286 near Eton, GA, as well as flood categories (in feet). The record historic crest was 20.52ft on March 28, 1994. This fell within the category of "Moderate Flood Stage".



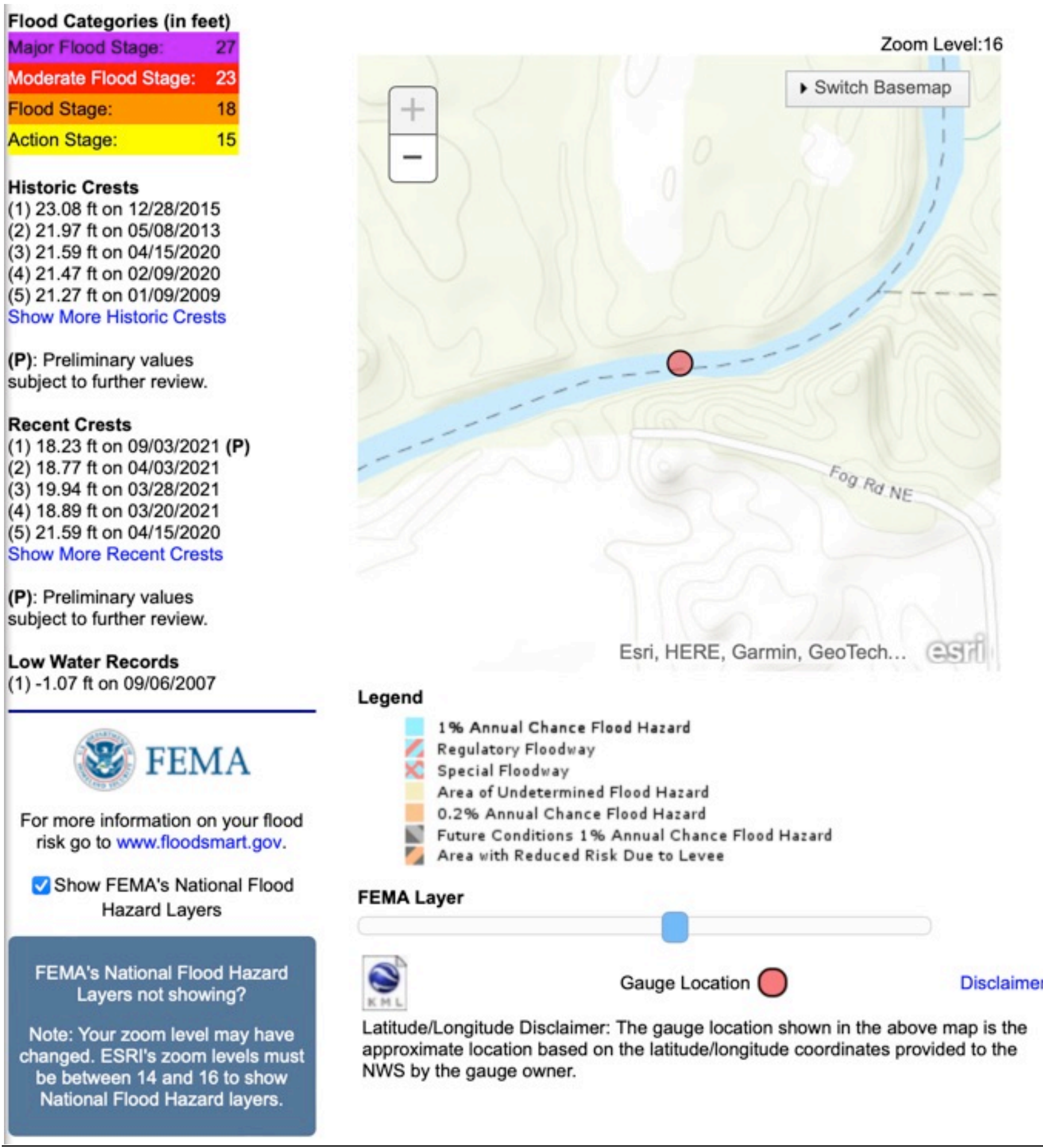
Below is a National Weather Service graphic illustrating both the historical and recent crests of the Coahulla Creek at Keith's Mill Road near Dalton, GA, as well as flood categories (in feet). The record historic crest was 25.42ft on March 14, 2020. This fell within the category of "Flood Stage".



Below is a National Weather Service graphic illustrating both the historical and recent crests of the Conasauga River at Tilton, as well as flood categories (in feet). The record historic crest was 34.00ft on April 1, 1886. This fell within the category of "Major Flood Stage".



Below is a National Weather Service graphic illustrating both the historical and recent crests of the Conasauga River at Sloan Bridge below Dalton, GA, as well as flood categories (in feet). The record historic crest was 23.08ft on December 28, 2015. This fell within the category of "Moderate Flood Stage".



The First Street Foundation and Risk Factor/Flood Factor

Homes across the country are at risk from multiple perils and that risk is only growing with each passing year. First Street Foundation is a non-profit research and technology group dedicated to quantifying and communicating those risks by incorporating world class modeling techniques and analysis with the most up to date science available in order to simply, and effectively, inform Americans of their risk today and into the future from all environmental changes. Risk Factor is a free tool created by First Street Foundation to make it easy to understand risks from a changing environment.

Some of the things that make First Street Foundation research unique are:

- Custom built models to calculate property-level climate risk statistics
- Transparent, peer-reviewed methodology that's proven against real environmental events
- Validated by millions of users every day who continuously improve the data and science
- Easy-to-understand experience that's trusted by industry leaders
- Building details and structure characteristics are used to customize information each specific property

Institutional real estate investors and insurers have long had access to environmental risk data from for-profit oligopolies who use non-transparent methodologies that do not advance science and which limit access to risk information for the country. Because of this, the majority of Americans have relied on sources such as the Federal Emergency Management Agency (FEMA), the United States Forest Service, and other public agencies to understand their risk. However, these agencies are not tasked with defining risk for individual properties, do not consider how environmental changes impact that risk in the near-term future, and are often unable to incorporate the latest science due to the bureaucratic and regulatory restrictions within which they operate, leaving millions of households and property owners unaware of their true risk.

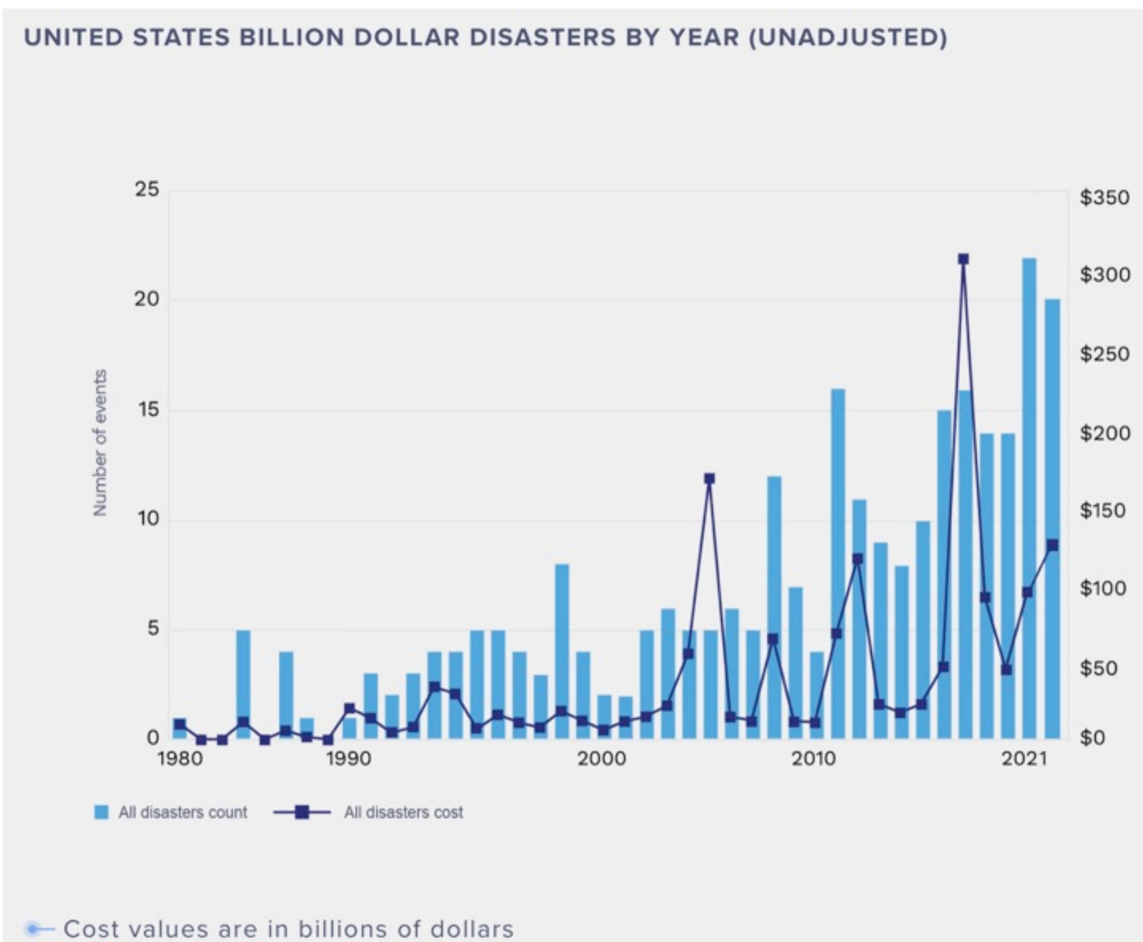
There has long been an urgent need for accurate, property-level, publicly available environmental risk information in the United States based on open source, peer reviewed science. In a mission to fill that need, First Street Foundation has built a team of leading modelers, researchers, and data scientists to develop the first comprehensive, publicly available risk models in the United States. Beginning with flood, moving on to wildfire, and now extreme heat, First Street works to correct the asymmetry of information in the market, empowering Americans to protect their most valuable asset–their home while working with industry and government entities to inform them of their risk.

People can freely access property-specific flood, wildfire, and extreme heat risk information for 145 million US properties at Risk Factor. The Foundation's data is also leveraged by industry and governments and used for critical analysis of the potential impact of these climate perils on infrastructure; mortgage and housing market inefficiencies; government spending and taxes; and vulnerable communities. Roughly 200 of the world's top academic researchers from 45 of the country's leading universities, including Harvard, Wharton, Johns Hopkins, and MIT, have partnered with the First Street Foundation Research Lab to analyze the data.

First Street Foundation Mission

First Street Foundation's mission is to make climate risk accessible, easy to understand and actionable for individuals, governments, and industry.

A changing climate is impacting the risks facing American properties, communities, and businesses as perils like flood, fire, heat, and drought become more common, and more severe. Currently the best science highlighting the issue is complex, happening in silos, and left in peer review journals, and there is no accurate way for individuals to understand how environmental changes will impact them personally. First Street Foundation initially looked only at flooding with the Flood Factor project. However, the scope of the Foundation has since expanded to focus on other threats as well under the scope of the Risk Factor project. Homes across the country are at risk from multiple perils and that risk is only growing with each passing year. There were 20 events in 2021 that each caused more than a billion dollars in damage.



The First Street Foundation Flood Model

The First Street Foundation Flood Model is a nationwide probabilistic flood model that shows the risk of flooding at any location in the contiguous 48 states due to rainfall (pluvial), riverine flooding (fluvial), and coastal surge flooding. In collaboration with more than 80 scientists, technologists, and experts, the First Street Foundation has built on decades of peer-reviewed research and models from climatology, hydrology, and statistics to create an unprecedented flood model of the entire United States.

While other hydraulic and hydrologic models show refined risks of flooding in certain areas, this model provides complete coverage across the United States at 3-meter resolution. Existing flood models are built for individual municipalities and can rely on widely varying assumptions. The First Street Foundation Flood Model provides a consistent and unified methodology across the entire country with continuous outputs. This extends into areas that have no previous flood modeling and even areas that do not have recorded hydrologic data. As a result, there is increased visibility into new regions of the entire country. Additionally, flood models are typically only produced under existing conditions using historic environmental data as a representation for current risk. The First Street Foundation Flood Model takes changing environmental factors into account by applying global climate model projections to forecast how flood risk will change over the next 30 years.

Fluvial Flooding

The First Street Foundation Flood Model relies on the Fathom-US model, a peer-reviewed hydraulic model that employs several key characteristics that allows it to create flood hazards for the entire United States. The hydraulic model represents river and stream channels using a one-dimensional representation that enables river width to be decoupled from model grid scale and therefore allows any river size to be represented within the model. This allows for hydraulic calculations to occur for rivers either wider or narrower than this native resolution, while still making computation over large areas more manageable and practical, thereby allowing for computation of the entire United States. Decoupling river width from the hydraulic calculations also simplifies the model complexity as the model does not need to have detailed river cross sections every few hundred feet along a river, instead relying on assumptions around when flow would leave the banks of the river. Once flow exceeds the carrying capacity within the river's banks, the hydraulic model simulates the flow of water over a high-precision digital elevation model. Another major aspect of the Fathom-US model that allows for calculation of flood risk throughout the country is the regionalized flood-frequency analysis. Conceptually, the Fathom framework is different from many earlier large-scale flood models because it does not employ a rainfall-driven hydrological model to create river flow rates at the border of one catchment to pass to another. The alternative to this rainfall-driven approach is to use flood-frequency analysis of river gauge records to characterize extreme river flows and generate boundary conditions of the hydraulic model. Flood-frequency analysis involves the fitting of a curve to the observed tail of a flow distribution from a river gauge. Once the curve is fitted, it is possible to estimate the flow associated with any return period. Of course, this is not possible to implement directly in ungauged catchments. To solve the problem of ungauged catchments, flow characteristics are assigned to ungauged catchments based on the similarity of their characteristics to those of gauged catchments. Essentially, by characterizing the similarity of catchments across features such as contributing area, precipitation patterns, land cover, and topography, the flow data in an ungauged catchment can be estimated based on those of highly similar gauged catchments.

Pluvial Flooding

While the hydraulic model is not a rainfall-runoff model, pluvial flooding is measured by applying rainfall directly on the elevation model surface and modeling surface runoff, accounting for things like land cover and impervious surfaces. Current rainfall data comes from NOAA's Atlas 14 data. At each return period analyzed, the model simulates events for durations of 1 hour, 6 hours, and 24 hours with rainfall intensities defined by the intensity-duration-frequency curves of the NOAA data. The pluvial hazard layer selected is the maximum inundation depth occurring in any of the three durations simulated for the given return period.

Coastal Flooding

Coastal areas may flood from extreme water levels resulting from high tides alone or the additional uplift caused by surges associated with storms. Extreme high tides can cause flooding in some low-lying coastal areas. When coastal storm systems such as hurricanes cause surges in addition to high tides, flooding is exacerbated in these low-lying areas and extends even further inland. The First Street Foundation Flood Model quantifies coastal flood risk due to surge and extreme high tides. The Model utilizes decades of readings from NOAA's tide gauge stations to identify regular tidal variations, storm surges, and long term sea level rise trends. Untangling these effects allows for the isolation of each element and ultimately reconstituting total water levels based on changes in surge frequency and mean sea level over time. Hurricanes have an outsized effect on the historical record. They are a very low frequency event that has extreme effects on the surge level distributions in the areas where they have occurred. The exact location of landfall greatly affects the historical record and therefore the likelihood of surge levels at those locations. Neighboring areas that may not have experienced the most significant hurricane surge effects will be comparatively under-representing the likelihood of major events within their historical record. The First Street Foundation Flood Model uses hundreds of thousands of realizations of thousands of synthetic hurricane tracks to generate the likelihoods of different water levels occurring at any location along the east and gulf coasts. These simulations were performed under 2020 climate conditions as well as under future climate conditions based on global climate model output. Mean sea level was also adjusted for future flood hazard simulation according to the most recent scientific studies, including the effects of ice sheet physical processes such as the hydrofracturing of ice shelves.

Hazard Coupling

In areas with no surge or tidal hazard, the fluvial and pluvial hazard layers for any given return period are combined by selecting the maximum value of the two layers. The interaction of these hazards is not explicitly accounted for because in inland areas, flooding is typically dominated by one source or the other. Because they are largely independent, a simple approach was selected to represent risk. In areas of coastal hazards, the First Street Foundation Flood Model presents a hazard layer agnostic to the source of flooding. Surge, fluvial, and pluvial hazards were modeled separately, and then modeled together in several different combinations of return periods by source. These were dynamic hydraulic simulations intended to capture the joint effects on flooding based on the varying co-occurrence of different flood hazards. Statistical analysis of the historical records of both tide and stream gauges in each catchment yielded co-occurrence of the different flood hazards, which gives an indication of how likely different surge levels are to occur at the same time as elevated river levels. These rates of co-occurrence then informed the combination of these hazards into an overall joint distribution at each location, generating new inundation depths per return period.

Future Hazards and a Changing Climate

The First Street Foundation Flood Model is also unique in the way it accounts for a changing climate. Typical flood models derive their flows based purely on statistical analyses of historical records of rainfall and stream gauges. The First Street Foundation Flood Model incorporates the output of an ensemble of 21 Global Climate Models (GCM) to account for the uncertainty of future climate scenarios as well as the current climate itself. Because extreme events occur infrequently by their nature, a long record of climate data is needed to attempt to characterize these extreme events. But by creating a long record, analysis would cloud the changes in climate over time. The First Street Foundation Flood Model uses a baseline historical period of 1980-2010, creating a 30-year period of observed data. The Global Climate Model projections for 2020 allow for the creation of not only a new climate that accounts for changes since the historical data was recorded, but also the potential spread of what the true climate actually is right now, as opposed to what a small sample has shown over the last few years. The 21 climate models create different outputs for several environmental factors. First Street has chosen to use the carbon emissions scenario represented by IPCC RCP 4.5. This represents a middle-ground scenario among the four primary emissions scenarios. Additionally, First Street chose to model low and high scenarios corresponding to the 25th and 75th percentiles of the distribution of the representation environmental change values in the 21 GCM outputs. The climate models vary in the way they predict environmental changes, and this distribution is wide enough to encompass the range of change factors from the median representations of the other carbon-emissions scenarios by 2050.

Historical Analyses

The First Street Foundation Flood Model also includes recreations of historic flooding events. The model has been used to recreate both fluvial flooding events as well as the flooding associated with coastal storms like hurricanes and nor'easters. Recreating historic events is challenging given the dynamics of flood events and the lack of data quantifying all of the variables at play during a real event. To create the large catalog of over 100 events, First Street relied on hydrologic models and public data sources detailing the impacts of flooding. Many of these methods were first tested and validated against remotely sensed satellite imagery of existing water after flooding events.

Riverine flooding events are recreated by applying historic USGS stream gauge readings during the identified flood events as the discharge at that point in the Fathom-US model. Because stream gauge levels are often not accurate during the major flood events when the river flow has exceeded the river channel's capacity, the First Street Foundation Flood Model chooses from several realizations based on scaling the gauge readings slightly up or down. Each of these realizations is then evaluated for correlation with other metrics such as high water marks recorded outside of the river floodway and claims of flooding made during the event. The claims include insurance and disaster relief claims on National Flood Insurance Program policies, FEMA Individual Assistance flood claims for those who do not have NFIP policies, and disaster assistance provided by the Small Business Administration. All three of these sources of claims data are available within a zip code, so the realizations are evaluated based on the correlation between number of claims in a zip code and the number of buildings that are modeled to have flooded in each realization. The realization with the highest correlation and lowest error is then chosen as representative, with a bias toward underpredicting flooding.

First Street has also recreated simulations of major coastal flooding events through a combination of ADCIRC+SWAN modeling and geospatial interpolation methods. Hurricane tracks and recorded atmospheric data serve as inputs to ADCIRC+SWAN, processed over the most relevant and accurate official FEMA ADCIRC model surface for each storm's given track. This simulation generates maximum surge levels along the coast for each event. These surge levels are then interpolated over high-resolution elevation models to determine depth of inundation at recorded USGS high-water mark locations. These inundation depths are then used to calibrate model outputs through the creation of a series of correction factors, which are then applied to the remainder of the interpolated depths to correct them against actual observed high water-marks from the storm.

In both inland and coastal events, comparisons against the First Street adaptation database are performed to see if there are any flood control structures in the extents of the model. The return period of the event is evaluated against the return period of the structure to assess whether flooding was likely to have occurred within that area and then checked against claims data (if available) to determine whether model-predicted flooding in these areas was likely or not.

Adaptation and Infrastructure

In order to create a national model with complete coverage of the contiguous United States, the First Street Foundation Flood Model relies on nationally available data that consistently represents the hydrologic conditions of the United States. However, most of this data represents the natural environment better than the modifications made by human activity that impact hydrology and therefore flooding. To make this model as accurate a representation of actual flood risk as possible, First Street has spent considerable time and effort to build a database of "grey" and "green" infrastructure and adaptation projects that affect the flow of water and therefore flooding.

Grey flood control projects include a variety of traditional infrastructure solutions like levees, pump stations, and flood control channels. Many green infrastructure projects also contribute to flood reduction, such as wetland restoration, floodable open space, retention basins, and creek rehabilitation projects. The First Street Foundation Flood Model also records and accounts for climate adaptation projects such as beach renourishment projects that are designed to counteract the effects of rising seas.

This data is collected from state, county, and city agencies across the United States. It is digitized by drawing the area for which a structure is providing flood protection and assigned a level of protection provided. These service areas can range in size from a few residential blocks to a small city. Each feature is associated with one or more sources of flooding for which it provides protection. Estimates of the level of protection are based on the return period to which it will continue to function.

This data is accounted for in the hydraulic and hydrologic model in several different ways. In most places, water is blocked within the model from entering a service area. This is similar to how a levee operates in real life, blocking water from entering a given location and pushing it somewhere else. Importantly, water is not removed from the model. In other cases like various runoff reduction green infrastructure projects, the service area of the project represents a change in the underlying soil classification within the hydrologic model. This replicates the way green infrastructure projects reduce runoff from their service area. In still other projects such as pump stations, the service area represents an adjustment to the flow of water in an area. Just as a pump station has a certain flowrate at which it will continue to be effective, even in an event beyond its design standard, this is represented in the model by removing an amount of flooding from an area equivalent to the modeled flow in the project's service area at the design standard. So a pump station designed for a 5 year event would always remove the equivalent of the 5 year event, even in a 100 year event.

Hazard Layer Validation

In addition to the modeling and methods, the First Street Foundation Flood Model has been validated through a thorough review of the output in all areas and for all hazard layers. Programmatic checks highlight locations for manual review. Comparisons are made against FEMA flood maps to identify where there may be additional flood control structures that would affect the flood output. Hazard layers are both manually and programmatically reviewed for errors and inconsistencies. Other data sources are utilized to gauge flood risk based on past occurrences of flooding. These include the same sources used in validation of the historic models, namely FEMA NFIP claims, Individual Assistance claims, and Small Business Administration flood claims. Additionally, First Street has geolocated instances of flooding from web-based news articles that describe flooding with additional information such as location, source of flooding, and intensity.

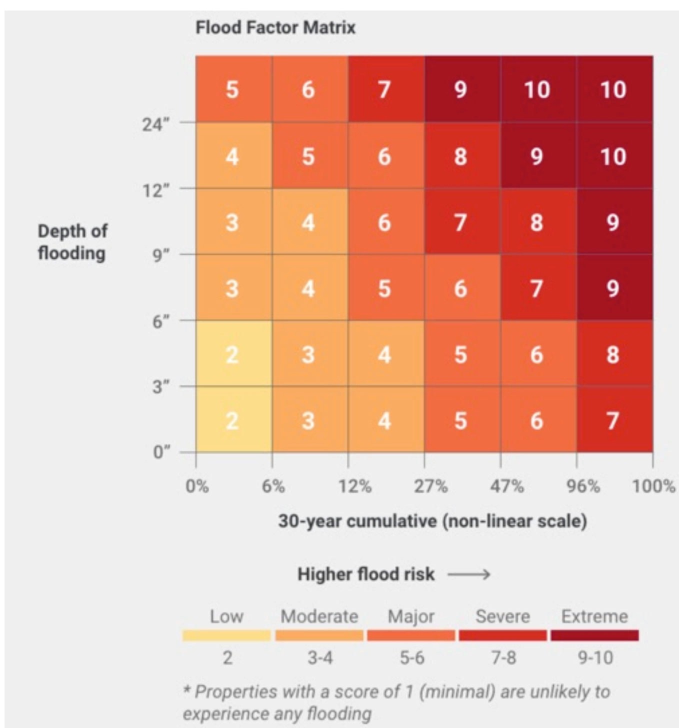
Interpolation of Flood Depths

Once all hazard layers are complete and validated, inundation depths are recorded on every property in the country. Building data from Mapbox, sourced from Microsoft and OpenStreetMap, is used on all properties where it is available to show the max inundation depth along the building footprint. For properties without building data, inundation depth is recorded at the centroid of the parcel. The First Street Foundation Flood Model then employs statistical methods to quantify flood risks and depths in scenarios that were not explicitly modeled. First, a non-linear regression of flood depth on the log of probability is employed to fill in the depth of flooding at various return periods of flooding in the years 2020 and 2050. This relationship was validated by explicitly modeling these return period hazard layers and recreating certain return periods that were not shown to the regression model. This proved to be quite accurate, especially in developed areas where buildings were located. This then allows for First Street to create a predicted depth of flooding at any point in the United States for any likelihood of flooding.

With this relationship of depth and probability charted out for both 2020 and 2050, the First Street Foundation Flood Model next employs a linear interpolation to estimate depth of flooding at any return period for any 5-year increment between 2020 and 2050. This interpolation utilizes a weight function to determine how much inundation there should be between the flood depths of 2020 and 2050 in 2030 or 2035. This weight function takes two explicitly modeled scenarios for 2035 to set the relationship the weights should follow at a given point. This linear interpolation across time closely follows the assumptions around changing environmental factors over time, which are driving the changes to flow and therefore depth of flooding.

<u>Probabilistic Statistics</u>

Using the relationship between depth and probability defined in the non-linear regression described above, the First Street Foundation Flood Model determines the likelihood of flooding at several different depth thresholds. So the model yields what the likelihood is to experience any flooding to the building footprint (if building footprint data is available) on a property, as well as the likelihood to experience at least 15cm (6 inches) or at least 30cm (1 foot) of flooding. This is determined in both 2020 and 2050 from the non-linear equations and then interpolated across years to determine the probability of flooding to a given depth in any year. These annual likelihoods are then added up to determine what the likelihood is of flooding to a certain depth at least once over a cumulative 15- or 30-year period. This is what is referred to as the cumulative likelihood of flooding. For instance, if a home is at risk of flooding in the 1% annual likelihood event (commonly referred to as the 1 in 100-year event), that home has a 26% chance of flooding at least once over 30 years. This cumulative likelihood number is different from the annual likelihood and gives people a much better idea of how likely their home is to flood over the course of their residence in that home (and the duration of many standard mortgages). All of these statistics help First Street generate a final, simplified risk score. The risk score is a number between 1 and 10 that encapsulates both the likelihood of flooding and the severity of flooding. A risk score is assigned based on the likelihood of flooding at various depth thresholds. The number increases as the probability increases or as the depth increases. Each property receives a risk rating for several different depths, with the most common of these several risk scores being selected as the overall risk score for the property, thereby representing overall risk at all likelihoods and depths. In this way, a 90% chance of flooding 12" has a higher score than a 20% chance of flooding 12". And a 20% chance of flooding 12" has a higher risk score than a property with a 20% chance of flooding 6".



Review Process

All methods outlined above are going through blind reviews for traditional peer-reviewed scientific publication and have already been through an additional expert panel-review process. The original technical methodology document, from which this document summarizes, was created as an exhaustive explanation of the methods used to create the First Street Foundation Flood Model and was reviewed by an expert panel. The panel review process took place in 4 stages and required the identification of expert scientists to serve as reviewers and the methods with a focus on the identification of model issues, limitations, and improvements. First Street took care to select 3 experts with no prior knowledge or relationship with the organization in order to maintain as objective a review as possible. The panelist selected for the review include world leading experts in: Fluvial/Pluvial (inland) flooding: Witek Krajewski (PhD), Professor of Engineering and Director of the Iowa Flood Center at the University of Iowa; Hydrology and the Built Environment: James Smith (PhD), Professor of Environmental Engineering at Princeton University; Climatology: Adam Scholosser (PhD), Research Scientist and Deputy Director of Science Research at the Massachusetts Institute of Technology's Joint Program on the Science and Policy of Global Change. This expert panel took part in a peer-review process that from December 2019 through March 2020 that was made up of 1) an initial read of the technical document with comments associated with identified weaknesses and limitations, 2) a formal response to all comments by the First Street, and partners, modeling team resulting in a revised technical methodology document, and 3) a formal meeting of the panel to discuss and hash out any requirements from the panel for the final document to be approved. Ultimately, the final document was approved as of February 24th, 2020 after all of the expert panelists agreed on the final set of requirements. In addition to the Panel Review process, additional peer-review was undertaken through a more formal submission of the full model methodology and historic simulation recreations to scientific peer-review journal outlets. The scientific peer-review articles are intended to summarize for a technical audience the methods covered in the technical methodology in a more concise and summarized form than the full technical methodology document that was reviewed by the expert panel. Ultimately, the First Street Foundation undertook both forms of peer-review in order to produce an exhaustive, open and transparent, technical methodology document that would be available to anyone on the First Street website; while also producing more traditional peer-review scientific articles to validate the methodology.

Summary of First Street Foundation Flood Model

The First Street Foundation Flood Model is a nationwide, probabilistic flood model that shows any location's risk of flooding from rain, rivers, tides, and storm surge. It builds off of decades of peer-reviewed research and forecasts how flood risks will change over time due to changes in the environment. To provide a 360˚ view of flood risk, the model has recreated many major U.S. floods and generated full coverage, high-resolution flood maps projecting current and future risks for more than 145 million properties all 50 states, Washington D.C and Puerto Rico. It additionally provides Federal Emergency Management Agency (FEMA) flood zone information for properties, as well as aggregated analyses of neighborhoods, zip codes, cities, counties, and states.

The First Street Foundation Flood Model considers a location's risk of flooding from high intensity rainfall, overflowing rivers and streams, high tides, and coastal storm surge.

- High intensity rainfall causes flooding when an area's sewage system and draining canals lack the necessary capacity to drain away the amount of rain that falls. Urban areas are particularly susceptible because there is little open soil that can store water.

- Overbank flooding of rivers and streams happens when there is an increase of water volume in a river channel, causing it to spill onto and flood the adjacent floodplain. Ongoing riverine floods can intensify and become flash floods when heavy rainfall results in a rapid surge of rising flood waters.

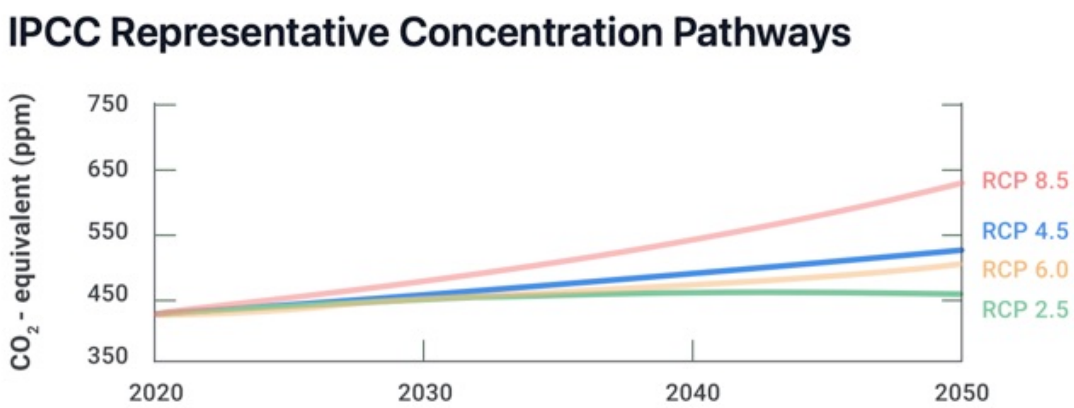
- Tidal flooding, sometimes known as sunny day flooding, king tide flooding, or nuisance flooding, is the temporary flooding of low-lying areas near the coast. It usually occurs during exceptionally high tide events, like full and new moons, and some areas experience this flooding multiple times a year.

- Storm surge refers to the rise of water generated by a storm, over and above predicted water levels. The more severe the hurricane or storm, the greater the storm surge, and the further water can travel. This flooding is often exacerbated by the rainfall that occurs along with the storm.

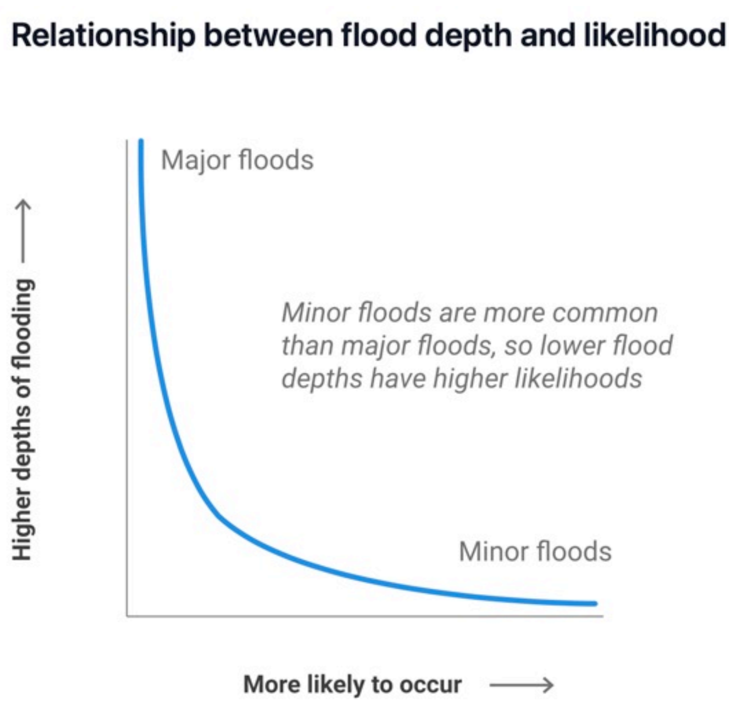
The First Street Foundation Flood Model is a probabilistic flood model, which means it considers uncertainty and outputs a distribution of likelihoods. It first asks the question: "what is the likelihood of a flood occurring within a given year?" Based on a location's history and geographic information (such as elevation, climate, proximity to water, and adaptation measures), the model creates a range of probabilities, known as "return periods."

The model then analyzes select probabilities (0.2%, 1%, 10%, 20%, 50%) to create "hazard layers," which show where and how deep flooding could occur for each probability. This allows First Street Foundation to not only calculate, but actually map flood risks for different probabilities within a given year.

The inclusion of environmental changes that impact flood risks, such as sea level rise and precipitation patterns, is an essential trademark of the First Street Flood Model. Using 1980-2010 as a baseline period, the model analyzes multiple environmental possibilities under the RCP 4.5 carbon emissions scenario with high and low uncertainty bounds. The resulting high, median, and low environmental scenarios are then used as inputs when calculating current and future flood risks to show how flood risks will change in fifteen and in thirty years.



Because the First Street Foundation Flood Model can calculate a flood depth for any probability, it can also determine the likelihood of a flood reaching a minimum depth in a given year, known as an annual flood likelihood. A property's annual flood likelihood for a specific depth in 15 or 30 years may differ from its annual likelihood this year because of changes in the environment.

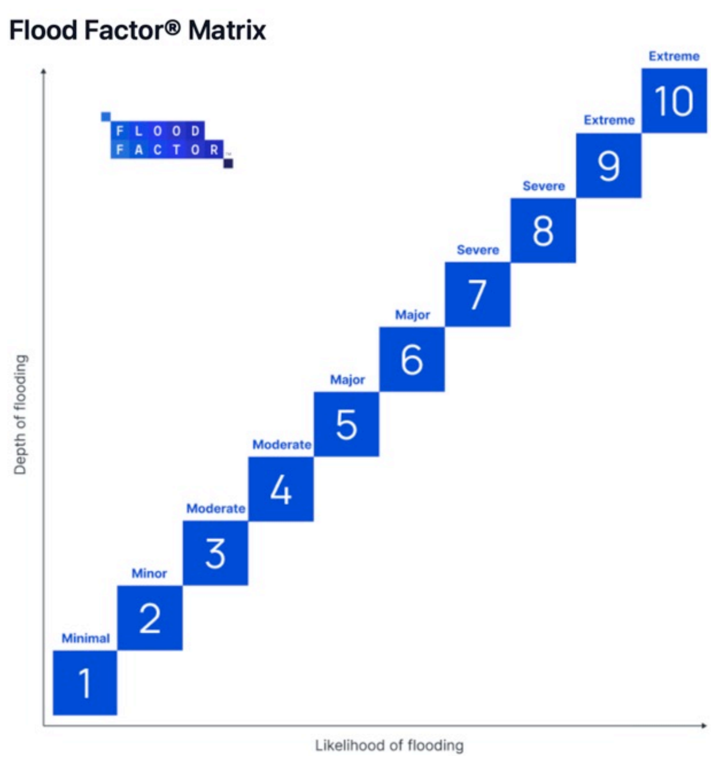


Flood risks do not occur on an annual basis, but rather accumulate over time. To simplify this, the model also calculates a cumulative flood likelihood, which shows the likelihood of flooding to a certain depth at least once over 15 or 30 years. For instance, if a home has a 1% annual flood likelihood (also know as a 100-year flood risk), that home has a 26% chance of flooding at least once over 30 years.

Cumulative Probabilities

Annual Probability	Over 5 years	Over 15 years	Over 30 years
50% (1/2)	97%	100%	100%
20% (1/5)	67%	97%	100%
10% (1/10)	41%	79%	96%

To simplify flood risks even further, the First Street Foundation Flood Model also calculates a property's Flood Factor. Flood Factor scores increase as the 30-year cumulative flood likelihood increases, or as the projected depth of flooding increases. Properties with a higher Flood Factor are either more likely to flood, are more likely to experience high floods, or both.

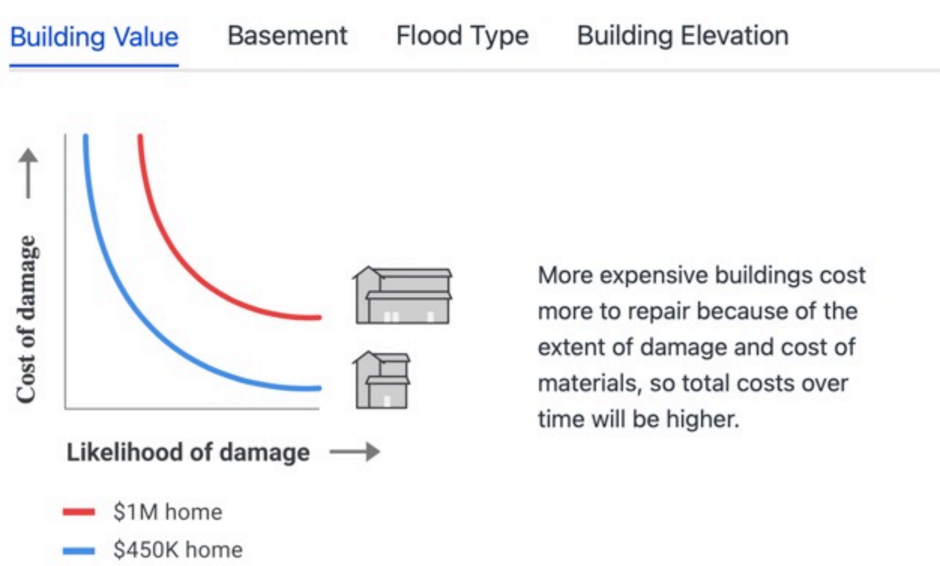


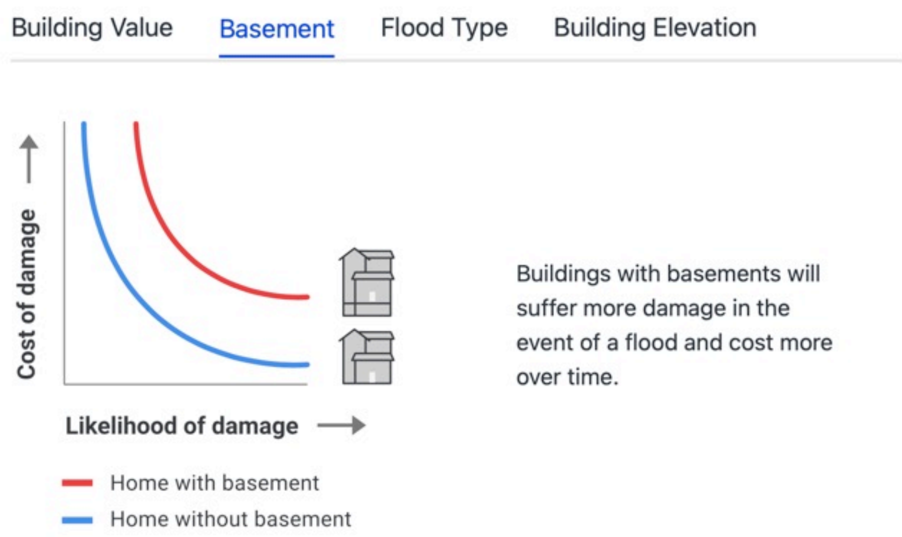
While it is still possible for properties with a Flood Factor® of 1 (minimal) to flood, these properties have a less than 0.2% chance of flood water reaching the building in every analyzed year.

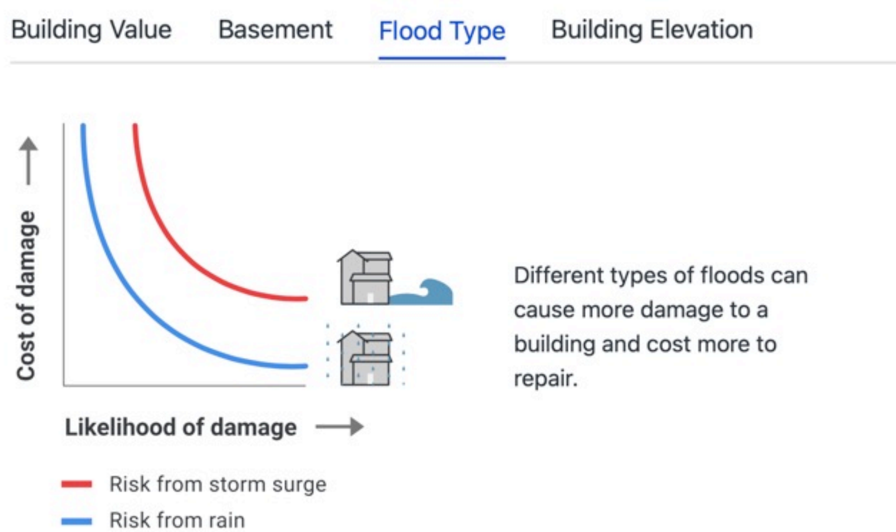
Average annual loss data provides a powerful way to understand flood risk by evaluating it in terms of its potential dollar cost to property owners. The annual flood damage cost estimates refer to how much, on average, a property-owner could expect to pay in repair costs from flood damage to their building in a given year. It is calculated based on a property's flood risks, the likelihoods and depths of flooding projected for a building and building characteristics, such as property type, elevation, materials, and building value. These estimates do not include costs to replace damaged contents, and do not consider inflation. Because the risk of loss changes as environmental conditions change, these costs generally increases over time alongside flood risk to a property.

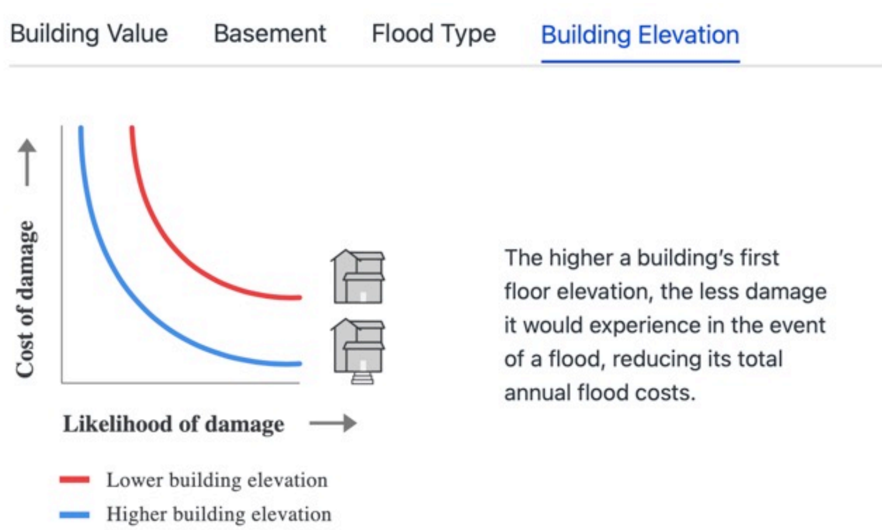
To assess average annual loss, First Street Foundation applied its comprehensive, property specific flood model to historical data from the United States Army Corps of Engineers, which tracks flooding to properties at various depths and combines this data with records of FEMA insurance claims.

Sample of contributing factors to higher annual flood damage estimates:




Building Value
Basement
Flood Type
Building Elevation
Cost of damage
Likelihood of damage
Buildings with basements will suffer more damage in the event of a flood and cost more over time.
Home with basement
Home without basement


Building Value
Basement
Flood Type
Building Elevation
Cost of damage
Likelihood of damage
Different types of floods can cause more damage to a building and cost more to repair.
Risk from storm surge
Risk from rain


Building Value
Basement
Flood Type
Building Elevation
Cost of damage
Likelihood of damage
The higher a building's first floor elevation, the less damage it would experience in the event of a flood, reducing its total annual flood costs.
Lower building elevation
Higher building elevation

Each assessment is based directly on a property's probability of flooding, so it is relative to each property's unique risk. The damage costs are also relative to a property's value; so homes with higher risks and/or higher values will have higher average annual loss estimates. Other variables, such as ground floor elevation and the presence of a basement can also impact the depth to damage relationship, and can be adjusted on the property-level to provide more precise estimates.

The creation of the First Street Foundation Flood Model required an unprecedented partnership of more than 80 world-renowned scientists, technologists and analysts. The data the model produces undergoes multiple reviews and must pass comprehensive check-points before being made publicly available. Where possible, data has been validated against historic flood reports and government flood claims. In developing its flood model, First Street Foundation created the first national adaptation database, including more than 40 different adaptation types, which is used to both inform and validate flood projections. All methods used by the First Street Foundation Flood Model have undergone an expert academic panel review and have been submitted to scientific peer-review journals.

First Street Foundation has made its flood model's full technical methodology available to the public because it supports scientific collaboration and data transparency. The First Street Foundation Flood Model will continue to incorporate feedback and expand its model over time, including an annual data update. Since its release in June 2020, Flood Factor® has continued to improve its data quality and site experience. As new data and model improvements become available, some properties may see changes in their flood risks. See the Help Center for more information on past updates.

The Extent of Flooding Risks for Whitfield County

FLOOD RISK OVERVIEW

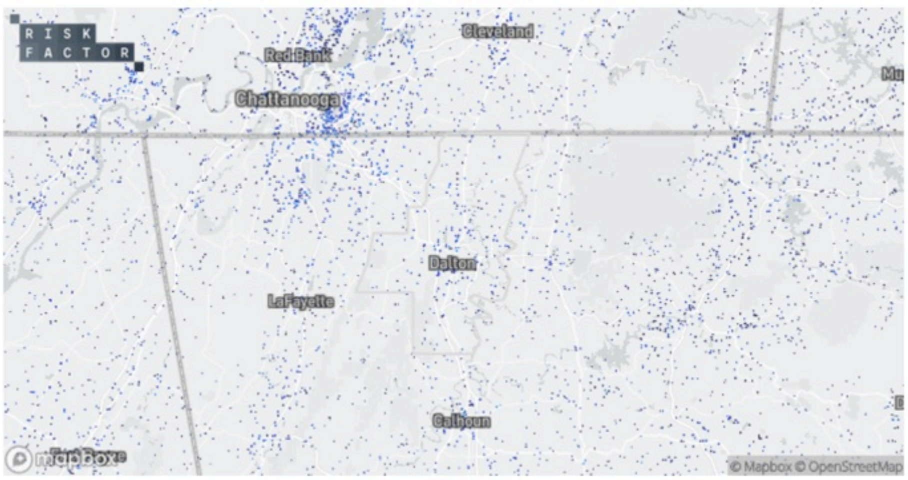
Does Whitfield County have risk?

Moderate

FLOOD FACTOR™

There are **4,098** properties in **Whitfield County** that have greater than a **26%** chance of being severely affected by flooding over the next 30 years. This represents **12%** of all properties in Whitfield County.

In addition to damage on properties, flooding can also cut off access to utilities, emergency services, transportation, and may impact the overall economic well-being of an area. Overall, **Whitfield County** has a **moderate risk of flooding** over the next 30 years, which means flooding is likely to impact day-to-day life within the community. This is based on the level of risk the properties face rather than the proportion of properties with risk.



View additional community impacts with Risk Factor Pro™.

Explore on map

Whitfield County Flood Risk

Residential **Moderate Risk**
3,154 out of **29,609** homes

Road **Moderate Risk**
411 out of **1,532** miles of roads

Commercial **Moderate Risk**
472 out of **2,393** commercial properties

Critical Infrastructure **Moderate Risk**
8 out of **37** infrastructure facilities

Social Facilities **Minor Risk**
12 out of **105** social facilities

Minor Moderate Major Severe Extreme

CURRENT PROTECTIONS

Is Whitfield County protected from flooding?

Communities that adapt to higher risks can limit damage and lower flood insurance costs. Whitfield County is already investing in flood risk reduction projects, but more may be needed. Learn more about solutions.

Adaptation measures

4 Known adaptation measures	**44** Properties protected by adaptation

WHERE TO START

How can communities begin to protect themselves?

Lowering flood risk starts with higher standards. Some places plan to a higher standard (a "500 year" standard) that lowers the number of properties at severe risk. Protecting homes to this level would reduce the risk to the **4,098** severely affected properties.

Flood event	% chance of flooding in a given year	% chance of flooding over 30 years
100 year	1%	26%
500 year	.02%	6%

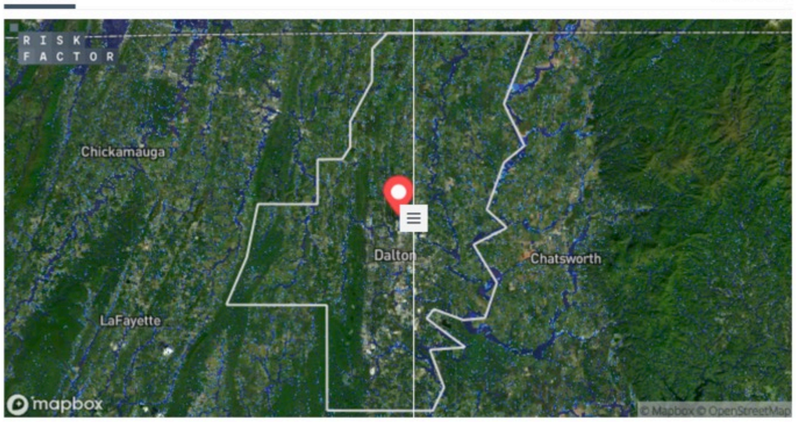
CURRENT & FUTURE RISK

How will Whitfield County's risk change?

Deeper floods from major events, like hurricanes, are less likely to occur, but affect more properties than more shallow flood events, like heavy rains. As Whitfield County feels the effects of a changing environment, however, events of all kinds will affect more properties within the community.

If a low-likelihood storm resulting in severe flooding (a 1-in-100 year flood event), occurred today, it could affect **3,911** properties in **Whitfield County**. This type of event has a 26% chance of occurring at least once over the life of a 30 year mortgage. 30 years from now, an event of this same likelihood would affect **4,098** properties due to a changing environment.

This year ← → In 30 years



Properties at risk

3,911 Today | **4,098** In 30 years

0 | 0.5 | 1 | 2 | 3+

Depth of flooding (ft.)

Note: 44 properties in this area are protected by an adaptation. While the above projections take into account this reduction, risks may substantially increase in the event of failure.

View additional scenarios for flooding and projections that range from likelihood of happening every-other year with Risk Factor Pro™.

