APPENDIX C

OTHER PLANNING DOCUMENTS

McDuffie County Emergency Management Agency

Emergency Operations Plan

Plan Approved:
12-APR-16

Revised:
12-APR-16

ARTICLE I. IN GENERAL

Secs. 26-1—26-25. Reserved.

ARTICLE II. EMERGENCY MANAGEMENT

Sec. 26-26. Definitions.

The following words, terms and phrases, when used in this article, shall have the meanings ascribed to them in this section, except where the context clearly indicates a different meaning:

Emergency management means the preparation for and the carrying out of all emergency and disaster functions other than those functions for which military forces or state and federal agencies are primarily responsible, to prevent, minimize, and repair injury and damage resulting from emergencies or disasters, or the imminent threat thereof, of manmade or natural origin. These functions include, without limitation, firefighting services, police services, medical and health services, rescue, engineering, warning services, communications, protection against the effects of radiological, chemical and other special weapons, evacuation of persons from stricken areas, emergency welfare services, emergency transportation, plant protection, shelter, temporary restoration of public utility services, and other functions related to civilian population, together with all other activities necessary or incidental to total emergency and disaster preparedness for carrying out the foregoing functions.
(Res. of 9-10-92, § I)

Cross reference—Definitions generally, § 1-2.

Sec. 26-27. Penalty for violation of article.

Any person violating any provision of this article, or any rule, order, or regulation made pursuant to this article, shall, upon conviction thereof, be punished as provided in section 1-13.
(Res. of 9-10-92, § VI)

Sec. 26-28. Appointment; duties of emergency management director.

In agreement with the governing officials of the cities within the county, there is hereby established the county emergency management agency. The chairman, county commissioners, with concurrence of the mayors of cities within the county, shall nominate for appointment by the governor, a director of emergency management for the entire county. When appointed, the emergency management director is charged with the following duties:

(1) Represent the governing officials of the county and cities therein on matters pertaining to emergency management.

(2) Assist county and city officials in organizing county and city departments for emergency operations.

(3) Develop, in conjunction with county and city departments, the county plan for emergency functions set forth in section 26-26. Such plan will be in consonance with the state natural disaster operations plan and nuclear emergency operations plan, and shall be submitted to the governing officials of the county and the cities therein for approval, and thence to the state emergency management agency for approval.

(4) Maintain the emergency management agency and carry out the day-to-day administration of the county emergency management program, including the submission of required reports to the state emergency management agency.

(5) Submit reports as required by governing officials in keeping with good management practices, e.g., financial, daily activity, etc.

(6) Obtain, with the authority of governing officials, a facility to be used as the county emergency operating center.

(7) Coordinate the activities of the county emergency operating center staff during periods of an emergency, and under the supervision of county governing officials.

(Res. of 9-10-92, § II)

Sec. 26-29. County emergency management agency.

(a) The county emergency management agency shall be established around existing county and city departments, and the emergency functions listed in section 26-26 are assigned as follows:

	Department/agency	*Functions*
(1)	Chairman, county commissioners, mayors of cities	Direction and control
(2)	Sheriff's office	Communications and warning Police department Police services Evacuation

	Department/agency	*Functions*
(3)	Emergency management agency	Public information State military support Training Preliminary damage assessment and reporting Public property assistance Attack preparedness Specific hazards Search, rescue, and recovery Hazardous materials Radiological protection within capabilities
(4)	Fire department	Search, rescue and recovery Fire services Hazardous materials Radiological protection within capabilities
(5)	Public works	Engineering Petroleum and solid fuel services Utilities and public services restoration
(6)	School superintendent	Transportation services Food services
(7)	Health department	Health and medical services
(8)	Clerk's office	Administrative services Resources management
(9)	Department of family and children services	Social services Shelter and temporary housing
(10)	McDuffie County Hospital	Medical services Mortuary services Casualty transport

(b) Heads of departments listed in subsection (a) of this section are responsible for developing appropriate annexes to the local emergency operations plan (EOP) for their assigned emergency functions. Such annexes will be submitted to the emergency management director for inclusion in the local EOP for submission to appropriate local officials for approval. (Res. of 9-10-92, § III)

Sec. 26-30. Powers of county leaders during an emergency or disaster.