Explore on map

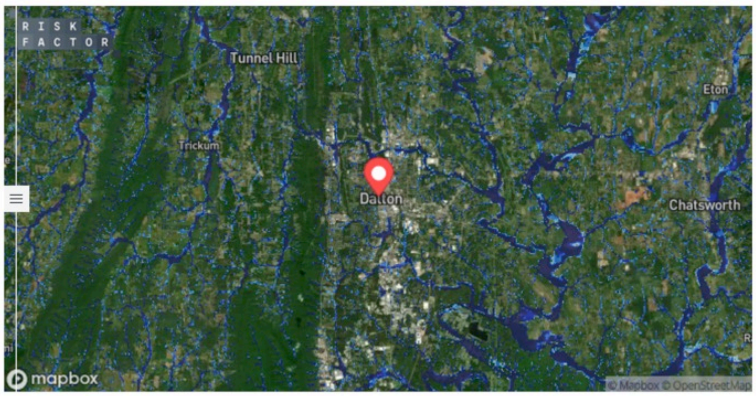
CURRENT & FUTURE RISK

How will Dalton's risk change?

Deeper floods from major events, like hurricanes, are less likely to occur, but affect more properties than more shallow flood events, like heavy rains. As Dalton feels the effects of a changing environment, however, events of all kinds will affect more properties within the community.

If a low-likelihood storm resulting in severe flooding (a 1-in-100 year flood event), occurred today, it could affect **1,222** properties in **Dalton**. This type of event has a 26% chance of occurring at least once over the life of a 30 year mortgage. 30 years from now, an event of this same likelihood would affect **1,284** properties due to a changing environment.

This year **In 30 years**



Properties at risk

1,222
Today

1,284
In 30 years

0 | 0.5 | 1 | 2 | 3+

Depth of flooding (ft.)

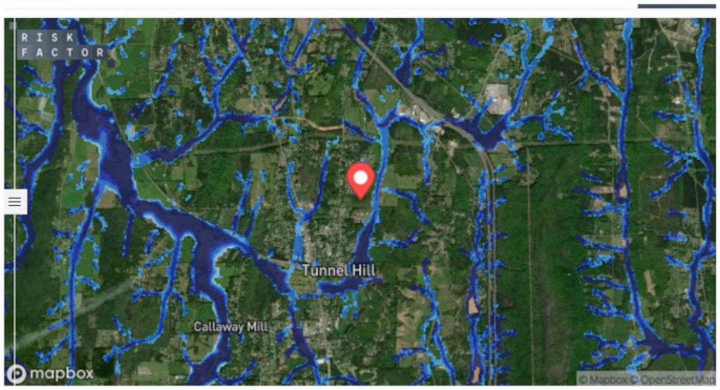
CURRENT & FUTURE RISK

How will Tunnel Hill's risk change?

Deeper floods from major events, like hurricanes, are less likely to occur, but affect more properties than more shallow flood events, like heavy rains. As Tunnel Hill feels the effects of a changing environment, however, events of all kinds will affect more properties within the community.

If a low-likelihood storm resulting in severe flooding (a 1-in-100 year flood event), occurred today, it could affect **30** properties in **Tunnel Hill**. This type of event has a 26% chance of occurring at least once over the life of a 30 year mortgage. 30 years from now, an event of this same likelihood would affect **33** properties due to a changing environment.

This year **In 30 years**



Properties at risk

30
Today

33
In 30 years

0 | 0.5 | 1 | 2 | 3+

Depth of flooding (ft.)

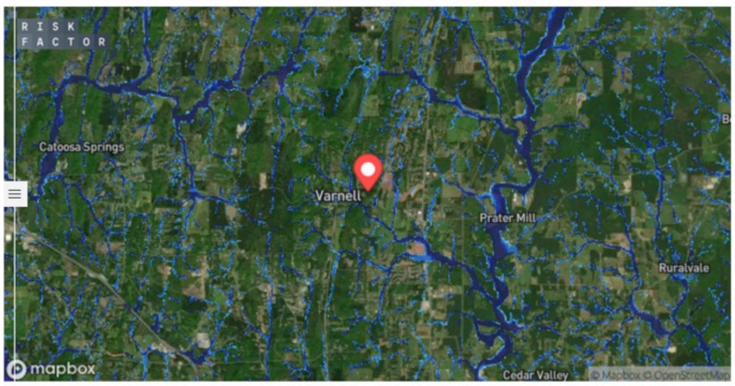
CURRENT & FUTURE RISK

How will Varnell's risk change?

Deeper floods from major events, like hurricanes, are less likely to occur, but affect more properties than more shallow flood events, like heavy rains. As Varnell feels the effects of a changing environment, however, events of all kinds will affect more properties within the community.

If a low-likelihood storm resulting in severe flooding (a 1-in-100 year flood event), occurred today, it could affect **83** properties in **Varnell**. This type of event has a 26% chance of occurring at least once over the life of a 30 year mortgage. 30 years from now, an event of this same likelihood would affect **89** properties due to a changing environment.

This year ← → **In 30 years**



Properties at risk

83 Today

89 In 30 years

0 | 0.5 | 1 | 2 | 3+

Depth of flooding (ft.)

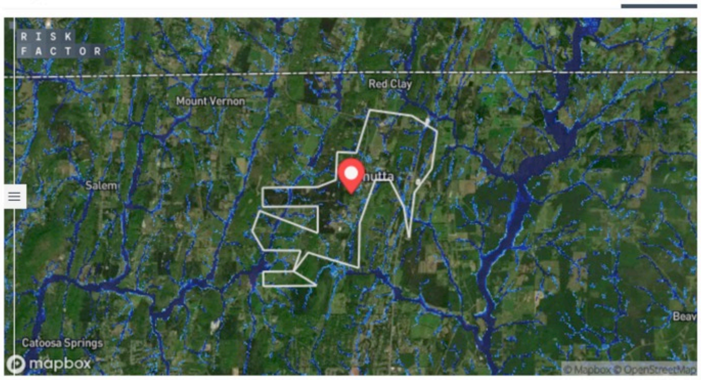
CURRENT & FUTURE RISK

How will Cohutta's risk change?

Deeper floods from major events, like hurricanes, are less likely to occur, but affect more properties than more shallow flood events, like heavy rains. As Cohutta feels the effects of a changing environment, however, events of all kinds will affect more properties within the community.

If a low-likelihood storm resulting in severe flooding (a 1-in-100 year flood event), occurred today, it could affect **54** properties in **Cohutta**. This type of event has a 26% chance of occurring at least once over the life of a 30 year mortgage. 30 years from now, an event of this same likelihood would affect **55** properties due to a changing environment.

This year ← → **In 30 years**



Properties at risk

54 Today

55 In 30 years

0 | 0.5 | 1 | 2 | 3+

Depth of flooding (ft.)

ENVIRONMENTAL CHANGES

Why is risk changing?

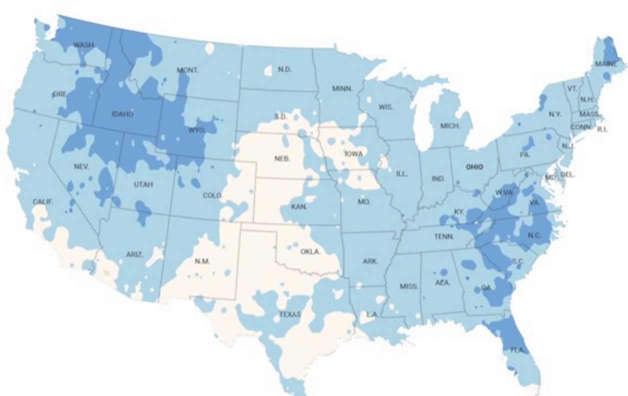
A changing environment means higher seas, new weather patterns, and stronger storms. As the atmosphere warms, there is more evaporation and more water available when it rains. A warmer atmosphere also means warmer oceans, which can intensify flooding from hurricanes and offshore storms. Sea level rise also increases coastal flood risks, as higher seas mean there's more water available when high tides and coastal storms cause flooding.

Precipitation Change

Sea Level Rise

Sea Surface Temperatures

Select year of projection | **This year** | In 15 years | In 30 years



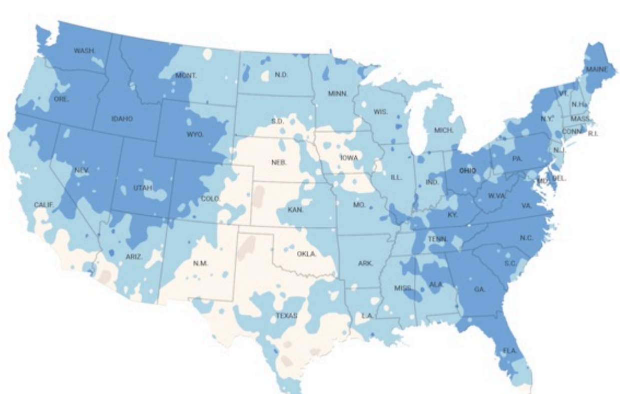
Change in extreme rain events compared to 1980-2010 average.

←LIGHTER HEAVIER→

-10% -5% 0% 5% 10%

Source: NASA Earth Exchange Global Daily Downscaled Projections (NEX-GDDP).

Select year of projection | This year | **In 15 years** | In 30 years



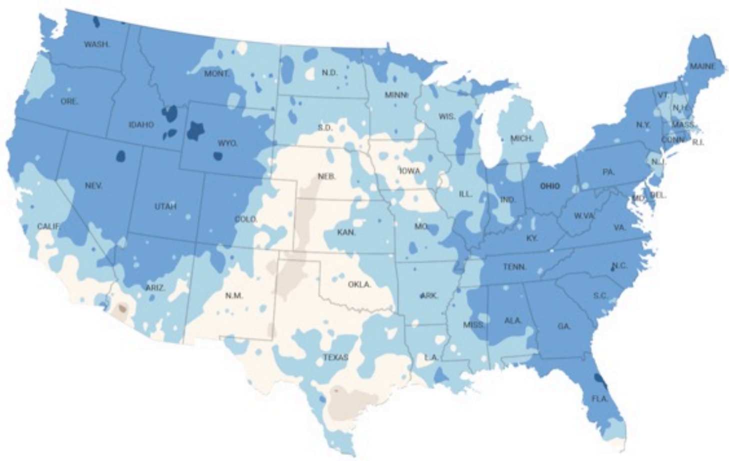
Change in extreme rain events compared to 1980-2010 average.

←LIGHTER HEAVIER→

-10% -5% 0% 5% 10%

Source: NASA Earth Exchange Global Daily Downscaled Projections (NEX-GDDP).

Select year of projection | This year | In 15 years | **In 30 years**



Change in extreme rain events compared to 1980-2010 average. ⓘ

←LIGHTER HEAVIER→

-10% -5% 0% 5% 10%

Source: NASA Earth Exchange Global Daily Downscaled Projections (NEX-GDDP).

Precipitation Change | **Sea Level Rise** | Sea Surface Temperatures

Select year of projection | **This year** | In 15 years | In 30 years

Rise in inches, compared to 1980-2010 average. ⓘ

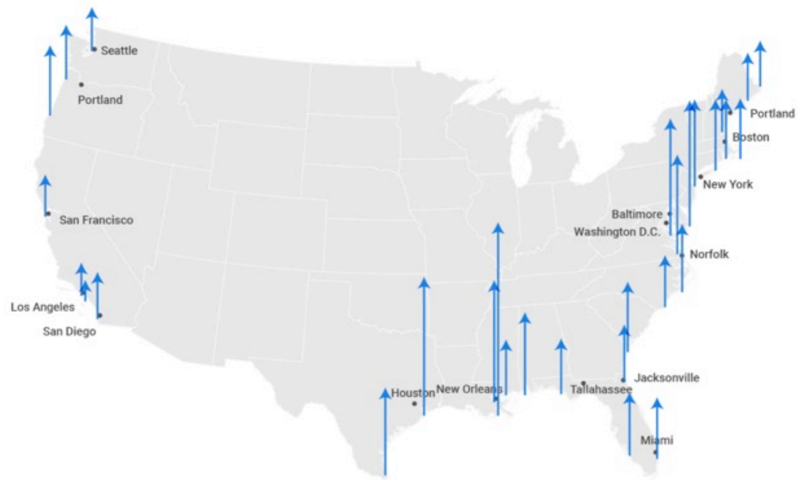
+5 in.

Place with highest sea level rise (inches)

14.4	Grand Isle, LA
10.3	Galveston Pier 21, TX
9.4	Ocean City Inlet, MD
9.1	New Canal Station, LA
8.7	Lewisetta, VA

Source: Kopp et al. (2017) Evolving Understanding of Antarctic Ice-Sheet Physics and Ambiguity in Probabilistic Sea-Level Projections.

Select year of projection | This year | **In 15 years** | In 30 years



Rise in inches, compared to 1980-2010 average.

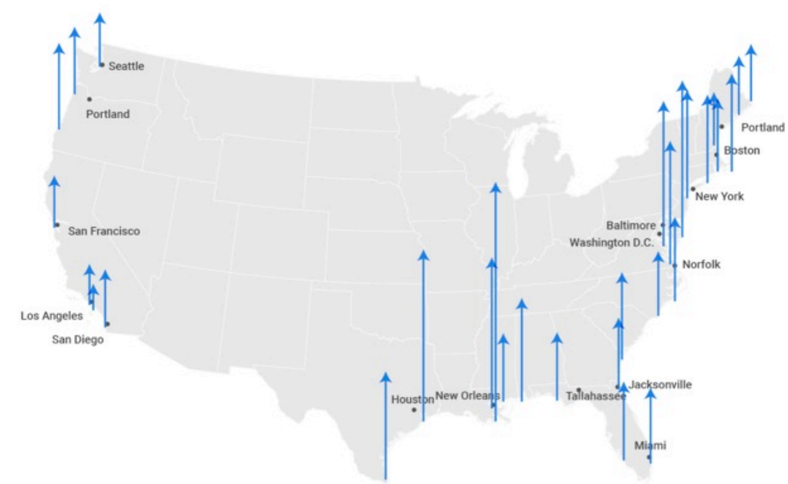
+5 in.

Place with highest sea level rise (inches)

19.8	Grand Isle, LA
14.2	Galveston Pier 21, TX
12.9	Ocean City Inlet, MD
12.5	New Canal Station, LA
12	Lewisetta, VA

Source: Kopp et al. (2017) Evolving Understanding of Antarctic Ice-Sheet Physics and Ambiguity in Probabilistic Sea-Level Projections.

Select year of projection | This year | In 15 years | **In 30 years**



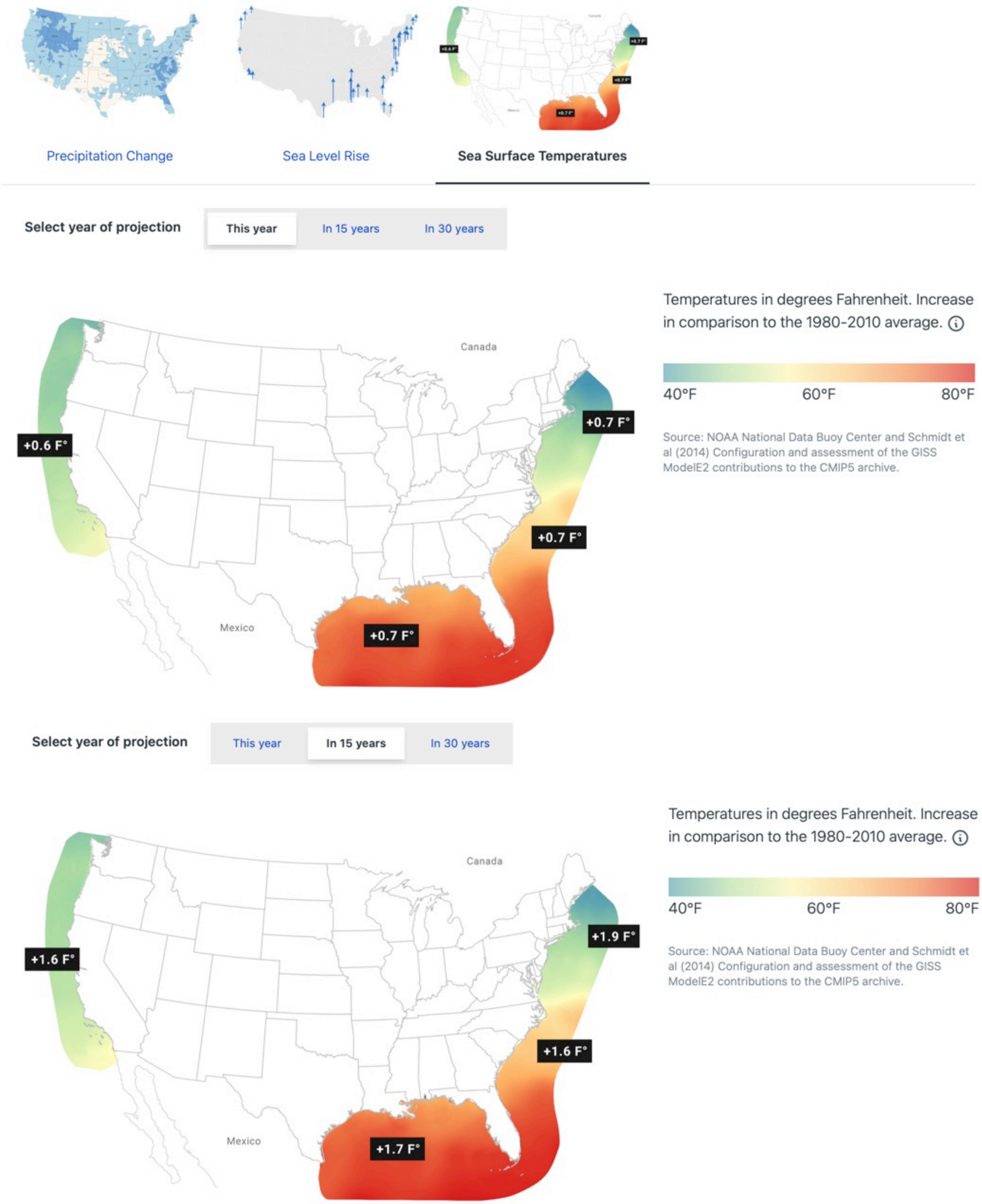
Rise in inches, compared to 1980-2010 average.

+5 in.

Place with highest sea level rise (inches)

25.2	Grand Isle, LA
18.1	Galveston Pier 21, TX
16.5	Ocean City Inlet, MD
15.9	New Canal Station, LA
15.3	Lewisetta, VA

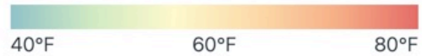
Source: Kopp et al. (2017) Evolving Understanding of Antarctic Ice-Sheet Physics and Ambiguity in Probabilistic Sea-Level Projections.


Precipitation Change
Sea Level Rise
Sea Surface Temperatures
Select year of projection
This year
In 15 years
In 30 years
Canada
Mexico
+0.6 F°
+0.7 F°
+0.7 F°
+0.7 F°
Temperatures in degrees Fahrenheit. Increase in comparison to the 1980-2010 average.
40°F
60°F
80°F
Source: NOAA National Data Buoy Center and Schmidt et al (2014) Configuration and assessment of the GISS ModelE2 contributions to the CMIP5 archive.
Select year of projection
This year
In 15 years
In 30 years
Canada
Mexico
+1.6 F°
+1.9 F°
+1.6 F°
+1.7 F°
Temperatures in degrees Fahrenheit. Increase in comparison to the 1980-2010 average.
40°F
60°F
80°F
Source: NOAA National Data Buoy Center and Schmidt et al (2014) Configuration and assessment of the GISS ModelE2 contributions to the CMIP5 archive.

Select year of projection

This year | In 15 years | **In 30 years**

Temperatures in degrees Fahrenheit. Increase in comparison to the 1980-2010 average.



Source: NOAA National Data Buoy Center and Schmidt et al (2014) Configuration and assessment of the GISS ModelE2 contributions to the CMIP5 archive.

COMMUNITY SOLUTIONS

What else can communities do?

Individuals, mayors, governors, and Congress can work together to build protections before flooding, build back stronger after flooding, and create plans that future-proof communities.

Green

Green infrastructure is a cost-effective and sustainable flood management approach that gathers and removes water at its source.

Grey

Grey infrastructure uses concrete or steel structures to control flooding. These engineered structures are costly, take time to build, and require regular maintenance.

Resilience

Resilience measures are community-wide, non-structural strategies that help people bounce back more quickly after floods.

NCDC records show that 54 flood events occurred within the County over the past fifty years, which equates to a 108% annual frequency based upon reported events. However, flooding events were obviously underreported during the first few decades of the fifty-year history since reported events for the twenty-year history equals a slightly lower 51. The more recent twenty-year history presents a much more active picture with a 270% annual frequency. In addition, it is clear that NCDC data does not account for what is probably dozens of smaller flood events. There are also no records at the local level for such events, even though members of the HMPC have a general recollection of some of them, albeit without dates or depth data. As a result, the NCDC data is incomplete and cannot be relied upon in any significant way. The following chart provides annual frequency of reported events over the past five, ten, twenty, and fifty-year periods. The most recent five-year period, covering the span of time since the last update to this Plan, is highlighted in gold.

Whitfield County – Flooding Frequency (based on Reported Events)				
Time Period	**5yrs (2017-2021)**	**10yrs (2012-2021)**	**20yrs (2002-2021)**	**50yrs (1972-2021)**
Number of Reported Events	**21**	**27**	**51**	**54**
Frequency Average per Year	**4.20**	**2.70**	**2.55**	**1.08**
Frequency Percent per Year	**420%**	**270%**	**255%**	**108%**

Whitfield County (CID No. 130193), the City of Dalton (CID No. 130194), the City of Tunnel Hill (CID No. 130489), the City of Varnell (CID No. 130667), and the Town of Cohutta (CID No. 130618) each participate in the National Flood Insurance Program (NFIP) and follow the Program guidelines to ensure future development is carried out in the best interests of the public. According to NFIP guidelines, each participating jurisdiction has executed a Flood Damage Prevention Ordinance. The purpose of this ordinance is to minimize the loss of human life and health as well as to minimize public and private property losses due to flood conditions. The ordinance requires that potential flood damage be evaluated at the time of initial construction of structures, facilities and utilities, and that certain uses be restricted or prohibited based on this County evaluation. The ordinance also requires that potential homebuyers be notified that property is located in a flood area. In addition, all construction must adhere to the Georgia State Minimum Standard Codes (Uniform Codes Act). The minimum standards established by these codes provide reasonable protection to persons and property within structures that comply with the regulations for most natural hazards.

According to the National Flood Insurance Reform Act, a repetitive loss structure is defined as "…a building covered by a contract for flood insurance that has incurred flood-related damages on two occasions during a 10-year period ending on the date of the event for which a second claim is made, in which the cost of repairing the flood damage, on the average, equaled or exceeded 25 percent of the market value of the building at the time of each such flood event." **As of October 15, 2022, there are six official "repetitive loss structures" on file for Whitfield County. Of these six, all are classified as "residential." All six are in unincorporated Whitfield County. Occupancy type is listed in the chart below describing all six properties.** *Specific addresses for repetitive loss structures cannot be included in this Plan, but a current list of these structures may be viewed in GMIS by authorized individuals, as determined by the EMA Director.*

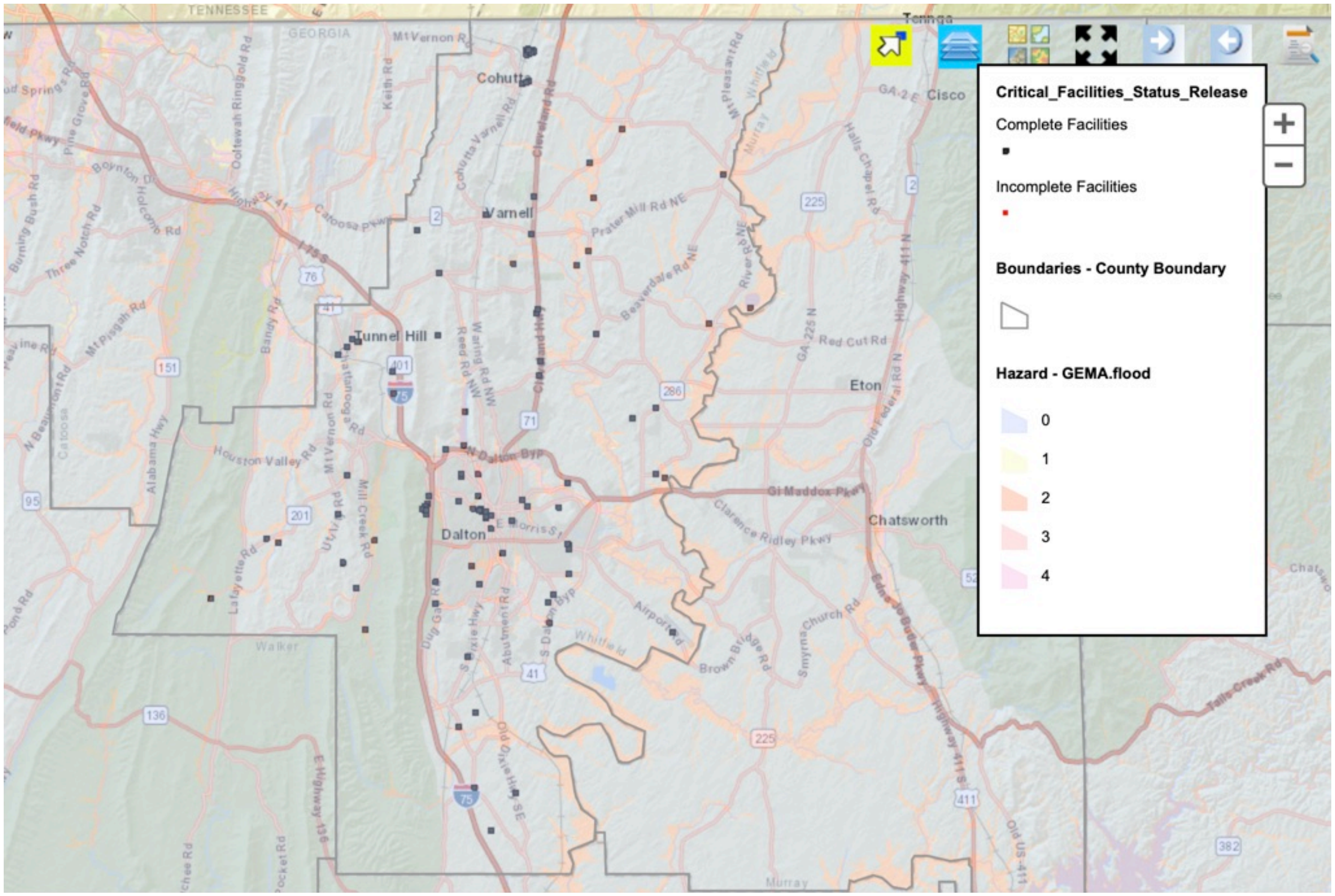
Community Name	FIPS	Occupancy	Mitigated	Cumulative Building Pymt	Cumulative Contents Pymt	Total # Losses	Total Paid
WHITFIELD COUNTY	130193	SINGLE FMLY	NO	48852.66	23319.01	7	72171.67
WHITFIELD COUNTY	130193	SINGLE FMLY	NO	17354.31	0	2	17354.31
WHITFIELD COUNTY	130193	SINGLE FMLY	NO	31774.53	9224.32	2	40998.85
WHITFIELD COUNTY	130193	SINGLE FMLY	NO	21930.53	1935.7	2	23866.23
WHITFIELD COUNTY	130193	SINGLE FMLY	NO	10388.42	16.04	2	10404.46
WHITFIELD COUNTY	130193	SINGLE FMLY	NO	10667.05	0	2	10667.05

C. Assets Exposed to Hazard – In evaluating assets that may potentially be impacted by the effects of flooding, the HMPC determined that, although all critical facilities, public and private property are potentially susceptible to flooding, structures most susceptible are located within the vicinity of:

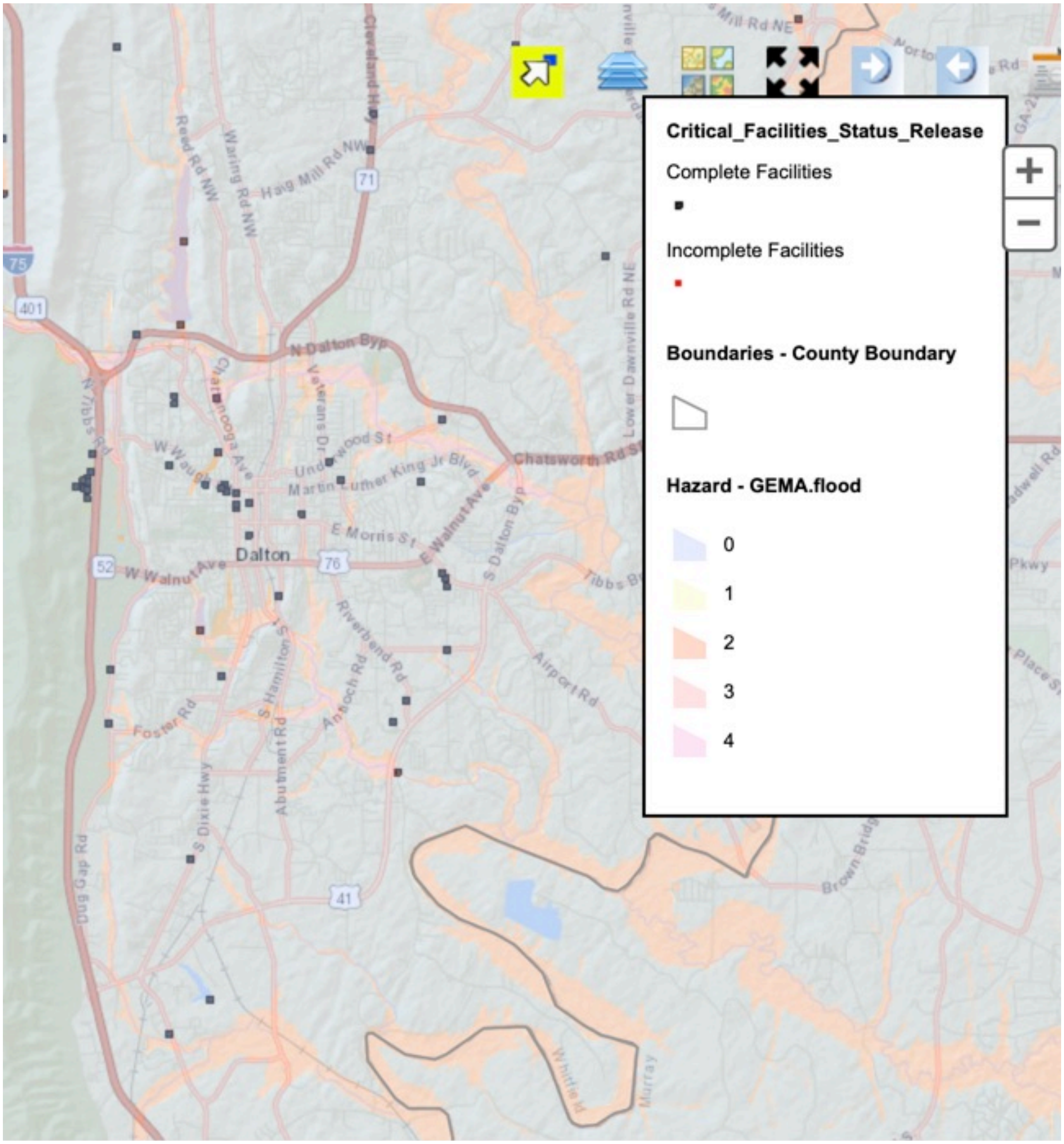
Dee St, Old Grade Rd at Admiral Mack Gaston Pkwy, Old Dixie Hwy at South Bypass, Hickory Flats Rd, Brock Dr, Susan Dr, Hunter Cr, 1710 Cleveland Hwy, Needham Dr, Mill Creek at Underwood Rd/Underwood St, Mill Creek at Environs Ln, Mill Creek at SR 71 (Cleveland Hwy), Mill Creek at I-75, and Mill Creek from US 41 at Willowdale Rd to US 41 at Shugart Rd. Other areas affected by flooding were associated with storm drain systems within the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta.

The GEMA maps that follow identify the locations of critical facilities in relationship to the known flooding hazard areas located within the County and each City and Town.

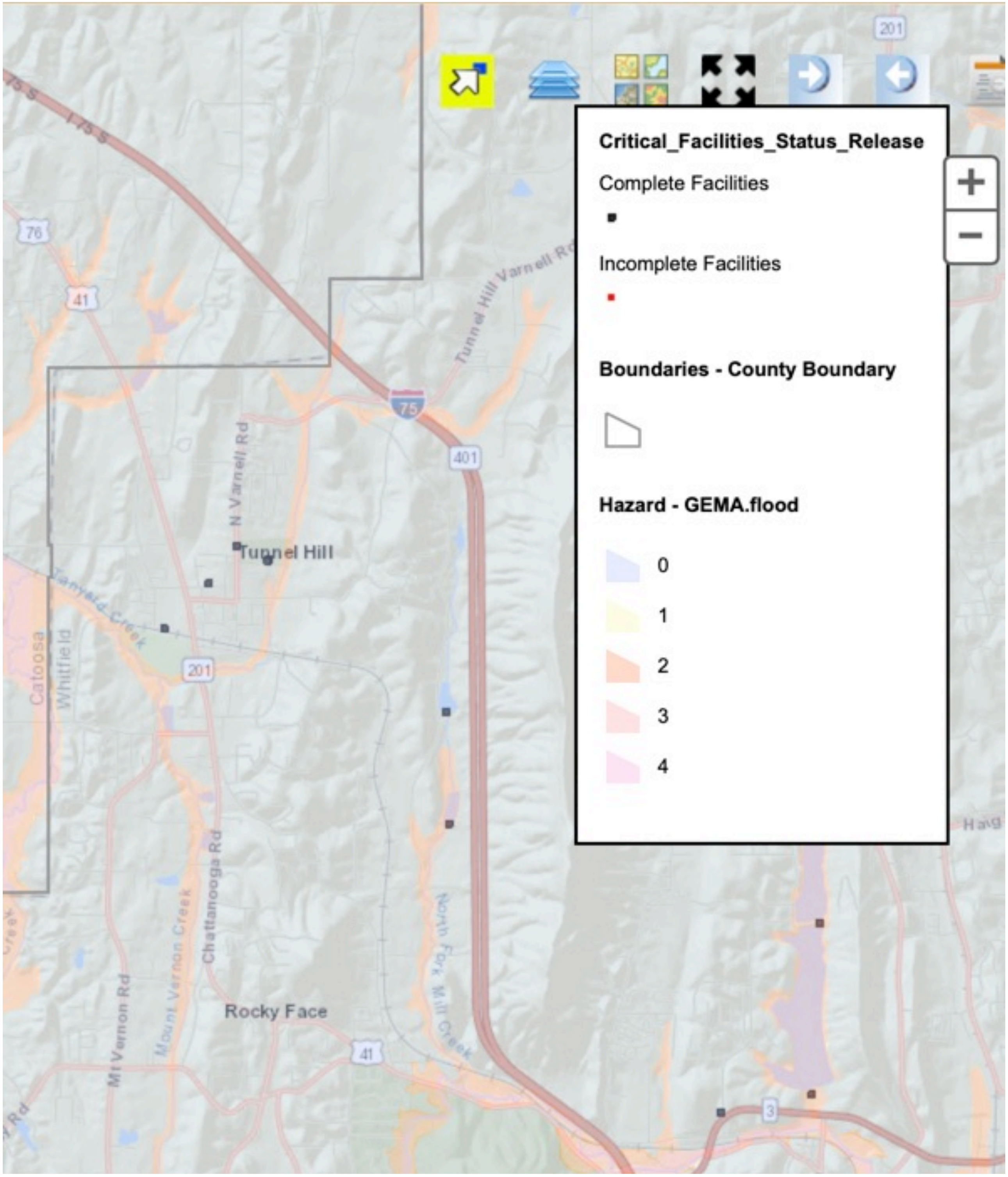
Whitfield County



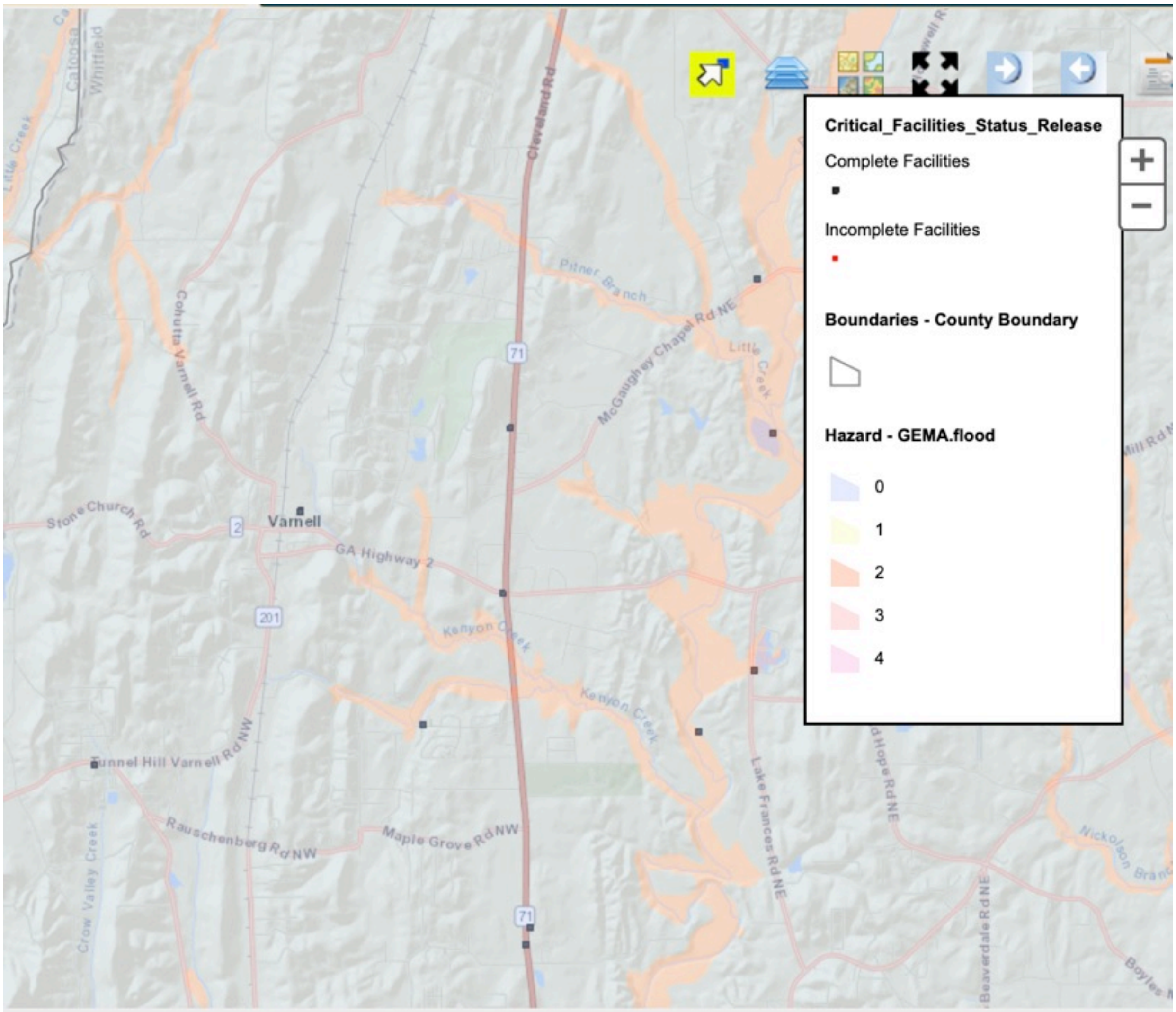
City of Dalton



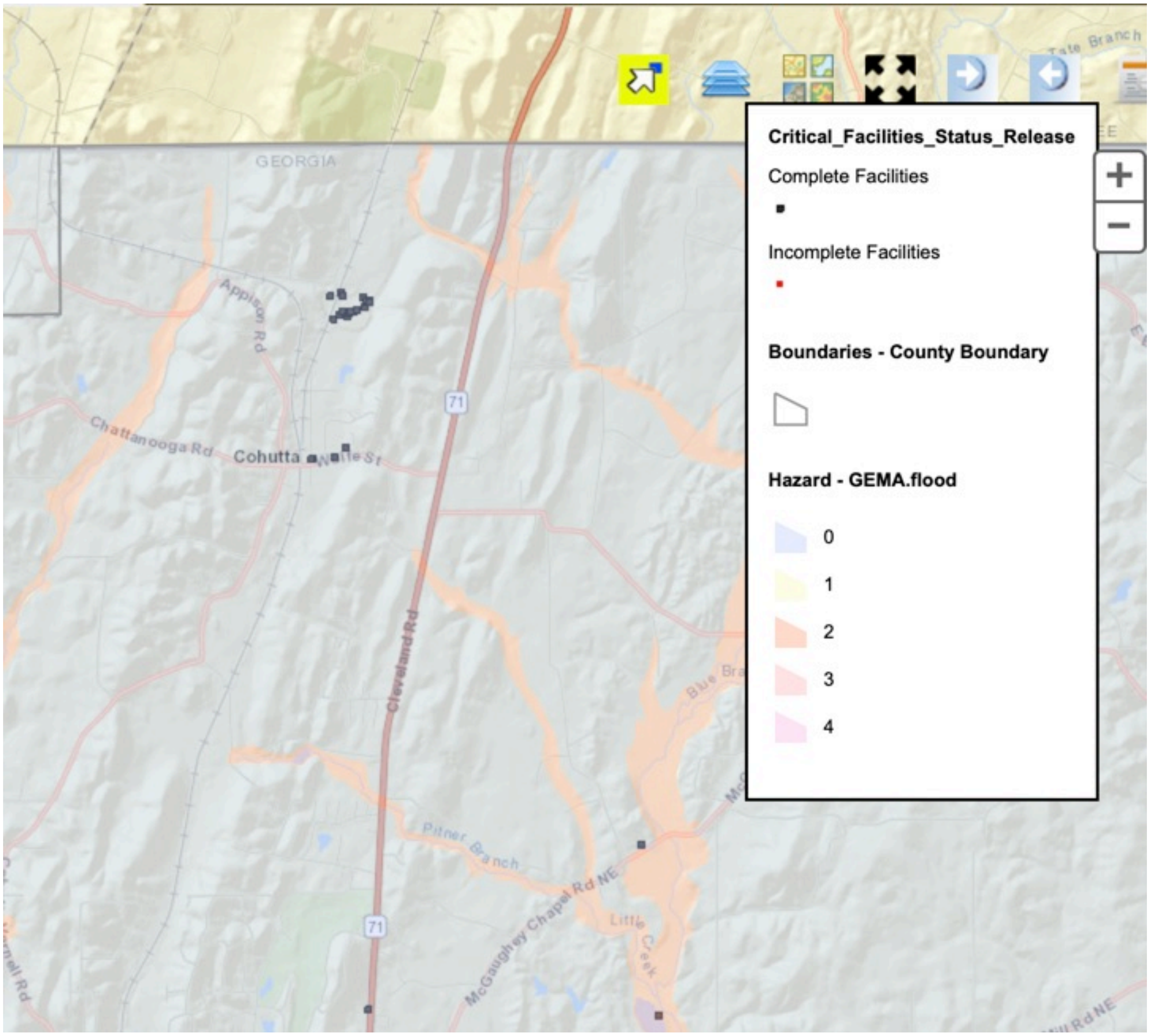
City of Tunnel Hill



City of Varnell



Town of Cohutta



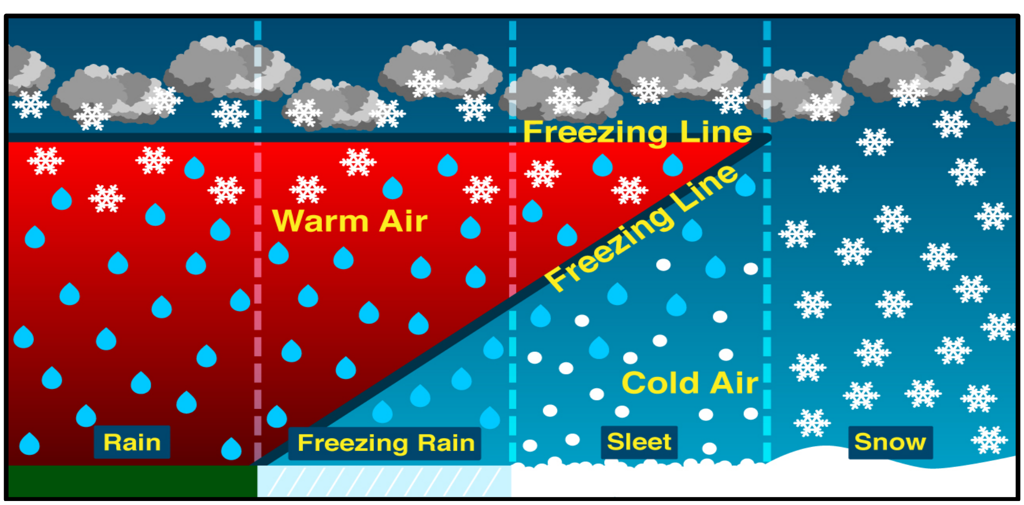
D. Estimate of Potential Losses – For loss estimate information, please refer to the Critical Facilities Database (Appendix A).

E. Multi-Jurisdictional Concerns – Any portion of Whitfield County can potentially be impacted by flooding. According to GMIS flood maps, the County and each of the municipalities all have significant flood-prone areas within their jurisdictions. All mitigation steps taken related to flooding will be pursued on a countywide basis and include the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta.

F. Hazard Summary – Severe flooding has the potential to inflict significant damage within Whitfield County. Mitigation of flood damage requires the community to have knowledge of flood-prone areas, including roads, bridges, bodies of water, and critical facilities, as well as the location of the County's designated shelters. The Whitfield County HMPC identified flooding as a hazard requiring mitigation measures and identified specific mitigation goals, objectives and action items they deemed necessary to lessen the impact of flooding. These findings are found in *Chapter 5*.

2.4 Winter Storms

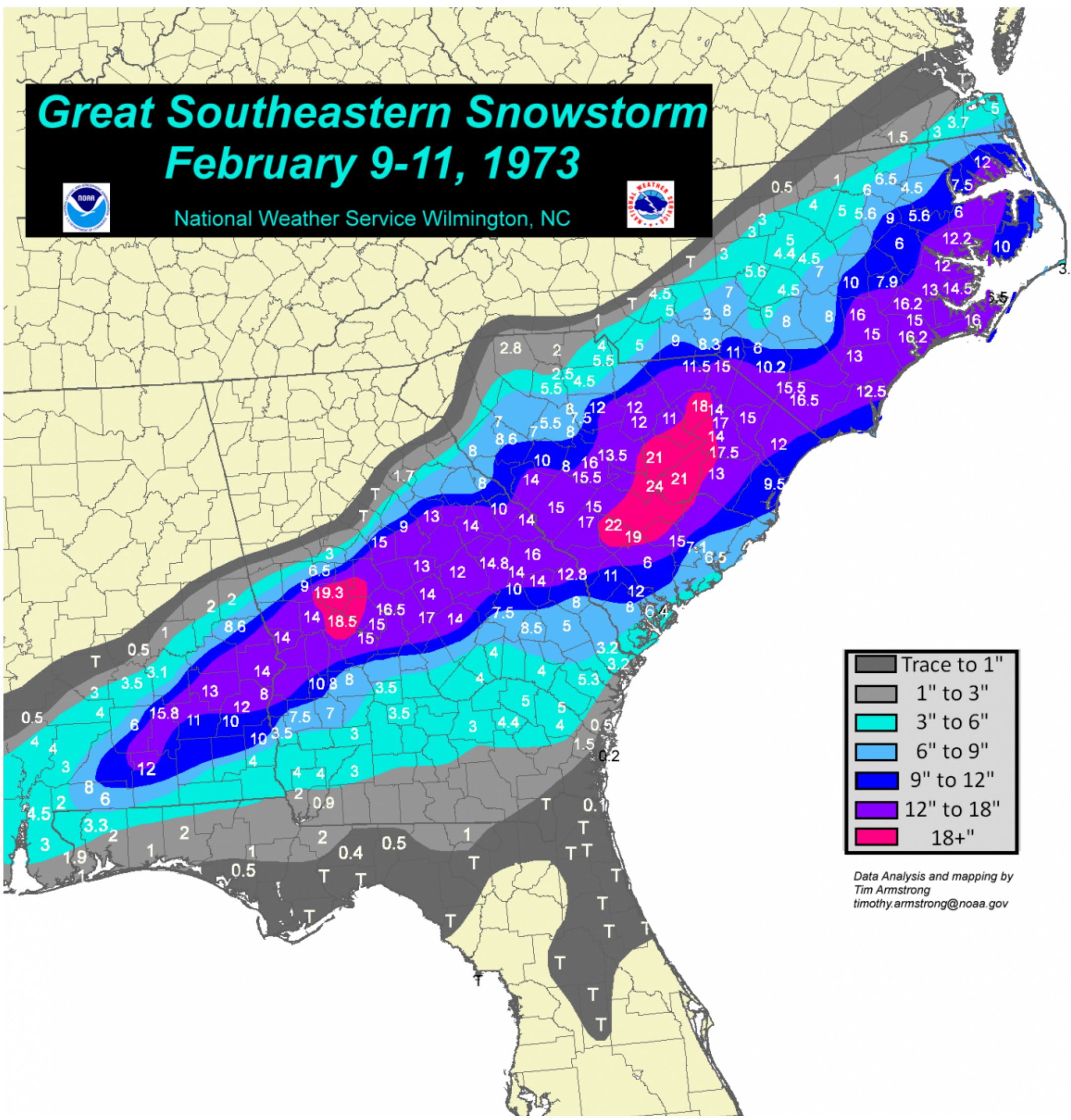
A. Hazard Identification – The Whitfield County HMPC researched historical data from the National Climatic Data Center, The National Weather Service, as well as information from past newspaper articles and various online resources relating to winter storms in Whitfield County. Winter storms bring the threat of freezing rain, ice, sleet, snow and the associated dangers. A heavy accumulation of ice, especially when accompanied by high winds, devastates trees and power lines. Such storms make highway travel or any outdoor activity extremely hazardous due to falling trees, ice, and other debris. The diagram below demonstrates the formation of these different forms of precipitation.



B. Hazard Profile – Although winter storms occur relatively infrequently, they have the potential to wreak havoc on the community when they do strike. Winter storms within Whitfield County typically cause damage to power lines, trees, buildings, structures, and bridges, to varying degrees. Portions of the County with higher elevations have highways with steep grades, resulting in very hazardous travel conditions when they are covered with frozen precipitation. Another hazard exists due to the large tree population. Trees and branches weighed down by snow and ice become very dangerous to person and property.

<u>February 9-11, 1973 Great Southeastern Snowstorm</u>

One of the greatest snowstorms in Southeastern United States history occurred February 9-11, 1973. This storm dropped one to two feet of snow across a region that typically sees only an inch or two of snow per year. New all-time snowfall records were established in a number of locations in Georgia, North Carolina and South Carolina. Measurable snow fell along the Gulf Coast from Texas to Florida.



Deep South of Nation Is Knee-Deep in Snow

ATLANTA (UPI)—A "once-in-a-hundred-years" snowstorm whipped across the Deep South today, blanketing the Mississippi Gulf Coast and dumping nearly a foot of snow on the midsection of Georgia.

The storm, rolling rapidly out of Louisiana, was blamed for three traffic deaths as it whipped through Mississippi and Alabama and spawned a line of squalls in Florida that damaged half a dozen homes near Stuart.

Eleven inches of snow was on the ground at Macon and the city was practically snowbound. The mayor there declared a state of emergency.

The National Guard was called out to rescue stranded motorists in central and south Georgia. It was the heaviest snowfall in a decade on the Mississippi Gulf Coast

Sleet and freezing rain hit the Carolinas' coastland early today and Wilmington, N.C., was blanketed with six inches of snow.

The storm followed a belt-line pattern, and except for frigid temperatures, missed Atlanta and North Georgia completely.

"This is probably what you would call a once-in-a-hundred years snow," said Columbus Mayor J. R. Allen. "And certainly the city is not equipped with snowplows and equipment for this situation."

The city measured nine inches of snow by early today.

Hazardous travel warnings were issued for northwest Florida and winds of from 25 to 30 miles an hour brought rough seas and high tides to Tampa.

South Carolina braced against sleet and freezing rain along the coastal areas and in the vicinity of Charleston and up to five inches of snow was expected today in the Aiken and Orangeburg areas.

The snow on the Mississippi Gulf Coast was the heaviest in a decade.

In Mississippi, the National Weather Service reported accumulations of two to four inches of snow along the coast and the state's highway patrol said most major bridges in the area were impassable.

Mississippi Power & Light Co. said electric service was interrupted in some areas north of the coastal region when ice accumulations snapped tree limbs and knocked down wires.

In Georgia, Columbus, Macon and Augusta reported seven inches of snow on the ground by Friday night, the heaviest ever recorded by the National Weather Service since recordkeeping was first started in 1947.

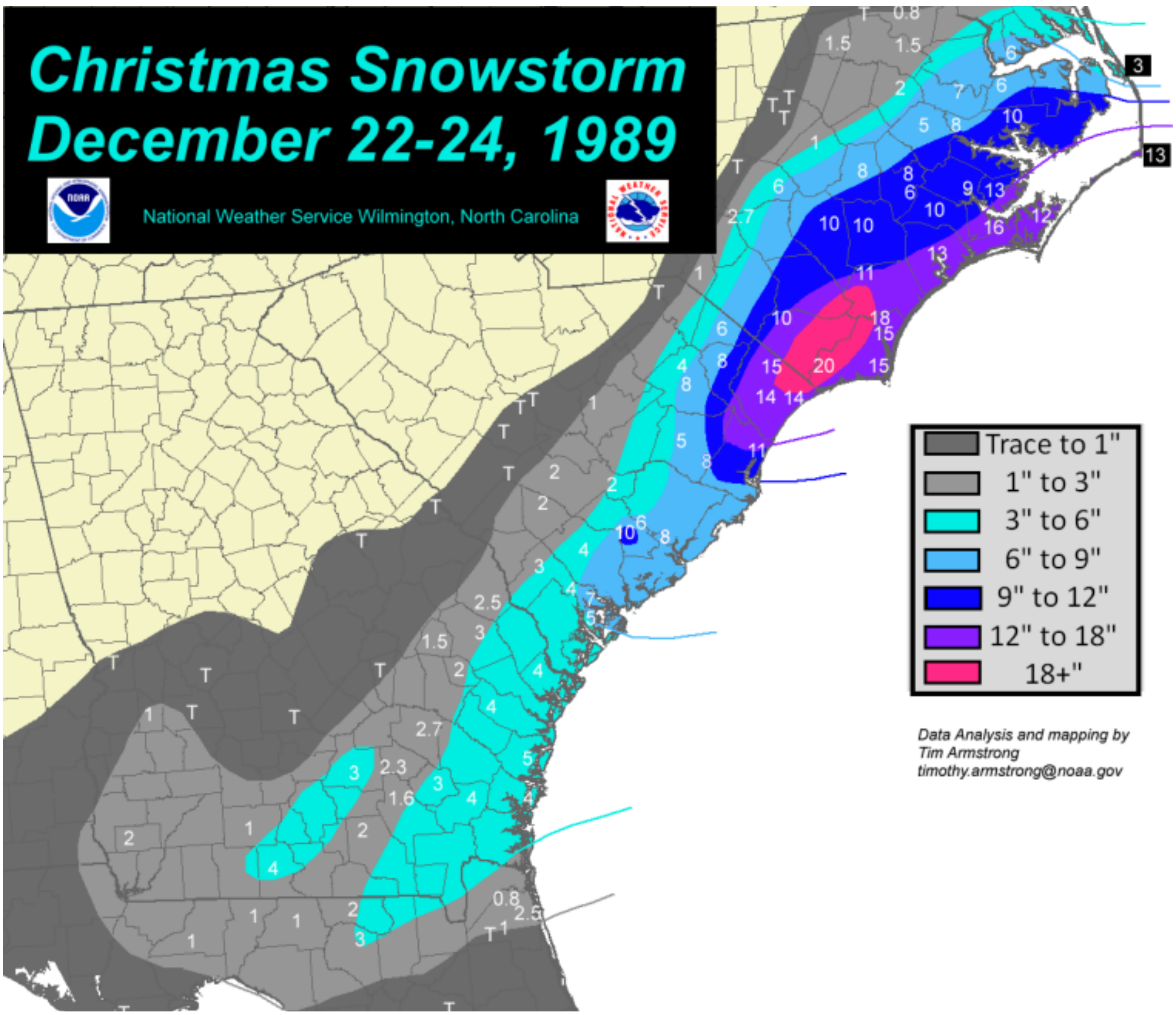
"Please get off the streets and go home for your own safety," said Columbus Mayor J. R. Allen in a special bulletin. City offices, schools and businesses shut down at noon Friday as the snow began to mount.

Georgia Gov. Jimmy Carter ordered the National Guard into rescue work on U.S. Highway 80 below Thomaston, where some 20 vehicles, including a Greyhound bus, were snowed in. The rescue teams evacuated occupants of the vehicles, sending them to a special disaster shelter for the night.

National Guard generators also provided emergency power for the hospital at Preston, in Webster County.

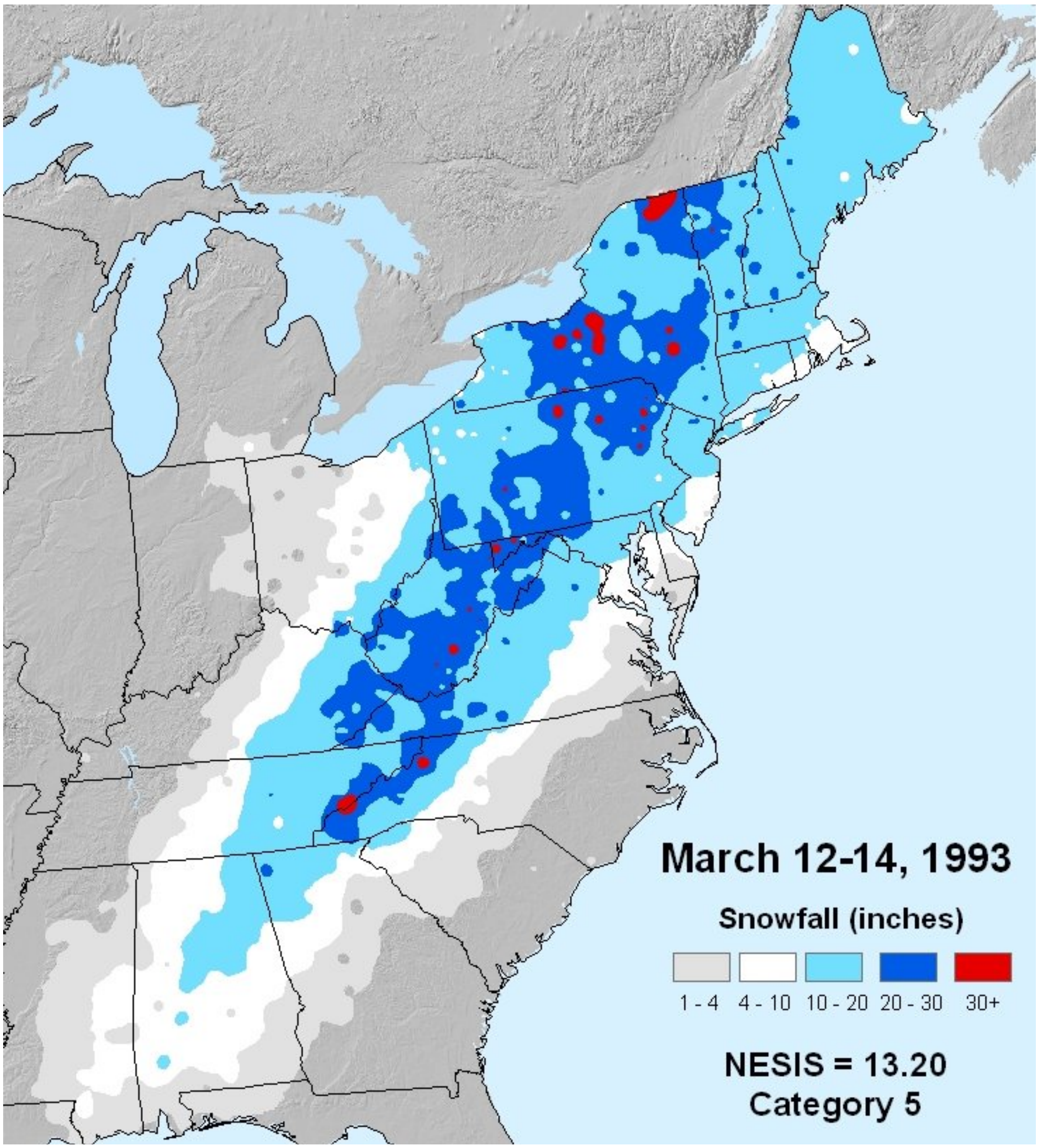
December 22-24, 1989 Christmas Snowstorm

The largest snowstorm in history for the Southeast U.S. coast occurred just before Christmas 1989. This storm broke all-time snowfall records in Wilmington (15.3 inches), Cape Hatteras (13.3 inches), Charleston (8 inches), and Savannah (3.6 inches). Measurable snow fell as far south as Jacksonville and Tallahassee, Florida, and snow flurries were reported in Tampa and near Sarasota. In addition to record amounts of snow unprecedentedly cold temperatures accompanied the storm. All-time record lows were smashed across coastal North Carolina. Arctic air flooded south into Florida as well with record lows observed all across the peninsula. Even Key West, FL reached 44 degrees tying the coldest December temperature ever seen. The Florida citrus industry suffered severe injury with newspaper reports indicating "nearly total destruction". This particular storm had little effect on Whitfield County specifically, but shows the threat to the area.



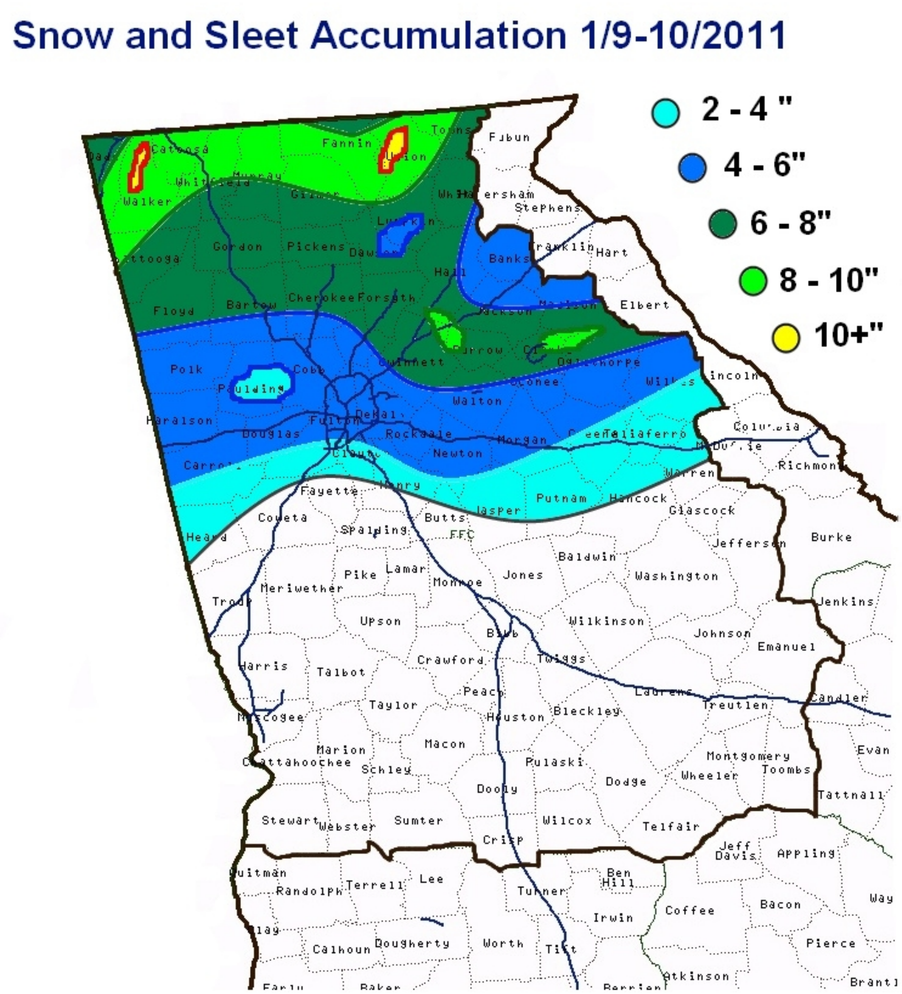
March 12-14, 1993 Storm of the Century

The Superstorm of 1993 (also called the Storm of the Century) was one of the most intense mid-latitude cyclones ever observed over the Eastern United States. The storm will be remembered for its tremendous snowfall totals from Alabama through Maine, high winds all along the East coast, extreme coastal flooding along the Florida west coast, incredibly low barometric pressures across the Southeast and Mid-Atlantic, and for the unseasonably cold air that followed behind the storm. In terms of human impact the Superstorm of 1993 was more significant than most landfalling hurricanes or tornado outbreaks and ranks among the deadliest and most costly weather events of the 20th century. Whitfield County accumulation was between 10 and 20 inches.



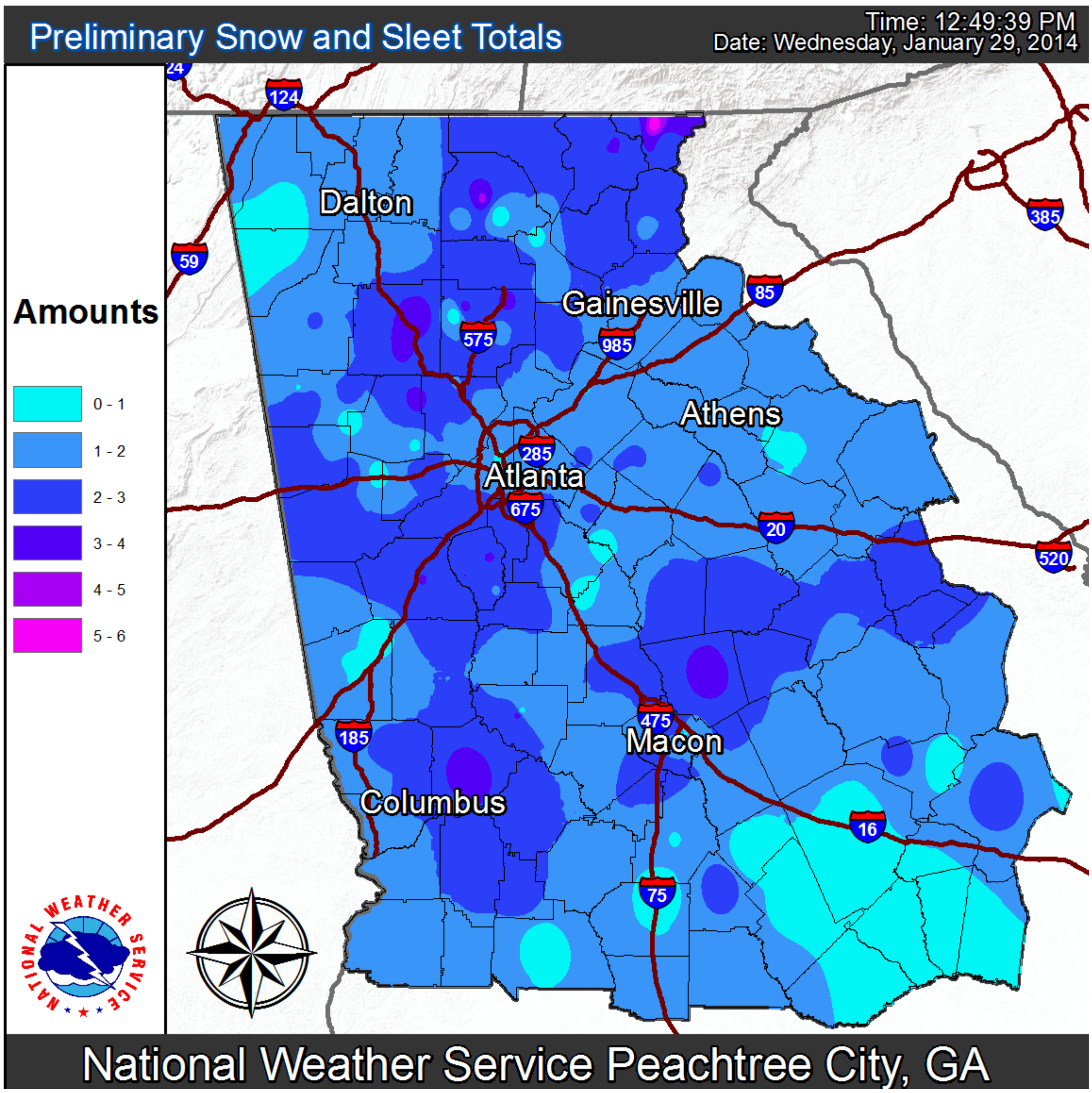
January 9-10, 2011 Winter Storm

Beginning Sunday, January 9, 2011, a mix of rain, sleet and snow fell across central Georgia, with accumulations of up to two inches. In north Georgia, where the cold air was deeper, precipitation fell in the form of mostly snow with some sleet. Between 10 p.m. and midnight on Sunday, an area of intense snow developed along and just north of the I-20 corridor, contributing to a narrow band of 6-8.5 inches total snowfall amounts in Eastern Georgia. To the north of I-20, the airmass was sufficiently cold and moist to produce widespread snowfall amounts greater than 6 inches. In the northernmost counties of Georgia, and especially at higher elevations, snowfall amounts of 8-10 inches were common. The heavier snow and sleet accumulations began tapering off by mid-day Monday, but temperatures hovered at or below freezing throughout the day. Persistent freezing drizzle and light freezing rain across much of central and northern Georgia on Monday helped extend the winter event into the afternoon. Reports of ice accumulations from 0.1- 0.5 inches were received on Monday – mainly across central Georgia. Whitfield County averaged 6-10 inches.



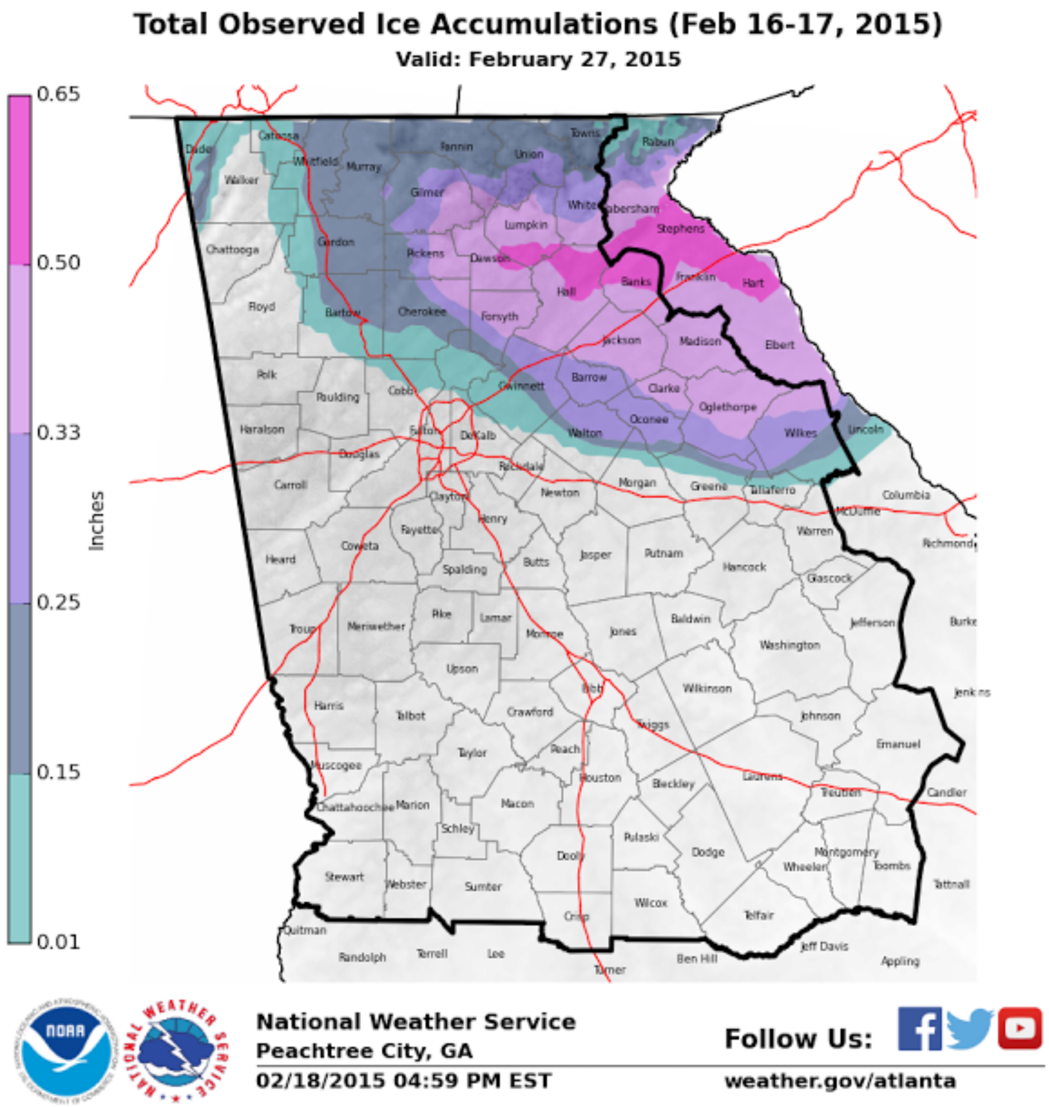
January 28, 2014 Winter Storm

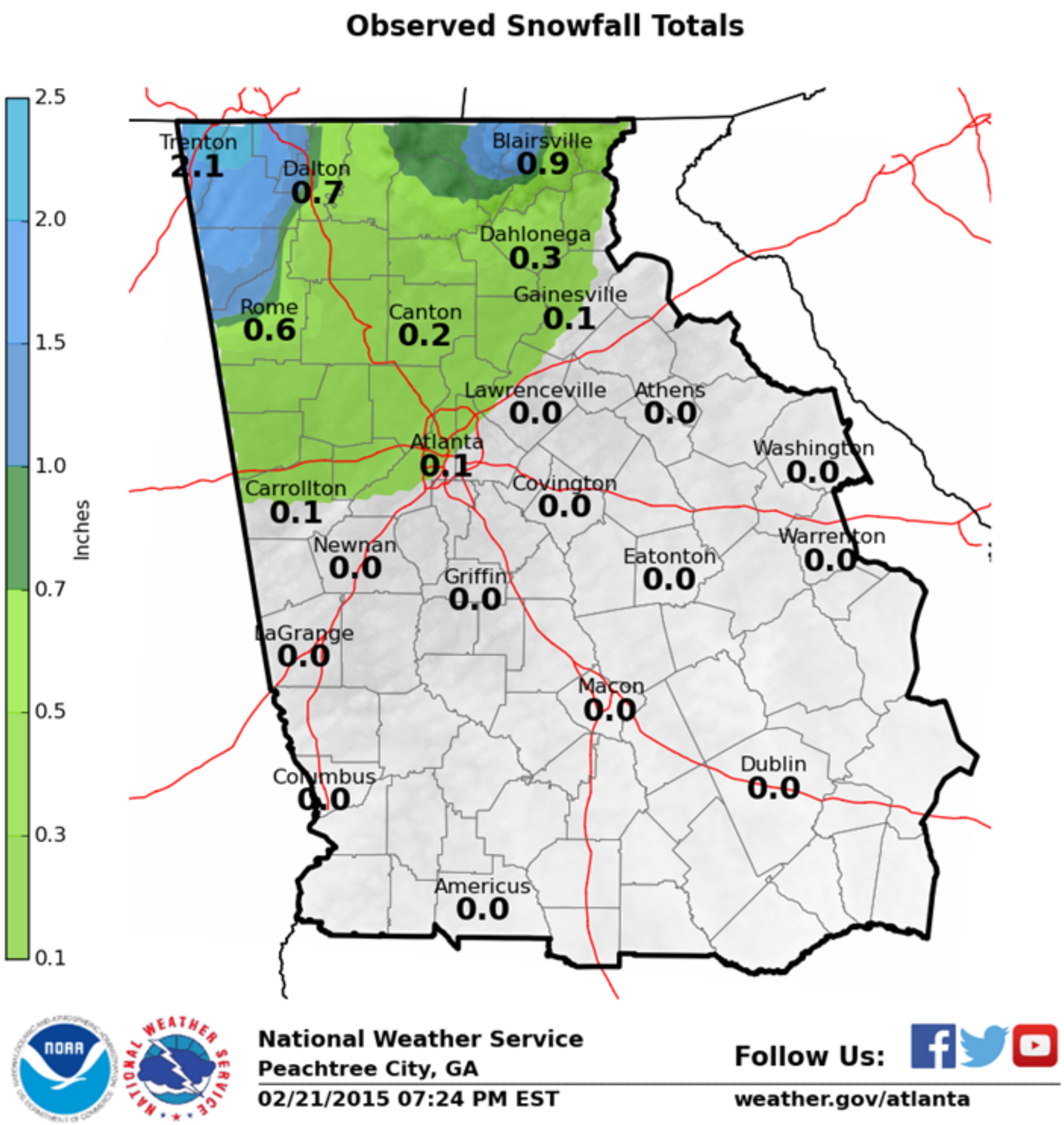
A cold arctic airmass that originated over northern Canada moved rapidly across the central United States on Monday, January 27, 2014. The advancing cold front moved rapidly out of the midwest and across north and central Georgia Monday night. By Tuesday morning, January 28, 2014, temperatures were already below freezing across northwest Georgia, and by afternoon, north and west Georgia temperatures were below freezing. By Tuesday night freezing temperatures were reported across the entire area. During this time, a 500 millibar (mb) short wave was moving out of the southwest United States and into the western Gulf of Mexico. By Tuesday this disturbance was spreading moisture out of the Gulf and across the Southeast. This resulted in a mix of winter precipitation across north and central Georgia with mostly snow across north Georgia, and a mix of freezing rain, sleet and snow across much of central Georgia. Whitfield County accumulation totals were between 1 and 2 inches.



February 16-17, 2015 Winter Storm

A significant winter storm to affect Whitfield County occurred in mid-February of 2015. A strong cold front pushed across Georgia by the morning of February 15th, bringing in plenty of below freezing temperatures to north Georgia. As a low-pressure system approached the area from the west on February 16th, warmer temperatures surged northward, bringing much of the area above freezing. However, temperatures at the surface across parts of north and northeast Georgia hovered at or below freezing as the rainfall increased, thanks to a wedge of cold air. Freezing rain continued for these areas into the early morning hours of February 17th before coming to an end. Freezing rain totals reached from 1/4" to 1/2" in some areas, leading to widespread tree and power line damage. By the morning of February 17th, more than 200,000 customers were without power, generally for the northeast Atlanta metro area and points north and east. The following map shows ice accumulations and snowfall totals in Whitfield County and surrounding areas.

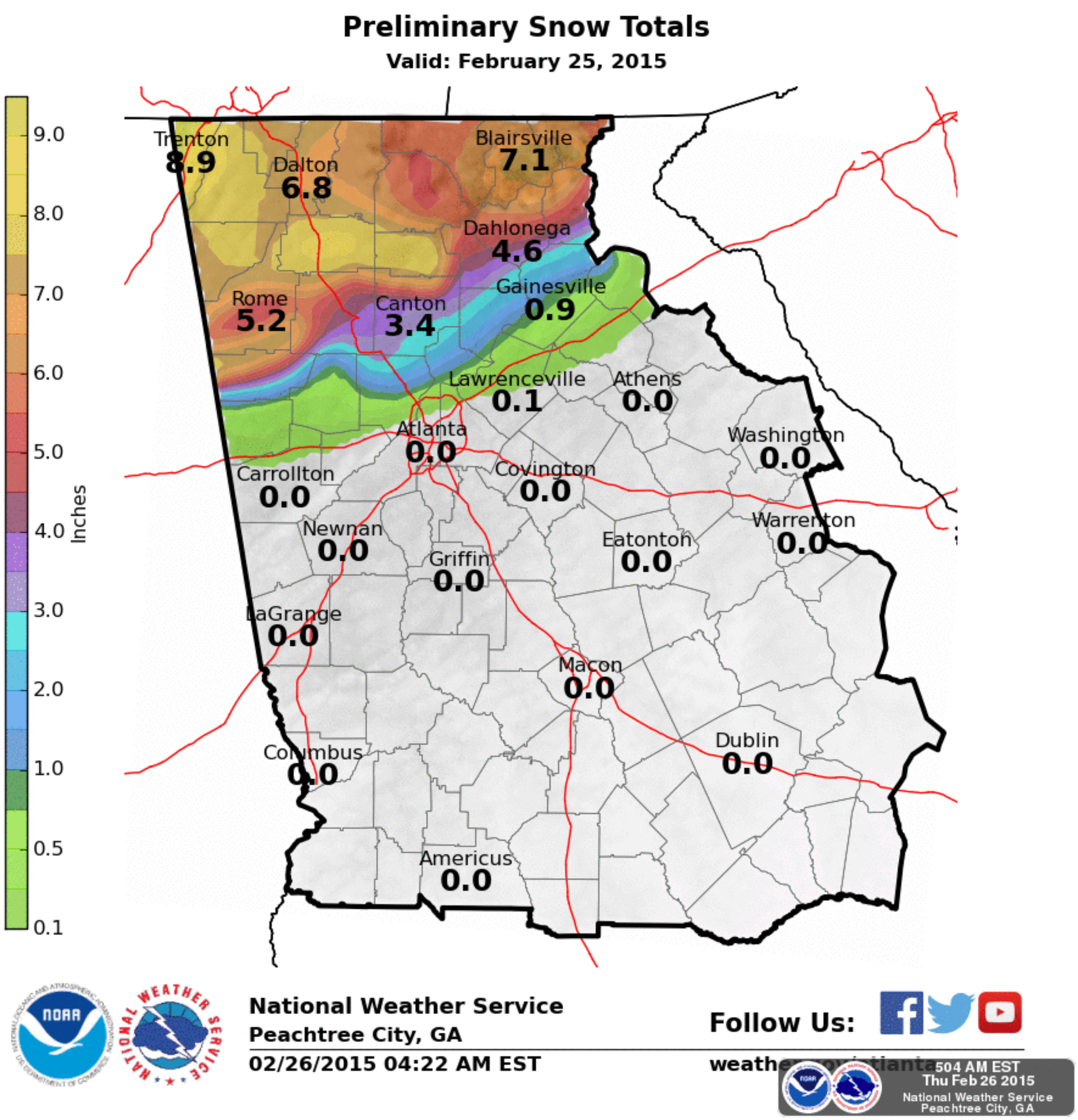




On April 6, 2015, Governor Nathan Deal requested a major disaster declaration due to the severe winter storm during the period of February 15-17, 2015. On April 20, 2015, President Obama declared that a major disaster exists in the State of Georgia. This declaration made Public Assistance requested by the Governor available to state and eligible local governments and certain private nonprofit organizations on a cost-sharing basis for emergency work and the repair or replacement of facilities damaged by the severe winter storm in Banks, Barrow, Dawson, Elbert, Forsyth, Franklin, Habersham, Hall, Jackson, Lumpkin, Madison, Oglethorpe, Pickens, Stephens, and White Counties. This declaration also made Hazard Mitigation Grant Program assistance requested by the Governor available for hazard mitigation measures statewide.

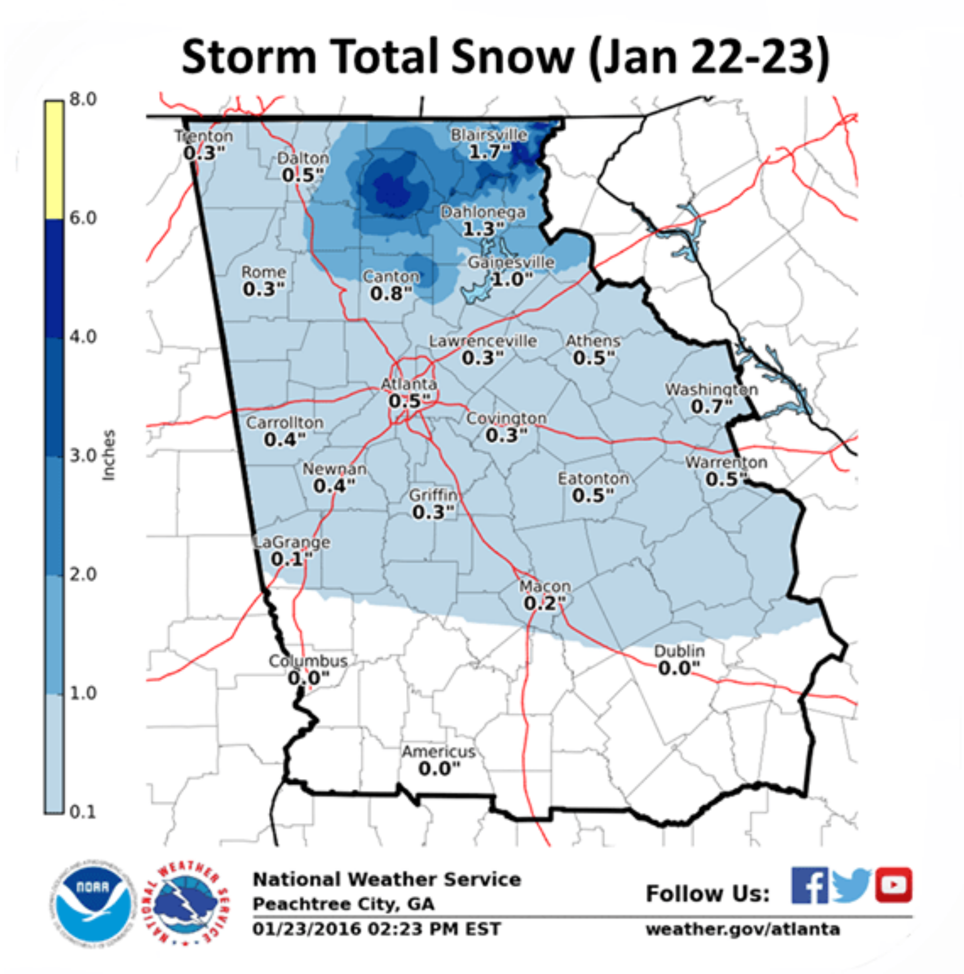
February 25, 2015 Winter Storm

Winter continued to let its presence be known across north Georgia on February 25, 2015. Moisture across the southeast spread over-top of dry, cold surface air already in place across north Georgia, causing temperatures to rapidly cool to near or just below freezing. Rain changed to a heavy, wet snow, generally across the Atlanta metro and areas northward. Towards evening, the surface low advected warmer air from the Gulf as far north as the Atlanta metro, changing snow to a rain/freezing rain mix. Areas north of the metro continued to experience snow, heavy at times, as low-level cold air remained in place. Most areas across far north Georgia received between 7-10 inches of snow, with a tight snow gradient setting up just north of the metro. Travel impacts were significant and widespread, as the heavy, wet snow stuck to roadways and accumulated quickly. This system rapidly exited the area overnight and into the morning hours of February 26, 2015. Whitfield County accumulation varied between approximately 6 and 7.5 inches.

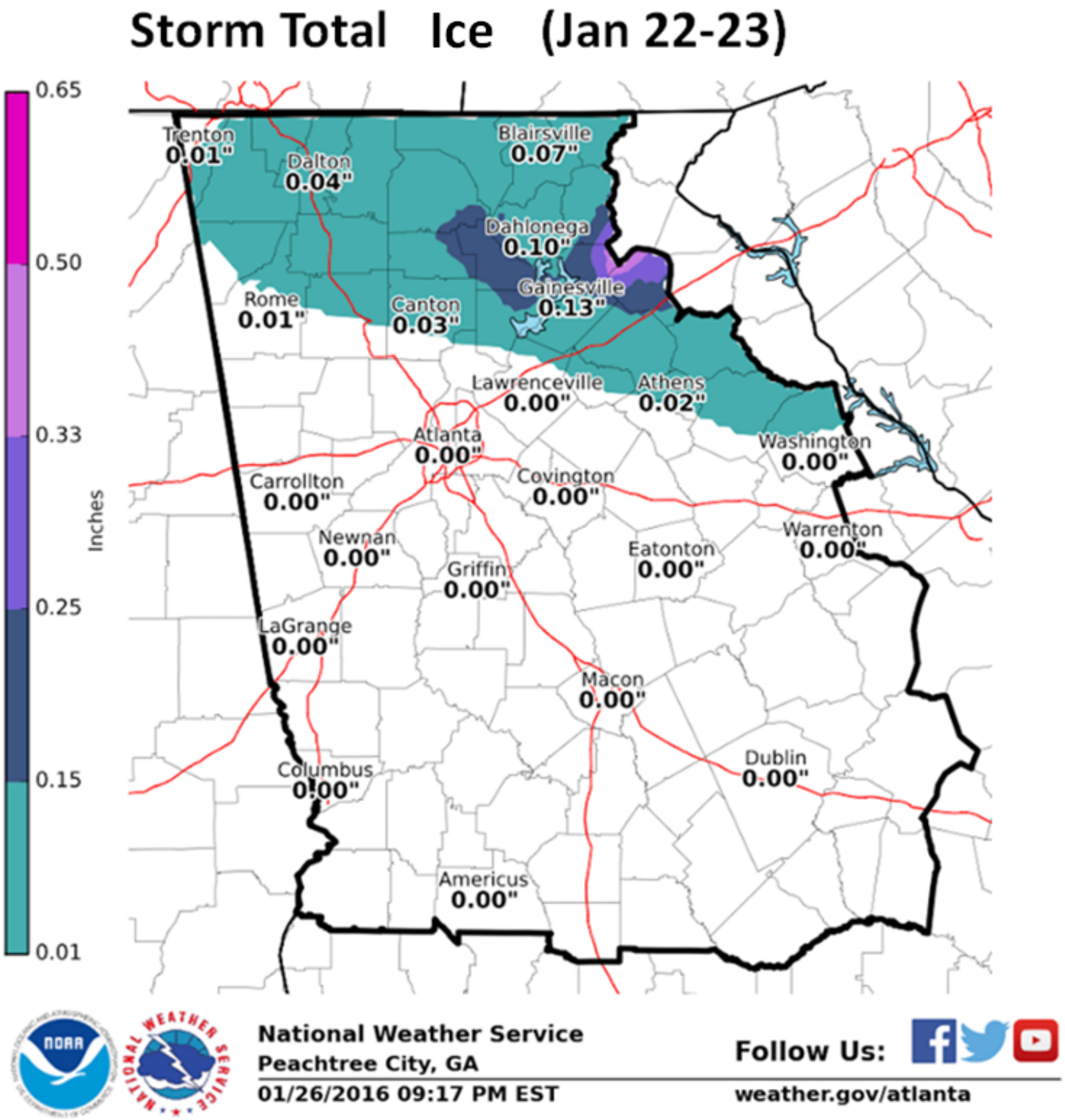


<u>January 22-23, 2016 Winter Storm</u>

A winter weather event impacted most of north Georgia from Friday, January 22nd through the morning of Saturday, January 23rd. This event resulted in light snowfall accumulations as far south as central Georgia, with more significant snow and ice accumulations in the north Georgia mountains. Snow totals ranged as high as 6+" in far north Georgia. This snow and ice was in association with a low pressure system moving into Georgia. Rain changed to frozen precipitation as cold air filtered in, which led to bands of light snow across a large portion of the area. The rain initially changed to freezing rain and snow in northeast Georgia as a wedge of cold air advected into these locations. By midnight Saturday morning, most of the remaining precipitation had transitioned into snow. This is the same system that led to blizzard conditions across the mid-Atlantic and parts of the northeastern United States. Whitfield County received up to 2 inches of snow.

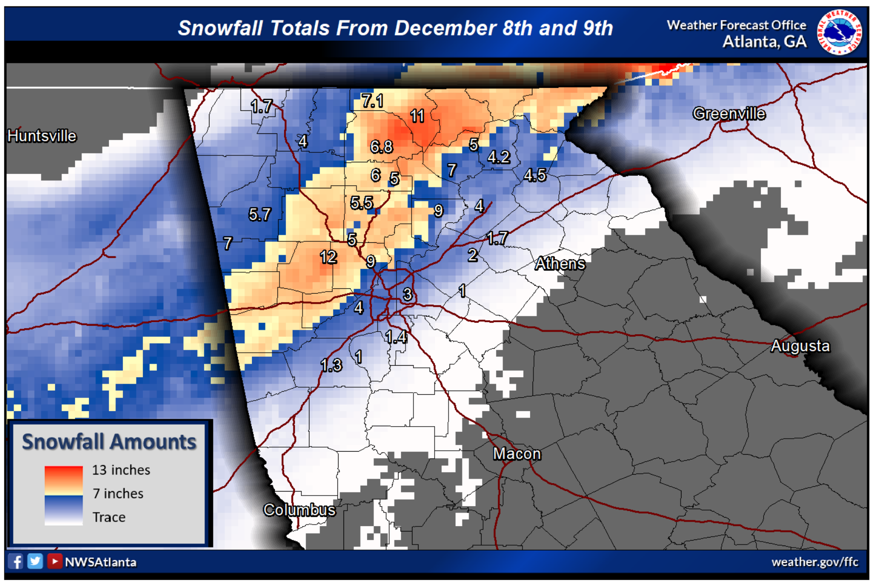


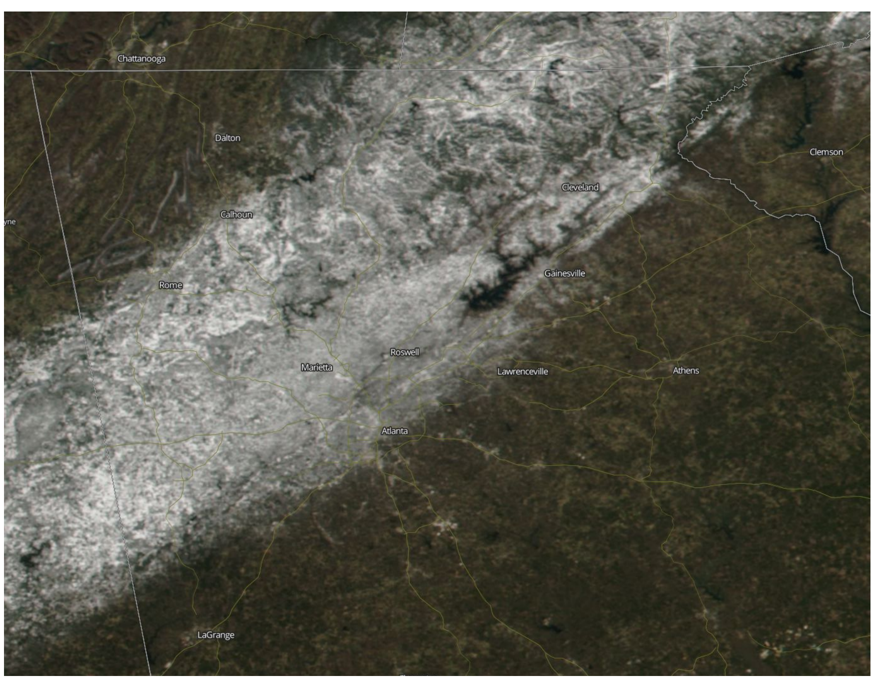
Some accumulations of freezing rain also occurred prior to the onset of most of the snow. Accumulations were light across portions of north Georgia, though a couple of locations did see accumulations over 1/4 inch. Whitfield County saw accumulations of up to 0.15 inches.



December 8, 2017 Winter Storm

A major early-season heavy snowfall affected north Georgia from Friday, December 8th into the morning of Saturday, December 9th. Many locations recorded up to a foot of snowfall, which is exceptionally rare for Georgia, especially in early December. This heavy snowfall also led to numerous power outages. At the height of the storm over 200,000 customers in north Georgia were in the dark. There was a sharp northwest to southeast gradient of accumulating snow through metro Atlanta. Areas southeast of Atlanta did not receive much accumulating snow, while areas north and west of the city received very significant totals. Whitfield County received between 2 and 6 inches of snow.

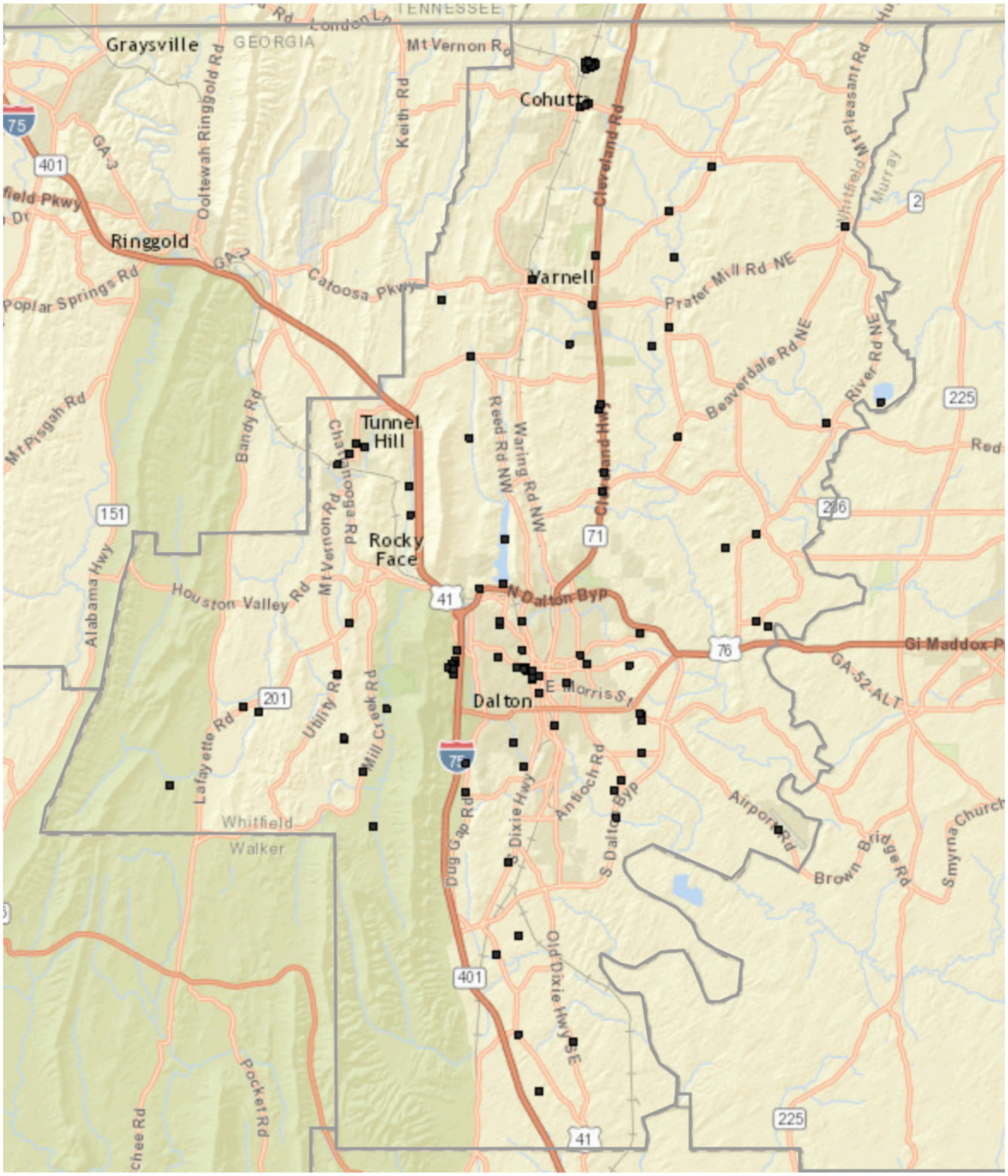




NCDC records show that 46 winter storms occurred within the County over the past fifty years, which equates to an 92% annual frequency based upon reported events. Winter storm events for the twenty-year history equals 33, equating to a much higher 165% annual frequency. It would appear that winter storm activity has increased over time within the County. This may be the case or it may simply be that record keeping and technology have improved significantly over the course of time, reflecting the higher numbers. It may also be a combination of these two factors. The following chart provides annual frequency of reported events over the past five, ten, twenty, and fifty-year periods. The most recent five-year period, covering the span of time since the last update to this Plan, is highlighted in gold.

Whitfield County – Winter Storm Frequency (based on Reported Events)				
Time Period	**5yrs (2017-2021)**	**10yrs (2012-2021)**	**20yrs (2002-2021)**	**50yrs (1972-2021)**
Number of Reported Events	**6**	**13**	**33**	**46**
Frequency Average per Year	**1.20**	**1.30**	**1.65**	**0.92**
Frequency Percent per Year	**120%**	**130%**	**165%**	**92%**

C. Assets Exposed to Hazard - All public and private property including critical facilities are susceptible to winter storms since this hazard is not spatially defined. The GEMA map below identifies critical facilities located within the hazard area, which in the case of winter storms includes all areas within the County, Cities, and Towns.



D. Estimate of Potential Losses - For loss estimate information, please refer to the Critical Facilities Database (Appendix A).

E. Multi-Jurisdictional Concerns – Any portion of Whitfield County can be negatively impacted by winter storms. Therefore, any mitigation steps taken related to winter storms will be pursued on a countywide basis and include the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta.

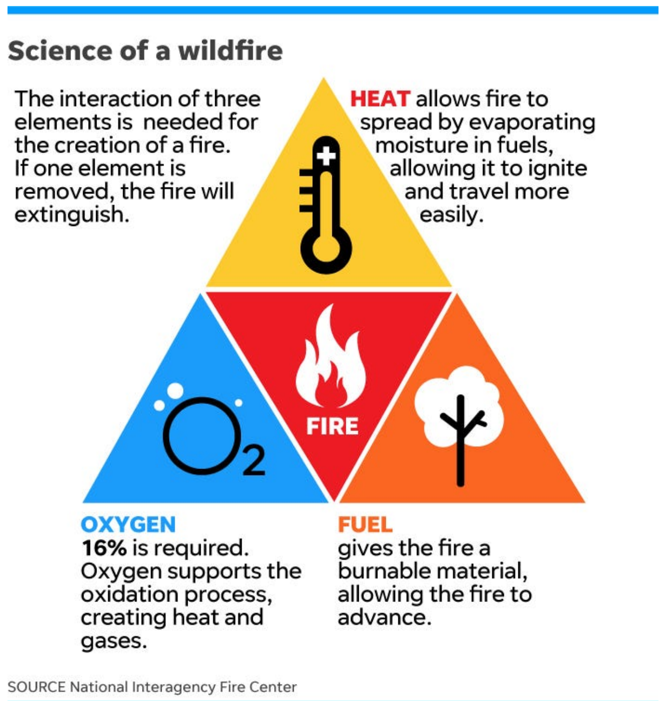
G. Hazard Summary – Winter storms, unlike other natural hazards, typically afford communities some advance warning. The National Weather Service issues winter storm warnings and advisories as these storms approach. Unfortunately, even with advance warning, some of the most destructive winter storms have occurred in the Southern United States, where buildings, infrastructure, crops, and livestock are not well-equipped for severe winter conditions. Motorists, not accustomed to driving in snow and icy conditions, pose an additional danger on roads and highways. The Whitfield County HMPC recognized the potential threats of winter storms and identified specific mitigation actions. These can be found in *Chapter 5*.

2.5 Wildfire

A. Hazard Identification – The Whitfield County HMPC utilized data from Georgia Forestry Commission (GFC) and the Community Wildfire Protection Plan (CWPP) in researching wildfires and their impact on the County.

A wildfire is defined as an uncontrolled fire occurring in any natural vegetation. For a wildfire to occur, there must be available oxygen, a supply of fuel, and enough heat to kindle the fuel. Often, these fires are begun by combustion and heat from surface and ground fires and can quickly develop into a major conflagration. A large wildfire may crown, which means it may spread rapidly through the topmost branches of the trees before involving undergrowth or the forest floor. As a result, violent blowups are common in forest fires, and on rare occasion they may assume the characteristics of a firestorm. A firestorm is a violent convection caused by a continuous area of intense fire and characterized by destructively violent surface indrafts. Sometimes it is accompanied by tornado-like whirls that develop as hot air from the burning fuel rises. Such a fire is beyond human intervention and subsides only upon the consumption of everything combustible in the locality. No records were found of such an event ever occurring within Whitfield County, but this potential danger will be considered when planning mitigation efforts.