In the event of manmade or natural disaster, actual enemy attack upon the United States, or any other emergency which may affect the lives and property of the citizens of the county,

the chairman, county commissioners, jointly with the mayors of the affected cities, or in their absences their legally appointed successors, the sheriff of the county or, in his absence, the mayor pro-tem of the cities of Thomson and Dearing, may determine that an emergency or disaster exists and thereafter shall have and may exercise for such periods such emergency or disaster exists or continues, the following powers:

(1) To enforce all rules, laws and regulations relating to emergency management, and to assume direct operational control over all emergency management resources.

(2) To seize or take for temporary use, any private property for the protection of the public.

(3) To sell, lend, give, or distribute all or any such property or supplies among the inhabitants of the county and to maintain a strict accounting of property or supplies distributed and for funds received for such property or supplies.

(4) To perform and exercise such other functions and duties, and take such emergency actions as may be necessary to promote and secure the safety, protection and well-being of the inhabitants of the county.

(Res. of 9-10-92, § IV)

Sec. 26-31. Volunteers.

All persons, other than officers and employees of the county and cities therein, performing emergency functions pursuant to this article shall serve with or without compensation. While engaged in such emergency functions, duly assigned volunteers shall have the same immunities as county and city officers and employees.

(Res. of 9-10-92, § V)

Secs. 26-32—26-49. Reserved.

ARTICLE III. STATE OF EMERGENCY*

Division 1. Imposition of Curfews During Times of Emergency or Disaster—Authorized

Sec. 26-50. Institution of curfew.

(a) Upon the declaration of a state of emergency by the governor, or upon the determination by the county governing authority, or its designee, of the existence of an emergency or disaster, the county governing authority, or its designee, or the

*Editor's note—Ordinances 1, 2, and 3 of May 1, 2002, amended the Code by adding §§ 27-1—27-6, 27-10—27-44, 27-20—27-29 and Ordinance of July 16, 2002 added §§ 27-30—27-33. These sections were added to the Code as ch. 26, art. III, §§ 26-50—26-55, 26-60—26-64, 26-70—26-79, 26-85—26-88 and 26-85—26-88.

RECORD OF REVISIONS

Date	Author	Section	Detail
04-12-2016 08:51:15	Leanza	Plan Approved	
04-05-2016 06:48:32	McDuffie	Local Resolution	
02-01-2016 05:24:18	McDuffie	ESF 7	
02-01-2016 05:23:12	McDuffie	ESF 7	
02-01-2016 04:44:01	McDuffie	Agencies	
02-01-2016 04:43:15	McDuffie	Agencies	
02-01-2016 04:41:59	McDuffie	Agencies	
02-01-2016 04:41:14	McDuffie	Agencies	
02-01-2016 04:40:33	McDuffie	Agencies	
02-01-2016 04:39:18	McDuffie	Agencies	
02-01-2016 04:35:05	McDuffie	Agencies	
02-01-2016 04:34:17	McDuffie	Agencies	
02-01-2016 04:33:09	McDuffie	Agencies	
02-01-2016 04:32:44	McDuffie	Agencies	
02-01-2016 04:32:09	McDuffie	Agencies	
02-01-2016 11:56:12	McDuffie	Agencies	
01-29-2016 05:06:00	McDuffie	Agencies	
01-29-2016 05:04:26	McDuffie	Agencies	
01-29-2016 04:57:46	McDuffie	Agencies	
01-29-2016 04:55:25	McDuffie	Agencies	
01-29-2016 04:45:32	McDuffie	Agencies	
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01-07-2016 03:42:53	McDuffie	Agencies	
01-07-2016 03:38:47	McDuffie	Agencies	
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01-07-2016 03:18:44	McDuffie	Agencies	
01-07-2016 03:14:53	McDuffie	Agencies	
01-07-2016 03:06:50	McDuffie	ESF 15	
01-07-2016 03:06:48	McDuffie	ESF 15	
01-07-2016 03:02:38	McDuffie	ESF 14	
01-07-2016 03:02:34	McDuffie	ESF 14	