The threat of wildfire varies with weather conditions: drought, heat, and wind participate in drying out the timber or other fuel, making it easier to ignite. Once a fire is burning, drought, heat, and wind all increase its intensity. Topography also affects wildfire, which spreads quickly uphill and slowly downhill. Dried grass, leaves, and light branches are considered flash fuels; they ignite readily, and fire spreads quickly in them, often generating enough heat to ignite heavier fuels such as tree trunks, heavy limbs, and the matted duff of the forest floor. Such fuels, ordinarily slow to kindle, are difficult to extinguish. Green fuels (growing vegetation) are not considered flammable, but an intense fire can dry out leaves and needles quickly enough to allow ready ignition. Green fuels sometimes carry a special danger: evergreens, such as pine, cedar, fir, and spruce, contain flammable oils that burst into flames when heated sufficiently by the searing drafts of a wildfire.



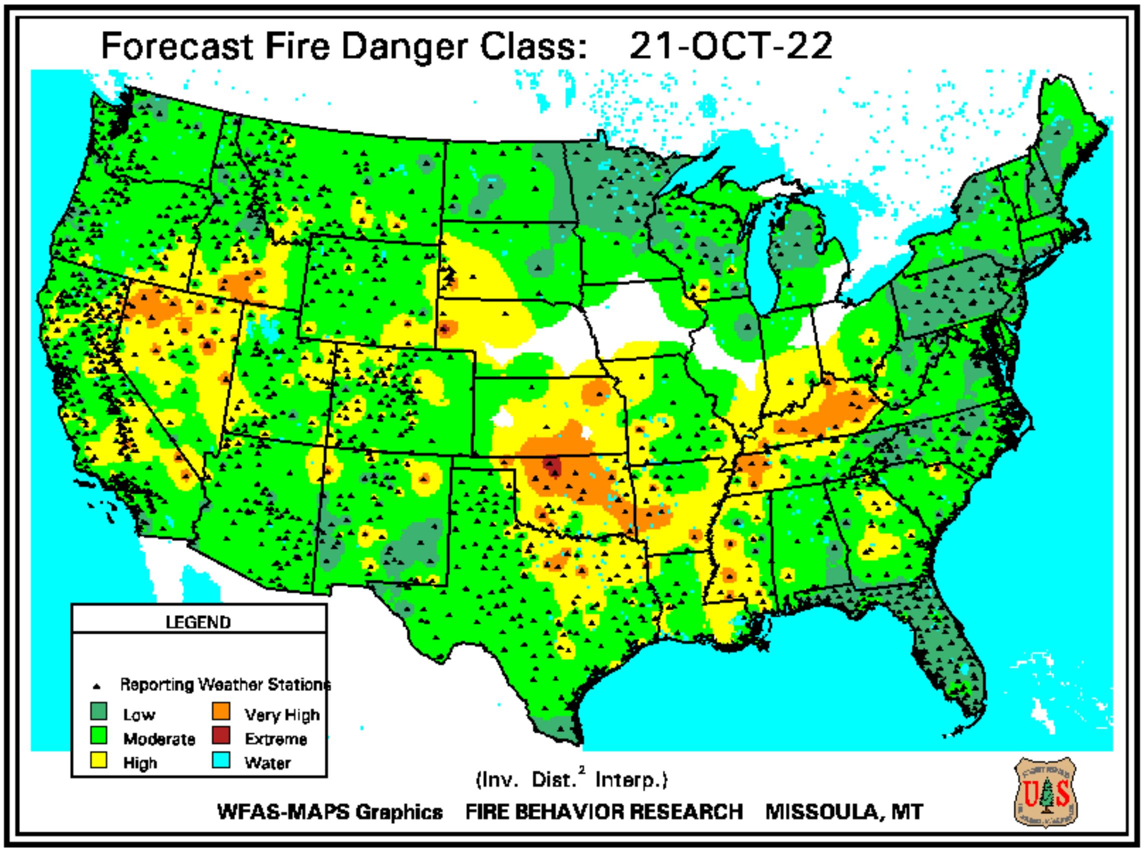
Tools for fighting wildfires range from the standard equipment of fire departments to portable pumps, tank trucks, and earth-moving equipment. Firefighting forces specially trained to deal with wildfire are maintained by local, state and federal entities including the Whitfield County Fire Department, Georgia Forestry, and U.S. Forest Service. These trained firefighters may attack a fire directly by spraying water, beating out flames, and removing vegetation at the edge of the fire to contain it behind a fire line. When the very edge is too hot to approach, a fire line is built at a safe distance, sometimes using strip burning or backfire to eliminate fuel in the path of the uncontrolled fire or to change the fire's direction or slow its progress. Backfiring is used only as a last resort.

The control of wildfires has developed into an independent and complex science costing hundreds of millions of dollars annually in the United States. Because of the extremely rapid spreading and customary inaccessibility of fires once started, the chief aim of this work is prevention. However, despite the use of modern techniques (e.g., radio communications, rapid helicopter transport, and new types of chemical firefighting apparatus) more than 10 million acres of forest are still burned annually. Of these fires, about two thirds are started accidentally by people, almost one quarter are of incendiary origin, and more than 10% are due to lightning.

B. Hazard Profile – Wildfires are a serious threat to Whitfield County.

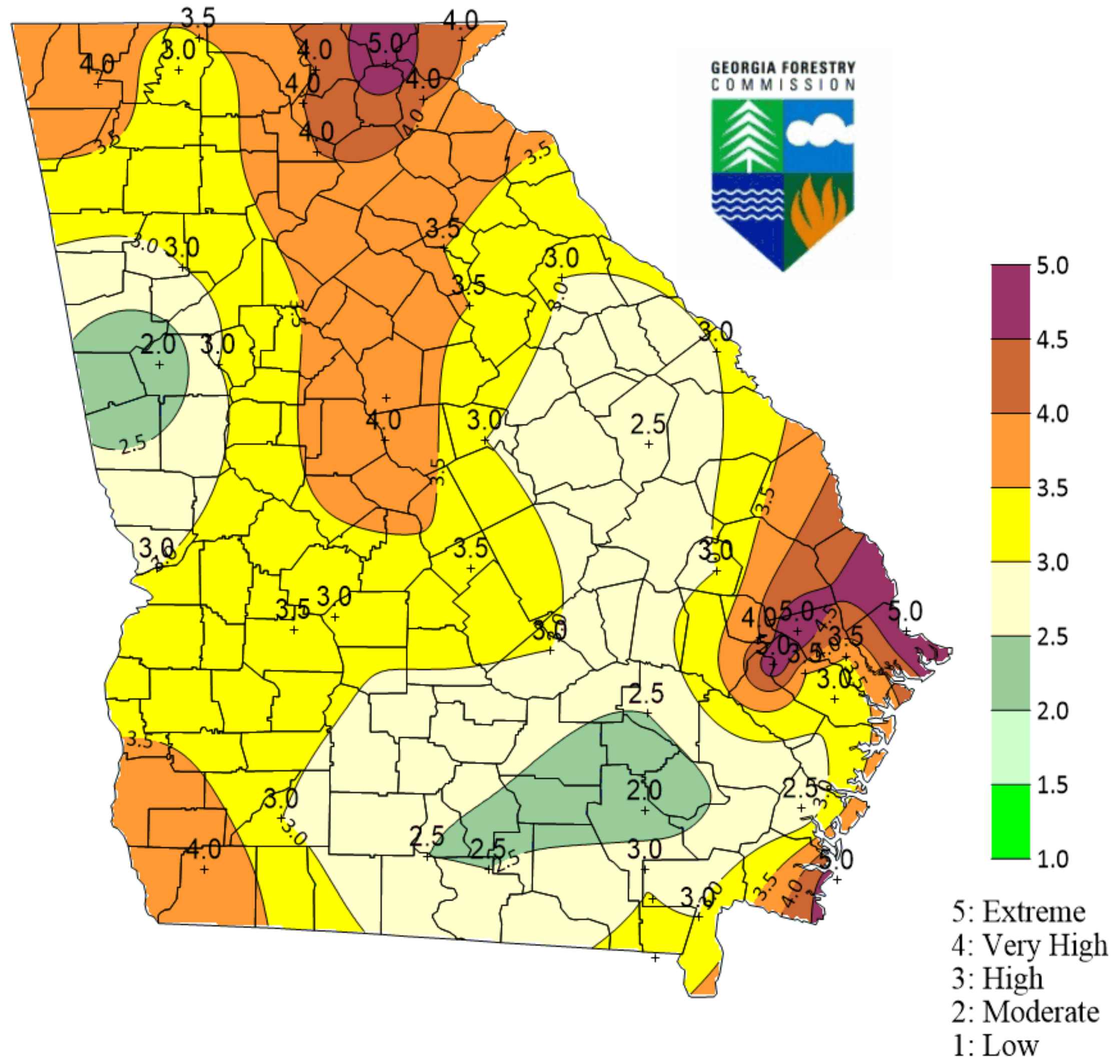
The South is one of the fastest growing regions in the nation, with an estimated population growth of 1.5 million people per year. The South also consistently has the highest number of wildfires per year. Population growth is pushing housing developments further into natural and forested areas where most of these wildfires occur. This situation puts many lives and communities at risk each year. In particular, the expansion of residential development from urban centers out into rural landscapes, increases the potential for wildland fire threat to public safety and the potential for damage to forest resources and dependent industries. This increase in population across the region will impact counties and communities that are located within the Wildland Urban Interface (WUI). The WUI is described as the area where structures and other human improvements meet and intermingle with undeveloped wildland or vegetative fuels. Population growth within the WUI substantially increases the risk from wildfire.

As of October 21, 2022, Whitfield County's threat of wildfire was classified as "moderate" by the U.S. Forest Service. However, this status can change from week to week. See the following map.



As of October 20, 2022, Whitfield County’s “Fire Danger” forecast level is classified as “high”.

Forecast Fire Danger for Tomorrow
Produced at October 20, 2022 130pm EST



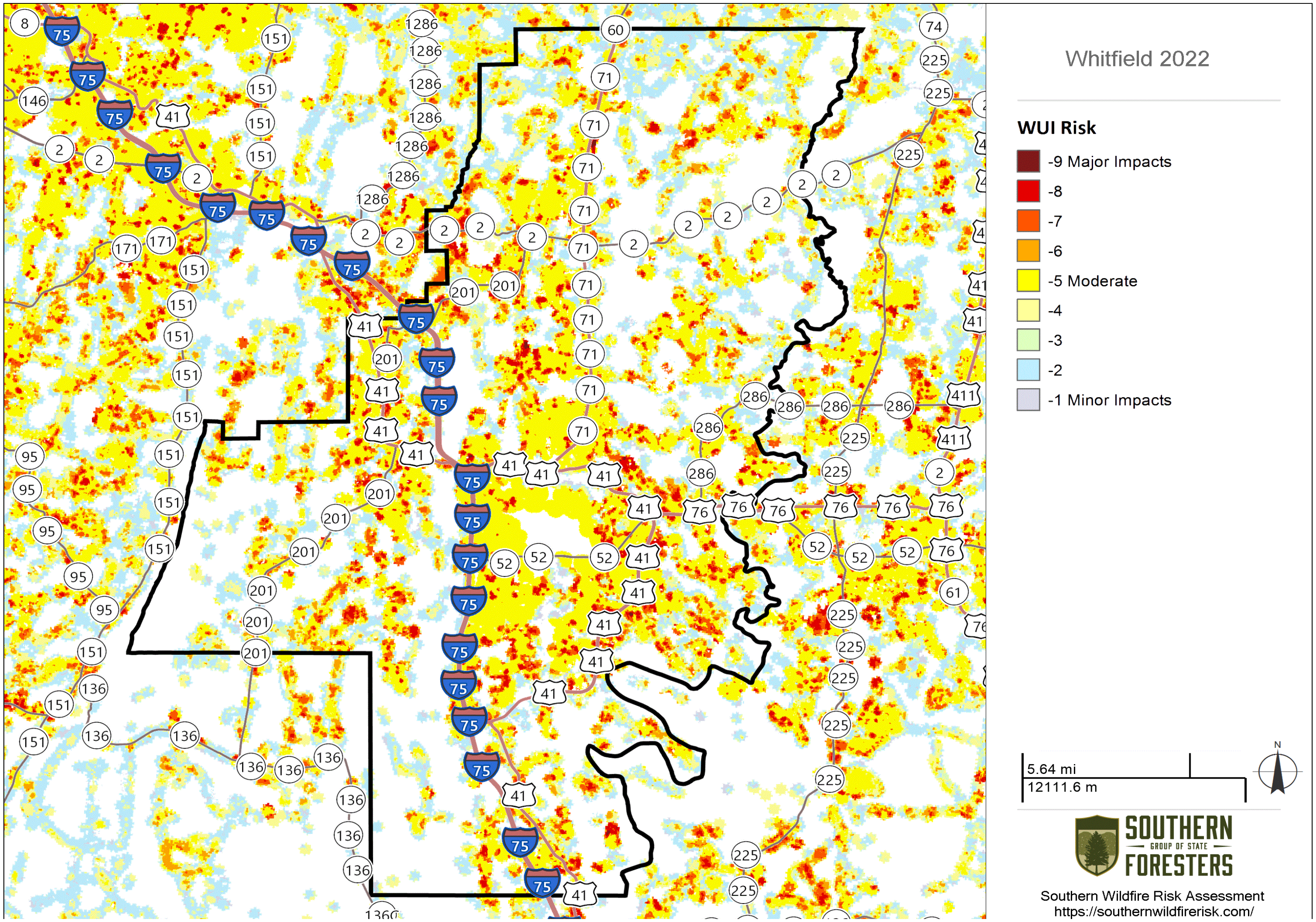
GFC records show that 2,757 wildfires occurred within the County over the past fifty years, which equates to a 5,900% annual frequency based upon reported events. Over the course of the entire 50-year period that frequency has steadily declined. It would appear that wildfire activity has decreased over time within the County. The following chart provides annual frequency of reported events over the past five, ten, twenty, and fifty-year periods. The most recent five-year period, covering the span of time since the last update to this Plan, is highlighted in gold.

Whitfield County – Wildfire (based on Reported Events)				
Time Period	5yrs (2017-2021)	10yrs (2012-2021)	20yrs (2002-2021)	50yrs (1972-2021)
Number of Reported Events	31	118	435	2757
Frequency Average per Year	6.20	11.80	21.75	55.14
Frequency Percent per Year	620%	1180%	2175%	5514%

C. Assets Exposed to Hazard – In evaluating assets that are susceptible to wildfire, the committee determined that all public and private property is susceptible to wildfire, including all critical facilities. The maps on the following pages display the wildfire risk potential for Whitfield County and each of the municipalities, including locations of critical facilities within the hazard areas.

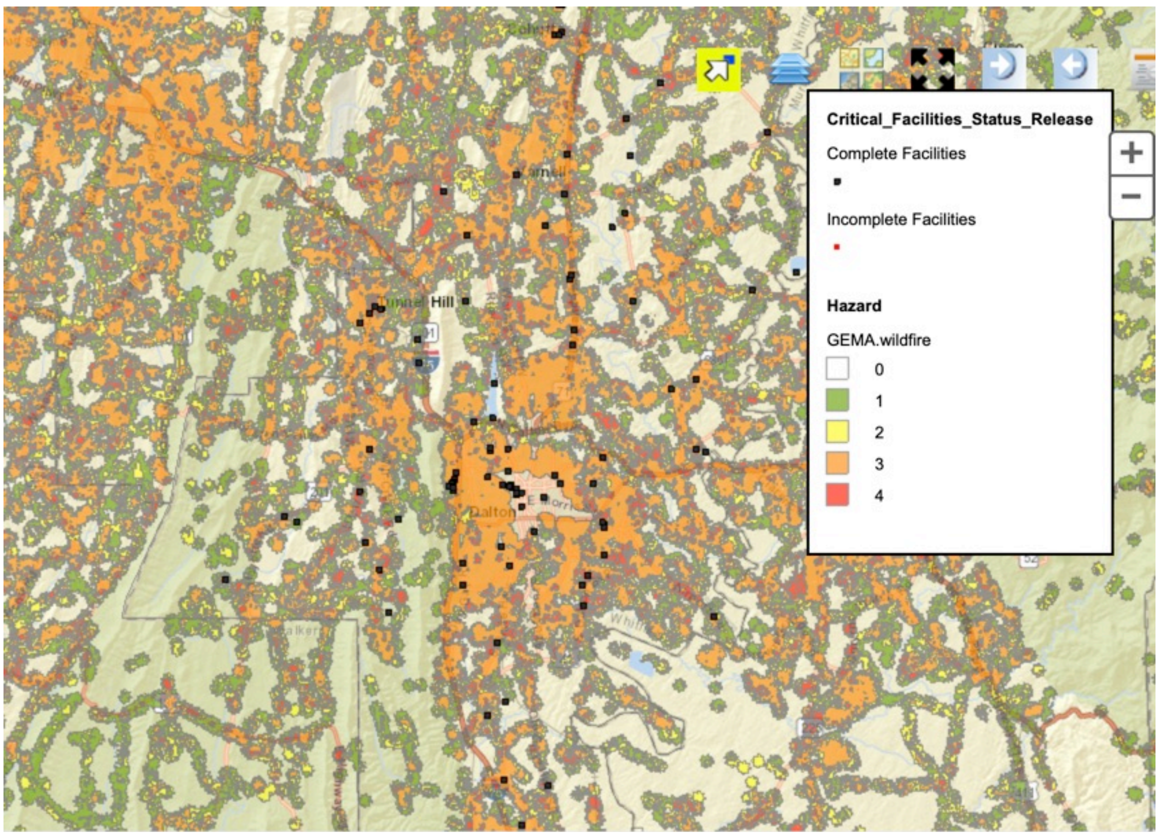
The Wildland Urban Interface (WUI) Risk Index layer is a rating of the potential impact of a wildfire on people and their homes. The key input, WUI, reflects housing density (houses per acre) consistent with Federal Register National standards. The location of people living in the Wildland Urban Interface and rural areas is key information for defining potential wildfire impacts to people and homes. The WUI Risk Rating is derived using a Response Function modeling approach. Response functions are a method of assigning a net change in the value to a resource or asset based on susceptibility to fire at different intensity levels, such as flame length. The range of values is from -1 to -9, with -1 representing the least negative impact and -9 representing the most negative impact. For example, areas with high housing density and high flame lengths are rated -9 while areas with low housing density and low flame lengths are rated -1. To calculate the WUI Risk Rating, the WUI housing density data was combined with Flame Length data and response functions were defined to represent potential impacts. The response functions were defined by a team of experts based on values defined by the SWRA Update Project technical team. By combining flame length with the WUI housing density data, you can determine where the greatest potential impact to homes and people is likely to occur. Fire intensity data is modeled to incorporate penetration into urban fringe areas so that outputs better reflect real world conditions for fire spread and impact in fringe urban interface areas. With this enhancement, houses in urban areas adjacent to wildland fuels are incorporated into the WUI risk modeling. All areas in the South have the WUI Risk Index calculated consistently, which allows for comparison and ordination of areas across the entire region. Data is modeled at a 30-meter cell resolution, which is consistent with other SWRA layers.

Whitfield County Wildland Urban Interface (WUI) Risk Map 2022



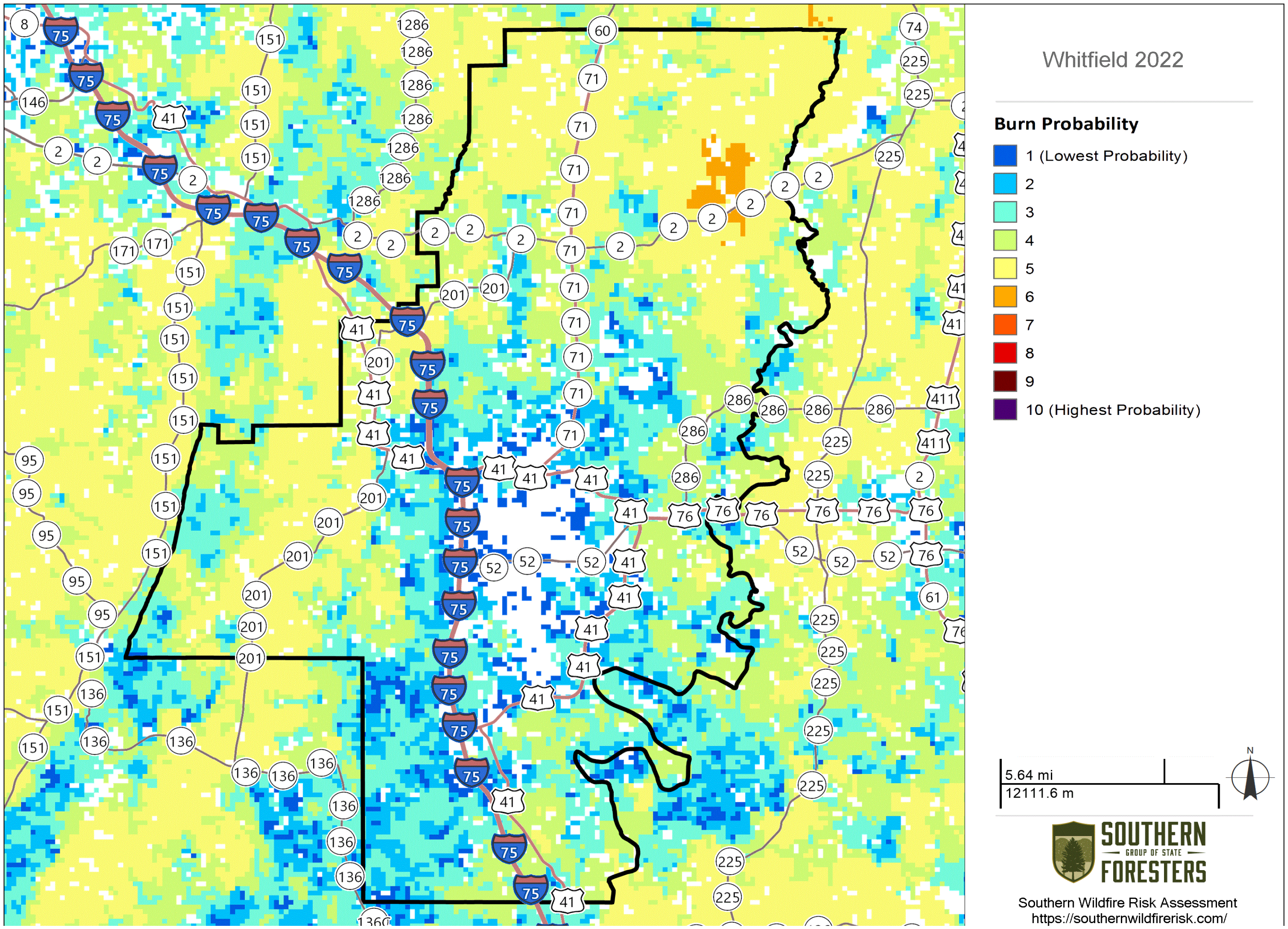
When considering the WUI Risk map above, many portions of the County, Cities, and Towns have been classified under WUI Risk Rating classes 1 through 3, which represent lower risks and WUI Risk Rating classes 4 through 5, which represent more moderate risks. However, there are many smaller pockets scattered throughout the County classified under WUI Risk Rating classes 7 through 9, which represent more major risks to those areas. It would appear that the closer to the center of Whitfield County, and the City of Dalton, the more concentrated the wildfire threat. Areas in and around each of the Cities and along Interstate 75 also seem to have a higher wildfire risk.

The following is GEMA's version of the same WUI Risk Map above.



Another useful tool in determining wildfire threat is the Burn Probability (BP) layer. The BP layer depicts the probability of an area burning given current landscape conditions, percentile weather, historical ignition patterns and historical fire prevention and suppression efforts. Described in more detail, it is the tendency of any given pixel to burn, given the static landscape conditions depicted by the LANDFIRE Refresh 2008 dataset (as resampled by FPA), contemporary weather and ignition patterns, as well as contemporary fire management policies (entailing considerable fire prevention and suppression efforts). The BP data does not, and is not intended to, depict fire-return intervals of any vintage, nor do they indicate likely fire footprints or routes of travel. Nothing about the expected shape or size of any actual fire incident can be interpreted from the burn probabilities. Instead, the BP data, in conjunction with the Fire Program Analysts FIL layers, are intended to support an actuarial approach to quantitative wildfire risk analysis (e.g., see Thompson et al. 2011). Values in the Burn Probability (BP) data layer indicate, for each pixel, the number of times that cell was burned by an FSim-modeled fire, divided by the total number of annual weather scenarios simulated. Burn probability raster data was generated using the large fire simulator - FSim - developed for use in the Fire Program Analysis (FPA) project. FSim uses historical weather data and current landcover data for discrete geographical areas (Fire Planning Units - FPUs) and simulates fires in these FPUs. Using these simulated fires, an overall burn probability and marginal burn probabilities at four fire intensities (flame lengths) are returned by FSim for each 270m pixel in the FPU. The fire growth simulations, when run repeatedly with different ignition locations and weather streams, generate burn probabilities and fire behavior distributions at each landscape location (i.e., cell or pixel). Results are objectively evaluated through comparison with historical fire patterns and statistics, including the mean annual burn probability and fire size distribution, for each FPU. This evaluation is part of the FSim calibration process for each FPU, whereby simulation inputs are adjusted until the slopes of the historical and modeled fire size distributions are similar and the modeled average burn probability falls within an acceptable range of the historical reference value (i.e., the 95% confidence interval for the mean).

Whitfield County Burn Probability Map 2022



According to the Burn Probability map above, it is clear that the entire County and all municipalities have a relatively low to moderate burn probability. No areas within the County borders are rated higher than a 6 (on a scale of 1 to 10) on the Burn Probability Scale. The highest probability is a relatively small area located in northeastern Whitfield County, and this area is only rated a 6.

Characteristic Fire Intensity Scale (FIS) is yet another way to gauge wildfire risk. FIS specifically identifies areas where significant fuel hazards and associated dangerous fire behavior potential exist based on a weighted average of four percentile weather categories. Similar to the Richter scale for earthquakes, FIS provides a standard scale to measure potential wildfire intensity. FIS consist of 5 classes where the order of magnitude between classes is ten-fold. The minimum class, Class 1, represents very low wildfire intensities and the maximum class, Class 5, represents very high wildfire intensities. Refer to descriptions below.

Class 1, Very Low

Very small, discontinuous flames, usually less than 1 foot in length; very low rate of spread; no spotting. Fires are typically easy to suppress by firefighters with basic training and non-specialized equipment.

Class 2, Low

Small flames, usually less than two feet long; small amount of very short range spotting possible. Fires are easy to suppress by trained firefighters with protective equipment and specialized tools.

Class 3, Moderate

Flames up to 8 feet in length; short-range spotting is possible. Trained firefighters will find these fires difficult to suppress without support from aircraft or engines, but dozer and plows are generally effective. Increasing potential for harm or damage to life and property.

Class 4, High

Large Flames, up to 30 feet in length; short-range spotting common; medium range spotting possible. Direct attack by trained firefighters, engines, and dozers is generally ineffective, indirect attack may be effective. Significant potential for harm or damage to life and property.

Class 5, Very High

Very large flames up to 150 feet in length; profuse short-range spotting, frequent long-range spotting; strong fire-induced winds. Indirect attack marginally effective at the head of the fire. Great potential for harm or damage to life and property.

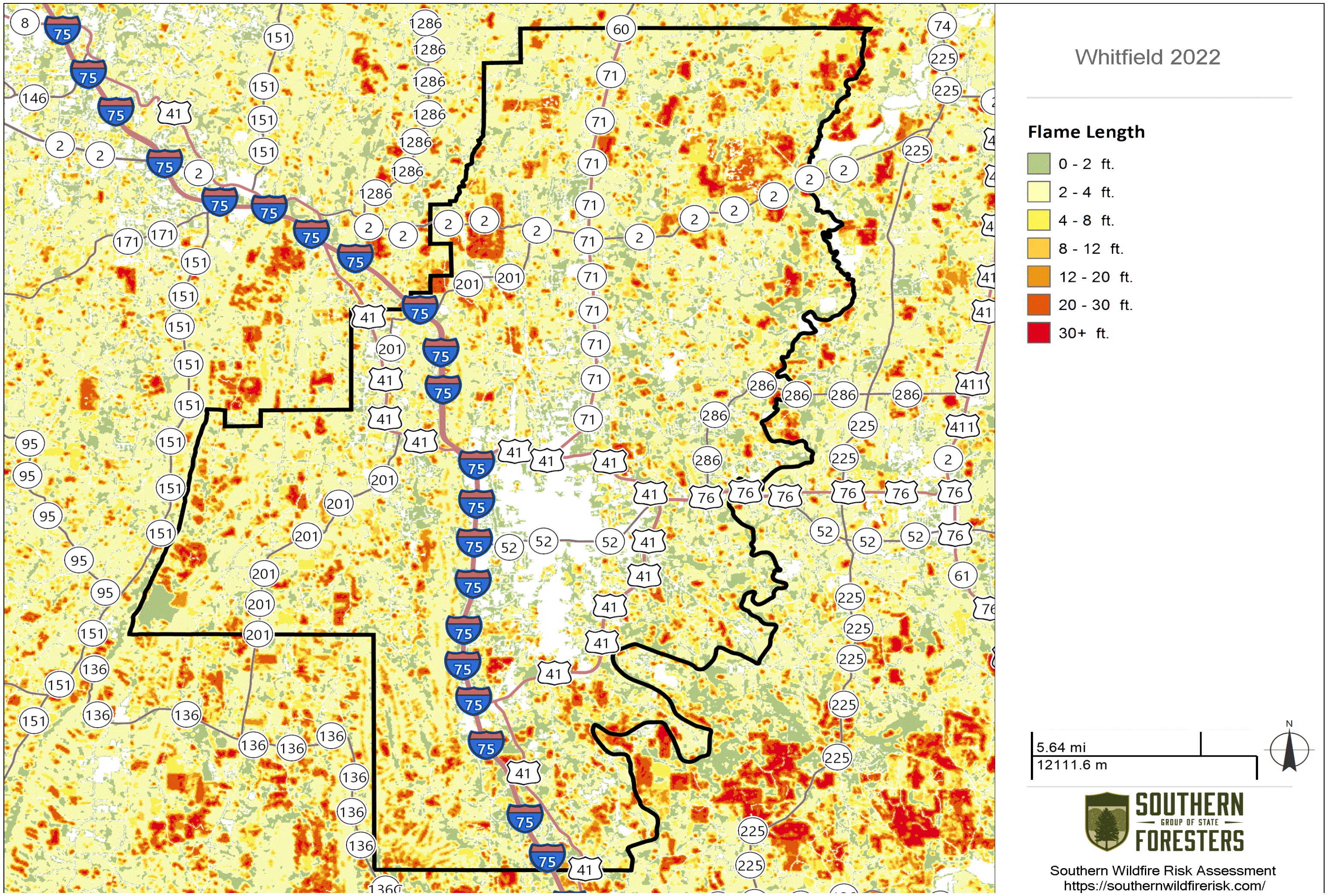
This dataset was derived from updated fuels and canopy data as part of the 2010 SWRA Update Project recently completed in May 2014. Since all areas in the South have fire intensity scale calculated consistently, it allows for comparison and ordination of areas across the entire region.

Fire intensity scale is a fire behavior output, which is influenced by three environmental factors - fuels, weather, and topography.

Weather is by far the most dynamic variable as it changes frequently. To account for this variability, four percentile weather categories were created from historical weather observations to represent low, moderate, high, and extreme weather days for each weather influence zone in the South. A weather influence zone is an area where, for analysis purposes, the weather on any given day is considered uniform.

The Fire Intensity Scale Map is derived at a 30-meter resolution. This scale of data was chosen to be consistent with the accuracy of the primary surface fuels dataset used in the assessment. While not appropriate for site specific analysis, it is appropriate for regional, county or local planning efforts. See the map on the following page.

Whitfield County Fire Intensity Scale Map 2022



A review of the Fire Intensity Scale map above shows that, generally speaking, the highest fire intensities would tend to occur along the perimeter of the County. Although there are plenty of smaller pockets scattered throughout the County that would also be prone to higher fire intensities. No portion of the County can truly be overlooked when considering fire intensities.

D. Estimate of Potential Losses – In most of the documented cases of wildfire within Whitfield County, relatively little information on damages, in terms of dollars, was available. The potential commercial value of the land lost to wildfire cannot be accurately calculated, other than replacement costs of structures and infrastructure. With regard to the land itself, aside from the loss of timber and recreation, the damage is inestimable in terms of land rendered useless by ensuing soil erosion, elimination of wildlife cover and forage, and the loss of water reserves collected by a healthy forest. For available loss estimate information, please refer to the Critical Facilities Database (Appendix A).

E. Multi-Jurisdictional Concerns – As shown in the current WUI Risk map, not only does the County have a serious risk of wildfire, but each of the Cities as well. Any steps taken to mitigate the effects of wildfire should be undertaken on a countywide basis and include the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta. For Whitfield County, it is estimated that 98.8 % percent of the total project area population live within the WUI.

F. Hazard Summary – Wildfires pose a serious threat to Whitfield County in terms of property damage, as well as injuries and loss of life. Wildfires are one of the most frequently occurring natural hazards within the County each year. Based on the frequency of this hazard, as well as its ability to inflict devastation most anywhere in the County, the mitigation measures identified in this plan will be thoroughly pursued. Specific mitigation actions related to wildfire are identified in *Chapter 5*.

2.6 Drought

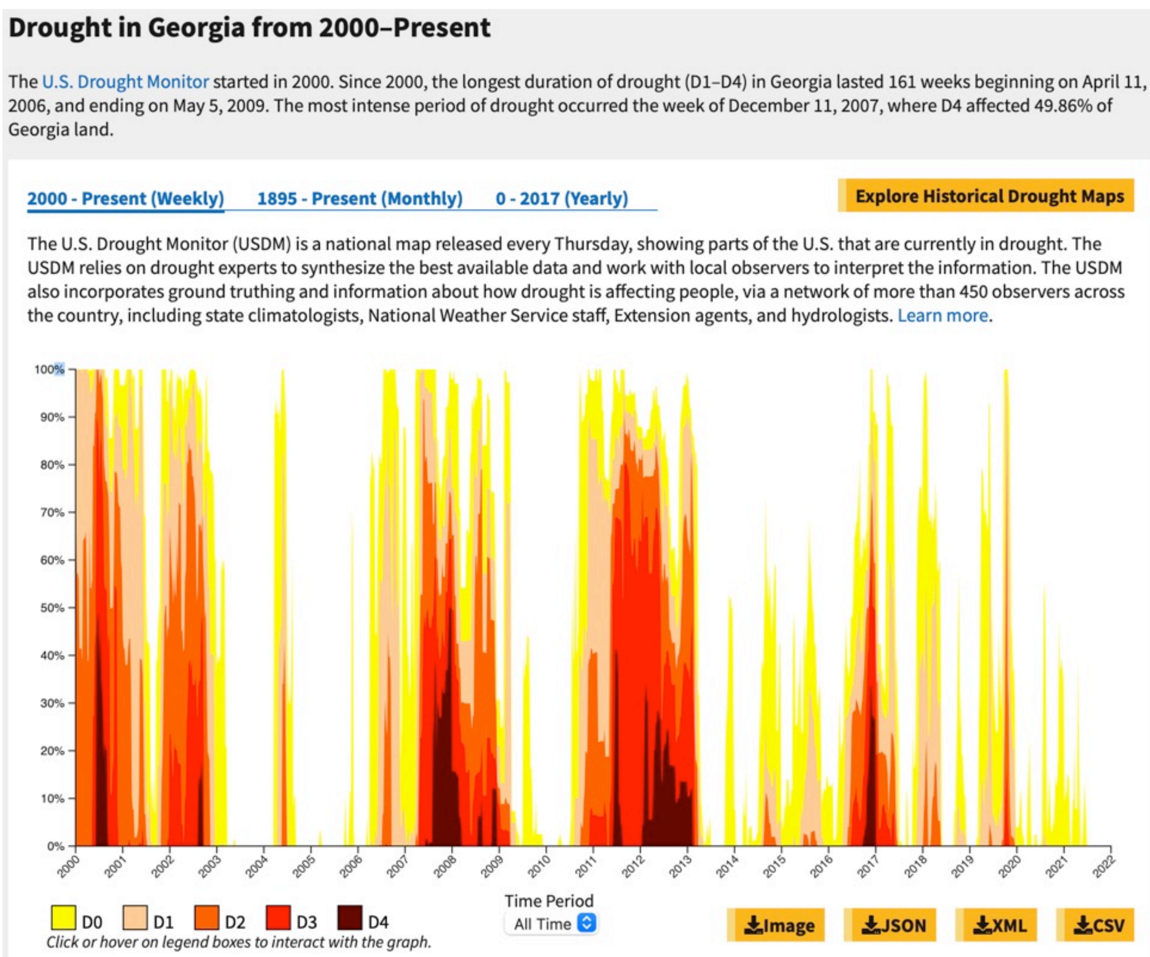
A. Hazard Identification –The term "drought" has various meanings, depending upon context. To a farmer, a drought is a period of moisture deficiency that affects the crops under cultivation (even two weeks without rainfall can stress many crops during certain periods of the growing cycle). To a water manager, a drought is a deficiency in water supply that affects water availability and water quality. To a meteorologist, a drought is a prolonged period when precipitation is less than normal. To a hydrologist, a drought is an extended period of decreased precipitation and streamflow.

Drought is a normal, recurrent feature of climate. It occurs almost everywhere, although its features vary from region to region. Droughts in Georgia historically have severely affected municipal and industrial water supplies, agriculture (including both livestock and crops), stream water quality, recreation at major reservoirs, hydropower generation, navigation, and forest resources. Drought is also a key factor in wildfire development by making natural fuels (grass, brush, trees, dead vegetation) more fire prone.

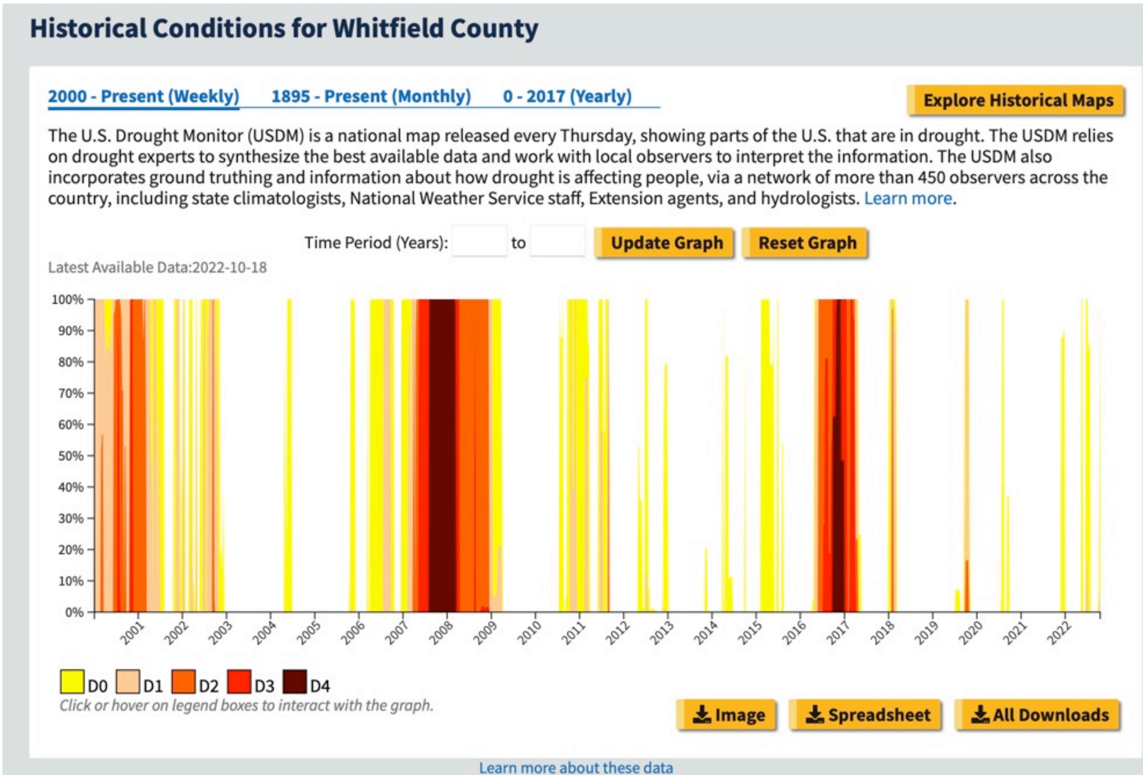
In Georgia, droughts have been documented at U.S. Geological Survey (USGS) streamflow gaging stations since the 1890's. From 1910 to 1940, about 20 streamflow gaging stations were in operation. Since the early 1950's through the late 1980's, about 100 streamflow gaging stations were in operation. Currently, the USGS streamflow gaging network consists of more than 135 continuous-recording gages. Groundwater levels are currently monitored at 165 wells equipped with continuous recorders.

B. Hazard Profile – The Whitfield County HMPC reviewed historical data from the National Oceanic and Atmospheric Administration (NOAA), the National Climatic Data Center (NCDC), the U.S. Geological Survey (USGS), the Georgia Department of Natural Resources (GA DNR) and the Georgia Forestry Commission (GFC) in researching drought events of the County and the State. Most historical information related to drought within this Plan has been derived from USGS streamflow data and NOAA precipitation data. Due to the nature of drought to affect large areas of the State simultaneously and the availability of only very limited County-specific drought information, the threat of drought is looked at within this Plan from a statewide perspective. Similarly, due to limited month-by-month information on drought, this hazard will be quantified on an annual basis (either there was a drought or there was not for any given year within the State). These guidelines are also used in Appendix B and Appendix C with regard to historical hazard information.

In the State of Georgia significant drought events, as identified by USGS, NOAA and other sources, have occurred in 24 of the last 50 years. Whitfield County was affected to varying degrees in each of those years.



Below is the same U.S. Drought Monitor map, but with a more specific look at Whitfield County rather than the entire State of Georgia.



Some of the most extreme droughts to affect the State include the following:

1903-1905: According to the USGS, the 1903 to 1905 drought is "the earliest recorded severe drought in Georgia." In 1904, the U.S. Weather Bureau (today's National Weather Service) reported, "Levels in streams and wells were the lowest in several years. Many localities had to conserve water for stock and machinery and many factories were forced to close or operate at half capacity." When the 1903 drought struck, farm jobs dried up as quickly as the fields. The cities attracted many of these workers who migrated to Atlanta.

1924-1927: The drought that struck from 1924 to 1927 affected a wider area than simply north Georgia, affecting the Coosa River and Altamaha Basin as well at the Chattahoochee River. The U.S. Weather Bureau reported the lowest stream levels ever recorded in north Georgia in July-September of 1925, stating that the drought not only affected agricultural operations, but industrial operations as well. The scarcity of water had a profound influence on industrial and agricultural conditions in Georgia. This may have been the first time Georgia media used the term "Drought of the Century". Combined with the ongoing devastation from the boll weevil and technological advances in agriculture that increased efficiency and thereby reduced the number of farm jobs, migration from rural Georgia to urban Georgia increased significantly. The impact of this drought, plus other natural events, helped send the Georgia economy into a depression well before the rest of the United States.

<u>1930-1935:</u> Although the drought of 1930-1935 had little long-term impact on north Georgia, it contributed to the ongoing economic problems throughout the state and the United States as a whole. The USGS reports that the severity of this drought "exceeded a 25-year recurrence interval" in central and southwestern Georgia and affected much of the Country. In extreme northern and southeastern Georgia, the recurrence interval was 10–25 years. This period was also referred to as the "Drought of the Century."

<u>1938-1944:</u> Many of the same areas that suffered during the 1930 to 1935 drought endured severe drought again from 1938 to 1944. The drought of 1938-1944 struck the upper Coosa River basin and the Chattahoochee River basin. According to USGS the recurrence interval exceeded 50 years in those areas. In extreme northern and southwestern Georgia, the drought had recurrence intervals of 10–25 years. It was this drought that convinced politicians to move towards massive hydroelectric projects that would supply power and keep water available to constituents throughout long dry spells. One of the key supporters of hydroelectric power in the United States was Senator Richard B. Russell, member of the Senate Appropriations Committee. The first such dam in the State, Allatoona, was begun in 1941 and completed after World War II.

1950-1957: A large statewide drought lasted from 1950 to 1957. Most streamflows had recurrence intervals exceeding 25 years according to USGS. The catastrophic drought devastated crops by 1954. This event also earned the title as "Drought of the Century." This drought was most severe in southern Georgia, with most streamflows having recurrence intervals exceeding 25 years. In northeastern Georgia, the drought severity also exceeded the 25-year recurrence interval. The low rainfall affected the length of time it took to fill Lake Lanier for the first time since its creation in 1950 and completion in 1956. In northwestern Georgia, the recurrence interval of the drought was between 10 and 25 years.

1976-1978: According to USGS, beginning in 1976, the weather over southwest Georgia turned towards a persistent pattern of late-summer drought including parts of the Chattahoochee Valley.

1980-1982: The 1980 to 1982 drought resulted in the lowest streamflows since 1954 in most areas, and the lowest streamflows since 1925 in others. Recurrence intervals of 10–25 years were common in most of Georgia. Pool levels at four major reservoirs receded to the lowest levels since first filling. Groundwater levels in many observation wells were lower than previously observed. Nearly continuous declines were recorded in some wells for as long as 20 consecutive months, and water levels remained below previous record lows for as long as nine consecutive months.

1985-1989: Many North Georgia residents remember the drought of 1985 to 1989 that saw Lake Lanier reach its lowest levels since it was filled in 1950. Streamflows touched the lows reached during the 1925 drought. Water-supply shortages occurred in Georgia in 1986. Shortages first occurred in a few Atlanta metropolitan systems, primarily because of large demand and small reservoir storage. As the drought continued, other systems in the southern part of the metropolitan area also had water-supply problems, as did several municipalities in northern and central Georgia. During 1986, the U.S. Army Corps of Engineers significantly decreased the release of water from Lake Lanier, but reservoir levels continued to recede to about 2 feet above the record minimum lake level. Ground-water levels in northern Georgia were significantly less than normal during the 1985 to 1989 drought, and shortages in ground-water supplies from domestic wells occurred in the northern one-third of the State.

1998-2002: From 1998 through 2002, with a brief respite in 2000-2001, North Georgia suffered through a historic drought. The term "historic," in this instance, is used by weathermen to describe a drought of unusually long duration, one of the three measures of a drought. While the regional impact of a long-term drought is massive, in North Georgia's case, the drought's effect was mitigated, simply because of technology, mostly the dams built by the Corps of Engineers and others. Earlier droughts, however, did not have the benefit of these dams and had a "historic" impact on North Georgia. Shortages of surface-water supplies similar to those during 1986 occurred in the 1998 to 2002 drought. Water shortages during the summer of 2000 prompted the Georgia Department of Natural Resources to institute statewide restrictions on outdoor water use.

2006-2009: Beginning in late 2006 another drought struck north Georgia, on the heels of the earlier 5-year drought. River levels plummeted, causing lakes to fill up more slowly when water was released. Georgia politicians battled against the Army Corps of Engineers' continuous flow requirement for Lake Lanier due to the looming water shortages. The Georgia Environmental Protection Division (EPD) declared a level four drought response across the northern third of Georgia, including Whitfield County, which prohibits most types of outdoor residential water use effective immediately.

Lake Lanier and Lake Allatoona 2007 (L to R)

2011-2012: For two years beginning in 2011, the County was impacted once again by a relatively short, but severe drought.

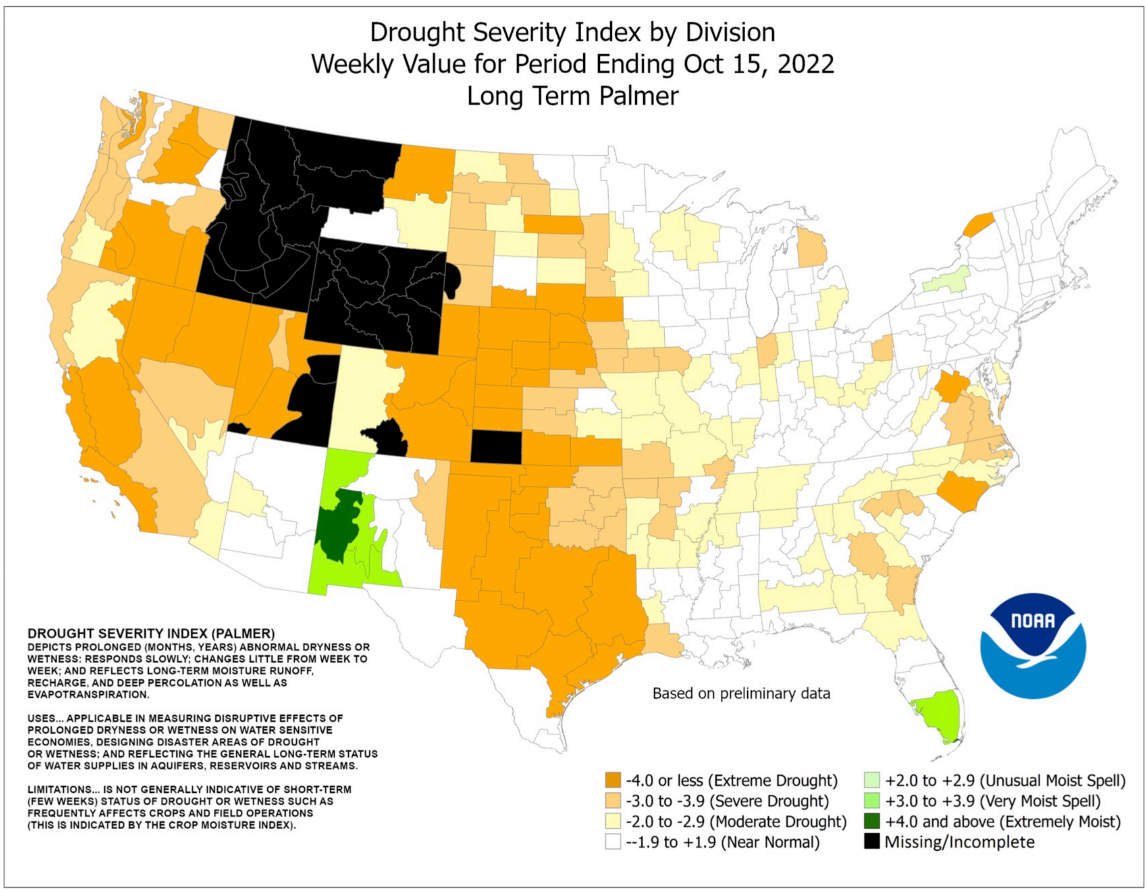
2016-2017: One of the more recent droughts began in 2016 and ended mid 2017.

Lake Blue Ridge

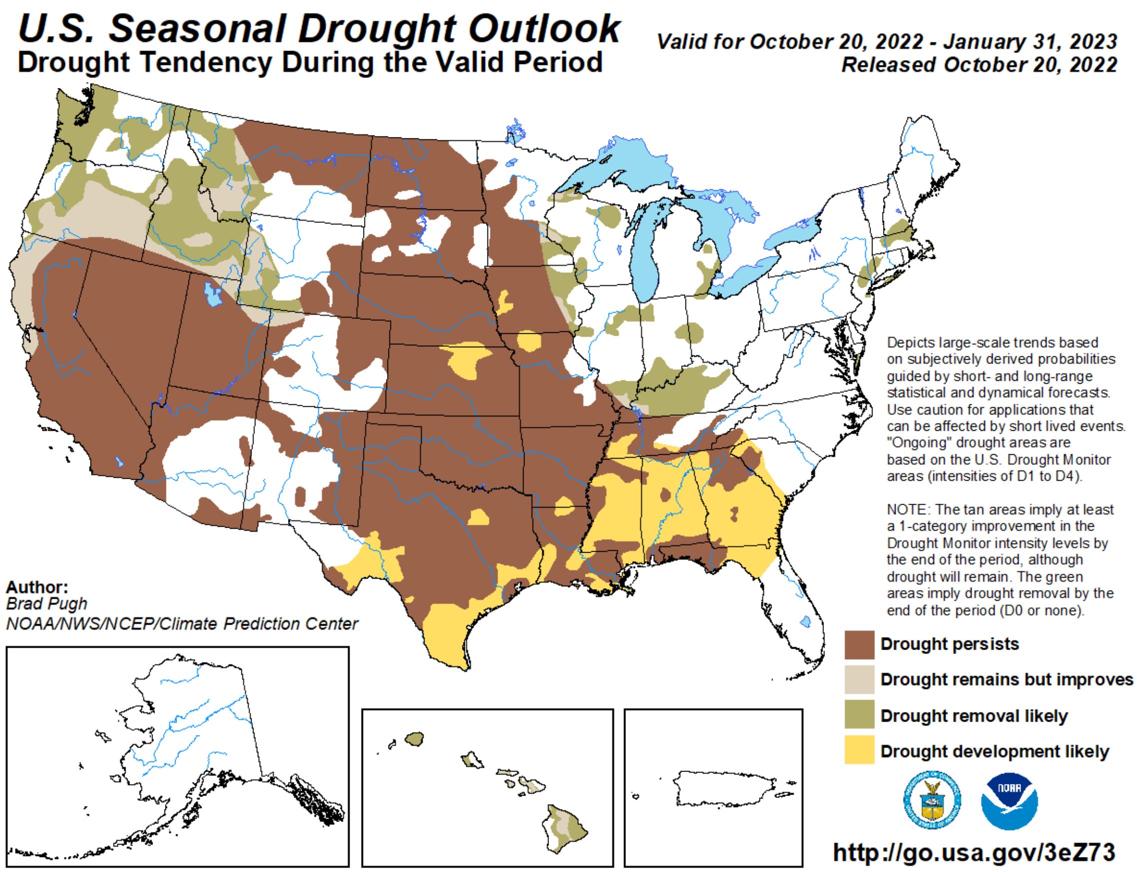
2022: At the time of this plan update, the County is experiencing moderate drought conditions which first began around the end of summer.