Distribution List

Agency	Number of Copies
American Red Cross	1
City of Thomson	1
Dearing Fire Department	1
Georgia Forestry Commission (McDuffie Unit)	1
Kilpatrick Baptist Association	1
McDuffie County	2
McDuffie County 911 Communications	1
McDuffie County Board of Education	10
McDuffie County Buildings and Grounds	1
McDuffie County Coroner	1
McDuffie County DFCS	1
McDuffie County EMA	1
McDuffie County Extension Service	1
McDuffie County Health Department	1
McDuffie County Road Department	1
McDuffie County Sheriff's Department	3
McDuffie Fire And Emergency Medical Services	6
Thomson Fire Department	2
Thomson Gas Dept.	1
Thomson Police Department	2
Thomson Public Works	3
Thomson-McDuffie Animal Shelter	1
Thomson-McDuffie County Planning Board	1
Thomson-McDuffie County Recreation Department	1
Thomson-McDuffie Information Technology Dept.	1
Thomson-McDuffie Water Sewer Dept. (maintenance)	1
Thomson-McDuffie Water Sewer Dept.(water tx)	2
Town of Dearing	3
University Hospital McDuffie	3

McDuffie County
EMERGENCY OPERATIONS PLAN

Local Resolution

Record of Revisions

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PREFACE

This Emergency Operations Plan (EOP) describes the management and coordination of resources and personnel during periods of major emergency. This comprehensive local emergency operations plan is developed to ensure mitigation and preparedness, appropriate response and timely recovery from natural and man made hazards which may affect residents of McDuffie County.

This plan supersedes the Emergency Operations Plan dated from old eLEOP. It incorporates guidance from the Georgia Emergency Management Agency (GEMA) as well as lessons learned from disasters and emergencies that have threatened McDuffie County. The Plan will be updated at the latest, every four years. The plan:

- Defines emergency response in compliance with the State-mandated Emergency Operations Plan process.
- Establishes emergency response policies that provide Departments and Agencies with guidance for the coordination and direction of municipal plans and procedures.
- Provides a basis for unified training and response exercises.

The plan consists of the following components:

- The Basic Plan describes the structure and processes comprising a county approach to incident management designed to integrate the efforts of municipal governments, the private sector, and non-governmental organizations. The Basic Plan includes the: purpose, situation, assumptions, concept of operations, organization, assignment of responsibilities, administration, logistics, planning and operational activities.
- Appendices provide other relevant supporting information, including terms, definitions, and authorities.
- Emergency Support Function Annexes detail the missions, policies, structures, and responsibilities of County agencies for coordinating resource and programmatic support to municipalities during Incidents of Critical Significance.
- Support Annexes prescribe guidance and describe functional processes and administrative requirements necessary to ensure efficient and effective implementation of incident management objectives.
- Incident Annexes address contingency or hazard situations requiring specialized application of the EOP. The Incident Annexes describe the missions, policies, responsibilities, and coordination processes that govern the interaction of public and private entities engaged in incident management and emergency response operations across a spectrum of potential hazards. Due to security precautions and changing nature of their operational procedures, these Annexes, their supporting plans, and operational supplements are published separately.

Georgia Emergency Operations Plan

JANUARY 2013

UPDATED: JANUARY 2015

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Executive Order-January 2013

2014 State of Georgia Hazard Mitigation Strategy





Georgia Hazard Mitigation Strategy

Standard and Enhanced Plan

Effective April 1, 2014-March 31, 2017

Prepared by the Georgia Emergency Management Agency

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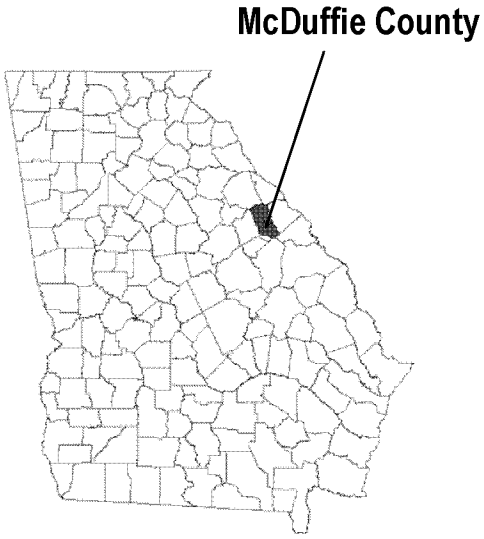
FLOOD INSURANCE STUDY

MCDUFFIE COUNTY, GEORGIA
AND INCORPORATED AREAS



COMMUNITY NAME	COMMUNITY NUMBER
DEARING, TOWN OF*	130356
MCDUFFIE COUNTY (UNINCORPORATED AREAS)	130357
THOMSON, CITY OF	130230

*Non-floodprone community

EFFECTIVE:
SEPTEMBER 29, 2010

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
13189CV000A

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) report may not contain all data available within the Community Map Repository. Please contact the Community Map Repository for any additional data.