Agricultural crop damage during periods of drought is difficult to estimate. Water supplies, industries, power generation, agriculture, forests, wetlands, stream water quality, navigation, and recreation for the State of Georgia have been severely impacted over time. Because of the extremely unpredictable nature of drought (to include duration), reliably calculating a recurrence interval is difficult. The Hazard Frequency Table in Appendix C analyzes historical data from the past fifty years to provide a general idea of the frequency of drought within the State.

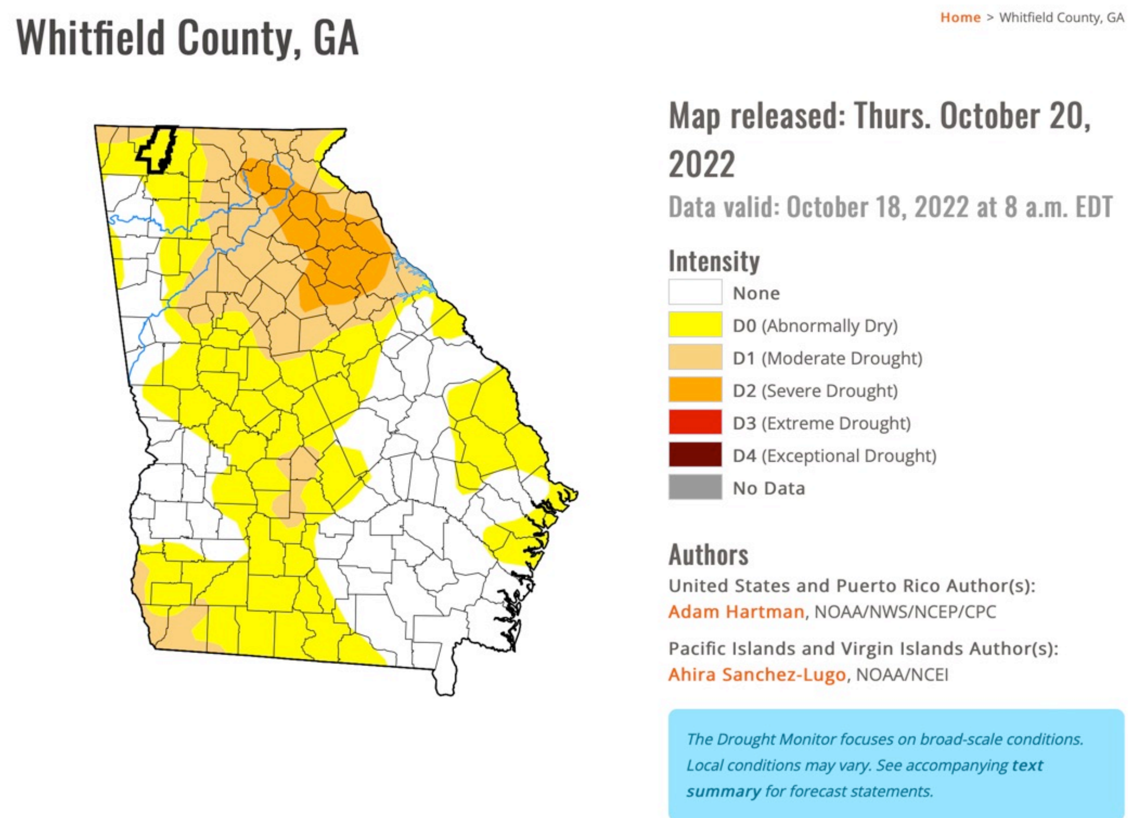
The Palmer Drought Severity Index map shows current drought conditions nationwide and is updated weekly. According to the map, the County's current drought status, as of October 15, 2022, is "moderate drought".



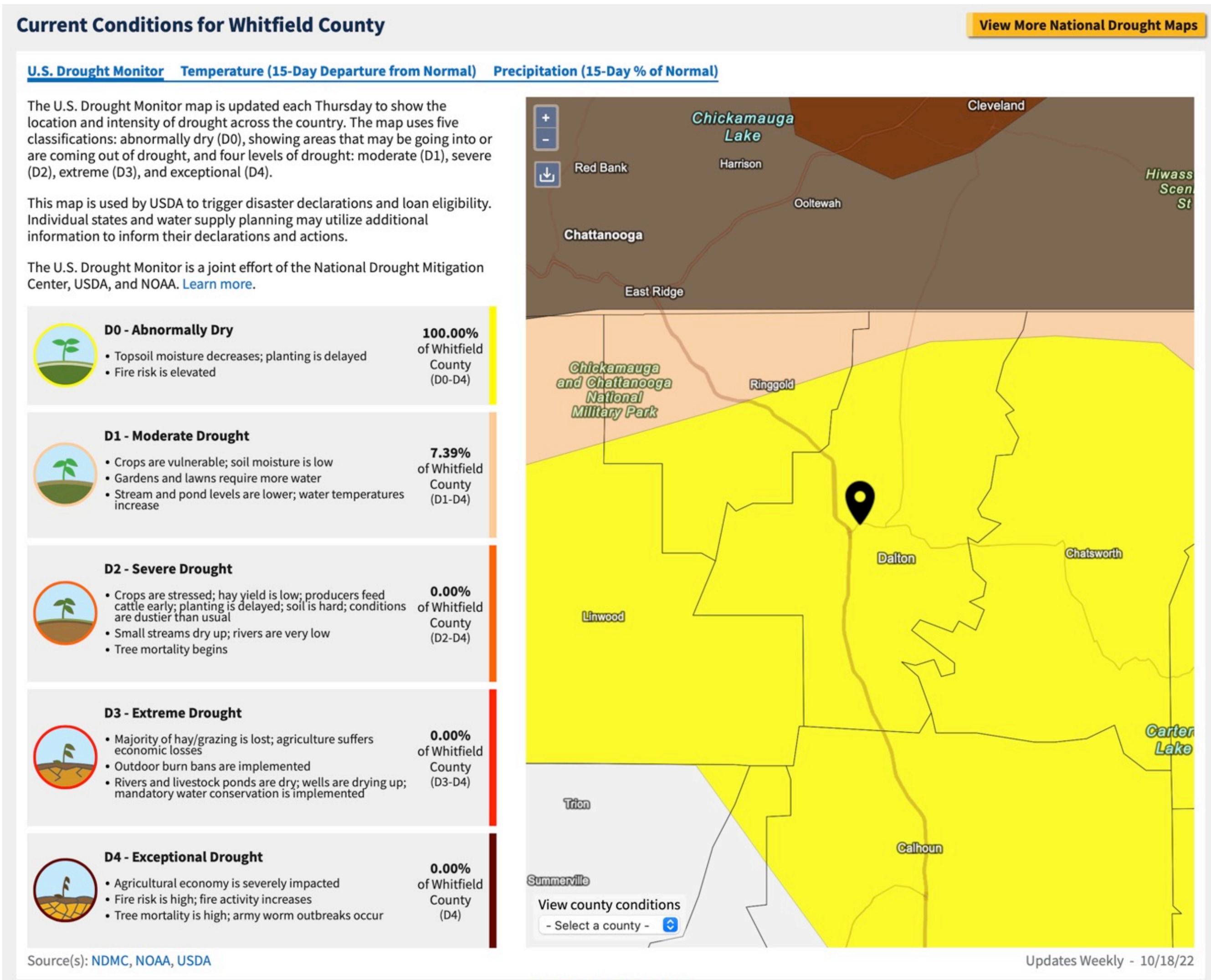
The U.S. Seasonal Drought Outlook map, forecasts likely drought conditions through January 31, 2023, which indicates that drought conditions are likely to develop and/or persist in Whitfield County within this time period.



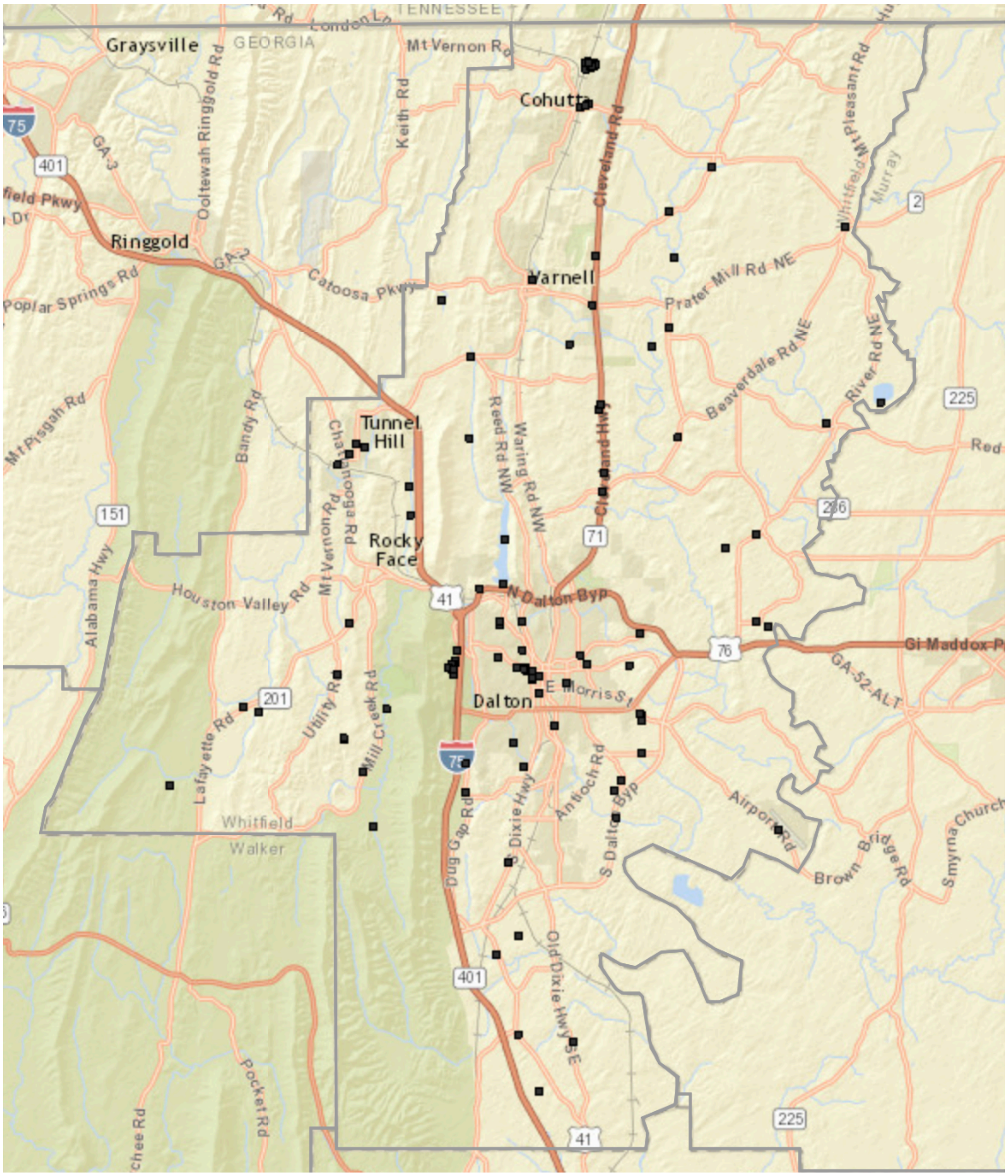
The U.S. Drought Monitor indicates that as of October 20, 2022, Whitfield County is experiencing abnormally dry conditions at this time.



According to the National Integrated Drought Information System, Whitfield County is experiencing abnormally dry conditions as of October 18, 2022. However, some portions of extreme north Whitfield County are now classified as experiencing a moderate drought. See map below.



C. Assets Exposed to Hazard – All public and private property including critical facilities are susceptible to drought since this hazard is not spatially defined. The danger of drought is compounded due to the fact that drought conditions create a heightened risk for wildfire. The GEMA map below identifies critical facilities located within the hazard area, which in the case of drought includes all areas within the County, Cities, and Towns.

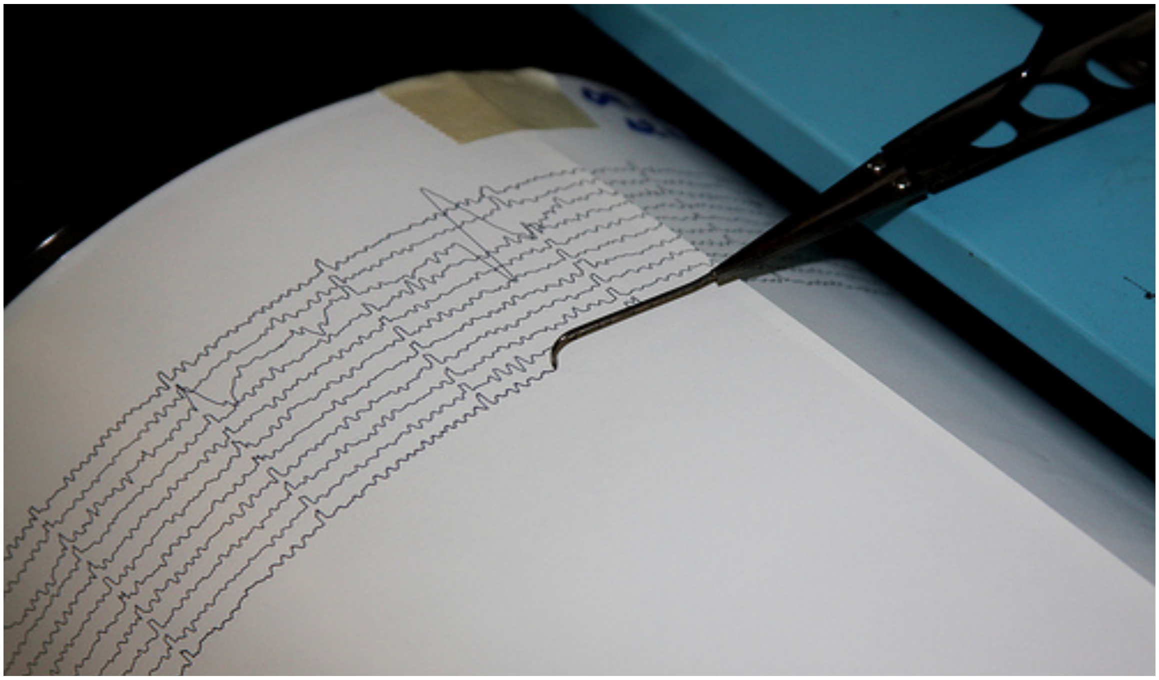


D. Estimate of Potential Losses – No damage to facilities is anticipated as a result of drought conditions, aside from the threat of wildfire. Crop damage cannot be accurately quantified due to several unknown variables: duration of the drought, temperatures during the drought, severity of the drought, rainfall requirements for specific crops and livestock, and the different growing seasons. There may also be financial losses related to water system shortages. For loss estimate information, please refer to Appendix A, the Critical Facilities Database, and Appendix D, Worksheet 3a, for each jurisdiction.

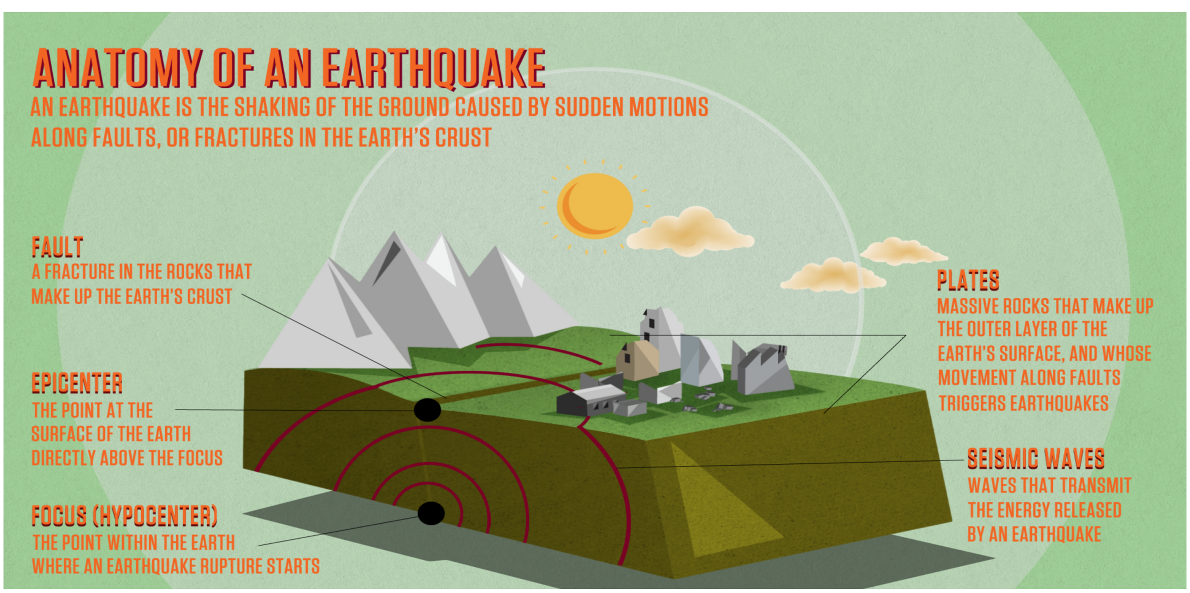
E. Multi-Jurisdictional Concerns – Agricultural losses associated with drought are more likely to occur in the rural, less concentrated areas of the County. Although the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta may be slightly less likely to experience agricultural-related drought losses than the County, they can be financially impacted by water resource-related drought losses.

F. Hazard Summary – Unlike other hazard events, drought causes damage slowly. A sustained drought can cause severe economic stress to the agricultural interests of the County and even the entire State or Region. The potential negative effects of sustained drought are numerous. In addition to an increased threat of wildfires, drought can affect water supplies, stream-water quality, water recreation facilities, hydropower generation, as well as agricultural and forest resources. The HMPC realized the limitations associated with mitigation actions for drought, but did identify some basic mitigation measures in *Chapter 5*.

2.7 Earthquakes

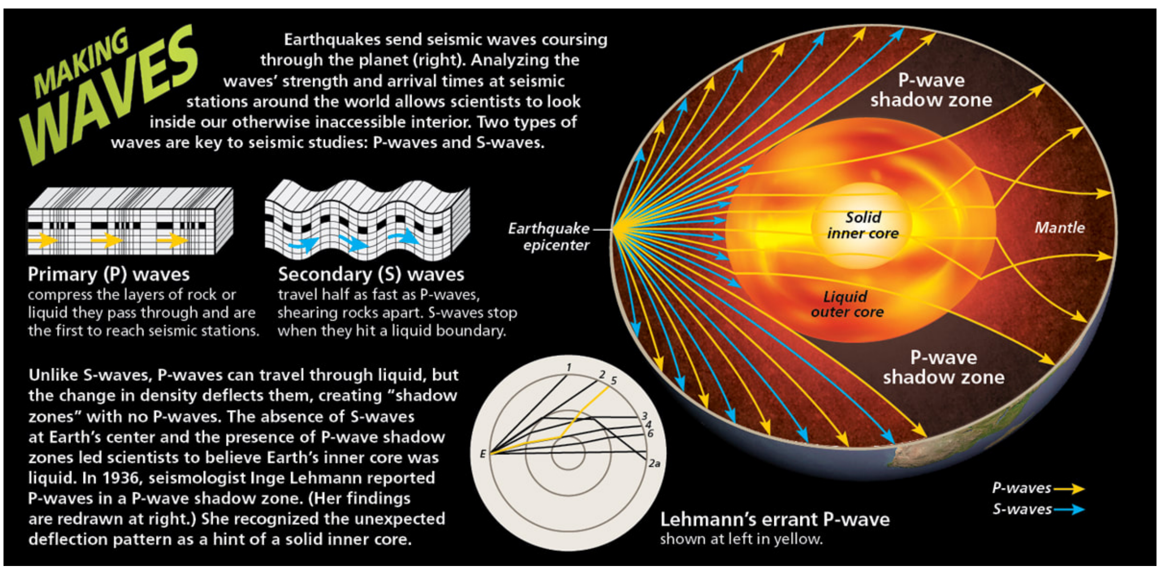


A. Hazard Identification – One of the most frightening and destructive natural hazards is a severe earthquake. An earthquake is a sudden movement of the Earth, caused by the abrupt release of strain that has accumulated over a long time. The forces of plate tectonics shape the Earth as the huge plates that form the Earth's surface slowly move over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free. If the earthquake occurs in a populated area, it may cause many deaths, injuries and extensive property damage.



The goal of earthquake prediction is to give warning of potentially damaging earthquakes early enough to allow appropriate response to the disaster, enabling people to minimize loss of life and property. The U.S. Geological Survey conducts and supports research on the likelihood of future earthquakes. This research includes field, laboratory, and theoretical investigations of earthquake mechanisms and fault zones. A primary goal of earthquake research is to increase the reliability of earthquake probability estimates. Ultimately, scientists would like to be able to specify a high probability for a specific earthquake on a particular fault within a particular year. Scientists estimate earthquake probabilities in two ways: by studying the history of large earthquakes in a specific area and the rate at which strain accumulates in the rock.

Scientists study the past frequency of large earthquakes in order to determine the future likelihood of similar large shocks. For example, if a region has experienced four magnitude 7 or larger earthquakes during 200 years of recorded history, and if these shocks occurred randomly in time, then scientists would assign a 50 percent probability (that is, just as likely to happen as not to happen) to the occurrence of another magnitude 7 or larger quake in the region during the next 50 years. But in many places, the assumption of random occurrence with time may not be true, because when strain is released along one part of the fault system, it may actually increase on another part.

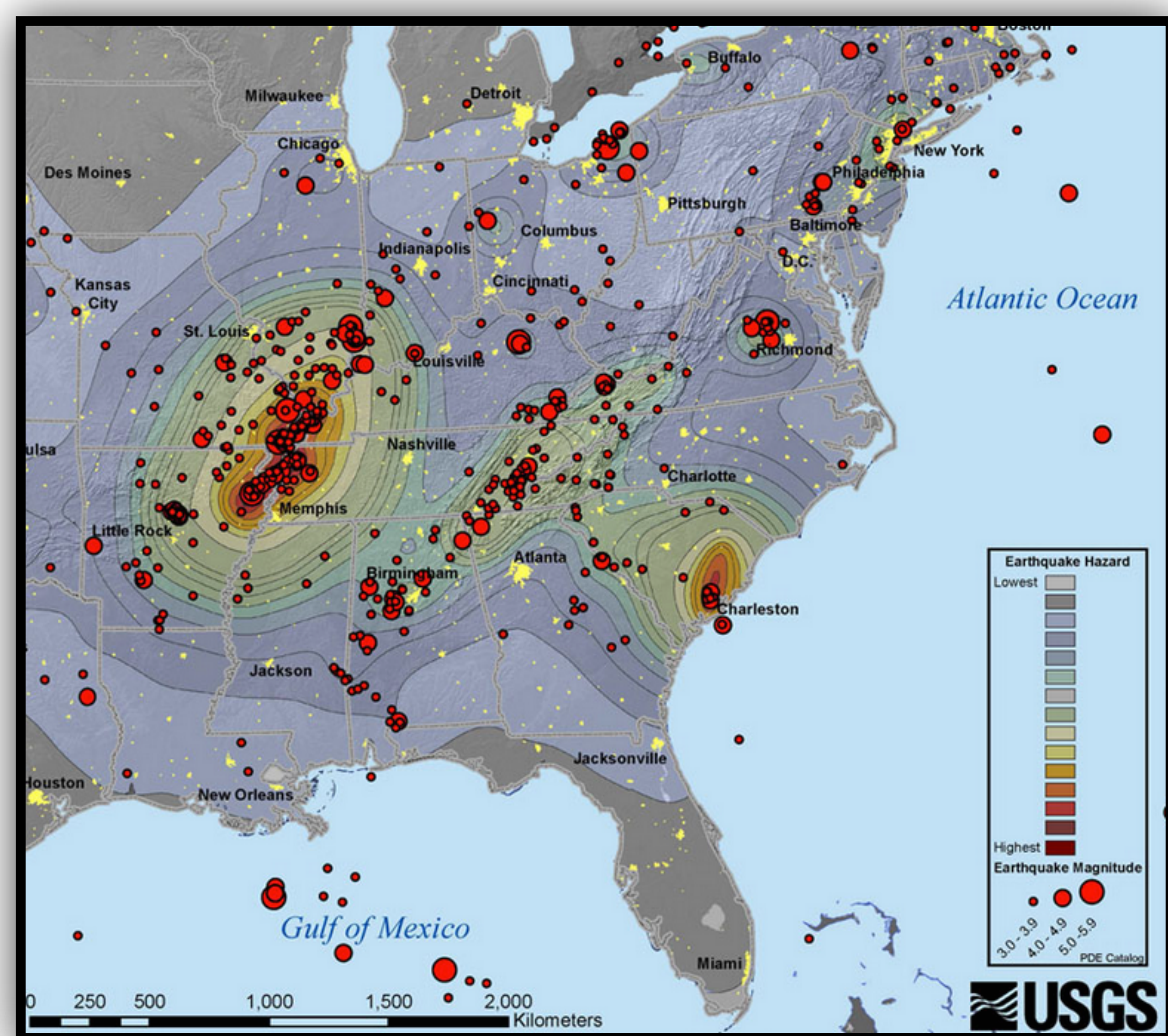


Another way to estimate the likelihood of future earthquakes is to study how fast strain accumulates. When plate movements build the strain in rocks to a critical level, like pulling a rubber band too tight, the rocks will suddenly break and slip to a new position. Scientists measure how much strain accumulates along a fault segment each year, how much time has passed since the last earthquake along the segment, and how much strain was released in the last earthquake. This information is then used to calculate the time required for the accumulating strain to build to the levels that result in an earthquake. This simple model is complicated by the fact that such detailed information about faults is rare. In the United States, only the San Andreas Fault system has adequate records for using this prediction method.

Magnitude and intensity measure different characteristics of earthquakes. Magnitude measures the energy released at the source of the earthquake and is determined from measurements on seismographs. Intensity measures the strength of shaking produced by the earthquake at a certain location and is determined from effects on people, human structures, and the natural environment. The following table compares the Richter Scale and the Modified Mercalli Intensity Scale, and describes intensities that are typically observed at locations near the epicenter of earthquakes of different magnitudes.

Richter Magnitude Scale (M)	**Modified Mercalli Intensity Scale (MMI)**	**Magnitude/Intensity felt near an earthquake epicenter**
1.0- 1.9	**I**	An M=1 is roughly equivalent to a quarry blast and can be generated by non-earthquake related events (such as a rock fall). Earthquakes of this intensity are generally not felt.
2.0-2.9	**II**	Felt by only a few people at rest, especially on the upper floors of buildings.
3.0-3.9	**III**	Felt noticeably by people indoors or on upper floors of buildings, but may not be recognized as an earthquake (similar to shaking by a passing truck, typically very short in duration).
4.0-4.9	**IV-V**	Felt noticeably by people both indoors and outdoors. Will wake some sleeping people. Walls will make cracking noises, and dishes, doors, and windows will rattle or move. Motor vehicles will rock noticeably. MMI=5 will cause unstable objects to fall or overturn; pendulum clocks may stop.
5	**VI-VII**	An M=5 earthquake is roughly equivalent to the force of a 10 kiloton nuclear blast (like Hiroshima). Earthquakes of this magnitude are felt by practically everyone. Damage is negligible in well-constructed buildings. Plaster may crack and fall; some chimneys may be broken.
6	**V11-IX**	Damage negligible in well-designed buildings. Slight to great damage to buildings and infrastructure of poor design.
7	**VIII and higher**	Well designed buildings may experience some damage. Building and bridges may shift off their foundations or partially collapse.
8	**X and higher**	Wooden building may be destroyed. Few masonry structures remain standing. Bridges destroyed; rail lines are bent.
9	**XII**	Damage total. The ground is distorted. Objects are thrown into the air.

The following USGS map provides a historical view of earthquakes in the Eastern United

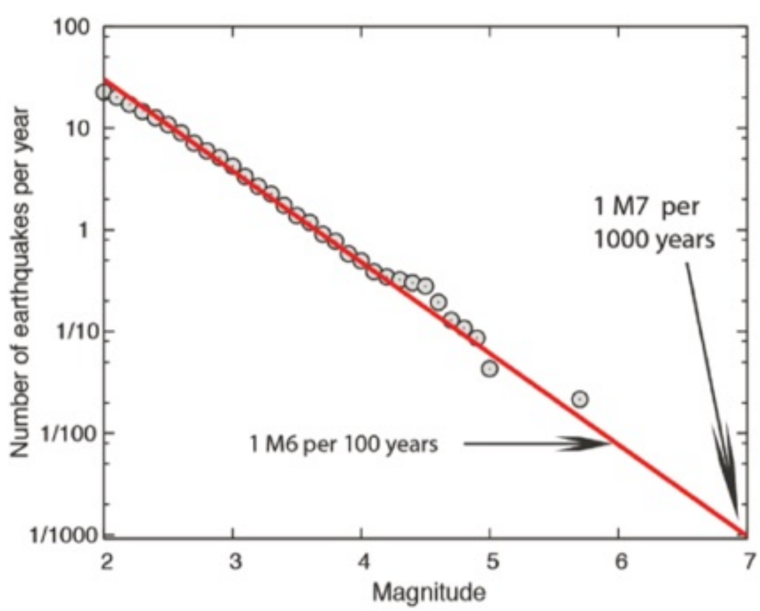


States.

B. Hazard Profile – Today, earthquakes are much more common and severe on the West Coast than they are on the East Coast. Significant earthquakes in Georgia are uncommon, which often leads to complacency over these potentially devastating events. Earthquakes that occur in the eastern U.S. are quite efficient at transmitting seismic energy over large distances. So the destruction and damage of these earthquake may be more significant than their magnitude would indicate.

Any portion of Georgia can feel the effects of an earthquake from time to time. The northern half of Georgia is the most seismically active, particularly in the most northwestern counties. Seismic activity in northwest Georgia is frequent by the standards of the State, but damage from this activity is usually minor or moderate at worst. The area usually experiences one magnitude 4.0 earthquake about every 5 to 10 years. This typically involves a startling vibration what may rock objects off shelves or crack some plaster, but does not involve devastating destruction.

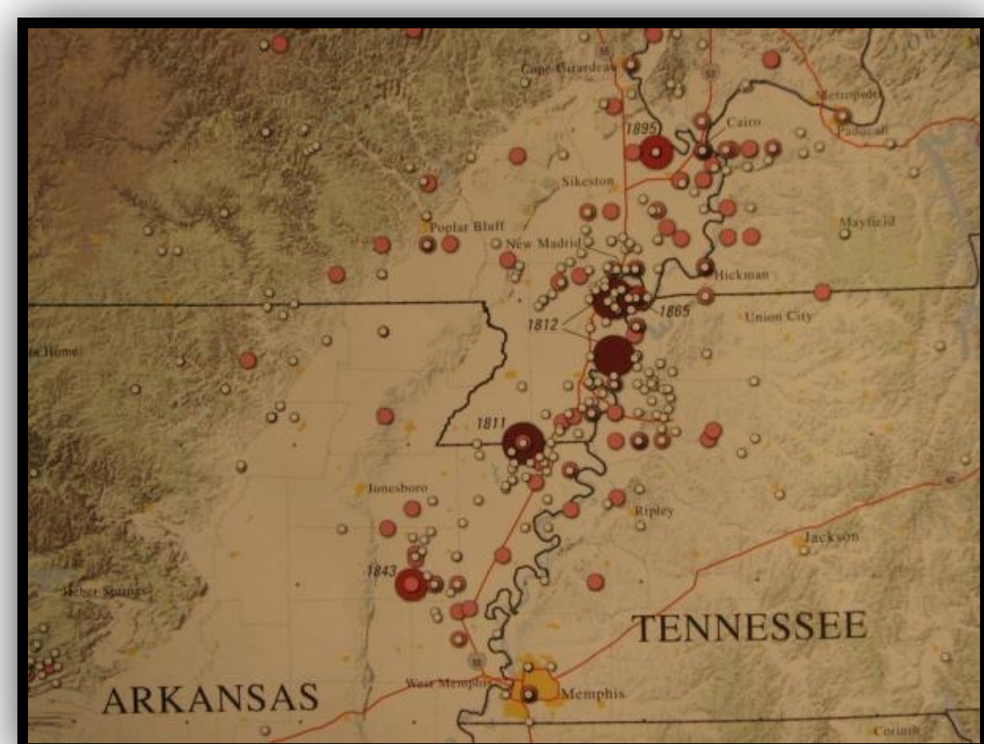
The greatest earthquake threat to the State of Georgia is most likely a repeat of a major earthquake outside of its borders. Both the great Charleston earthquake of 1886 and the New Madrid earthquakes of 1811-1812 caused the greatest damage within Georgia of any other known earthquakes on record. Damages included toppled chimneys, broken windows, cracked plaster, and other similar damage. Due to population growth, a similar earthquake today would have the potential to be much more devastating. On average, these major earthquakes have the potential to occur about once every 100 years in the eastern U.S.



Using the earthquakes recorded in and around Georgia since 1962 the long-term estimated return period of larger earthquakes can be estimated. A magnitude 6 is expected about every 100 years and a magnitude 7 about every 1000 years. See graph above.

Significant and/or recent earthquakes that impacted Georgia

1811-1812: The first earthquakes recorded as being felt in Georgia were the great New Madrid earthquakes of 1811-1812 (also known as the Mississippi River Valley earthquakes) centered in northeast Arkansas and New Madrid, Missouri. There were hundreds of earthquakes during the two month period between December 16, 1811 and February 7, 1812. On the basis of the large area of damage (600,000 square kilometers), the widespread area of perceptibility (5,000,000 square kilometers), and the complex physiographic changes that occurred, this series of earthquakes rank as some of the largest in the United States since its settlement by Europeans. The area of strong shaking associated with these shocks is two to three times larger than that of the 1964 Alaska earthquake and 10 times larger than that of the 1906 San Francisco earthquake. The first three major earthquakes occurred in northeast Arkansas on December 16, 1811 (three shocks - Mfa 7.2/MSn 8.5; Mfa 7.0/MSn 8.0; and MSn 8.0). There were six aftershocks on December 16th and 17th alone in the range of M5.5 to M6.3 (Note: aftershocks actually *are* earthquakes). The fourth earthquake occurred in Missouri on January 23, 1812 (Mfa 7.1/MSn 8.4). The fifth earthquake occurred in New Madrid, Missouri on February 7, 1812 (Mfa 7.4/ MSn 8.8). This is the earthquake that created Reelfoot Lake, located in northwest Tennessee. It was reported to have been formed as the Mississippi River flowed backward for 10–24 hours to fill the lake. As a result of this earthquake, the original town of New Madrid now lies under the Mississippi River.



This accounted for a total of five earthquakes of magnitude MSn 8.0 or higher occurring in a period of 54 days. The first earthquake caused only slight damage to man-made structures, mainly because the region was so sparsely populated. However, as the earthquakes continued, they began to open deep cracks in the ground, created landslides on the steeper bluffs and hillsides, large areas of land were uplifted, and sizable sink areas were created. These five main earthquakes, and several aftershocks, were felt over almost all of the eastern United States including the State of Georgia. In Georgia this series of earthquakes was strong enough to have shaken bricks from chimneys and other minor damage.

August 31, 1886: The great Charleston, South Carolina, earthquake of 1886 killed approximately 60 people. The magnitude 7.3 earthquake is the most damaging earthquake on record to occur in the southeastern U.S. and one of the largest historic shocks in the eastern U.S. It damaged or destroyed many buildings in the old city of Charleston. Property damage was estimated at $5-$6 million. Structural damage was reported several

hundred kilometers from Charleston including in the State of Georgia. On August 31, 1886 at 9:25 pm, preceded by a low rumble, the shock waves reached Savannah. People had difficulty remaining standing. One woman died of fright as the shaking cracked walls, felled chimneys, and broke windows. Panic at a revival service left two injured and two more were injured in leaping from upper story windows. Several more were injured by falling bricks. Ten buildings in Savannah were damaged beyond repair and at least 240 chimneys damaged. People spent the night outside. At Tybee Island light station the 134 foot lighthouse was cracked near the middle where the walls were six feet thick, and the one-ton lens moved an inch and a half to the northeast. In Augusta, the shaking was the most severe (VIII on the Modified Mercalli scale) in the State. An estimated 1,000 chimneys and many buildings were damaged. The business and social life was paralyzed for two days. Brunswick and Darien were affected as well.

June 17, 1872: An earthquake on June 17, 1872 in Milledgeville, GA and had an intensity of at least V on the Modified Mercalli scale, the lowest intensity in which some damage may occur. It was reported as a sharp shock, jarring brick buildings and rattling windows.

November 1, 1875: On November 1, 1875, at 9:55 in the evening, an intensity VI earthquake occurred near the South Carolina border. It was felt from Spartanburg and Columbia, South Carolina, to Atlanta and Macon, Georgia, from Gainesville to Augusta, and generally over an area of 25,000 square miles.

October 18, 1902: A more local event occurred on October 18, 1902, with a sharp shock felt along the east face of Rocky Face Mountain, just west of Dalton, GA with intensity VI and at LaFayette, GA with intensity V. The earthquake was felt over an area of about 1500 square miles including Chattanooga, Tennessee.

January 23, 1903: The Savannah, GA area was shaken with an intensity VI earthquake on January 23, 1903. Centering near Tybee Island, it was felt over an area of 10,000 square miles including Savannah (intensity VI), Augusta (intensity III), Charleston (intensity IV-V), and Columbia (intensity III-IV). Houses were strongly shaken.

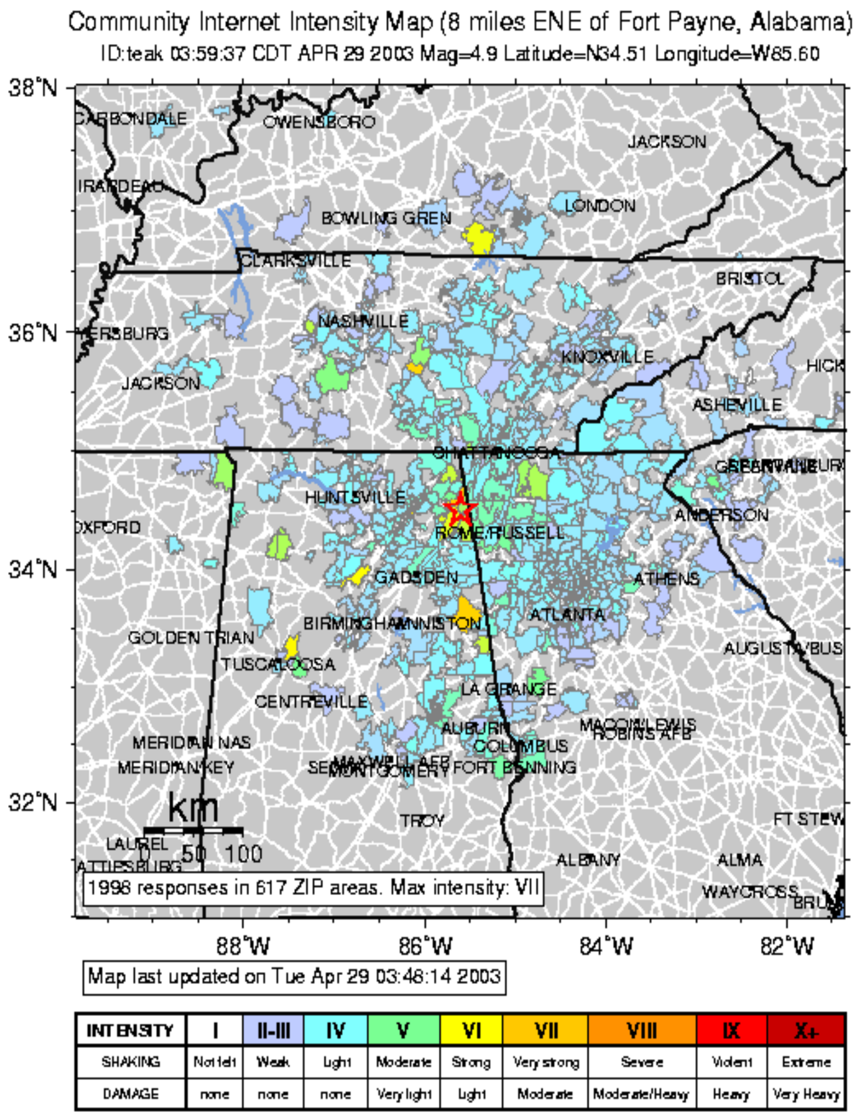
June 20, 1912: Another shock was felt on June 20, 1912, at Savannah with intensity V.

March 5, 1914: According to USGS, Georgia experienced another earthquake on March 5, 1914. Magnitude 4.5.

March 5, 1916: On March 5, 1916, an earthquake centered 30 miles southeast of Atlanta was felt over an area of 50,000 square miles, as far as Cherokee County, North Carolina, by several people in Raleigh, and in parts of Alabama and Tennessee.

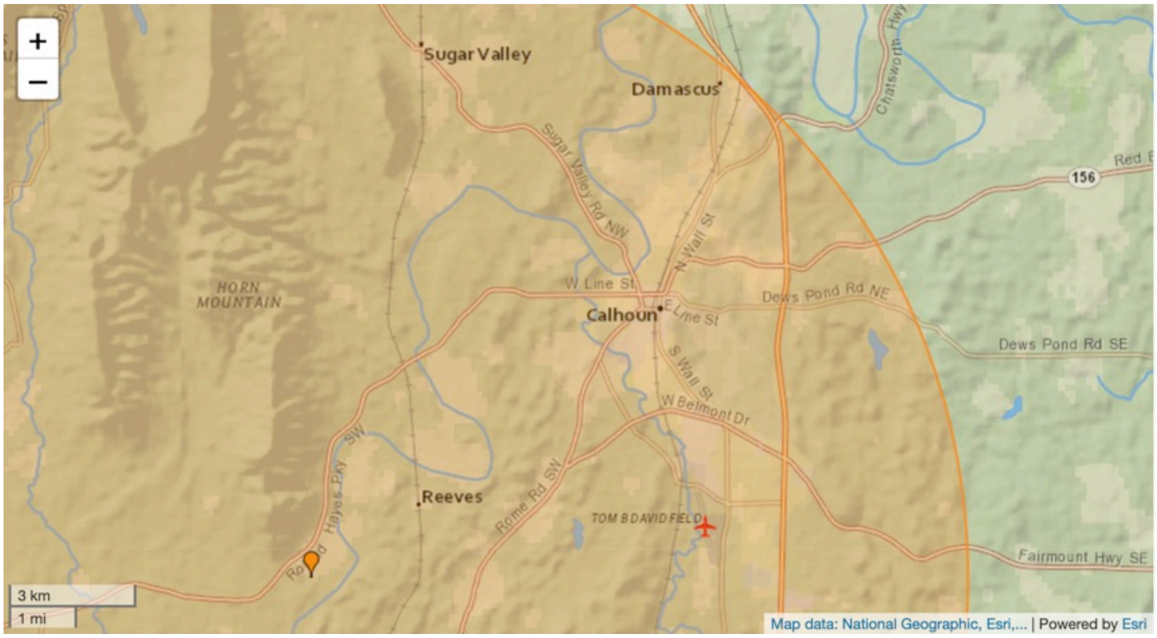
March 12, 1964: An earthquake of intensity V or over occurred on March 12, 1964, centered near Haddock, GA less than 20 miles northeast of Macon. Intensity V was recorded at Haddock while shaking was felt in four counties over a 400-square-mile area.

April 29, 2003: On April 29, 2003 just before 5:00 a.m. a moderate earthquake, rated 4.9 on the Richter Scale, shook most of the northwest corner of Georgia, south to Atlanta. The epicenter was located in Menlo, GA, about 37 miles south of Chattanooga. See map to right.



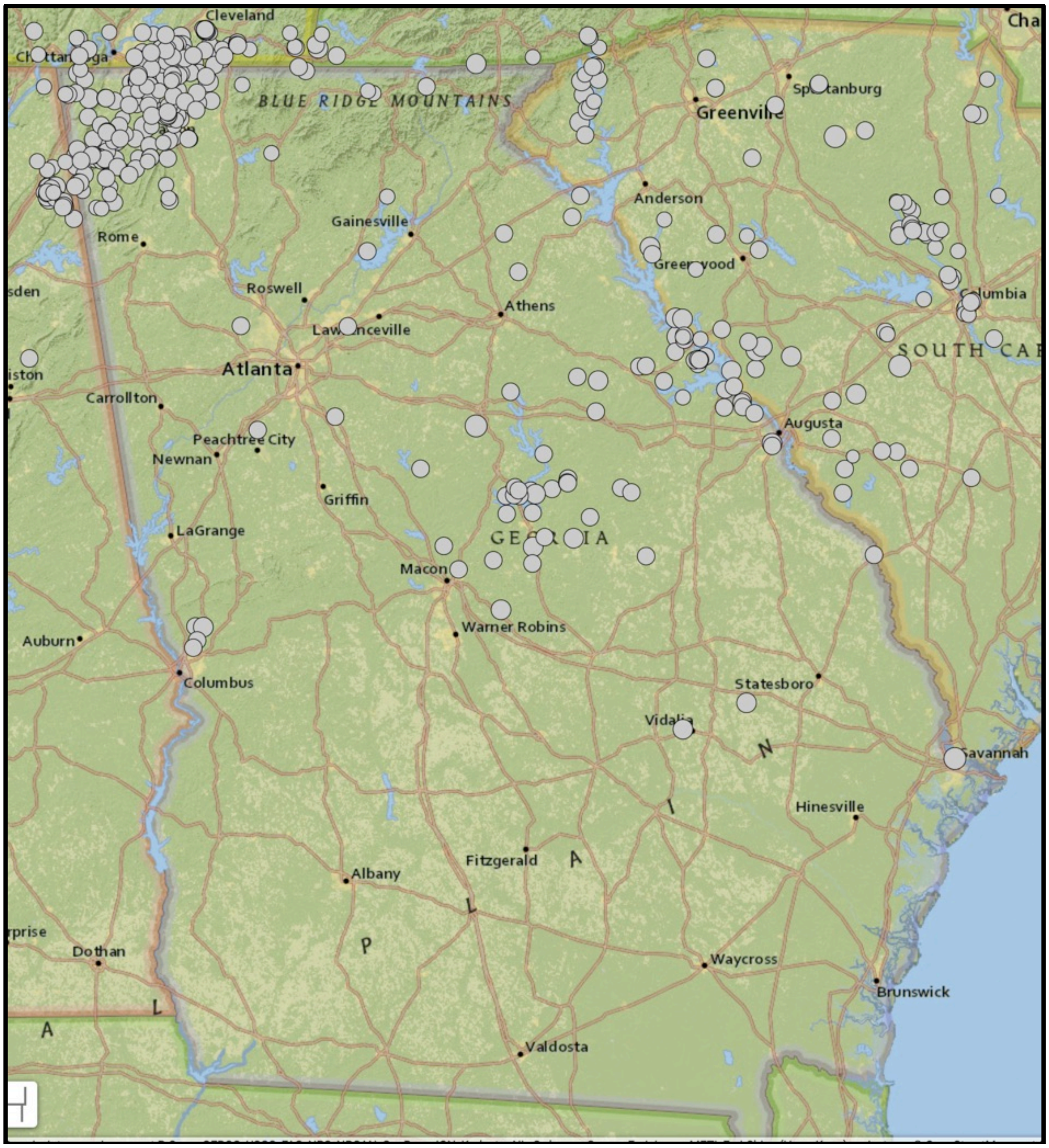
August 23, 2011: On August 23, 2011 at 1:51pm, a 5.8 magnitude earthquake originated near Louisa and Mineral, Virginia. It struck Washington DC (about 100 miles away from epicenter) causing moderate shaking and potentially significant damage. The earthquake was recorded all along the Appalachians, from Georgia to New England. The earthquake was felt so widely because it was a shallow earthquake, and geologic conditions in the eastern U.S. allow the effects of earthquakes to propagate and spread much more efficiently than in the western United States. Only mild movement was felt in Whitfield County.

December 21, 2018: On November 5, 2019 at 4:02am, a 1.9 magnitude earthquake originated 10km southwest of Calhoun, GA. See the map below.

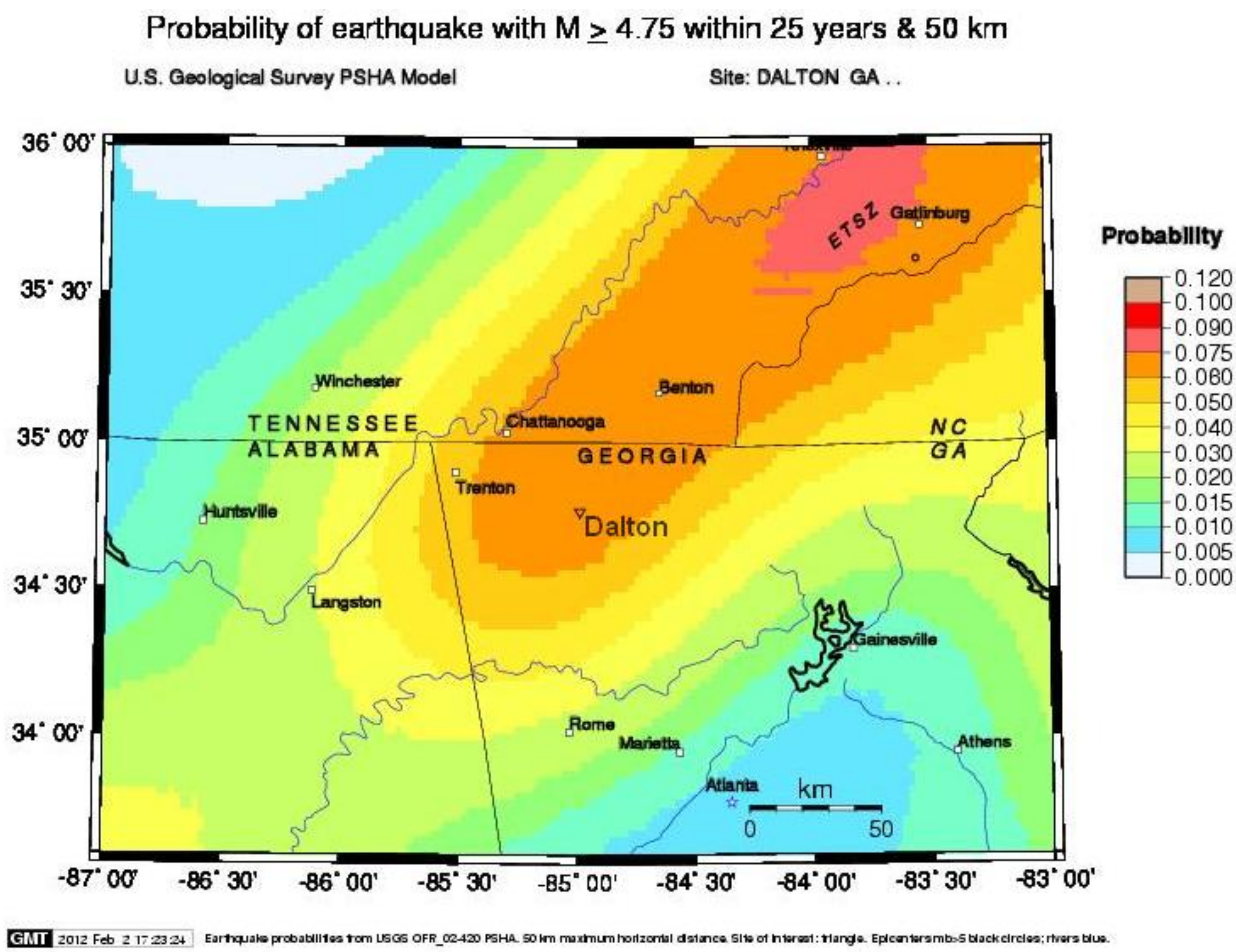


In researching earthquake history for this Plan, two problems have greatly limited the ability to develop concise technical data regarding the number of and magnitude of earthquakes that would have impacted Whitfield County. The first is that beyond the past couple of decades, record keeping for minor earthquakes in this area was quite limited. The second is the difficulty in determining which earthquakes should be counted. Earthquakes from many states away that are “felt” but cause no damage sometimes merit mention, but are not truly a hazard event for the County. Likewise, very minor earthquakes nearby that are inconsequential and cause very little or no damage are also not truly considered hazard events by the County. For the purposes of this plan many of these types of unimpactful earthquakes might be compared to snow flurries (vs. winter storm) or minor thunderstorm (vs. severe thunderstorm). Sure, they demonstrate that the potential for a true hazard exists, but the events themselves are not hazards. In summary, the HMPC has concluded that, while many minor or distant earthquakes may be felt in the County, the true earthquake threat is probably more straightforward. It is likely the major earthquake that occurs once every hundred plus years. With that in mind, the examples of earthquakes shown on previous pages do not represent an all-inclusive list. They simply represent some of the more historic and/or recent earthquakes that had an impact, however minor, on Whitfield County.

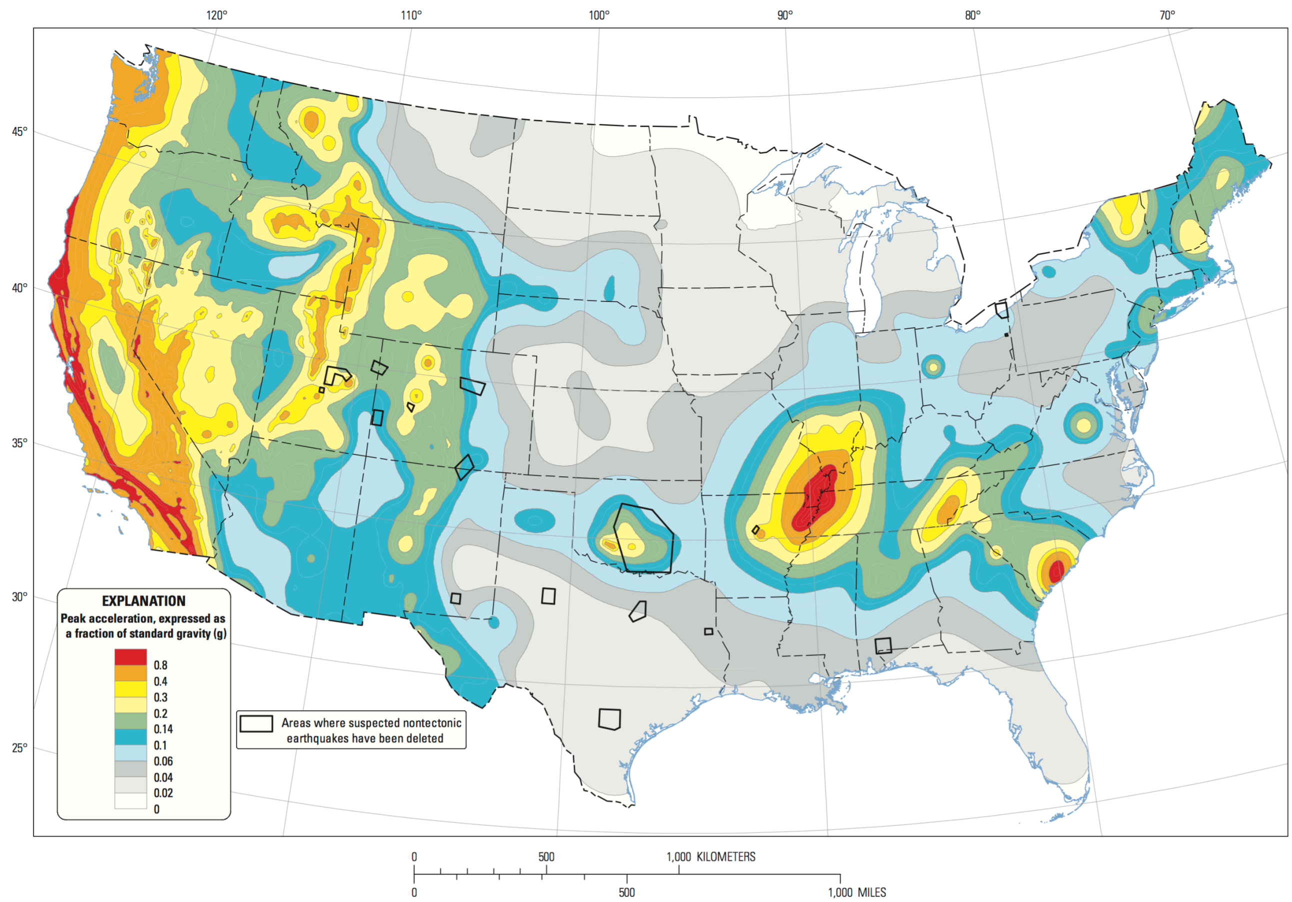
Seismic activity for the State of Georgia is shown on the following USGS map for the period 1900 to present.



Based on U.S. Geological Survey estimations using the earthquake frequency method described in the section above, the probability of an earthquake of a magnitude over 5.0 within Whitfield County over the next 25 years is between 6% and 7.5% (see map below). As discussed above, such predictions are based on limited information, and cannot necessarily be relied upon for their precision. However, they do help demonstrate that the threat of earthquakes cannot be overlooked especially in the northwestern portions of Georgia.



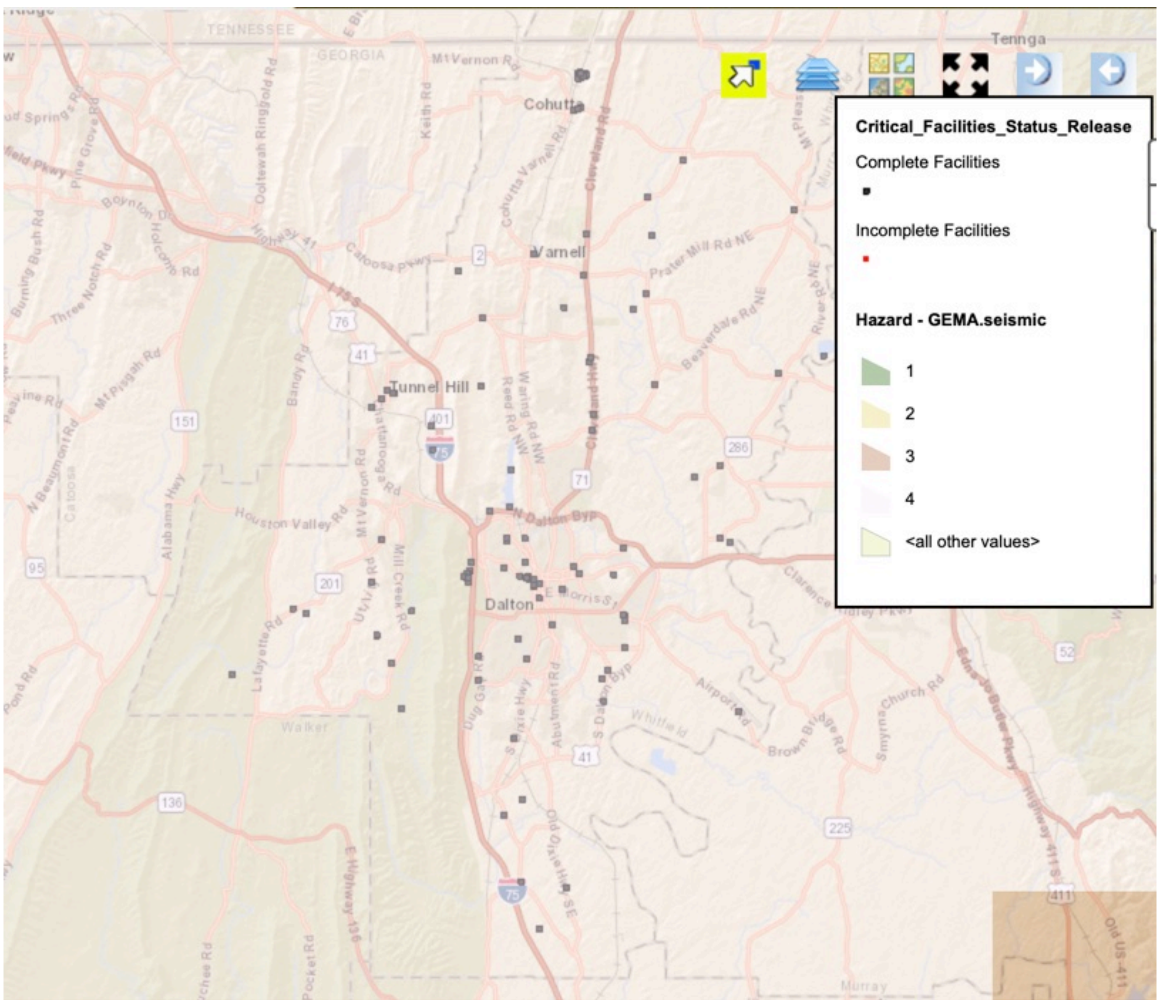
The 2014 U.S. Geological Survey (USGS) National Seismic Hazard Maps, including the one on the following page, display earthquake ground motions for various probability levels across the United States and are applied in seismic provisions of building codes, insurance rate structures, risk assessments, 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. The new probabilistic hazard maps represent an update of the seismic hazard maps; previous versions were developed by Petersen and others (2008) and Frankel and others (2002), using the methodology developed Frankel and others (1996). Algermissen and Perkins (1976) published the first probabilistic seismic hazard map of the United States which was updated in Algermissen and others (1990).



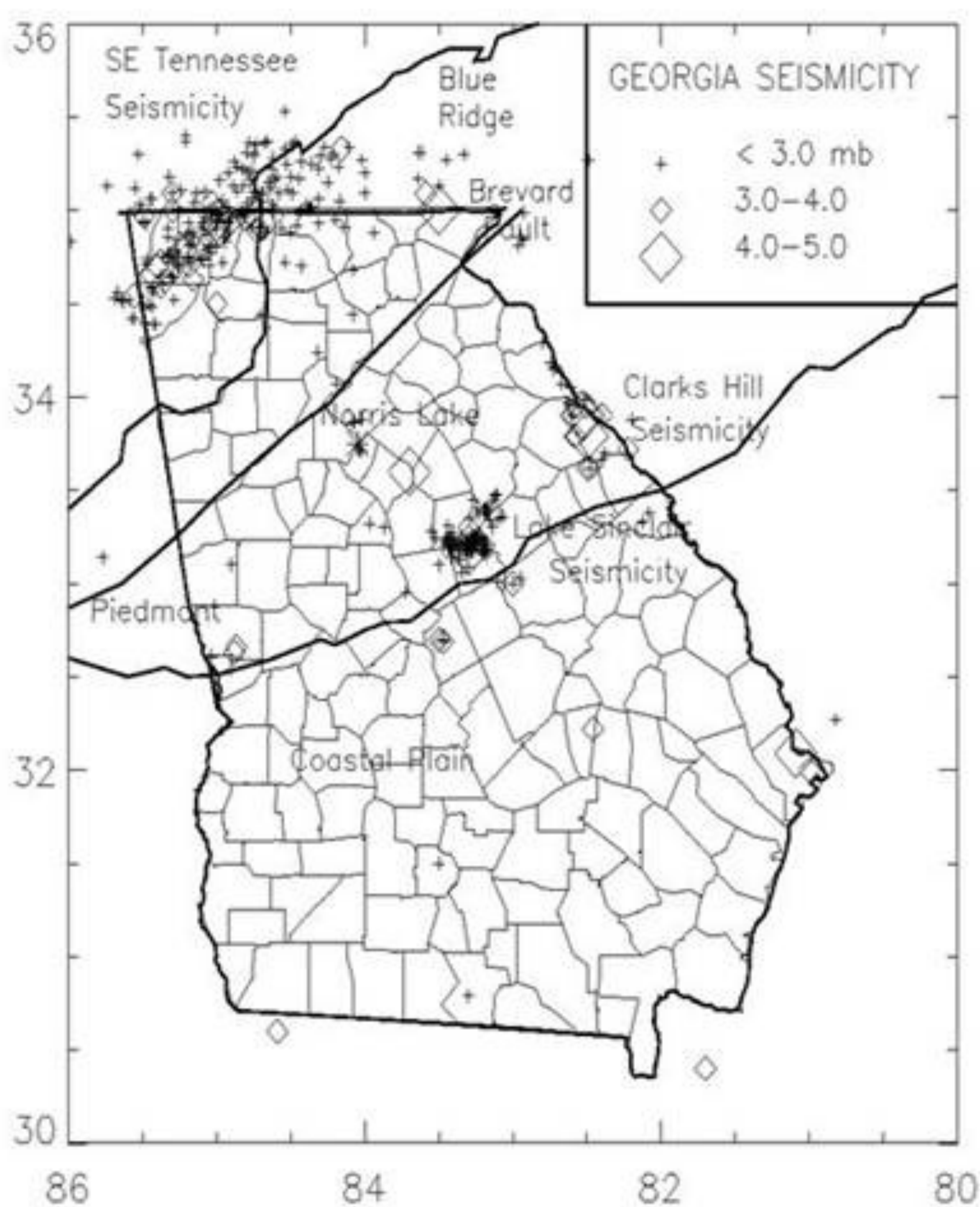
Two-percent probability of exceedance in 50 years map of peak ground acceleration

C. Assets Exposed to Hazard - All structures and facilities within Whitfield County are susceptible to earthquake damage since they can occur in any portion of the County or City. The likelihood of an earthquake in Whitfield County and the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta ranges from moderate to high.

The seismic hazard layer used in the map that follows is based on the USGS Probabilistic Seismic Hazard Map, showing the percentage of gravity that the area has a 2 percent probability of exceedance in 50 years. The score classification reflects that used by the IRC Seismic Design Categories. The horizontal positional accuracy is unknown for this layer. All areas of the County and each of the municipalities are located within Seismic Threat Category 4, "highest threat".



Georgia has a few large faults, including the Blue Ridge fault. The Blue Ridge fault extends from Alabama through Georgia and into Tennessee. The fault runs across the northwest corner of Georgia. This region of Georgia is the most seismically active in the State. Whitfield County is located directly in this active area.



D. Estimate of Potential Losses – For loss estimate information, please refer to Appendix A, the Critical Facilities Database, and Appendix D, Worksheet 3a, for each jurisdiction.

E. Multi-Jurisdictional Concerns – All of Whitfield County has the potential to be affected by earthquakes. The threat appears to be moderate and fairly uniform throughout the County, Cities, and Towns. Any steps taken to mitigate the effects of earthquake will be undertaken on a countywide basis and include the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta.

F. Hazard Summary – Scientific understanding of earthquakes is of vital importance to the Nation. As the population increases, expanding urban development and construction works encroach upon areas susceptible to earthquakes. With a greater understanding of the causes and effects of earthquakes, we may be able to reduce damage and loss of life from this destructive phenomenon. The HMPC was limited in its ability to develop mitigation measures associated with earthquakes, but did provide some guidance in *Chapter 5*.

2.8 Landslides

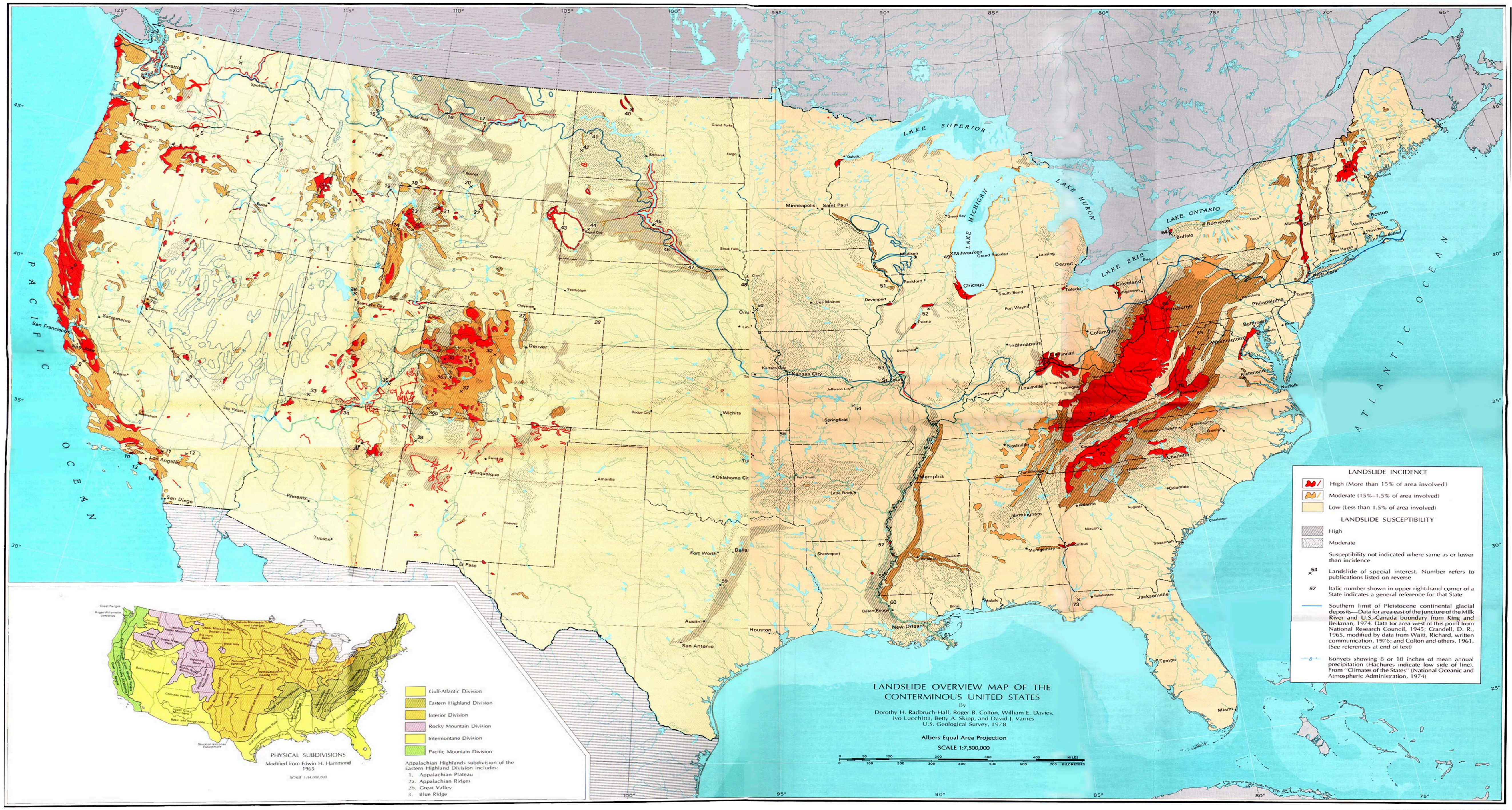
A. Hazard Identification – Landslides occur in every U.S. state and territory. In a landslide, masses of rock, earth, or debris move down a slope. Landslides can be small, large, slow or rapid. They can be activated by storms, earthquakes, volcanic eruptions, fires, freeze/thaw cycles, and steep-slope erosion. Landslides are often more damaging and deadly than the triggering event. The dangerous conditions may be high even as emergency personnel are providing rescue and recovery services. Landslide problems can be caused by land mismanagement, particularly in mountain, canyon and coastal regions. In areas burned by forest and brush fires a lower threshold of precipitation may initiate landslides. Land-use zoning, professional inspections, and proper design can minimize many landslide, mudflow, and debris flow problems.

B. Hazard Profile – Landslides are a threat to Whitfield County. Steep slopes, combined with the potential for wildfires increase the probability of a landslide occurring in Whitfield County within any given year. Though the HMPC did not find specific records detailing landslides within the County, it was determined that this threat should be included in the risk assessment.

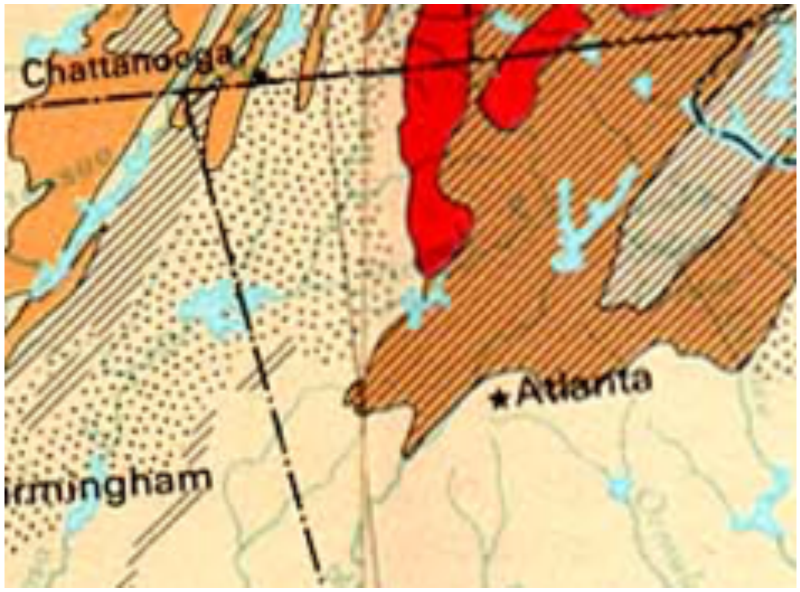
The accompanying map below is a preliminary digital version of Geological Survey Professional Paper 1183, Landslide Overview Map of the Conterminous United States, by Dorothy H. Radbruch-Hall, Roger B. Colton, William E. Davies, Ivo Lucchitta, Betty A. Skipp, and David J. Varnes, 1982. This map and the original delineate areas where large numbers of landslides have occurred and areas which are susceptible to landsliding in the conterminous United States. There is no updated version of this USGS map as of the date of this plan and it is believed to be the best available information at this time.

<u>Landslide Overview Map of the Conterminous United States</u>

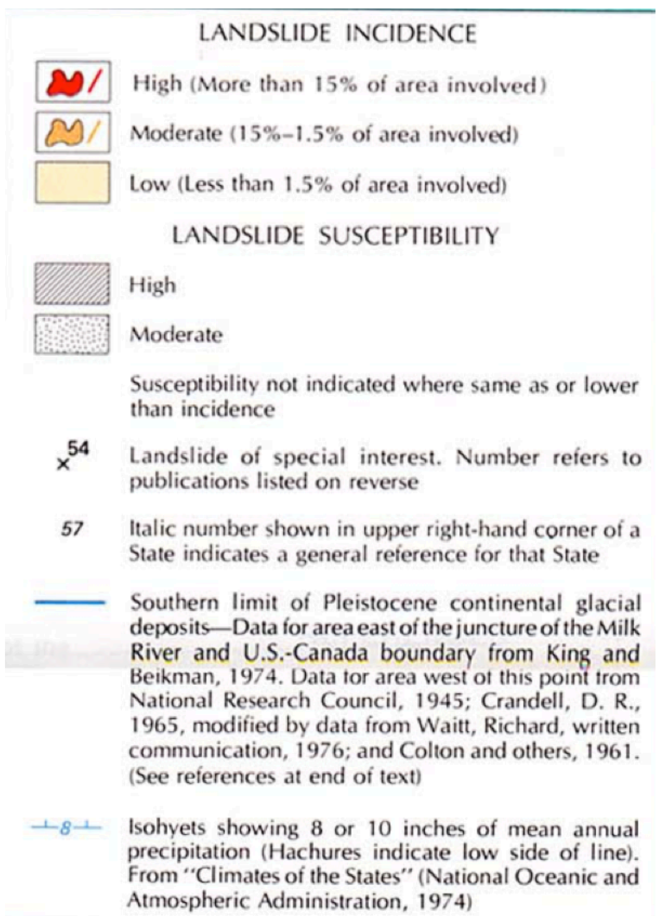
United States Geological Survey — Department of the Interior



Closer view of Northwest Georgia section of map:



Legend



Notes on the methods used to compile map:

In compiling the original map, the authors considered landslides to be any downward and outward movement of earth materials on a slope. Not included in the compilation were talus deposits, deposits resulting from ancient landslides not related to present slopes, large gravitational thrust sheets, solifluction deposits, snow avalanches, and debris deposited by flows that contribute to alluvial fans in arid regions. Individual landslides could not be shown at this scale. The map was prepared by evaluating formations or groups of formations shown on the geologic map of the United States (King and Beikman, 1974) as being of high, medium, or low susceptibility to landsliding and classified the formations as having high, medium, or low landslide incidence (number of landslides). Susceptibility to landsliding was defined as the probable degree of response of the areal rocks and soils to natural or artificial cutting or loading of slopes or to anomalously high precipitation. High, medium, and low susceptibility are delimited by the percentages given below for classifying the incidence of landsliding. Susceptibility is not indicated where lower than incidence. The effect on slope stability caused by earthquakes was not evaluated, although many catastrophic landslides have been generated by ground shaking during earthquakes. Areas susceptible to ground failure under static conditions would probably also be susceptible to failure during earthquakes. In areas of continental glaciation, additional data were used to identify surficial deposits that are susceptible to slope movement The map units were classified into three incidence categories according to the percentage of the area involved in landslide processes. Area involved in landsliding Incidence >15% High 1.5-15% Medium <1.5% Low. Published data were used whenever possible for the original map. In many places, the percentage of a formation involved in landsliding, as shown on large-scale published maps, was determined by counting squares of a superimposed grid. Formations shown on the large-scale maps were then correlated with geologic units on the geologic map of the United States. Aerial photography, newspaper accounts, fieldwork, and other published data were used in other areas. For many parts of the country, however, particularly for parts of the Western United States, information on landslides and their relation to geologic conditions is sparse. Data from the relatively small number of geologic maps and reports that give detailed information on slope stability in scattered places, were therefore extrapolated as accurately as possible into adjacent areas. Although both slope angle and precipitation influence slope stability, full weight was not given to these factors in preparing the original map. At that time no slope map or detailed precipitation map existed at a suitable scale for the entire United States. The susceptibility categories are largely subjective because insufficient data were available for precise determinations. Where source maps show slope movement for one part of a geologic unit but not for others, it is generally unknown whether the absence of recorded landslides indicates a difference in natural conditions or simply a scarcity of information on landslides for those parts of the unit. Generally, the authors assumed that anomalous precipitation or changes in existing conditions can initiate landslide movement in rocks and soils that have numerous landslides in parts of their outcrop areas. Because the map is highly generalized, owing to the small scale and the scarcity of precise landslide information for much of the country, it is unsuitable for local planning or actual site selection.

C. Assets Exposed to Hazard – In evaluating assets that are susceptible to landslides, the HMPC determined that any public and private property located in the vicinity of Whitfield County's steep slopes is susceptible to landslides, including critical facilities. In addition, any portion of the County, Cities, and Towns can be negatively impacted in the event a landslide blocks a road or highway preventing public safety response.

D. Estimate of Potential Losses – Landslide losses are difficult to estimate due to their unpredictable nature. For available loss estimate information, please refer to the Critical Facilities Database (Appendix A).

E. Multi-Jurisdictional Concerns – Due to topography, many portions of Whitfield County and the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta can be negatively impacted by landslides. There are also many portions of the County and municipalities that are located within "high incidence" and "high susceptibility" zones for landslides. Therefore, any mitigation steps taken related to these weather events will be pursued on a countywide basis and include all jurisdictions.

F. Hazard Summary – Though not very common, landslide events do pose a threat to Whitfield County in terms of property damage, injuries and loss of life. Specific mitigation actions related to these weather events are identified in *Chapter 5*.

Chapter 3
Local Technological/Biological Hazard, Risk and Vulnerability (HRV) Summary

The Whitfield County Hazard Mitigation Planning Committee (HMPC) has also included information relating to technological/biological hazards into this plan. The term, "technological hazard" refers to incidents resulting from human activities such as the manufacture, transportation, storage, and use of hazardous materials, or perhaps the failure of a manmade structure. The term, "biological hazard", also known as a biohazard, is an organism or a by-product from an organism that is harmful or potentially harmful to other living things, primarily human beings. Common types of biological hazards include bacteria, viruses, medical waste and toxins that were produced by organisms. This would include pandemics.

Unfortunately, the information relating to technological/biological hazards is much more limited, due largely to the very limited historical data available. This causes a greater level of uncertainty with regard to mitigation measures. However, enough information has been gathered to provide a basic look at technological/biological hazards within Whitfield County.

The Whitfield County Hazard Mitigation Planning Committee (HMPC) identified technological/biological hazards that the County is vulnerable to based upon available data including scientific evidence, known past events, and future probability estimates. As a result of this planning process, which included an analysis of the risks associated with probable frequency and impact of each hazard, the HMPC determined that each of the technological/biological hazards included in this chapter pose a threat significant enough to address within this Plan. An explanation and results of the vulnerability assessment are found in Tables 3-1 and 3-2.

Table 3.1 – Hazards Terminology Differences

Hazards Identified in Georgia Hazard Mitigation Strategy Plan (2019-2024)	**Equivalent/Associated Hazards identified in the current Whitfield County Plan**	**Difference**
Hazards Identified in Georgia Hazard Mitigation Strategy Plan (2019-2024)	Equivalent/Associated Hazards identified in the current Whitfield County Plan	Difference

Table 3.2 – Vulnerability Assessment - Technological Hazards
(see Keys A, B, C below)

Hazard	Whitfield County	Dalton	Tunnel Hill	Varnell	Cohutta
Hazardous Materials Release - Severity	H	H	H	H	H
Hazardous Materials Release – Frequency	M	M	M	H	M
Hazardous Materials Release - Probability	H	H	L	H	H
Dam Failure – Severity	H	M	L	L	H
Dam Failure – Frequency	L	L	L	L	L
Dam Failure – Probability	L	L	L	L	L
Pandemic – Severity	H	H	H	H	H
Pandemic – Frequency	L	L	L	L	L
Pandemic – Probability	L	L	L	L	L

Key A for Table 3.2 – Vulnerability Assessment Severity Definitions

Code	Definitions
L	Low Severity Average hazard event would typically result in relatively low damage. For example, a hazard that significantly affects less than 5% of the jurisdiction typically with no serious injuries. All data is compiled from the most recent vulnerability assessment survey responses.
M	Medium Severity Average hazard event would typically result in moderate damage. For example, a hazard that significantly affects up to 15% of the jurisdiction or results in multiple injuries. All data is compiled from the most recent vulnerability assessment survey responses.
H	High Severity Average hazard event would typically result in significant damage. For example, a hazard that significantly affects 25% of the jurisdiction or results in multiple injuries and/or deaths. All data is compiled from the most recent vulnerability assessment survey responses.

Key B for Table 3.2 – Vulnerability Assessment Frequency Definitions

Code	Definitions
L	Low Frequency The hazard has not occurred or has rarely occurred within the past five years. All data is compiled from the most recent vulnerability assessment survey responses and hazards history data.
M	Medium Frequency The hazard has occurred one or more times within the past five years. All data is compiled from the most recent vulnerability assessment survey responses and hazards history data.
H	High Frequency The hazard has occurred multiple times within the past five years, and at least once within the past year. All data is compiled from the most recent vulnerability assessment survey responses and hazards history data.

Key C for Table 3.2 – Vulnerability Assessment Probability Definitions

Code	Definitions
L	Low Probability The probability for the hazard to occur at least one time within the next five years is estimated to be between 1% and 30%. All data is compiled from the most recent vulnerability assessment survey responses.
M	Medium Probability The probability for the hazard to occur at least one time within the next five years is estimated to be between 31% and 70%. All data is compiled from the most recent vulnerability assessment survey responses.
H	High Probability The probability for the hazard to occur at least one time within the next five years is estimated to be between 71% and 100%. All data is compiled from the most recent vulnerability assessment survey responses.

3.1 Hazardous Materials Release

A. Hazard Identification – Hazardous materials (hazmat) refers to any material that, because of its quantity, concentration, or physical or chemical characteristics, may pose a real hazard to human health or the environment if it is released. Hazmat includes flammable and combustible materials, toxic materials, corrosive materials, oxidizers, aerosols, and compressed gases. Specific examples of hazmat are gasoline, bulk fuels, propane, propellants, mercury, asbestos, ammunition, medical waste, sewage, and chemical, biological, radiological, nuclear, and explosive (CBRNE) threat agents. Specific federal and state guidelines exist on transport and shipping hazardous materials. Research institutes, industrial plants, individual households, and government agencies all generate chemical waste. Approximately one percent is classified as hazardous.

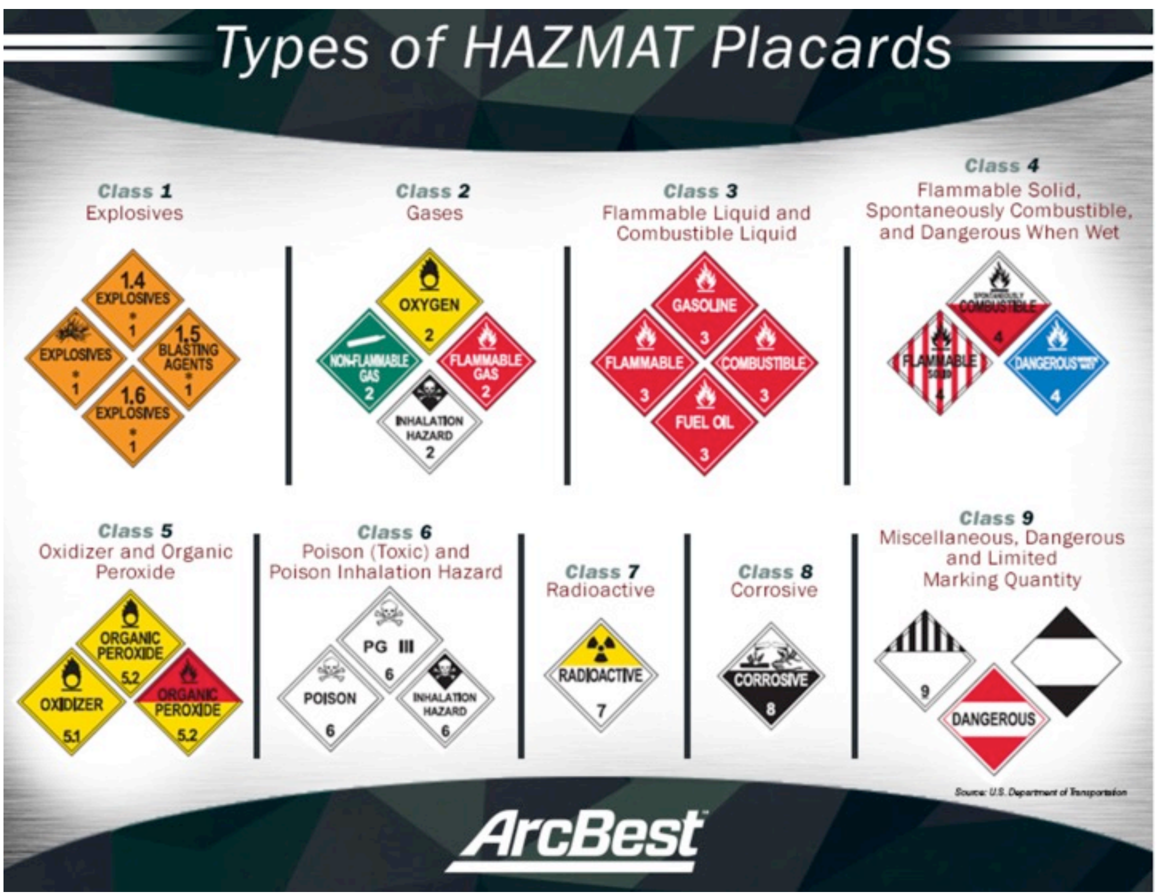
A hazmat spill or release occurs when hazardous material or waste gets into the environment in an uncontrolled fashion. Many manufacturing processes use hazardous materials or generate hazardous waste, but a hazardous spill doesn't always come from a chemical plant or a factory. Any substance in the wrong place at the wrong time in too large an amount can cause harm to the environment. The response to a spill depends on the situation. When the emergency response team is notified of a spill, it must quickly decide what sort of danger is likely. Members of the team collect appropriate clothing and equipment and travel to the scene. There they try to contain the spill, sometimes testing a sample to identify it. If necessary, they decontaminate themselves before leaving the area. Once material has been identified, other personnel arrive to remove it.

When transporting hazardous materials, hazmat placards provide details about the kind of cargo a truck is carrying. The United States Department of Transportation (DOT) requires carriers to display these signs when moving hazardous goods because they inform emergency responders of what substances are involved in case of an accident. More than two dozen truck placards are used to represent dangerous goods, and you can determine what a truck is carrying by the specific details on the sign.

A hazmat placard has six main parts (though not every sign includes all six):

Hazard class number
UN/NA number
Compatibility letters
Color
Words
Graphics

See hazmat placard chart below. Source: ArcBest.



Hazard class numbers

Numbers 1-9 represent the different hazardous classes and their divisions (class numbers are located at the bottom of the sign and division numbers are in the middle):

Class 1 — Explosives
1.1: Products with the potential to create a mass explosion
1.2: Products with the potential to create a projectile hazard
1.3: Products with the potential to create a fire or minor blast
1.4: Products with no significant risk of creating a blast
1.5: Products considered very insensitive that are used as blasting agents
1.6: Products considered extremely insensitive with no risk to create a mass explosion

Class 2 — Gases
2.1: Flammable gases
2.2: Nonflammable gases
2.3: Toxic gases

Class 3 — Flammable and combustible liquids

Class 4 — Flammable materials
4.1: Flammable solids
4.2: Spontaneously combustible
4.3: Dangerous when wet

Class 5 — Oxidizer and organic peroxide
5.1: Oxidizing substances
5.2: Organic peroxides

Class 6 — Poisons
6.1: Toxic substances
6.2: Infectious substances

Class 7 — Radioactive
Class 8 — Corrosive
Class 9 — Miscellaneous

United Nations/North American numbers

Four-digit numbers ranging from 0004-3534 are called United Nations (UN) numbers. They help identify hazardous international cargo traveling in the United States. Goods that aren't classified or regulated by the United Nations receive North American (NA) numbers. These four-digit numbers range from 8000-9279 and are assigned by the DOT. All UN and NA placards come with an identifier that helps shippers determine the cargo's class, division and compatibility group.

Compatibility letters

On some placards, you may see the letters A-S. These compatibility letters help shippers and carriers know which explosives can be loaded together onto a trailer.

Colors, words and graphics

One of the easiest ways to identify hazmat placards, other than the class numbers, is by the color (along with the words and graphics on each sign):

Orange
Orange represents explosive materials which can include products like dynamite, fireworks and ammunition. These signs typically have the words explosives or blasting agents on them and a graphic indicating something blowing up. They'll also have the number 1 to indicate the class.

Red
Red is for flammable goods like gasoline, rubbing alcohol, paint and acetone, which can fall into Classes 2 or 3. These placards feature a flame image and usually have the words flammable, gasoline, combustible or fuel oil.

Green
If the truck has a green sign, it's transporting nonflammable substances like compressed and liquefied gases. You'll see the word nonflammable gas, an image of a gas canister and the number 2.

Yellow
Yellow indicates oxidizers — substances, that when mixed with oxygen, are likely to combust (Classes 2 or 5). Common oxidizers include ammonium nitrate, potassium nitrate, halogens and nitric acid. These signs have oxygen written on them and a graphic of an "O" with flames.

White
White indicates poisonous and biohazardous substances like dyes, acids, aerosols and medical waste. For toxic materials, the sign will be labeled poison, PG III (PG = packing group) or inhalation hazard with a skull-and-crossbones image. For biohazards, the placard will say infectious substance and have a biohazard symbol (three circles overlapping one center circle). These types of materials can fall into Classes 2 or 6.

Blue

Blue represents goods that are dangerous when wet — meaning when these materials meet water, they can become flammable. Examples include sodium, calcium and potassium. You'll see dangerous when wet, an image of a flame and the number 4 on these placards.

Red and white

If you see a sign that's half red and half white with spontaneously combustible written on it, a flame graphic and the number 4, that means there are substances present that may ignite when exposed to air. This can include things like aluminum and lithium alkyls or white phosphorous.

Red and white stripes

Signs that have red and white vertical stripes with the number 4 represent flammable solids such as matches and magnesium. These placards are labeled flammable solid and have a fire graphic.

Red and yellow

Red and yellow indicate organic peroxides which have the potential to ignite or explode (these fall under the division 5.2). Common examples are methyl ethyl ketone peroxide and benzoyl peroxide. These signs say organic peroxide and will either have the graphic of "O" with flames or just a normal fire graphic.

Yellow and white

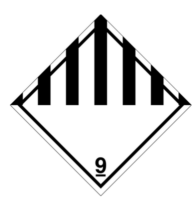
Yellow and white represent radioactive substances that are often found in medical equipment. You'll see the word radioactive, the radiation symbol of three blades surrounding a small circle, and the number 7.

White and black

Half white and half black signifies corrosive materials that can irritate and harm the skin. Examples include batteries, hydrochloric acid, sulfuric acid and sodium hydroxide. These signs say corrosive, show substances spilling onto hands, and have the number 8.

White with black stripes

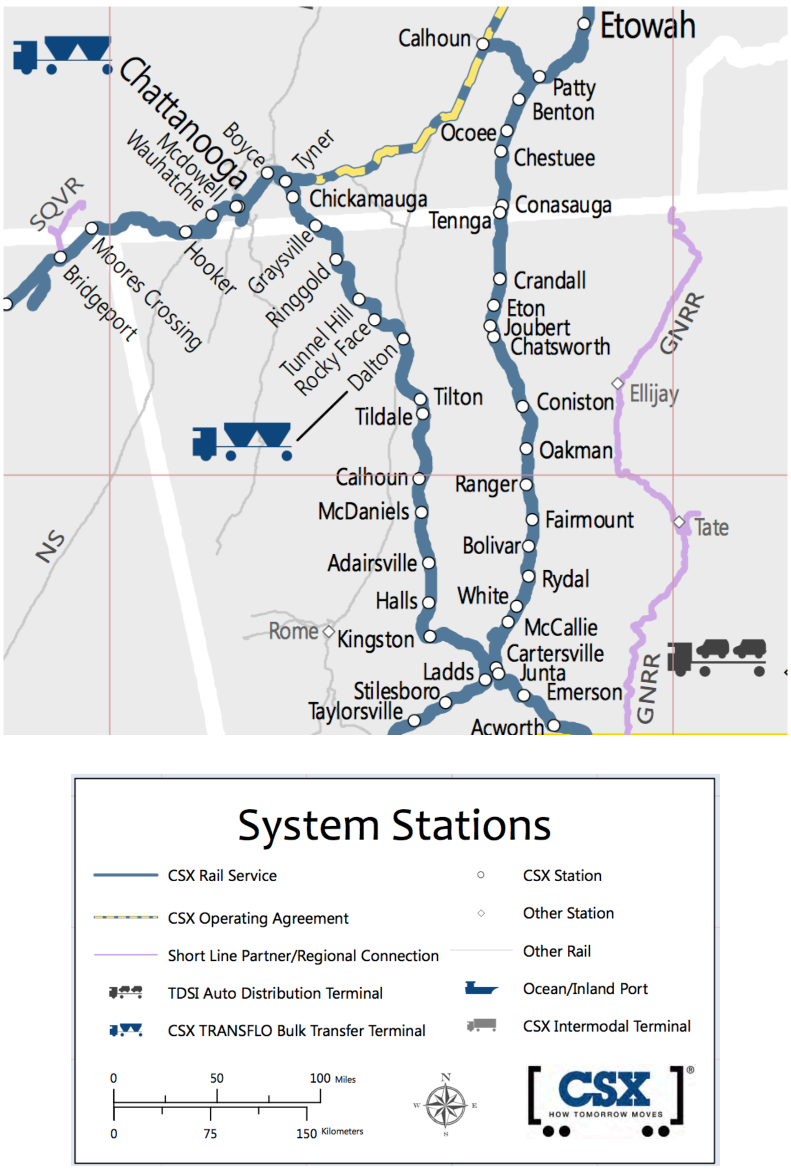
A white sign with black vertical stripes at the top and the number 9 at the bottom signals miscellaneous dangerous goods. This includes environmentally hazardous substances that don't fall into a specific class like asbestos and dry ice.



B. Hazard Profile – Hazmat spills are usually categorized as either fixed releases, which occur when hazmat is released on the site of a facility or industry that stores or manufactures hazmat, or transportation-related releases, which occur when hazmat is released during transport from one place to another. Both fixed and transportation-related hazmat spills represent tremendous threats to Whitfield County. Potential fixed hazmat spills within the County would come from local commercial and industrial establishments. Whitfield County also has major CSX and Norfolk Southern rail lines running through the County carrying some of the heaviest loads in the State. This represents a major threat to the County and Cities with regard to hazmat release.

CSX and Norfolk Southern rail lines travel through Whitfield County and each of the Cities of Dalton, Varnell and Tunnel Hill and the Town of Cohutta. See maps below.

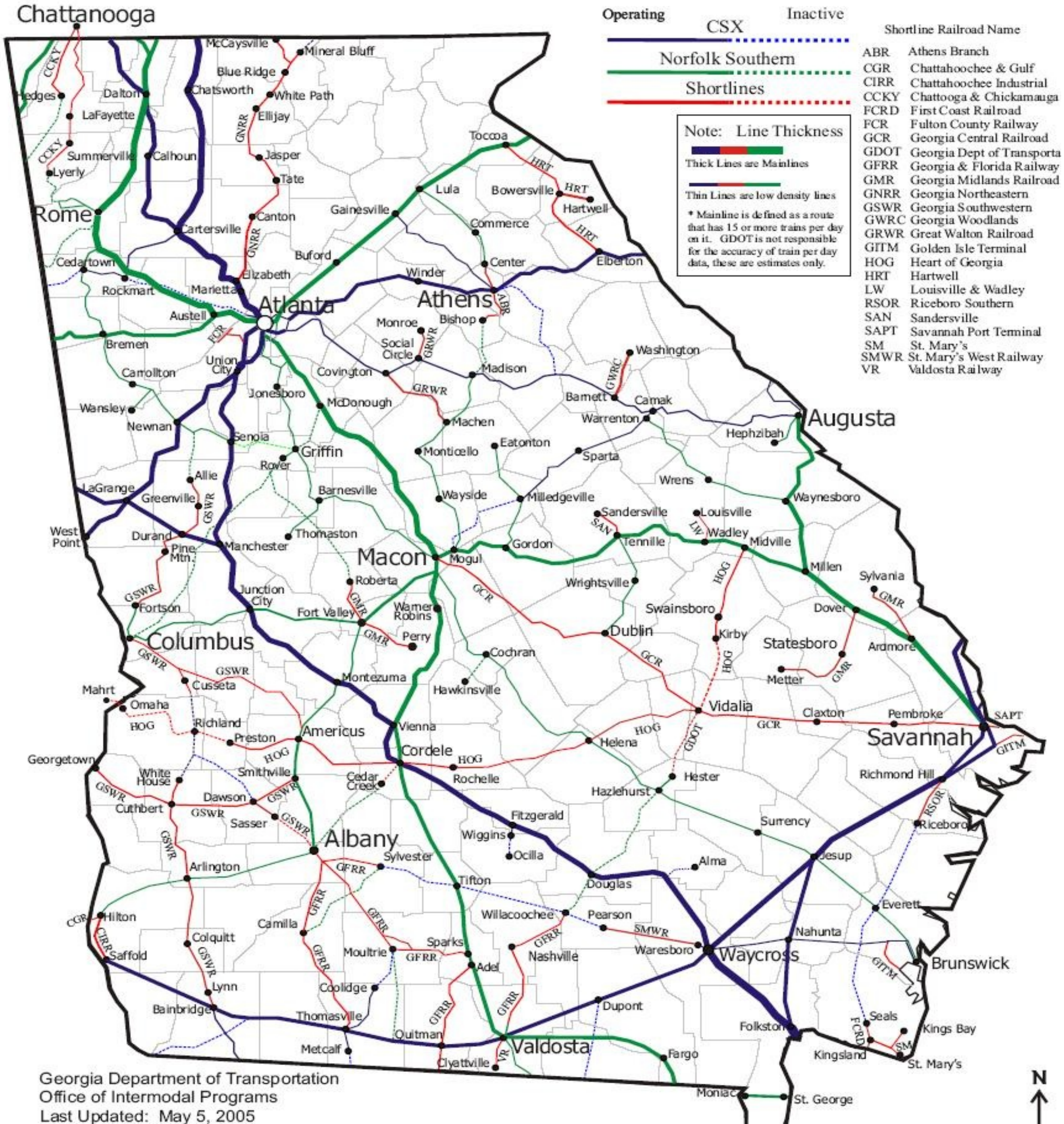
CSX Rail Lines Map:



Norfolk Southern Rail Lines Map:

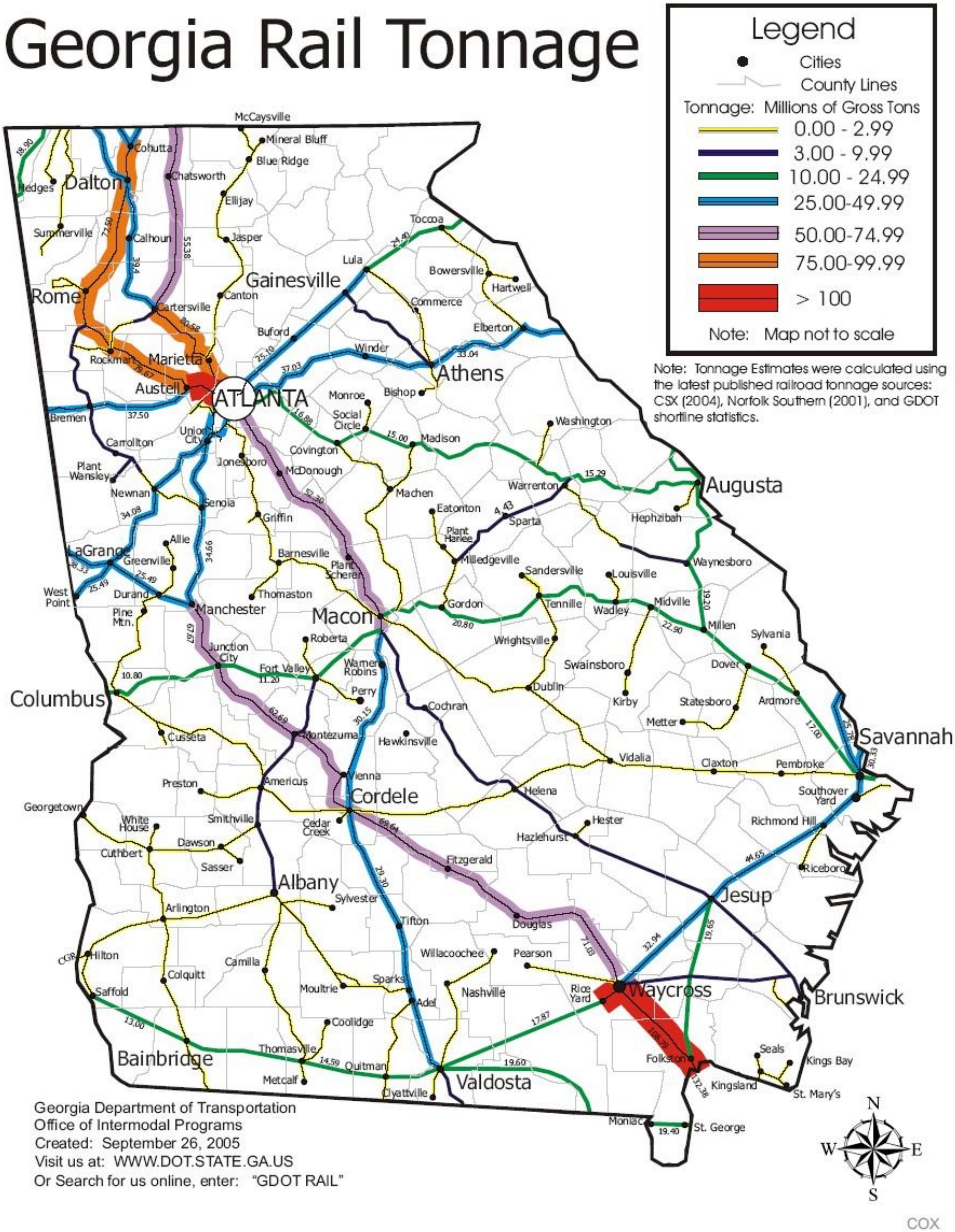
The Georgia Department of Transportation (GDOT) rail maps on the following two pages provide locations of the rail lines running through Whitfield County, as well as the information relating to tonnage.

Georgia Rail System



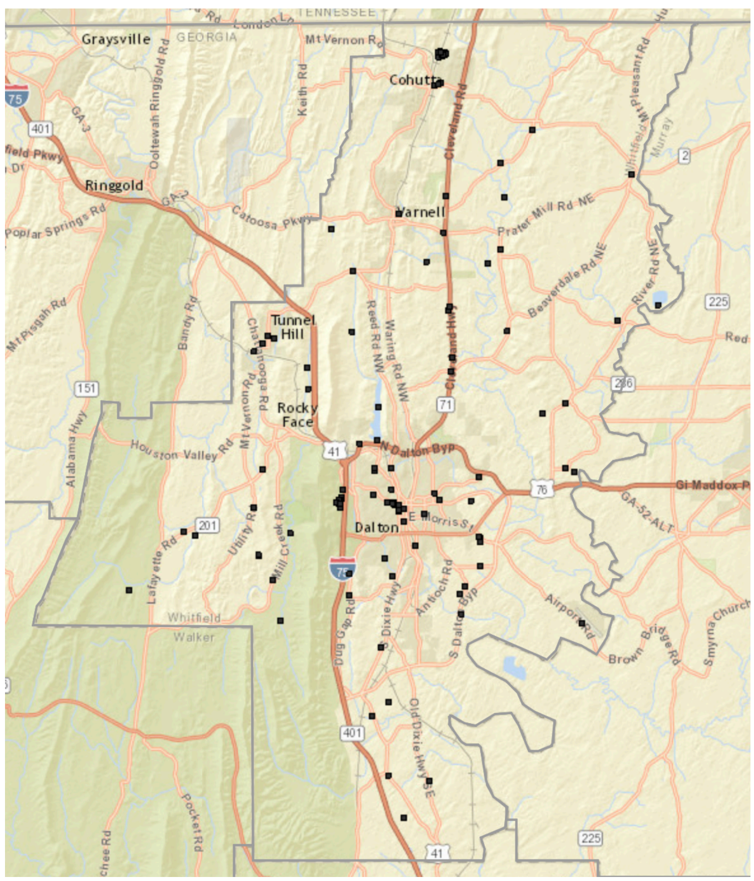
Georgia Department of Transportation
Office of Intermodal Programs
Last Updated: May 5, 2005
Visit us at: WWW.DOT.STATE.GA.US
Or Search for us online, enter: "GDOT RAIL"

Georgia Rail Tonnage



C. Assets Exposed to Hazard – The environment is especially vulnerable to hazardous materials releases, with waterways being at greatest risk of contamination. Georgia EPD tracks information on waterways within Whitfield County that have been contaminated to varying degrees due to hazmat spills. These incidents include contamination to Mill Creek, Tar Creek, Cohutta Creek, Conasauga River, Swamp Creek, Bear Creek, Drowning Bear Creek, Tanyard Creek, Oostanaula River as well as other unnamed creeks, lakes, storm sewers, wells, and drainage ditches. Such releases are also a potential threat to all property and persons within any primary highway corridors or railroad corridors of Whitfield Co. since certain hazmat releases can create several square miles of contamination. The same holds true of property and persons located in the vicinity of facilities or industries that produce or handle large amounts of hazardous materials. The most common hazmat releases have generally included diesel, gasoline, oil, and sewage. Unfortunately, Georgia EPD no longer makes specific hazmat spill information available to the public as they once did. If at some point this changes, that data will be considered at the next Plan update.

All public and private property including critical facilities are susceptible to hazardous materials release since this hazard is not spatially defined. The map below identifies critical facilities located within the hazard area, which in the case of drought includes all areas within the County, Cities, and Towns.



D. Estimate of Potential Losses - It is difficult to determine potential damage to the environment caused by hazardous materials releases. What can be calculated are the significant response costs incurred once a hazmat release does occur including emergency response, road closings, evacuations, watershed protection, expended man-hours, and cleanup materials and equipment. Corridors for Interstate 75, US Routes 41, 76, and 411, and State Routes 2, 52, 71, 201, 286, 520, and for CSX and Norfolk Southern rail lines are most vulnerable to transportation-related releases. However, such releases can occur in virtually any part of the County accessible by road. Fixed location releases are not as likely to affect the more rural areas of the County. For additional loss estimate information, please refer to the Critical Facilities Database (Appendix A).

E. Multi-Jurisdictional Concerns – All of Whitfield County, including the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta, is vulnerable to both fixed and transportation-related hazardous materials releases.

F. Hazard Summary – Hazardous materials releases are a significant threat to Whitfield County. Unknown quantities and types of hazmat are transported through the County by truck and railroad on a daily basis. The main corridors of concern are Interstate 75, US Routes 41, 76, and 411, and State Routes 2, 52, 71, 201, 286, 520, and for CSX and Norfolk Southern rail lines. These hazmat shipments pose a great potential threat to all of Whitfield County. The fact that the County is unable to track these shipments seriously limits the mitigation measures that can be put into place. Fixed hazmat releases are also considered to be a major threat to Whitfield County due to the industries located therein. Therefore, the Whitfield County HMPC has identified specific mitigation actions for hazardous materials releases in *Chapter 5*.

3.2 Dam Failure

A. Hazard Identification – Georgia law defines a dam as any artificial barrier which impounds or diverts water, is 25 feet or more in height from the natural bed of the stream, or has an impounding capacity at maximum water storage evaluation of 100 acre-feet (equivalent to 100 acres one foot deep) or more. Dams are usually constructed to provide a ready supply of water for drinking, irrigation, recreation and other purposes. They can be made of rock, earth, masonry, or concrete or of combinations of these materials.

Dam failure is a term used to describe the major breach of a dam and subsequent loss of contained water. Dam failure can result in loss of life and damage to structures, roads, utilities, crops, and livestock. Economic losses can also result from a lowered tax base, lack of utility profits, disruption of commerce and governmental services, and extraordinary public expenditures for food relief and protection. National statistics show that overtopping due to inadequate spillway design, debris blockage of spillways, or settlement of the dam crest account for one third of all U.S. dam failures. Foundation defects, including settlement and slope instability, account for another third of all failures. Piping and seepage, and other problems cause the remaining third of national dam failures. This includes internal erosion caused by seepage, seepage and erosion along hydraulic structures, leakage through animal burrows, and cracks in the dam. The increasing age of dams nationwide is a contributing factor to each of the problems above.

B. Hazard Profile – Congress first authorized the US Army Corps of Engineers to inventory dams in the United States with the National Dam Inspection Act (Public Law 92-367) of 1972. The Water Resources Development Act of 1986 (P.L. 99-662) authorized the Corps to maintain and periodically publish an updated National Inventory of Dams

(NID), with re-authorization and a dedicated funding source provided under the Water Resources Development Act of 1996 (P.L. 104-3). The Corps also began close collaboration with the Federal Emergency Management Agency (FEMA) and state regulatory offices to obtain more accurate and complete information. The National Dam Safety and Security Act of 2002 (P.L. 107-310) reauthorized the National Dam Safety Program and included the maintenance and update of the NID by the Corps of Engineers.

The most recent Dam Safety Act of 2006 reauthorized the maintenance and update of the NID.

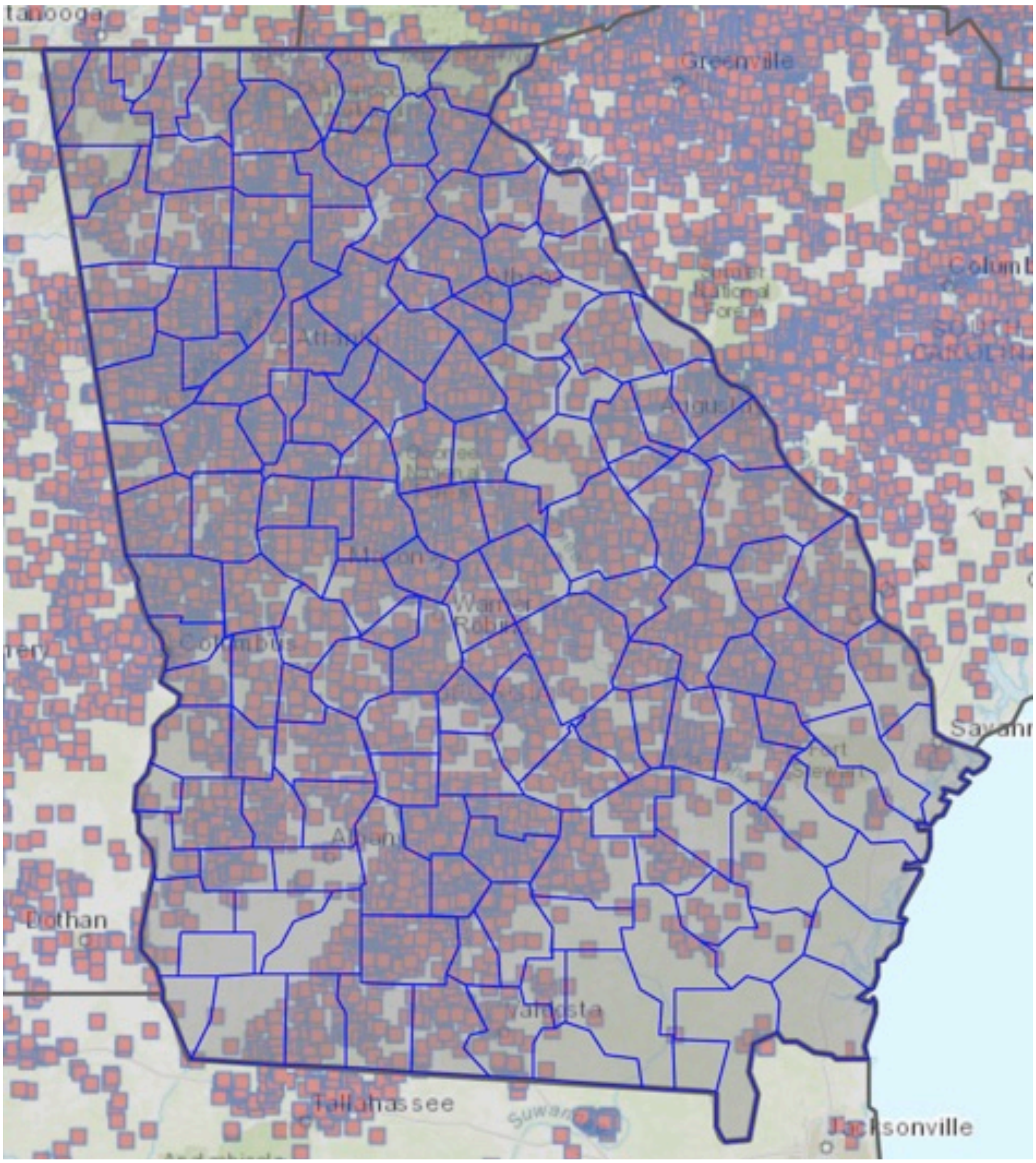
The NID consists of dams meeting at least one of the following criteria:

1) High hazard classification - loss of one human life is likely if the dam fails,
2) Significant hazard classification - possible loss of human life and likely significant property or environmental destruction,
3) Equal or exceed 25 feet in height and exceed 15 acre-feet in storage,
4) Equal or exceed 50 acre-feet storage and exceed 6 feet in height.

The goal of the NID is to include all dams in the U.S. that meet these criteria, yet in reality, is limited to information that can be gathered and properly interpreted with the given funding. The inventory initially consisted of approximately 45,000 dams, which were gathered from extensive record searches and some feature extraction from aerial imagery. Since continued and methodical updates have been conducted, data collection has been focused on the most reliable data sources, which are the various federal and state government dam construction and regulation offices. In most cases, dams within the NID criteria are regulated (construction permit, inspection, and/or enforcement) by federal or state agencies, who have basic information on the dams within their jurisdiction. Therein lies the biggest challenge, and most of the effort to maintain the NID; periodic collection of dam characteristics from states, territories, and 18 federal offices. Database management software is used by most state agencies to compile and export update information for the NID. With source agencies using such software, the Corps of Engineers receives data that can be parsed and has the proper NID codes. The Corps can then resolve duplicative and conflicting data from the many data sources, which helps obtain the more complete, accurate, and updated NID.

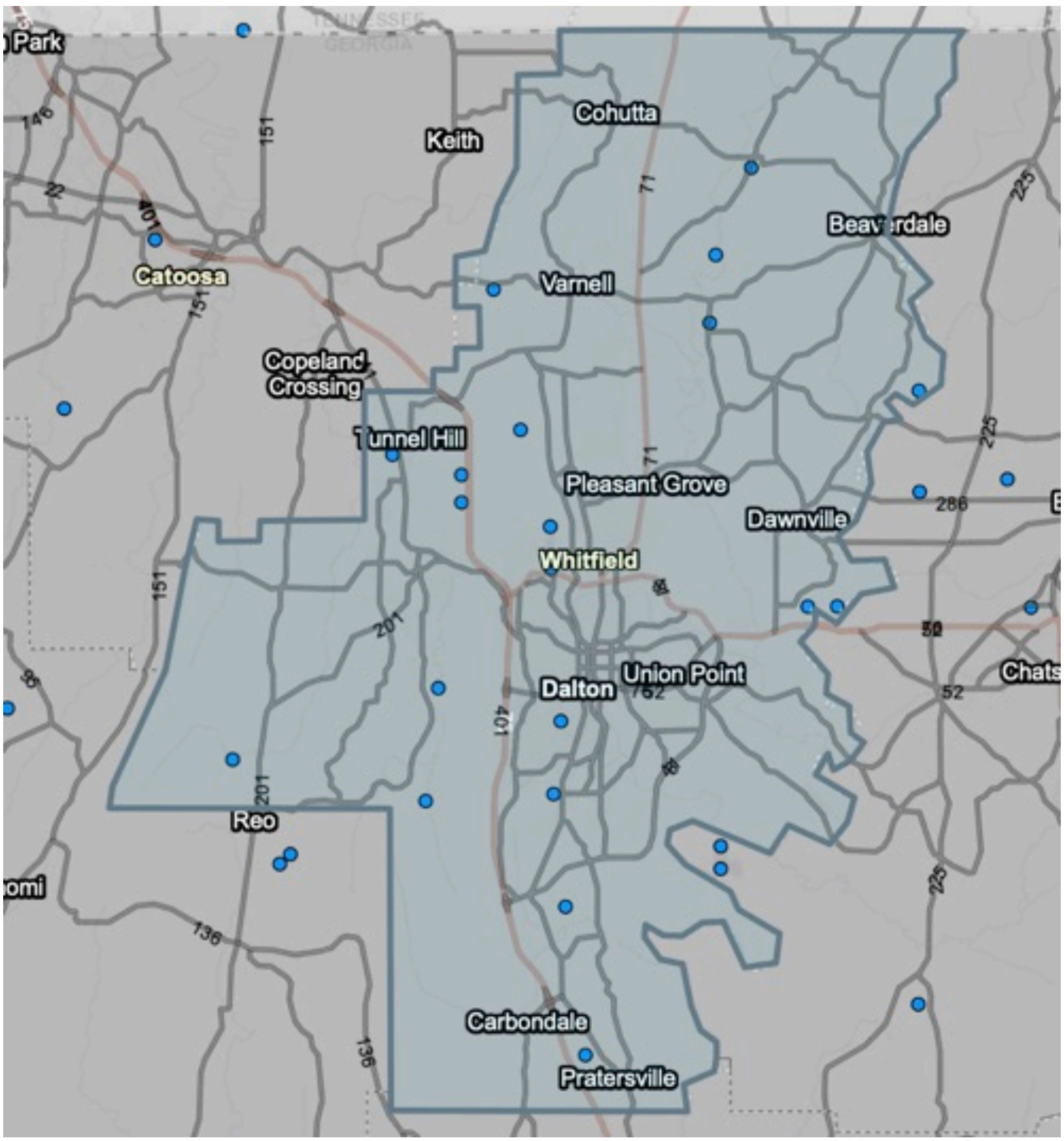
The National Inventory of Dams Map for the State of Georgia is located below and displays a State inventory of 5,455 dams. According to the data, the average age of a dam in Georgia is 61 years. Only 2% of Georgia dams are regulated by a Federal agency and 9% of Georgia dams are regulated by a State agency. 1% of Georgia dams generate hydropower. 81% of Georgia high hazard potential dams have an emergency action plan (EAP).

U.S Army Corps of Engineers National Inventory of Dams



The National Inventory of Dams Map for Whitfield County is located below and displays a county inventory of 22 dams. According to the data, the average age of a dam in Whitfield County is 59 years. No Whitfield County dams are regulated by a Federal agency and 23% of Whitfield County dams are regulated by a State agency. No Whitfield County dams generate hydropower. 80% of Whitfield County high hazard potential dams have an emergency action plan (EAP).

U.S Army Corps of Engineers National Inventory of Dams – Whitfield Co.



A summary of the dams found in the NID is as follows:

Lower Haig Mill Reservoir Dam
Hazard Potential Classification: High
Emergency Action Plan: Yes
Owner Name: Dalton Utilities

Upper Haig Mill Lake Dam
Hazard Potential Classification: High
Emergency Action Plan: Yes
Owner Name: Dalton Utilities
Primary Purpose: Flood Risk Reduction

River Road Reservoir Dam
Hazard Potential Classification: High
Emergency Action Plan: Yes
Owner Name: Dalton Utilities
Primary Purpose: Water Supply

Dalton Utilities Impoundment Dike #3
Hazard Potential Classification: High
Emergency Action Plan: Yes
Owner Name: Dalton Utilities
Primary Purpose: Water Supply

Lake Kathy Dam
Hazard Potential Classification: High
Emergency Action Plan: No
Owner Name: Lake Kathy, Inc. Mr. & Mrs. Danny Ogles Larry Deel
Primary Purpose: Recreation

Mill Creek WS Str # 2
Hazard Potential Classification: Low
Emergency Action Plan: Not Required
Owner Name: LIMESTONE VALLEY S & WCD
Primary Purpose: Flood Risk Reduction

Impoundment Dike #4 Lake Dam
Hazard Potential Classification: Low
Emergency Action Plan: Not Required
Owner Name: Dalton Utilities
Primary Purpose: Water Supply

Mill Creek Watershed Structure No. 10
Hazard Potential Classification: Low
Emergency Action Plan: Not Required
Owner Name: Limestone Valley Soil & Water Conservation District
Primary Purpose: Flood Risk Reduction

C & C Lake Dam
Hazard Potential Classification: Low
Emergency Action Plan: Not Required
Owner Name: Whitfield County Board of Commissioners
Primary Purpose: Recreation

Mill Creek Watershed Structure No. 7
Hazard Potential Classification: Low
Emergency Action Plan: Not Required
Owner Name: LIMESTONE VALLEY S & WCD
Primary Purpose: Flood Risk Reduction

Mill Creek Watershed Structure No. 8
Hazard Potential Classification: Low
Emergency Action Plan: Not Required
Owner Name: Limestone Valley Soil and Water Conservation District
Primary Purpose: Flood Risk Reduction

Parker Lake Dam
Hazard Potential Classification: Low
Emergency Action Plan: Not Required
Owner Name: B & E Plaza Properties, LLC
Primary Purpose: Recreation

Griffin Lake Dam
Hazard Potential Classification: Low
Emergency Action Plan: Not Required
Owner Name: Heritage Lake Farms, Inc
Primary Purpose: Recreation

Crown Mill Lake Dam
Hazard Potential Classification: Low
Emergency Action Plan: Not Required
Owner Name: Development Authority of Whitfield County
Primary Purpose: Recreation

Leisure Lake Dam
Hazard Potential Classification: Low
Emergency Action Plan: Not Required
Owner Name: Leisure Lake, Inc.
Primary Purpose: Recreation

Ridley Lake Dam
Hazard Potential Classification: Low
Emergency Action Plan: Not Required
Owner Name: Bryant, John E.
Primary Purpose: Recreation

Shaheen Lake Dam
Hazard Potential Classification: Low
Emergency Action Plan: Not Required
Owner Name: Shaheen, John & Angela
Primary Purpose: Recreation

Cobblestone Lake Dam
Hazard Potential Classification: Low
Emergency Action Plan: Not Required
Owner Name: Cobblestone Lake LLC
Primary Purpose: Recreation

Frances Lake Dam
Hazard Potential Classification: Low
Emergency Action Plan: Not Required
Owner Name: Lake Frances, Inc.
Primary Purpose: Recreation

Barrett Lake Dam
Hazard Potential Classification: Low
Emergency Action Plan: Not Required
Owner Name: Boring, James Marcus III
Primary Purpose: Recreation

Threadmill Lake Dam
Hazard Potential Classification: Undetermined
Emergency Action Plan: Not Required
Owner Name: Lake Shores, Inc.
Primary Purpose: Recreation

The Georgia Safe Dams Act of 1978 established Georgia's Safe Dams Program following the November 6, 1977 failure of the Kelly Barnes Dam in Toccoa, GA, in which 39 people lost their lives when the breached dam, which held back a 45-acre lake, sent a 30-foot-high wall of water sweeping through Toccoa Falls College.

The Kelly Barnes Dam failed about 1:30 a.m., on November 6, 1977. The dam went through various stages of development. First as a rock crib dam and then with subsequent stages as an earth dam. The rock crib dam was completed about 1899 to back up water which would be used to power a small hydroelectric plant located near the foot of the Falls. About 1937, the Toccoa Falls Bible Institute was interested in developing a more dependable power source and decided to build an earth dam over the rock crib dam. This construction was performed with equipment provided by a local manufacturer. After World War II, the earth fill was raised to a point where an earth spillway on the left side of the valley could be utilized, and a low point on the rim on the right side away from the dam would serve as a secondary spillway in case high flows occurred. The final height of the dam was approximately 42 feet above the rock foundation. This installation served as a power source until 1957 for the Toccoa Falls Bible Institute, which later became the Toccoa Falls College. At this time, the development of power was stopped but the dam continued to be used as a recreation lake. The Federal Investigative Board could not determine a sole cause of the failure. It does conclude that a combination of factors caused the failure. The most probable causes are a local slide on the steep downstream slope probably associated with piping, an attendant localized breach in the crest followed by progressive erosion, saturation of the downstream embankment, and subsequently a total collapse of the structure.

The Environmental Protection Division (EPD) within the Georgia Department of Natural Resources (DNR) is responsible for administering the Safe Dams Program. The purpose of the Program is to *provide for the inspection and permitting of certain dams in order to protect the health, safety, and welfare of all citizens of the state by reducing the risk of failure of such dams.* The Program has two main functions: (1) to inventory and classify dams and (2) to regulate and permit high hazard dams. Structures below the State minimum height and impoundment requirements (25 feet or more in height or an impounding capacity of 100 acre-feet or more) are exempt from regulation by the Georgia Safe Dams Program. The Program checks the flood plain of the dam to determine its hazard classification. Specialized software is used to build a computer model to simulate a dam breach and establish the height of the flood wave in the downstream plain. If the results of the dam breach analysis, also called a flood routing, indicate that a breach of the dam would result in a probable loss of human life, the dam is classified as Category I (high-hazard). The Safe Dams Program also approves plans and specifications for construction and repair of all Category I dams. In addition, Category I dams are continuously monitored for safety by Georgia EPD.

To date, the Safe Dam Program has identified **five Category I dams** within Whitfield County: Threadmill Lake Dam, Mill Creek Watershed No. 9, Dalton Utilities Impoundment Dike No. 3, River Road Reservoir Dam, and Lower Haig Mill Lake Dam. The remaining 15 classified dams within the County are Category II dams (13) or exempt dams (2). There may be a number of unclassified dams within the County as well. The Program requires all Category II dams to be inventoried at least every five years.

The Whitfield County HMPC reviewed data from the US Army Corps of Engineers National Inventory of Dams, the Environmental Protection Division (EPD) within the Georgia Department of Natural Resources (Georgia Safe Dams Program), as well as County records in their research involving dam failure within Whitfield County. Fortunately, Whitfield County has never experienced a total dam failure with a Category I dam. It is possible that some small private dams have been breached at some point in the past, but no records have been found to indicate any type of emergency response related to such a failure, or even that such a failure has taken place. However, the potential for such a disaster does exist, and the appropriate steps must be taken to minimize such risks. Both the National Inventory of Dams and the Georgia Safe Dams Program help to accomplish that.

C. Assets Exposed to Hazard – Areas most vulnerable to the physical damages associated with dam failure within Whitfield County, though such a risk appears to be relatively low, are the low-lying and downstream areas associated with each of the dams inventoried by the Safe Dam Program. Although physical damages associated with dam failure would be limited to certain areas, the damage to the local economy and problems associated with delivery of water and other utilities could be felt Countywide and include all areas of the County, Cities, and Towns.

D. Estimate of Potential Losses - Loss estimation due to dam failure is an approximate effort, at best. Direct loss to infrastructure, critical facilities and businesses in terms of repair and replacement may be roughly estimated. Most flood inundation studies that would provide additional data related to losses are not available to the public for obvious security reasons and therefore cannot be made a part of this Plan. For additional loss estimate information, please refer to the Critical Facilities Database (Appendix A).

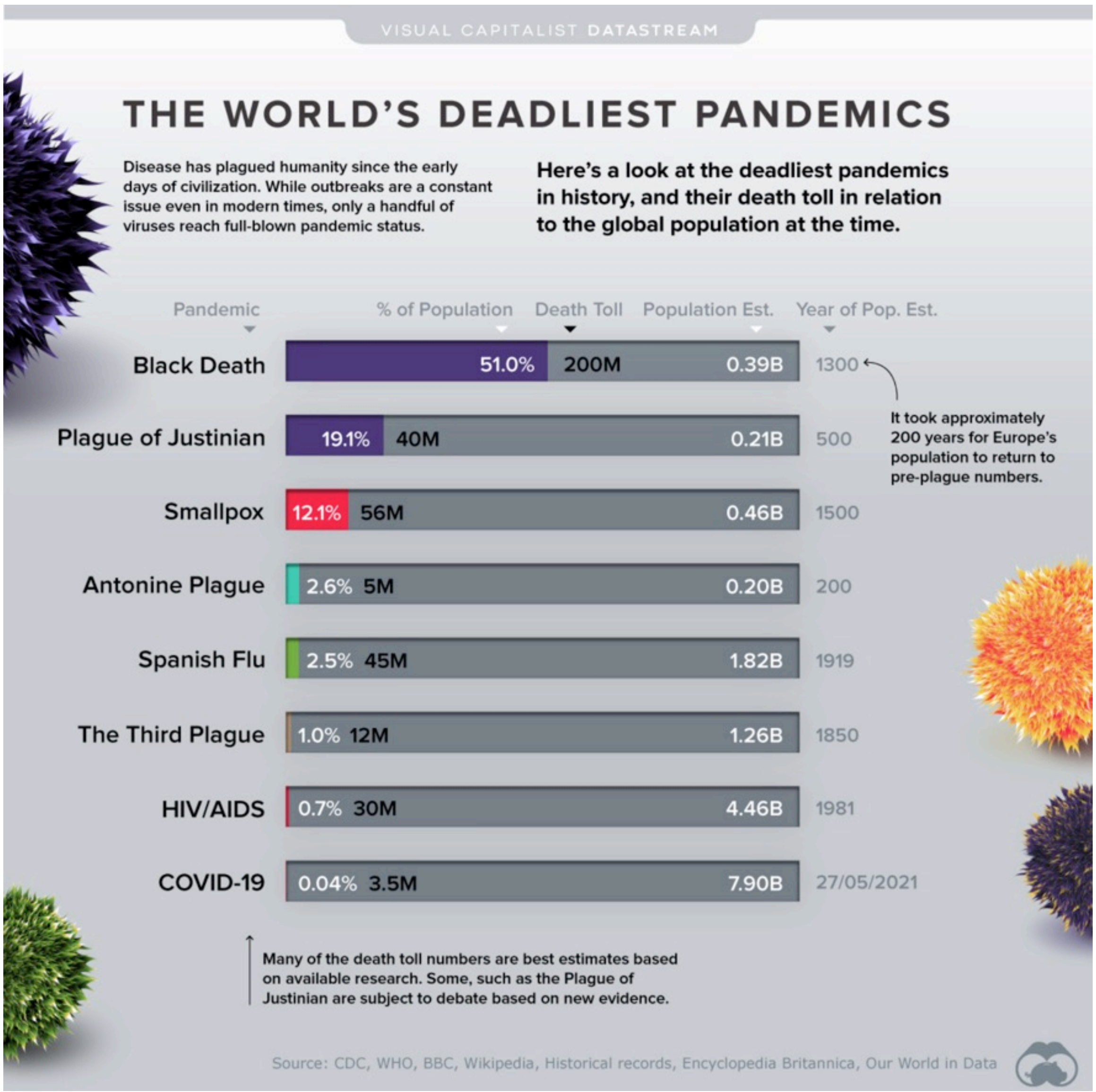
E. Multi-Jurisdictional Concerns – All of Whitfield County, including the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta, is vulnerable to the negative impact of dam failure.

F. Hazard Summary – Although infrequent, dam failure poses a significant threat to Whitfield County. The Whitfield County HMPC has identified some specific mitigation actions for dam failure in *Chapter 5*.

3.3 Pandemic

A. Hazard Identification – A pandemic is defined as an outbreak of a disease that occurs over a wide geographic area and affects an exceptionally high proportion of the population. A widespread endemic disease with a stable number of infected people is not a pandemic. Widespread endemic diseases with a stable number of infected people such as recurrences of seasonal influenza are generally excluded as they occur simultaneously in large regions of the globe rather than being spread worldwide. A pandemic is an epidemic occurring on a scale that crosses international boundaries, usually affecting people on a worldwide scale. A disease or condition is not a pandemic merely because it is widespread or kills many people; it must also be infectious. For instance, cancer is responsible for many deaths but is not considered a pandemic because the disease is neither infectious nor contagious.

B. Hazard Profile – Throughout history, there have been a number of pandemics of diseases such as smallpox and tuberculosis. The most fatal pandemic recorded in human history was the Black Death (also known as The Plague), which killed an estimated 200 million people in the 14th century. Other notable pandemics include the 1918 influenza pandemic (Spanish flu). Current pandemics include HIV/AIDS and COVID-19. See the chart below showing some of the most significant pandemics in history.



COVID-19 deaths to date

C. Assets Exposed to Hazard –. All areas within Whitfield County are susceptible to pandemics since they can occur anywhere that people are located. The more densely populated the specific area, the higher the likelihood of transmission. The likelihood of a pandemic in Whitfield County and the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta is low, but the consequences should one occur has the potential to be extremely high.

D. Estimate of Potential Losses - For loss estimate information, please refer to Appendix A, the Critical Facilities Database, and Appendix D, Worksheet 3a, for each jurisdiction.

E. Multi-Jurisdictional Concerns – All of Whitfield County, including the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta, is vulnerable to the negative impact of pandemics.

F. Hazard Summary – The Whitfield County HMPC has identified some specific mitigation actions for pandemic in *Chapter 5*.

Chapter 4
Land Use and Development Trends

After review by the HMPC, it was determined that current and future development does not appear to significantly impact the vulnerabilities of Whitfield County, Including the Cities of Dalton, Tunnel Hill, and Varnell, and the Town of Cohutta. Nevertheless, the most current development information available is outlined below.

Whitfield County includes the municipalities of Cohutta, Dalton, Tunnel Hill and Varnell. It also consists of numerous smaller communities that are not incorporated cities but are recognized places in the County. These are addressed by geographic area:

Northside
The northern portion of the County (north of Dalton city limits/Dawnville Road area and east of I-75) includes agricultural and low density residential uses east of SR 71/Cleveland Highway, suburban neighborhoods and commercial nodes along SR 71, and the ridges of Rocky Face and Cohutta. Northside Whitfield County includes the following communities: Beaverdale, Cedar Valley, Cohutta Ridge, Hopewell, Norton, Plainview, Pleasant Grove, Prater's Mill, Norton, Rocky Face Ridge, Toonerville and Waring.

Southside
The south side of Whitfield County is located south of the City of Dalton. The area includes portions of the Chattahoochee National Forest located west of I-75, interchange areas at Carbondale and Connector 3 as well as historic rural communities located throughout the area. Southside Whitfield County includes the following communities: Carbondale, Five Springs, Nance Springs, Phelps, River Bend and Tilton.

Westside
The west side of the County is comprised of the areas west of I-75, including residential areas south of Tunnel Hill, the steep slopes of the Dug Gap Ridge, the Chattahoochee National Forest and the western most portion of the county, and the following communities: Dug Gap Ridge, Gordon Springs, Mill Creek, Mt. Vernon and Trickum.

Eastside
The eastern portion of Whitfield County includes areas east of the City of Dalton, including a segment of the Dalton Bypass, commercial development along SR 76, higher density residential areas just east of Dalton, and the Dalton Municipal Airport. Eastside Whitfield County includes the following communities: Dawnville, Cedar Ridge and Keith's Mill.

Within Whitfield County, unincorporated areas make up roughly 90.9% of the County's 291.5 square miles. Table 4-1 compares the existing land use for the total County (includes cities) with the unincorporated areas.

Table 4-1 - Existing Land Use (Whitfield County)

Land Use Classification	Unincorporated Whitfield County		Whitfield County	
	Acres	% of Total	Acres	% of Total
Unknown	3,698.9	2.3%	4,181.0	2.3%
Agricultural/Rural/Undeveloped	108,575.9	66.3%	111,567.1	62.1%
Commercial	3,948.4	2.4%	6,103.2	3.4%
Parks/Recreation/Conservation	13,545.2	8.3%	14,744.8	8.2%
Public/Institutional	5,748.2	3.5%	7,793.6	4.3%
Historical	0.0	0.0%	6.4	0.0%
Industrial	3,838.7	2.3%	5,878.2	3.3%
Public Utility	460.1	0.3%	527.7	0.3%
Residential - Multi-Family	288.2	0.2%	811.9	0.5%
Residential Less than 0.5 Acres	2,035.4	1.2%	3,561.0	2.0%
Residential 0.5-to-1 acre	5,384.7	3.3%	6,502.2	3.6%
Residential 1-to-5 acres	16,225.6	9.9%	17,892.2	10.0%
Total	163,749.3	100.0%	179569.2	100.0%

Land classified as Agricultural/Rural/Undeveloped makes up the largest portion of both the County as a whole and the unincorporated areas. More than 62.1% of the total County and 66.3% of the unincorporated areas of the County are categorized as Agricultural/Rural/Undeveloped areas.

Land classified as Residential (combination of less than 0.5 acre, 0.5-to-1.0 acre and 1.0-to-5.0 acres) makes up 16.1% of the County and 15.6% of the unincorporated areas of the County. The bulk of these residential classifications are represented by the 1-to-5 acre category.

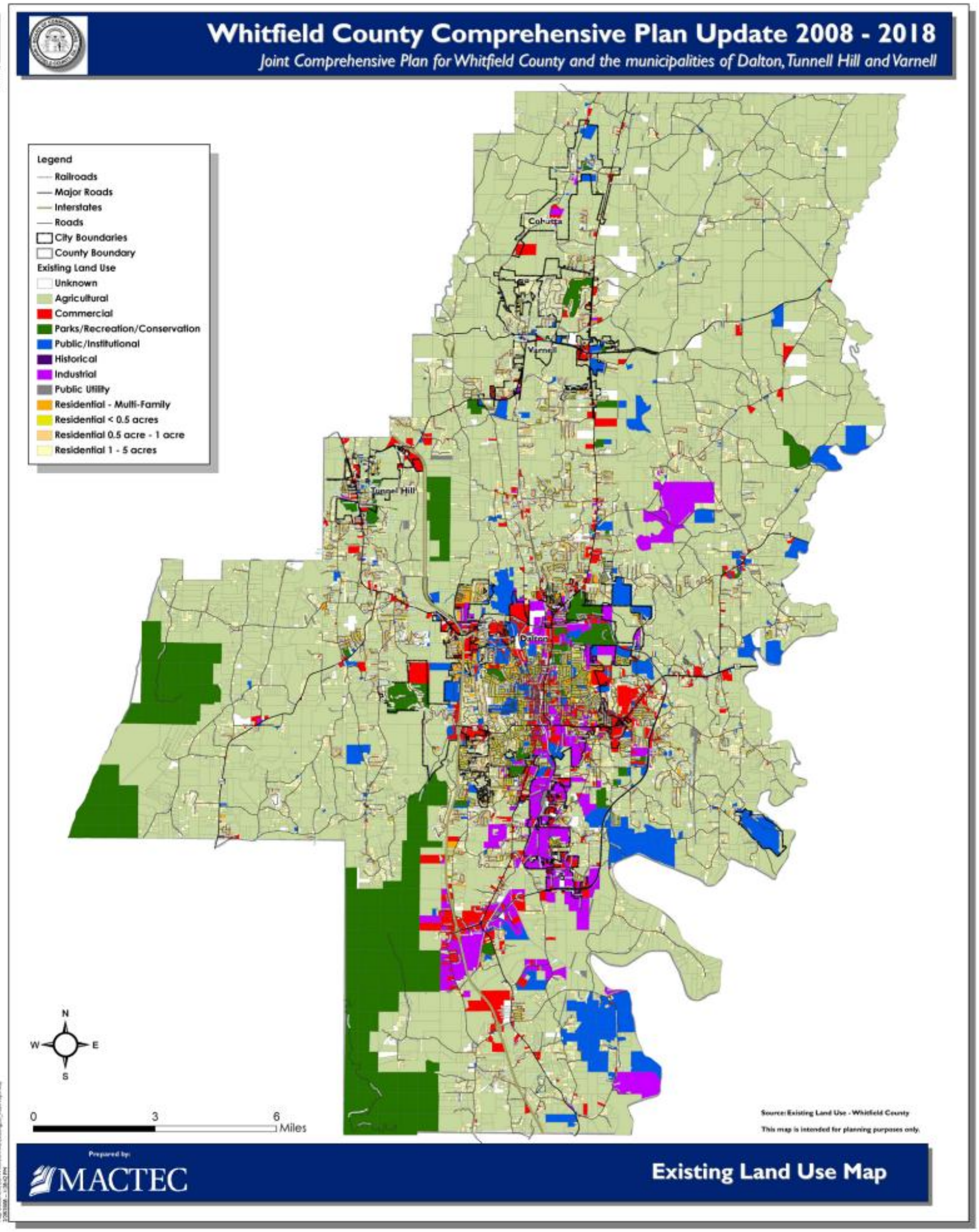
Land classified as Parks, Recreation, and Conservation makes up almost 8.2% of the County's total area. In addition to conservation land, this category includes golf courses, public and private ball fields as well as public parks.

Properties classified as Public/Institutional account for approximately 4.3% of the total county and 3.5% of the unincorporated area. Public/Institutional uses include schools and places of worship.

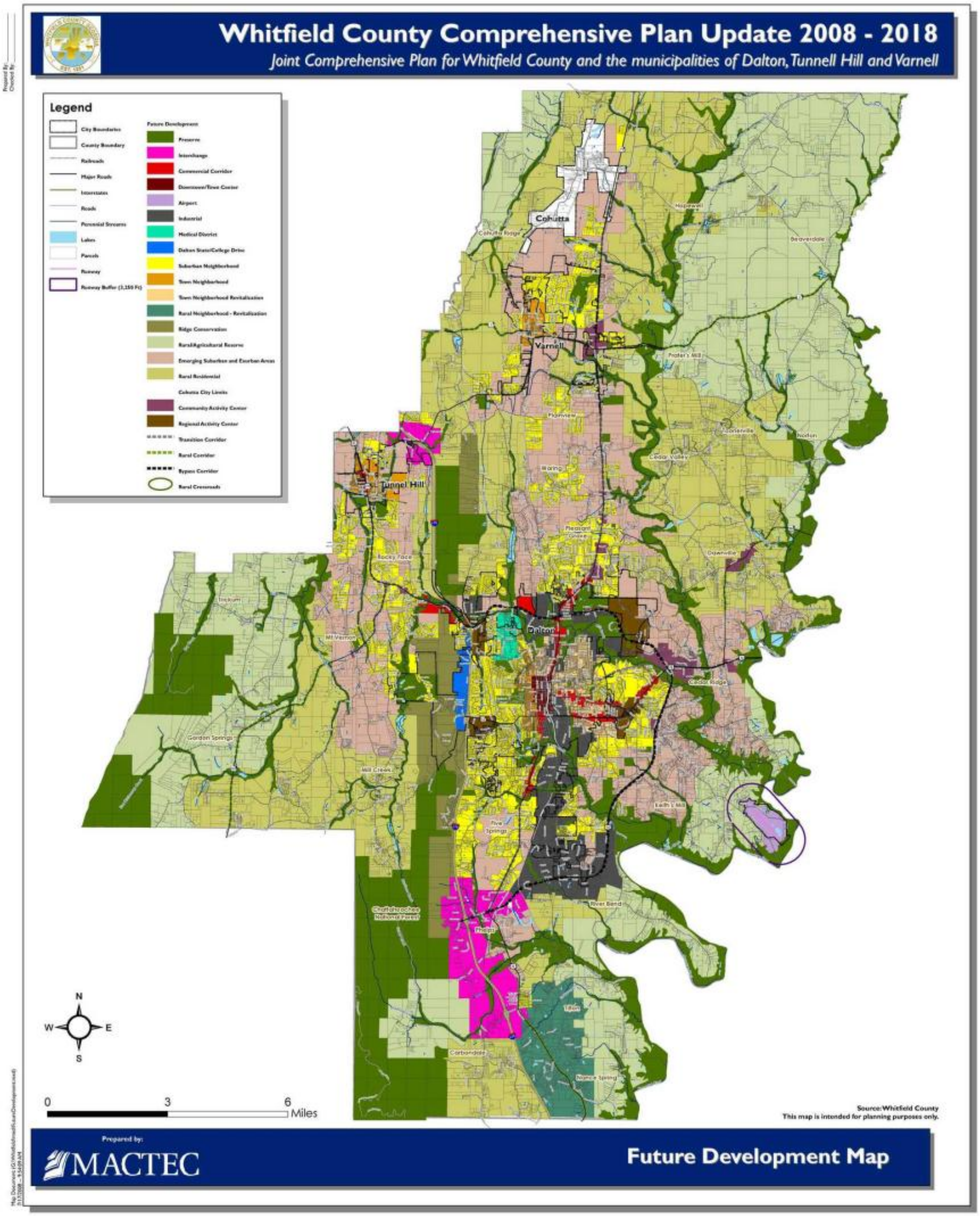
Commercial classification properties make up only 3.4% of the total County area. Commercial land uses are primarily within the cities. Commercial properties account for

2.4% of the unincorporated area of the County. Properties classified as Industrial account for approximately 3.3% of the total County and 2.3% of the unincorporated area. Industrial uses include light and heavy manufacturing and warehousing/distribution.

Existing Land Use Map for Whitfield County:



Future Land Use Map for Whitfield County:



City of Dalton

The incorporated city of Dalton includes roughly 6.9% of the County's 291 square miles. Table 4-2 presents the existing land use distribution and the Dalton Existing Land Use Map, found at this end of this chapter, shows existing land use for the city of Dalton.

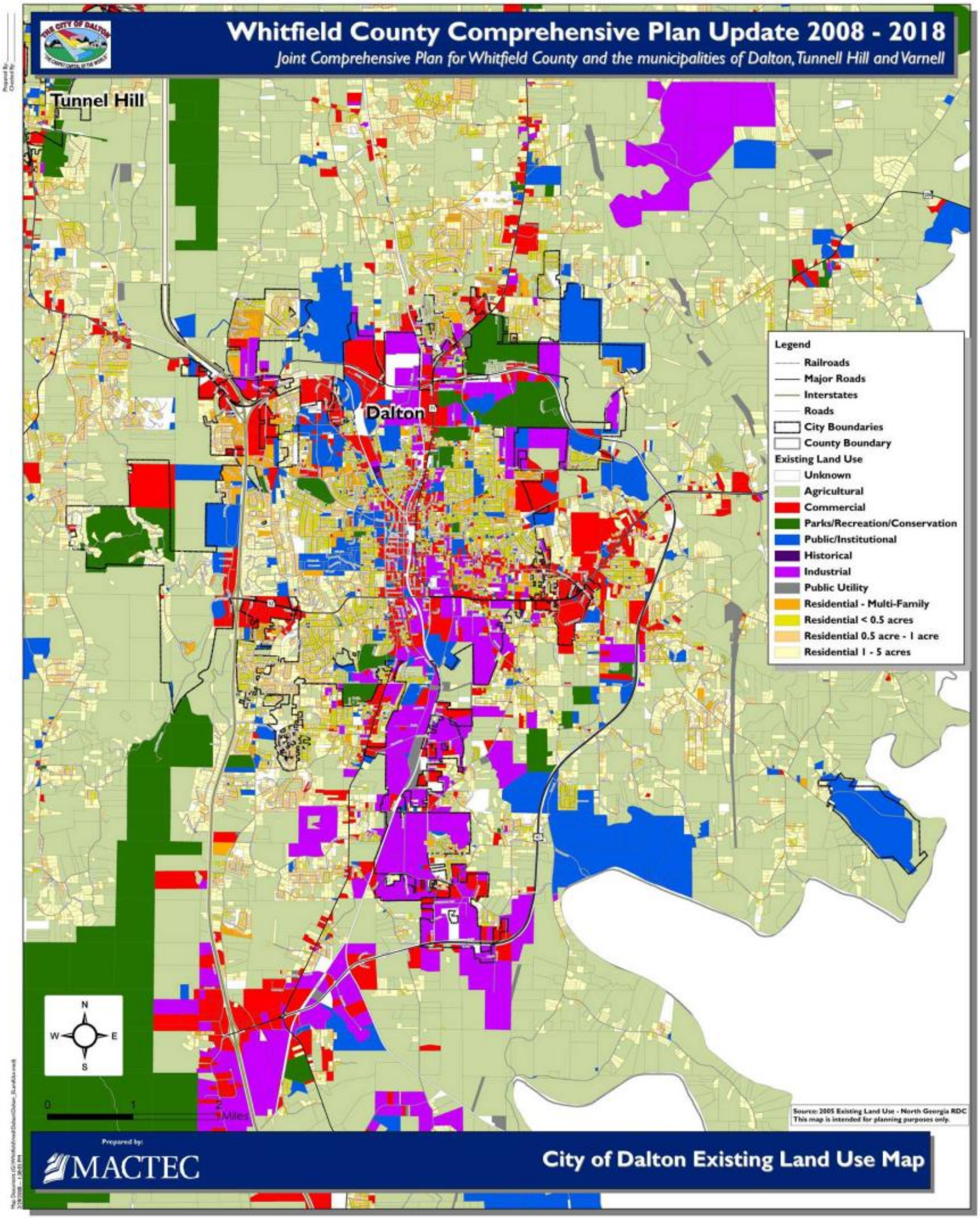
Table 4-2 – Existing Land Use (City of Dalton)

Land Use Classification	Acres	% of Total
Unknown	417.3	3.6%
Agricultural	860.2	7.4%
Commercial	1,909.9	16.4%
Parks/Recreation/Conservation	1,058.7	9.1%
Public/Institutional	1,732.2	14.9%
Historical	6.4	0.1%
Industrial	1,975.8	17.0%
Public Utility	61.5	0.5%
Residential - Multi-Family	517.3	4.4%
Residential Less than 0.5 Acres	1,355.8	11.6%
Residential 0.5 acre to 1 acre	830.4	7.1%
Residential 1 to 5 acres	912.8	7.8%
Total	11,638.3	100.0%

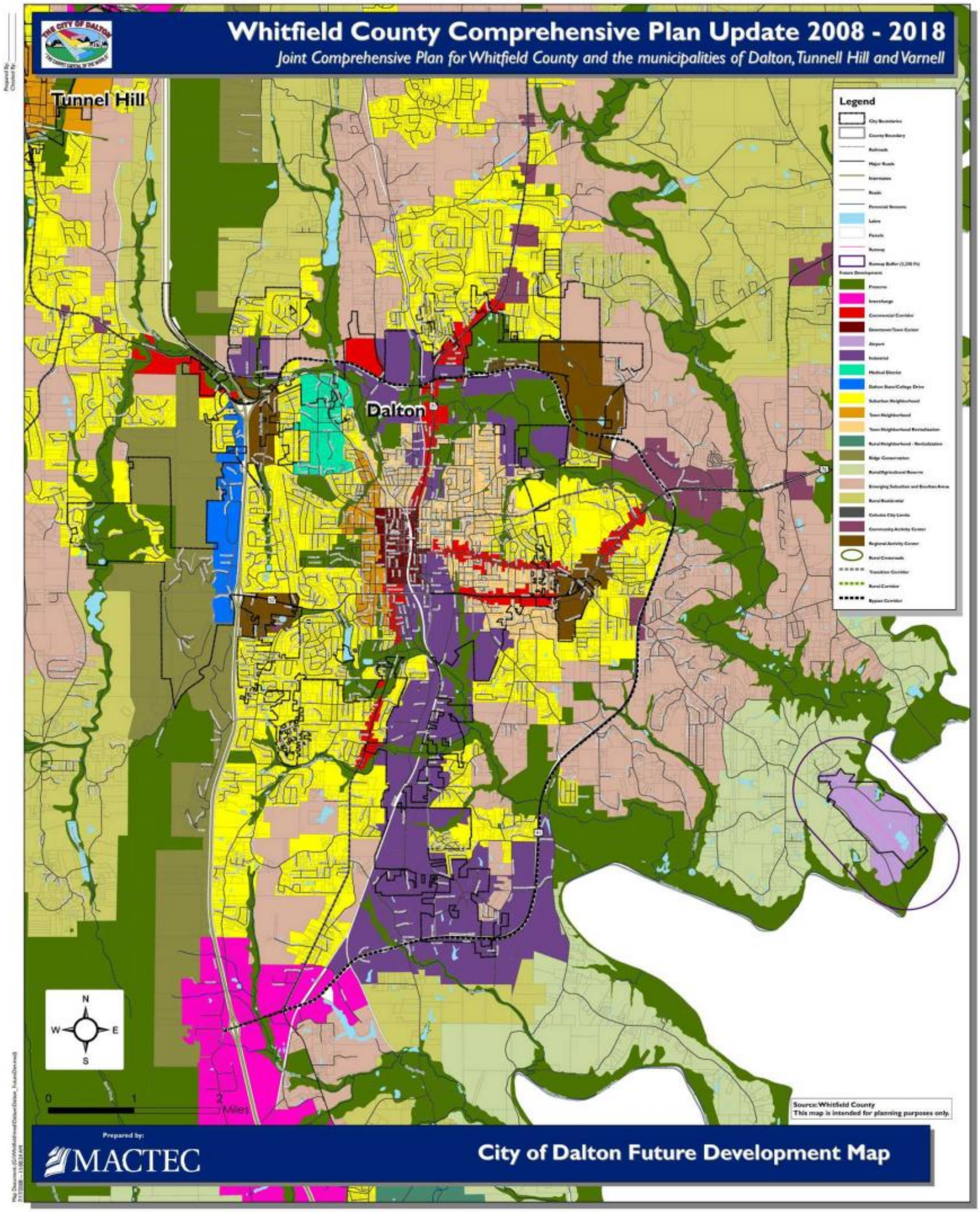
Land classified as Residential (combination of less than 0.5 acre, 0.5 to 1.0 acre and 1.0 to 5.0 acres) makes up the largest portion of the city at 26.5%. More than 40% of this residential classification falls into the less than 0.5 acres classification. Multifamily Development makes up 4.4%. Agricultural/Rural/Undeveloped land represents 7.4% of the city. Properties classified as Industrial account for 17.0%. Industrial includes light and heavy manufacturing and warehousing/distribution. Commercial classification properties make up 16.4% of the city.

Land classified as Parks, Recreation, and Conservation equates to almost 9.1% of the city's total area. In addition to conservation land, this category includes golf courses, public and private ball fields as well as public parks. Properties classified as Public/Institutional account for approximately 14.9%. Public/Institutional areas include schools and places of worship.

Existing Land Use Map for the City of Dalton:



The Future Land Use Map for the City of Dalton:



City of Tunnel Hill

The incorporated city of Tunnel Hill makes up roughly one percent of the County's 291 square miles. Table 4-3 presents the existing land use for the city. The Tunnel Hill Existing Land Use Map, found at this end of this chapter, shows existing land use for unincorporated Tunnel Hill.

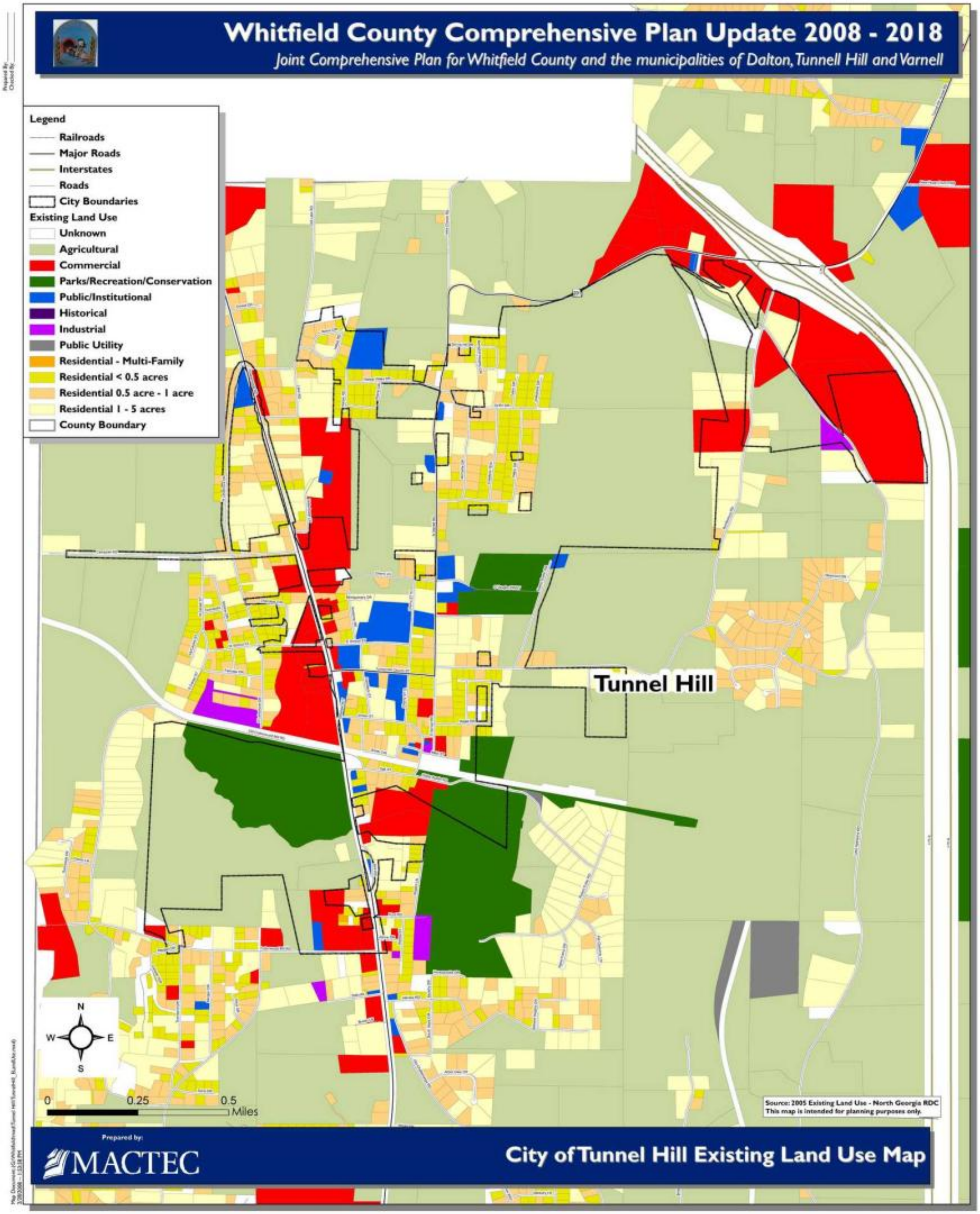
Table 4-3 – Existing Land Use (City of Tunnel Hill)

Land Use Classification	Acres	% of Total
Unknown	12.0	1.3%
Agricultural/Rural/Undeveloped	424.0	48.2%
Commercial	90.2	10.0%
Parks/Recreation/Conservation	99.2	11.0%
Public/Institutional	32.8	3.6%
Industrial	2.7	0.3%
Residential - Multi-Family	0.3	0.0%
Residential Less than 0.5 Acres	79.1	8.7%
Residential 0.5 acre to 1 acre	70.3	7.8%
Residential 1 to 5 acres	94.7	10.5%
Total	905.4	100.0%

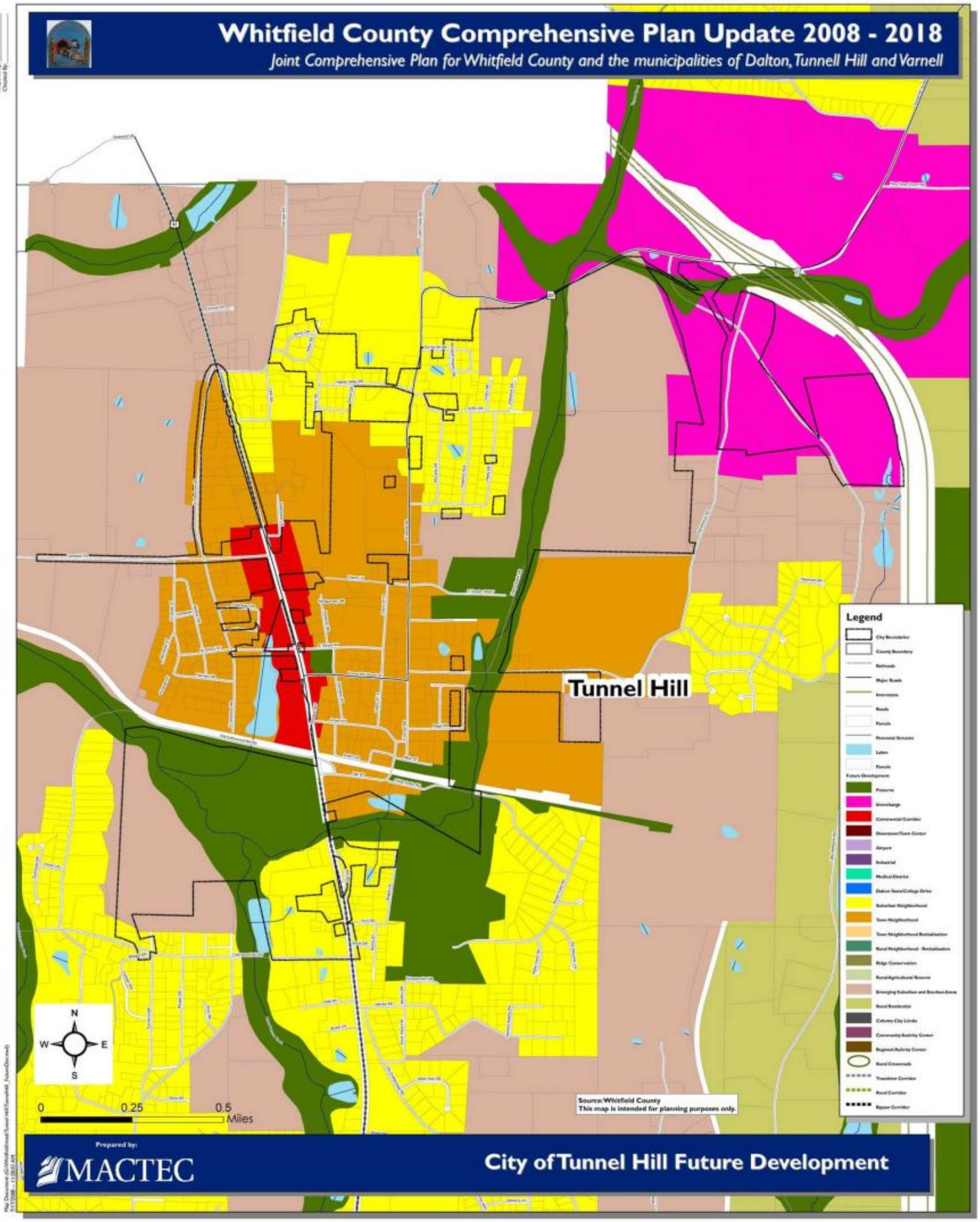
Agricultural/Rural/Undeveloped land makes up the largest portion of the city. Roughly 48.2% of the city is categorized as Agricultural/Rural/Undeveloped areas. Land classified as Residential makes up 27% of the city, including 10.5% in the Residential 1-to-5 acres category. Properties classified as Industrial account for approximately 0.3% of the city. Industrial includes light and heavy manufacturing and warehousing/distribution. Commercial classification properties made up 10.0% of the city.

Land classified as Parks, Recreation, and Conservation makes up almost 11.0% of the city's total area. In addition to conservation land, this category includes areas such as golf courses, public and private ball fields, public parks and includes the historic tunnel. Properties classified as Public/Institutional account for approximately 3.6%. Public/Institutional areas include schools and places of worship.

Existing Land Use Map for the City of Tunnel Hill:



Future Land Use Map for the City of Tunnel Hill:



City of Varnell

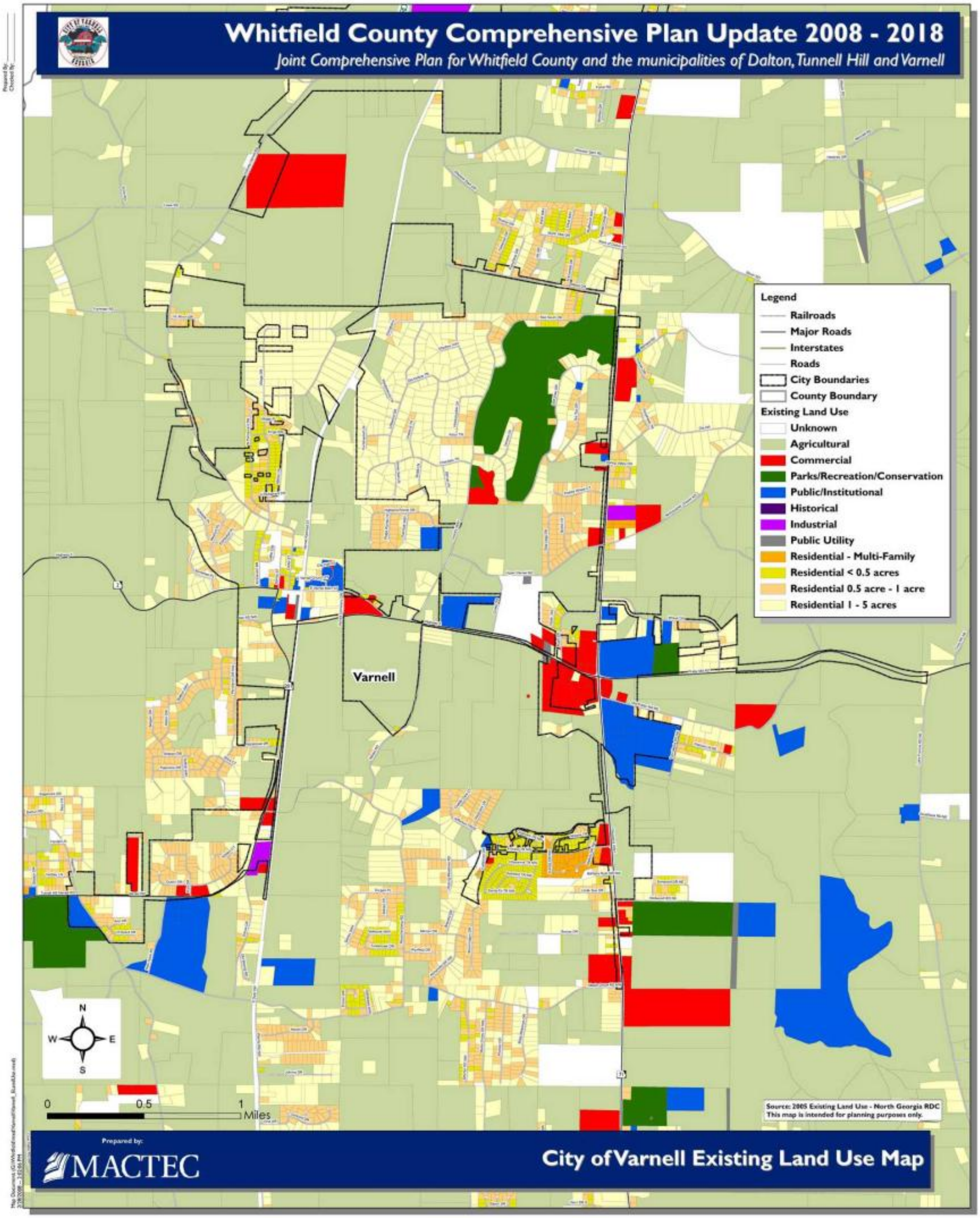
The incorporated city of Varnell makes up roughly one percent of the County's 291 square miles. Table 4-4 presents the existing land use for the city. The Varnell Existing Land Use Map, found at this end of this chapter, shows existing land use for Varnell.

Table 4-4 – Existing Land Use (City of Varnell)

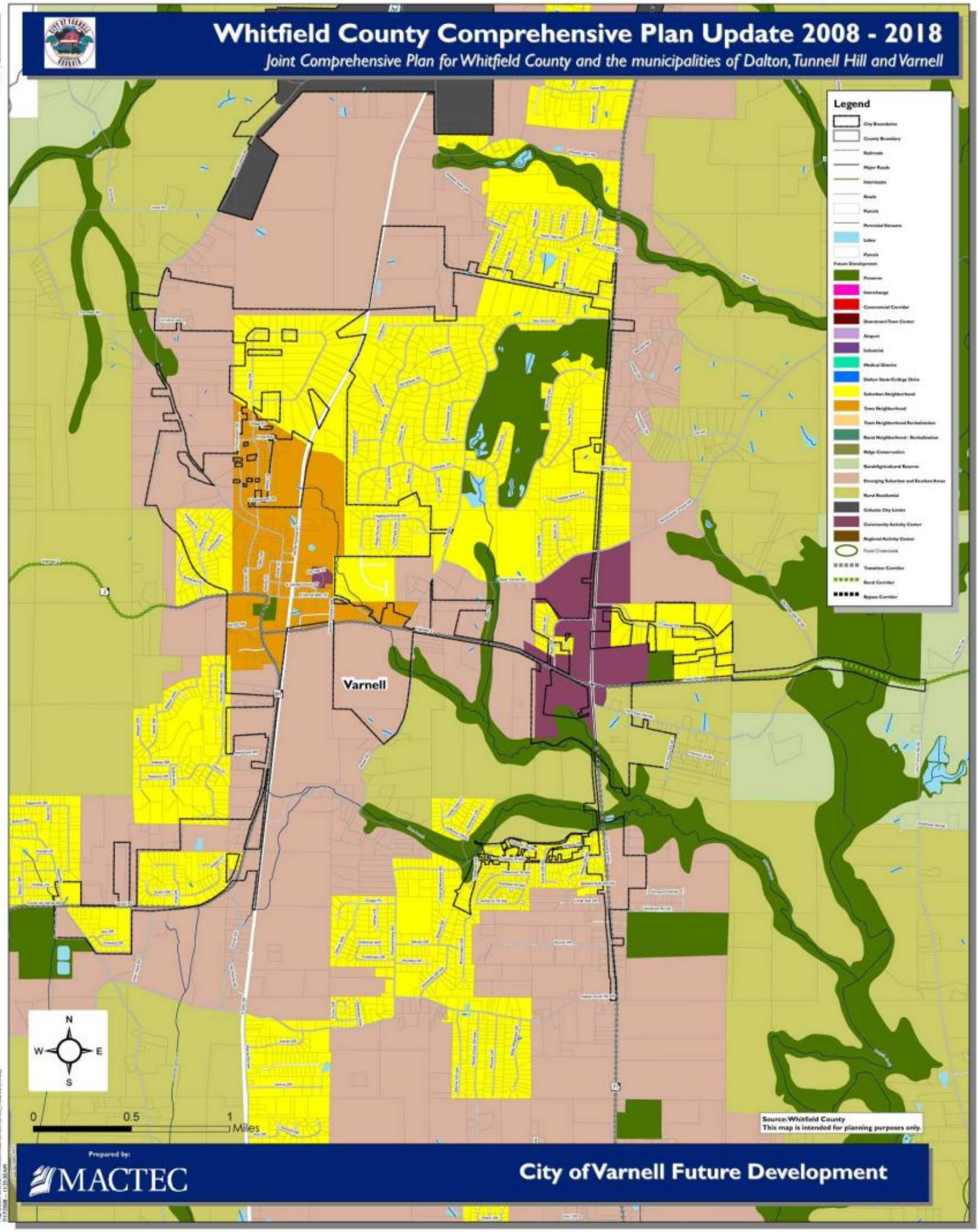
Land Use Classification	Area	% of Total
Unknown	35.9	2.0%
Agricultural/Rural/Undeveloped	787.8	44.9%
Commercial	79.0	4.5%
Parks/Recreation/Conservation	15.7	0.9%
Public/Institutional	161.7	9.2%
Industrial	6.5	0.4%
Public Utility	1.8	0.1%
Residential - Multi-Family	3.2	0.2%
Residential Less than 0.5 Acres	71.8	4.1%
Residential 0.5 acre to 1 acre	166.8	9.5%
Residential 1 to 5 acres	425.4	24.2%
Total	1,755.7	100.0%

Agricultural/Rural/Undeveloped land makes up the largest portion of the city. Roughly 44.9% of the city is categorized as Agricultural/Rural/Undeveloped areas. Land classified as Residential (1 to 5 acres) makes up the second largest portion of the city at 24.2% and Multifamily Development makes up 0.2%. Properties classified as Industrial accounts for approximately 0.4% of the city. Industrial includes light and heavy manufacturing and warehousing/distribution. Commercial classification properties make up 4.5% of the city. Land classified as Parks, Recreation, and Conservation makes up almost 0.9% of the city's total area. In addition to conservation land, this category includes areas such as golf courses, public and private ball fields as well as public parks. Properties classified as Public/Institutional account for approximately 9.2% Public/ Institutional areas include schools and places of worship.

Existing Land Use Map for the City of Varnell:



Future Land Use Map for the City of Varnell:



Local Capabilities Assessment

Local mitigation capabilities are existing authorities, policies, programs and resources that reduce hazard impacts or that could be used to implement hazard mitigation activities. The HMPC reviewed local capabilities and the available information is included in the Local Capabilities Assessment Chart below.

Plan, Code/Ordinance, Tool or Funding Method	In place to address hazard mitigation by following jurisdictions (W-Whitfield, D=Dalton, T= Tunnel Hill, V=Varnell, C=Cohutta)	Adequately utilized or enforced to address hazard mitigation	Updated regularly or as required by law	Notes
Comprehensive Plan	W, D, T, V, C	Y	Y	Updated 2018
Local Emergency Operations Plan (LEOP)	W	Y	Y	
Transportation Plan	W	Y	Y	
Community Wildfire Protection Plan (CWPP)	W	Y	Y	Updated as required
Building Code	W, D	Y	Y	2019 International Building Code
Site Plan Review	W, D	Y	Y	process continuously updated
ISO Rating	W, D	Y	Y	ISO Rating: W=3, D=2
Zoning Ordinance	W, D	Y	Y	
Subdivision Ordinance	W, D	Y	Y	
Floodplain Ordinance	W, D, T, V, C	Y	Y	as required by NFIP participation
Planning Commission	W	Y	Y	
Hazard Mitigation Planning Committee (HMPC)	W, D, T, V, C	Y	Y	2022 HMP update
Mutual Aid Agreements	W, D, T, V, C	Y	Y	State and local jurisdictions
Mass Notification System	W	Y	Y	
Grant Writing	W, D, T, V, C	Y	NA	staff and contracted grant writers
CERT Team	W	Y	Y	
Public outreach & education programs	W, D, T, V, C	Y	Y	see mitigation actions chart
GEMA School Safety Plan	W	Y	Y	updated annually & submitted to GEMA
Storm Ready Certification	W	NA	NA	
Capital improvement projects	W, D, T, V, C	Y	NA	see mitigation actions chart
Impact fees	W	NA	NA	NA
Bonds, taxes, utility fees	W, D, T, V, C	Y	NA	ongoing

Chapter 5
Hazard Mitigation Goals, Objectives, & Actions

When Whitfield County and the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta begin any large-scale planning effort, it is imperative that the planning process is driven by a clear set of goals and objectives. Goals and objectives are the foundation of an effective Hazard Mitigation Plan. They address the key problems and opportunities to help establish a framework for identifying risks and developing strategies to mitigate those risks. During the planning process, Whitfield County's multi-jurisdictional Hazard Mitigation Planning Committee (HMPC) reviewed the previous plan and took into consideration community growth and minor changes that were made to infrastructure in order to evaluate to what extent the previously identified hazards had affected the jurisdictions since the last plan revision. While this information was used to review all of the goals, objectives, and action items from the previous plan for relevance and usability, there were no changes in overall priorities identified at the time of this plan update.

In order to fully understand the hazard mitigation goals, objectives, and actions, it is necessary to clearly define the terms **"goal"**, **"objective"**, and **"action"**:

A **goal** is a broad-based statement of intent that establishes the direction for the Whitfield County Hazard Mitigation Plan. Goals can essentially be thought of as the desired "outcomes" of successful implementation of the Plan.
An **objective** is the stated "means" of achieving each goal, or the tasks to be executed in the process of achieving goals.
An **action** is a project-specific strategy to mitigate a particular hazard event within the context of the overarching goals and objectives.

While specific mitigation actions are listed later in this chapter, it is important to note that the actions were selected and evaluated in relation to the overarching hazard mitigation goals and objectives of this plan, which are as follows:

Goal #1. Protect life and minimize loss of property damage.

Objective 1-1. Implement mitigation actions that will assist in protecting lives and property by making homes, businesses, public facilities, and infrastructure more resistant to vulnerable hazards.
Objective 1-2. Review existing ordinances, building codes, and safety inspection procedures to help ensure that they employ the most recent and generally acceptable standards for the protection of buildings.
Objective 1-3. Ensure that public and private facilities and infrastructure meet established building codes and enforce the codes to address any deficiencies.
Objective 1-4. Implement mitigation actions that encourage the protection of the environment.

Objective 1-5. Integrate the recommendations of this plan into existing land use plans and capital improvement programs.
Objective 1-6. Build upon past databases to ensure that vulnerable hazards' risks are accurate.
Goal #2. Increase Public Awareness.

Objective 2-1. Develop and implement additional education and outreach programs to increase public awareness of the risks associated with hazards and on specific preparedness activities available.
Objective 2-2. Encourage homeowners and businesses to take preventative actions and purchase hazard insurance.

Goal #3. Encourage Partnerships.

Objective 3-1. Strengthen inter-jurisdictional and inter-agency communication, coordination, and partnerships to foster hazard mitigation actions designed to benefit multiple jurisdictions.
Objective 3-2. Identify and implement ways to engage public agencies with individual citizens, nonprofit organizations, business, and industry to implement mitigation activities more effectively.

Goal #4. Provide for Emergency Services.

Objective 4-1. Where appropriate, coordinate and integrate hazard mitigation actions with existing emergency operations plans.
Objective 4-2. Identify the need for, and acquire, any special emergency services and equipment to enhance response capabilities for specific hazards.
Objective 4-3. Encourage the establishment of policies to help ensure the prioritization and implementation of mitigation actions designed to benefit critical facilities, critical services, and emergency traffic routes.

Format Utilized to Develop Mitigation Actions

The HMPC reviewed each jurisdiction's annual budget, multiyear work programs, and comprehensive plans to determine existing mitigation actions that met the goals and objectives of this Plan. The committee then developed a list of tentative mitigation actions based on committee members' personal knowledge, interviews with other officials of each jurisdiction, and knowledge of successful actions implemented in other communities.

The committee members developed a prioritized list of mitigation actions utilizing the GEMA recommended STAPLEE prioritization methodology, with special emphasis on the following:

1. Cost effectiveness (and when potential federal projects are anticipated, cost-benefit reviews will be conducted prior to application);
2. Comprehensiveness, i.e. addresses a specific goal and objective;
3. Addresses reducing effects of hazards on new and existing buildings and infrastructure;
4. Addresses reducing effects of hazards on critical facilities where necessary; and,
5. Identification of future public buildings and infrastructure (Note: recognizing that the Plan may be modified and evaluated during the monitoring and evaluation period, and will definitely be completely updated within the federally mandated five year approval cycle, future development including future buildings will only include the five year period from Plan completion).

Each individual HMPC member, or non-member participant, was provided with information on the STAPLEE method and asked to prioritize the list of mitigation actions according to the criteria, with special emphasis on what they would consider most beneficial to the community. Once this information was received from participating individuals, these individual prioritization rankings of mitigation actions were composited to represent the consensus of the HMPC.

Through this prioritization process, several projects emerged as being a greater priority than others. Some of the projects involved expending considerable amounts of funds to initiate the required actions. Most projects allowed the community to pursue completion of the project using potential grant funding. Still others required no significant financial commitment by the community. All proposed mitigation actions were evaluated to determine the degree to which the County would benefit in relation to the project costs. After a final review by the HMPC, the composited prioritization list of mitigation measures, as presented within this Plan, was determined.

This same method of prioritization was utilized for the prior update to this Plan. Additionally, it was reviewed by the HMPC during the current plan update process and approved for continued use due to its effectiveness. No changes were recommended.

Mitigation Actions

Each mitigation action is presented by jurisdiction, or in the case of joint actions by multiple jurisdictions, or by independent public bodies, or by private nonprofits, in priority order (objective), by best estimate of cost, if applicable, by potential funding source if other than operating budgets, by department or agency that will administer the action, and by timeframe. Timeframes do not begin until funding is obtained for any particular project unless otherwise indicated.

The Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta have relatively small populations when compared to that of the County. Due to limited financial and human resources, much support with regard to public safety is provided by Whitfield County. This includes assistance with emergency management, fire protection, and law enforcement. The Cities and Towns do have some capability, but it is augmented by the County. Therefore, many mitigation actions included on behalf of the County in the Plan are likely to have an indirect benefit for the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta. Other mitigation actions are fully supported and actively engaged by multiple jurisdictions.

Many of the mitigation actions included within this Plan update are carried over from the previous 5-year planning period. Some of these action items were left unchanged while others were revised as needed. This is not uncommon in the more rural counties of North Georgia. It is not a result of failure to review existing mitigation actions carefully or to consider new ones. Rather, it is primarily the result of the unavailability of funding, whether that be general funds, private and private grants, or other sources. The HMPC selects mitigation actions during the planning process based upon perceived benefit, not based upon likelihood of funding opportunities. To do otherwise would result in a very short list of mitigation actions.

Each mitigation action listed in the Mitigation Actions Chart on the pages that follow is designed to mitigate one or more hazards discussed in this Plan. Those specific hazards are listed for each mitigation action at the end of each mitigation action description. The term "All" as used in the "Hazards Addressed" section below refers to all hazards discussed in this Plan. Each mitigation action listed may be supported by one or more jurisdictions. Mitigation actions that will be joint projects between all jurisdictions are listed under the "Jurisdictional Participants" section as "All." Each mitigation action that follows mitigates the effects of hazards on existing structures/infrastructure, future structures/infrastructure, or both, as indicated. In addition, the status of each mitigation action that follows is indicated by one of the following three terms:

PRELIMINARY – unfunded projects or projects in planning stages.
IN PROGRESS – funded projects that have begun but aren't completed.
ONGOING – continuous projects that are never truly completed; may be funded or unfunded at any given time but are expected to continue unless removed from Plan.
**Note: fully completed or deleted projects are not found below, but in Appendix D.*

Mitigation Action	Hazard(s) Addressed	Jurisdictional Participants	Responsible Party or Agency	Project Status	Cost Estimate	Potential Funding Sources	Project Length	Goals and Objectives	Structures & Infrastructure Impacted
Floodplain Management	Flooding	All	All jurisdictions planning depts	Ongoing	Staff time	Each jurisdiction	5 years	1-1, 1-2, 1-3, 1-4, 1-6, 2-1, 2-2, 4-3	Existing and Future
Flooding Mitigation Projects for areas associated with Mill Creek	Flooding	Whitfield Dalton	Whitfield Planning Dalton Planning	Preliminary	$1.5 million	Public or private grants	5 years	1-1, 1-2, 1-3, 1-4, 1-6, 2-1, 2-2	Existing and Future
Flooding Mitigation Projects for areas associated with Underwood Road	Flooding	Dalton	Dalton Planning	Preliminary	$320K	Public or private grants	5 years	1-1, 1-2, 1-3, 1-4, 1-6, 2-1, 2-2	Existing and Future
Flooding Mitigation Projects for areas associated with Tar Creek	Flooding	Dalton	Dalton Planning	Preliminary	$300K	Public or private grants	5 years	1-1, 1-2, 1-3, 1-4, 1-6, 2-1, 2-2	Existing and Future
Updated Floodplain Mapping – minor updates by FEMA	Flooding Dam Failure	All	All jurisdictions planning depts	In progress	FEMA	Public or private grants	5 years	1-1, 1-2, 1-3, 1-4, 1-6, 2-1, 2-2	Existing and Future
Road Maintenance Equipment and Supplies for Winter Weather	Winter Storm	Whitfield	Whitfield Public Works	Ongoing	$300K	Public or private grants	5 years	4-1, 4-2	Existing and Future
Generators for Critical Facilities & Infrastructure (including necessary wiring)	All	All	Whitfield EMA and all jurisdictions	Ongoing	Minimum $100K each	Public or private grants	5 years	1-3, 3-1, 4-1, 4-2	Existing and Future
Update of LEOP	Hazmat Release	All	Whitfield EMA	Ongoing	Staff time	Whitfield County	2 years	1-2, 1-3, 1-4, 1-5, 1-6, 2-1, 3-1, 3-2, 4-1, 4-2, 4-3	Existing and Future
Community Awareness Program – GEMA Area 6	All	All	Whitfield EMA	Preliminary	$256K	Public or private grants	5 years	1-2, 1-3, 1-4, 1-5, 1-6, 2-1, 3-1, 3-2, 4-1, 4-2, 4-3	Existing
Dalton Public Education Program – Fire Safety House	Wildfire	Dalton Whitfield	Dalton Fire Dept	Preliminary	$50K	Public or private grants	3 years	2-1, 3-1, 3-2, 4-2	Existing
Weather Radios for citizens	All	All	Whitfield EMA	Ongoing	$300K	Public or private grants	2 years	2-1, 3-1, 3-2, 4-2	Existing
Sound Design and Comprehensive Inspection of unclassified Dams	Dam Failure	Whitfield	All jurisdictions planning depts	Preliminary	$100K per year minimum	Public or private grants; general funds	5 years	1-2, 1-3, 1-4, 1-6, 3-1, 3-2, 4-1	Existing and Future
CERT Program	All	All	Whitfield EMA	Ongoing	$14K per year	Public or private grants; general funds	1 year	2-1, 3-1, 3-2, 4-1	Existing and Future
GEMA School Safety Plan updates	All	All	Whitfield EMA	Ongoing	Staff time	Whitfield County	1 year	1-3, 1-6, 2-1, 3-1, 3-2, 4-1, 4-2	Existing

Mitigation Action	Hazard(s) Addressed	Jurisdictional Participants	Responsible Party or Agency	Project Status	Cost Estimate	Potential Funding Sources	Project Length	Goals and Objectives	Structures & Infrastructure Impacted
Community Wildfire Protection Plan updates	Wildfire	All	Whitfield Fire and Dalton Fire Depts	Ongoing (last update 2014)	Staff time	Whitfield County	5 years	1-1, 1-2, 1-3, 1-4, 1-5, 1-6, 2-1, 2-2, 3-1, 3-2, 4-1	Existing and Future
Community Rating System	Flooding	All	Whitfield Planning	Ongoing	Staff time	Whitfield County	5 years	1-1, 1-2, 1-3, 1-4, 1-6, 2-1, 2-2, 4-3	Existing and Future
Seismic Loss Estimation Studies	Earthquake	All	Whitfield Planning	Preliminary	$100K minimum	Public or private grants	5 years	1-1, 1-2, 1-3, 1-4, 1-5, 1-6, 2-1, 2-2, 3-1, 3-2, 4-1	Existing
Hazardous Materials Rescue Team – supplies, equipment, training (see Appendix D)	Hazmat Release	All	Whitfield Fire and Dalton Fire Depts	Ongoing	$125K per year	Public or private grants; general funds	1 year	3-1, 4-1, 4-2	Existing
City of Dalton Fire Stations Construction	All	Dalton	Dalton Fire Dept	Preliminary	$1.3 million per station plus property cost	Public or private grants; SPLOST	5 years	1-1, 1-2, 1-3, 1-4, 1-5, 1-6, 4-1, 4-2	Future
Mass Casualty Incident supplies, equipment, training	All	All	Whitfield Fire	Ongoing	$100K	Public or private grants; general funds	2 years	3-1, 4-2	Existing and Future
Hamilton Medical Center Decontamination Incident – supplies, equipment, training	Hazmat Release	All	Hamilton Medical Center	Ongoing	$115K	Public or private grants, HMC	4 years	1-4, 3-1, 3-2, 4-1, 4-2	Existing and Future
In-cab Terminals linked to 911 Center	All	All	Whitfield 911	Preliminary	$150K	Public or private grants	5 years	3-1, 4-2	Existing and Future
Quarantine Supplies	All	All	Whitfield Fire and Dalton Fire Depts	Ongoing	$500K	Public or private grants	2 years	1-4, 4-1, 4-2	Existing and Future
Medical Personnel Transportation 4x4 vehicles	Winter Storm	All	Hamilton Medical Center	Preliminary	$63K	Public or private grants, HMC	3 years	3-1, 3-2, 4-1, 4-2	Existing and Future
Hospital Physical Security	All	All	Hamilton Medical Center	Preliminary	$42K	Public or private grants, HMC	2 years	1-3, 4-2	Existing
Manufactured Homes Anchoring	Tornado	All	Whitfield Planning	Preliminary	Staff time	Whitfield County	3 years	1-1, 1-2, 2-1, 3-2	Existing
Electronic Traffic Signs	All	Whitfield Dalton	Whitfield EMA and Dalton Fire Dept	Preliminary	$30K each	Public or private grants	2 years	2-1, 3-1, 3-2, 4-1, 4-2	Existing and Future
National Historic Register – structure protection	Flooding	All	Whitfield Planning	Ongoing	TBD	Public or private grants	5 years	1-1, 1-2, 1-3, 1-4, 1-6, 2-1, 2-2	Existing

Mitigation Action	Hazard(s) Addressed	Jurisdictional Participants	Responsible Party or Agency	Project Status	Cost Estimate	Potential Funding Sources	Project Length	Goals and Objectives	Structures & Infrastructure Impacted
Emergency Fuel Plan	All	Whitfield Dalton	Whitfield and Dalton Public Works	Preliminary	$50K	Public or private grants; general funds	2 years	4-1, 4-2	Existing and Future
Fuel Supply (Mobile Tankers)	All	Whitfield Dalton	Whitfield and Dalton Public Works	Preliminary	$250K each	Public or private grants	5 years	4-1, 4-2	Existing and Future
Expansion of Fixed Fuel Supply	All	Whitfield Dalton	Whitfield and Dalton Public Works	Preliminary	TBD	Public or private grants; general funds	5 years	4-1, 4-2	Existing and Future
Collect GPS and other data on critical facilities needed by GMIS for Hazus Reports	All	Whitfield	Whitfield EMA	Ongoing	Staff time	Whitfield County	3 years	1-6, 3-1, 4-1	Existing and Future
Communication Systems Technological Upgrades	All	All	Whitfield EMA	Preliminary	$5 million	Public or private grants; general funds	5 years	3-1, 4-2	Existing and Future
Technical Rescue Team	All	Whitfield	Whitfield EMA	Preliminary	$125K	Public or private grants; general funds	3 years	2-1, 3-1, 3-2, 4-1	Existing and Future
New SCBA equipment	All	Whitfield	Whitfield Fire	Preliminary	$950K	Public or private grants; general funds	2 years	3-1, 3-2, 4-1, 4-2	Existing and Future
NFPA Compliant Turn-out gear	All	Whitfield	Whitfield Fire	Preliminary	$422,400	Public or private grants; general funds	2 years	3-1, 3-2, 4-1, 4-2	Existing and Future
New Fire Station #13 to cover class 9 rated area	All	Whitfield	Whitfield Fire	Preliminary	$2.2 million	General funds SPLOST Public & Private grants	5 years	3-1, 3-2, 4-1, 4-2	Existing and Future
Relocate Fire Station #1 to include HQ and Maintenance Shop	All	Whitfield	Whitfield Fire	Preliminary	$7.75 million	General funds SPLOST Public & Private grants	5 years	3-1, 3-2, 4-1, 4-2	Existing and Future
Updated Training Facility to include Tower, Classrooms and Restrooms	All	Whitfield	Whitfield Fire	Preliminary	$2.5 million	General funds SPLOST Public & Private grants	5 years	3-1, 3-2, 4-1, 4-2	Existing and Future
Mobile Air Truck	All	Whitfield	Whitfield Fire	Preliminary	$435K	General funds SPLOST Public & Private grants	3 years	3-1, 3-2, 4-1, 4-2	Existing and Future
Replacement of station generators installed in late 1990's (10 stations)	All	Whitfield	Whitfield Fire	Preliminary	$450K	General funds SPLOST Public & Private grants	3 years	3-1, 3-2, 4-1, 4-2	Existing and Future

Mitigation Action	Hazard(s) Addressed	Jurisdictional Participants	Responsible Party or Agency	Project Status	Cost Estimate	Potential Funding Sources	Project Length	Goals and Objectives	Structures & Infrastructure Impacted
Replacement of four Class A Pumpers due to age of approx.. 20yrs	All	Whitfield	Whitfield Fire	Preliminary	$2.1 million	General funds SPLOST Public & Private grants	5 years	3-1, 3-2, 4-1, 4-2	Existing and Future
Replace 2005 LDV Mobile Command Vehicle (MCV1) with a newer model vehicle with more space and capabilities	All	All	Whitfield EMA	Preliminary	$1.5 million	General funds SPLOST Public & Private grants	5 years	3-1, 3-2, 4-1, 4-2	Existing and Future
New EMA Facility with EOC and warehouse / bay space for mobile command & response equipment/trailers	All	All	Whitfield EMA	Preliminary	$5 million	General funds SPLOST Public & Private grants	5 years	3-1, 3-2, 4-1, 4-2	Existing and Future
Install 700/800 MHz interop repeaters on all Whitfield Simulcast Sub Sites, Dug Gap, 911, North and South	All	All	Whitfield EMA	Preliminary	$40K	General funds SPLOST Public & Private grants	2 years	3-1, 3-2, 4-1, 4-2	Existing and Future
Install weather monitoring and surveillance equipment to each Whitfield Simulcast Sub Site for security and situational awareness	All	All	Whitfield EMA	Preliminary	$30K	General funds SPLOST Public & Private grants	2 years	3-1, 3-2, 4-1, 4-2	Existing and Future
Replace Motorola APX 7000/6000 P25 Radios with current APX model to include the Smart Connect features and the latest technologies offered.	All	All	Whitfield EMA	Preliminary	$5 million	General funds SPLOST Public & Private grants	5 years	3-1, 3-2, 4-1, 4-2	Existing and Future
Replace 2010 EMA 4x4 Ford Expedition with a F250 4x4 crew cab or similar model for towing resource trailers and hauling equipment.	All	All	Whitfield EMA	Preliminary	$125K	General funds SPLOST Public & Private grants	5 years	3-1, 3-2, 4-1, 4-2	Existing and Future
Rope Rescue Equipment and Supplies	All	Dalton	Dalton Fire	Preliminary	$13,657	General funds SPLOST Public & Private grants	5 years	3-1, 3-2, 4-1, 4-2	Existing and Future
Confined Space Rescue Equipment and Supplies	All	Dalton	Dalton Fire	Preliminary	$40,622	General funds SPLOST Public & Private grants	5 years	3-1, 3-2, 4-1, 4-2	Existing and Future

Chapter 6
Executing the Plan

6.1 – Action Plan Implementation

The hazard mitigation planning process was overseen by the Whitfield County Emergency Management Agency. Facilitation of the planning process was conducted by North Georgia Consulting Group, LLC. Once GEMA completes its initial review of this Plan, it will be presented to the Whitfield County Board of Commissioners for consideration. Once adopted, the Whitfield County EMA Director shall assume responsibility for the maintenance of the Plan. It shall be the responsibility of the EMA Director to ensure that this Plan is utilized as a guide for initiating the identified mitigation measures within the community. The EMA Director shall be authorized to convene a committee to review and update this Plan annually. The Plan will also have to be updated and resubmitted once every five years. Through this Plan updating process, the EMA Director shall identify projects that have been successfully undertaken in initiating mitigation measures within the community. These projects shall be noted within the planning document to indicate their completion. Additionally, the committee called together by the EMA Director shall help to identify any new mitigation projects that can be undertaken in the community.

Members of the HMPC prioritized the potential mitigation measures identified in this Plan. A list of mitigation goals, objectives and related action items was compiled from the inputs of the HMPC, as well as from others within the community. The subcommittee prioritized the potential mitigation measures based on what they considered most beneficial to the community. Several criteria were established to assist HMPC members in the prioritization of these suggested mitigation actions. Criteria included perceived cost benefit or cost effectiveness, availability of potential funding sources, overall feasibility, measurable milestones, multiple objectives, and both public and political support for the proposed actions. Through this prioritization process, several projects emerged as being a greater priority than others. Some of the projects involved expending considerable amounts of funds to initiate the required actions. Most projects allowed the community to pursue completion of the project using potential grant funding. Still others required no significant financial commitment by the community. All proposed mitigation actions were evaluated to determine the degree to which the County will benefit in relation to the project costs. After review by the HMPC, the prioritized list of mitigation measures, as presented within this Plan, was determined.

6.2 – Evaluation

As previously stated, the Whitfield County EMA Director will be charged with ensuring that this plan is monitored and updated at least annually or more often if deemed necessary. The method of evaluation will consist of utilizing a checklist to determine what mitigation actions were undertaken, the completion date of these actions, the cost associated with each completed action, and whether actions were deemed to be successful. A committee, perhaps with much of the same membership as the existing HMPC, will convene in order to accomplish the annual plan evaluation. Additionally, the EMA Director is encouraged to maintain a schedule of regular meetings, either quarterly or semiannually to preserve continuity throughout the continuing process. These meetings will provide an opportunity to discuss the progress of the action items and maintain the partnerships that are essential for the sustainability of the HMP. The EMA Director will ensure the results of the evaluation(s) are reported to the Whitfield County Board of Commissioners, as well as to any agencies or organizations having an interest in the hazard mitigation activities identified in the plan.

6.3 – Multi-Jurisdictional Strategy and Considerations

As set forth by Georgia House Bill 489, the Emergency Management Agency is the overall implementing agency for projects such as hazard mitigation. Whitfield County will work in the best interests of the County as well as the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta. Each of these municipalities played an active role in the planning process. Participation from each jurisdiction was solicited and received by Whitfield County EMA. As a result, a truly multi-jurisdictional plan was created for Whitfield County and the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta, with ideas and viewpoints of all participants included.

6.4 – Plan Update and Maintenance

According to the requirements set forth in the Disaster Mitigation Act of 2000, Whitfield County is required to update and revise the Hazard Mitigation Plan every five years. However, the Hazard Mitigation Planning Committee will meet on the plan approval anniversary date of every year, or within 30 days of said date as determined and scheduled by the EMA Director, to complete a review of the Hazard Mitigation Plan. At each such meeting, the HMPC will review the main facets of the HMP including the vulnerability assessment, critical facilities inventory, and mitigation goals, objectives, and actions. All revisions will be posted to the County website for public review and comment. Further revisions may take place based upon public comments received.

It is during this review process that the mitigation strategies and other information contained within the Hazard Mitigation Plan are considered for incorporation into other planning mechanisms as appropriate. Opportunities to integrate the requirements of this HMP into other local planning mechanisms will continue to be identified through future meetings of the HMPC on an annual basis.

The HMPC recognizes the need to integrate other plans, codes, regulations, procedures and programs into future Hazard Mitigation Plan (HMP) updates. This plan is multi-jurisdictional; therefore the mechanism for implementation of various mitigation plan items may vary by jurisdiction. This includes reviewing other local planning documents, processes or mechanisms for possible integration with the HMP.

To Be Reviewed in Future Update

Existing planning mechanisms	Method of use in Hazard Mitigation Plan
Comprehensive Plan (multi-jurisdictional)	Development trends
Local Emergency Operations Plan	Identifying hazards; Assessing vulnerabilities
Storm Water Management / Flood Damage Protection Ordinance	Mitigation strategies
Building and Zoning Codes and Ordinances	Development trends; Future growth
Mutual Aid Agreements	Assessing vulnerabilities
State Hazard Mitigation Plan	Risk assessment
Land Use Maps	Assessing vulnerabilities; Development trends; Future growth
Critical Facilities Maps	Locations
Community Wildfire Protection Plan	Mitigation strategies

It will be the responsibility of each participating jurisdiction to determine additional implementation procedures when appropriate.

During the planning process for new and updated local planning documents such as a comprehensive plan or Local Emergency Operations Plan, the EMA Director will provide a copy of the HMP to the appropriate parties. It will be recommended that all goals and strategies of new and updated local planning documents be consistent with, and support the goals of, the HMP and will not contribute to increased hazards in the affected jurisdiction(s).

Although it is recognized that there are many benefits to integrating components of this plan into other local planning mechanisms, and that components are actively integrated into other planning mechanisms when appropriate, the development and maintenance of this stand-alone HMP is deemed by the committee to be the most effective method to ensure implementation of local hazard mitigation actions at this time. Therefore, the review and incorporation efforts made in this update and the last, which consisted of a simple review of the documents listed in the chart above by various members of the HMPC, are considered successful by the HMPC and will likely be utilized in future updates.

The County's EMA is committed to incorporating hazard mitigation planning into its Local Emergency Operations Plan and other public emergency management activities. As the EMA Director becomes aware of updates to other County or City plans, codes, regulations, procedures and programs, the Director will continue to look for opportunities to include hazard mitigation into these mechanisms.

The Whitfield County HMPC will reconvene not later than the fourth anniversary of the plan approval anniversary date, as determined and scheduled by the EMA Director, to begin planning for the formal Hazard Mitigation Plan revision process. The revision process will include a clear schedule and timeline, and identify any agencies or organizations participating in the plan revision. The committee will review the mitigation goals, objectives and actions to determine their relevance to changing situations within the different jurisdictions, as well as changes in State or Federal policy, and to ensure current and expected conditions are being addressed. The HMPC will also review the prior vulnerability assessments to determine if this information should be updated or modified, given any new available data.

Whitfield County is dedicated to involving the public directly in reviews and updates of the HMP. During the plan revision process, the committee will conduct, at a minimum, two public hearings during the revision process. These public hearings will provide the public a forum for which they can express their concerns, opinions, or ideas about the Plan. Additionally, if persons from the community express interest in participation in the planning process, they will be provided the opportunity, via meetings, the County website, social media, and/or public forums, to suggest possible mitigation measures for the community. Documentation will be maintained to indicate all efforts at continued public involvement. All relevant information will be forwarded to GEMA and FEMA as a product of the proposed plan revision. Public involvement activities will continue throughout the 5-year planning cycle and will be evaluated for effectiveness by the HMPC next planning cycle.

The EMA Director will ensure the revised plan is presented to the governing body of each jurisdiction for formal adoption. In addition, all holders of the HMP will be notified of affected changes. The EMA Director shall submit a revised Hazard Mitigation Plan not later than the five-year anniversary of the most recently updated HMP to the Georgia Emergency Management Agency for review and subsequent submittal to the Federal Emergency Management Agency for ultimate approval.

Once approved by FEMA, copies of the Whitfield County Hazard Mitigation Plan will be provided by the EMA Director to the appropriate governmental jurisdictions, agencies, and/or departments for review and possible inclusion into plans and programs. The HMP will be distributed by the EMA Director to the appropriate officials to allow them to review the Plan and determine to what extent the Plan should be integrated into, or referenced by, other plans and programs. Limitations may be placed on certain sensitive information by the EMA Director.

Chapter 7
Conclusion

7.1 – Summary

Whitfield County has gained a great deal of knowledge relating to the County's disaster history and future potential for disaster as a result of the hazard mitigation planning process. This includes an extensive hazard history of recorded hazard events from the past fifty years, a detailed critical facilities database with valuable information on some of most critical county and city structures, as well as some valuable ideas from the community abroad concerning measures that should be considered for future hazard mitigation. Community involvement has been at the heart of this effort. Not only did the planning process include the creation of a Hazard Mitigation Planning Committee with representatives from all walks of life, but two public hearings were conducted to provide all Whitfield County citizens with the opportunity to comment on, and offer suggestions concerning potential hazard mitigation measures within the community. Whitfield County and the Cities of Dalton, Tunnel Hill and Varnell, and the Town of Cohutta all worked in concert to ensure a broad range of citizens were represented. Elected officials, local government employees, public safety officials, Red Cross representatives, GA Forestry representatives, businesspersons, media, and other volunteers and interested parties provided important varying viewpoints to create a workable Plan. GEMA and NGCG provided valuable assistance as well. These efforts have all had the effect of better protecting our Community from the threats of nature and technology. While it would be naïve to believe this Plan provides complete protection to Whitfield County and its residents, it is the hope of all parties involved in this planning process that the recommended mitigation measures contained within the Plan will provide some level of increased preparedness as well as spur further discussion and planning related to the important subject of Hazard Mitigation.

7.2 – References

Publications/Documents:
The Disaster Mitigation Act of 2000
Robert T. Stafford Disaster Relief and Emergency Assistance Act
FEMA Pre-Disaster Mitigation *How-to Guides #1, 2, 3, 7*
GEMA Supplements to FEMA Pre-Disaster Mitigation How-to Guides
Georgia Tornado Database 1808 – 2002 (Westbrook)
Earthquake Information Bulletin, Volume 3, Number 6, November-December 1971
Whitfield County Hazard Mitigation Plan

Web Sites:
www.fema.gov (FEMA)
www.usfa.fema.gov (USFA)
www.fs.fed.us (USFS Fire Danger Class)
www.cpc.ncep-noaa.gov (Drought Severity Index)
www.ncdc.noaa.gov (National Climatic Data Center)
http://eqint.cr.usgs.gov (USGS Earthquake Probability Maps)
www.tornadoproject.com (Tornado Project Online)
www.disastercenter.com (The Disaster Center)
www.gema.state.ga.us (GEMA)
www.gfc.state.ga.us (GFC)
www.georgiadrought.org (Drought in Georgia)
www.weather.com (The Weather Channel)
www.riskfactor.com (Risk Factor)
www.accuweather.com (AccuWeather)

Other Sources:
American Red Cross
American Society of Civil Engineers
Whitfield County
City of Dalton
City of Varnell
City of Tunnel Hill
Town of Cohutta
Federal Emergency Management Agency
Georgia Department of Natural Resources
Georgia Emergency Management Agency
Georgia Forestry Commission
Georgia Safe Dams Program
National Climatic Data Center
National Oceanic & Atmospheric Administration
National Weather Service
New Georgia Encyclopedia (www.georgiaencyclopedia.org)
U.S. Army Corps of Engineers
U.S. Census Bureau

U.S. Fire Administration
U.S. Forest Service
U.S. Geological Survey

Appendices

Appendix A – Critical Facilities Database

Appendix B – Hazard History Database

Appendix C – Hazard Frequency Table

Appendix D – Worksheet 3a Forms

Appendix E – Hazard Risk Analysis (UGA)

Appendix F – GMIS Reports

Appendix G – Other Planning Documents

Appendix H - Glossary