The Federal Emergency Management Agency (FEMA) may revise and republish part or all of this FIS report at any time. In addition, FEMA may revise part of this FIS report by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS report. Therefore, users should consult with community officials and check the Community Map Repository to obtain the most current FIS report components.

Initial Countywide FIS Effective Date: September 29, 2010

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FLOOD INSURANCE STUDY
MCDUFFIE COUNTY, GEORGIA AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of McDuffie County, including the City of Thomson; the Town of Dearing; and the unincorporated areas of McDuffie County (referred to collectively herein as McDuffie County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

Please note that the Town of Dearing has no mapped flood hazard areas.

In some States or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

The Digital Flood Insurance Rate Map (DFIRM) and FIS report for this countywide study have been created in digital format. Flood hazard information was converted to meet the Federal Emergency Management Agency (FEMA) DFIRM database specifications and Geographic Information System (GIS) format requirements. The flood hazard information was created and is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community.

1.2 Authority and Acknowledgments

The sources of authority for this FIS are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

No previous FIS reports were prepared for the City of Thomson, the Town of Dearing, and the unincorporated areas of McDuffie County.

The hydrologic and hydraulic analyses for the detailed study stream, Boggy Gut Creek, came from the Columbia County Letter of Map Revision (LOMR), case number 07-04-4973P, dated March 19, 2008 (FEMA, 2008).

The hydrologic and hydraulic analyses for the approximate study were performed by Dewberry & Davis LLC, for FEMA, under Contract No. EMA-2008-CA-5870. This work was completed in June 2009.

Base map information shown on the FIRM was derived from digital orthoimagery produced at a scale of 1:20,000, from National Agriculture Imagery Program dated 2007. The projection used in the preparation of this map is Georgia State Plane West FIPS Zone 1002 (feet), and the horizontal datum used is North American Datum 1983, GRS80 spheroid.

1.3 Coordination

An initial meeting is held with representatives from FEMA, the community, and the study contractor to explain the nature and purpose of a FIS, and to identify the streams to be studied or restudied. A final meeting is held with representatives from FEMA, the community, and the study contractor to review the results of the study.

The initial meeting was held on July 9, 2008, and attended by representatives of FEMA, the Georgia Department of Natural Resources, and the study contractor.

The results of the study were reviewed at the final meeting held on August 18, 2009, and attended by representatives of Georgia Department of Natural Resources – Environmental Protection Division, McDuffie County, the City of Thomson, the Town of Dearing, FEMA, and the study contractor. All problems raised at that meeting have been addressed.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of McDuffie County, Georgia, including the incorporated communities listed in Section 1.1. The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction through July 2008.

For this countywide FIS, the FIS report and FIRM are in countywide format, and the flooding information for the entire county, including both incorporated and unincorporated areas, is shown. Also, the vertical datum is North American Vertical Datum of 1988 (NAVD 88). In addition, the Transverse Mercator projection, State Plane coordinates are referenced to the North American Datum of 1983.

Boggy Gut Creek is studied by detailed methods in this FIS report. The limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM (Exhibit 2).

All or portions of numerous flooding sources in the county were studied by approximate methods. Approximate analyses were used to study those areas having low development potential or minimal flood hazards. The scope and methods of study were proposed to and agreed upon by FEMA and McDuffie County.

2.2 Community Description

McDuffie County, encompassing approximately 260 square miles, is located in eastern Georgia, approximately 125 miles east of the City of Atlanta. The county is bordered on the north by Wilkes and Lincoln Counties; on the south by Richmond and Jefferson Counties; on the east by Columbia County; and on the west by Warren County. Major transportation routes that serve McDuffie County include Interstate 20, U.S. Highways 78, 221, and 278, and State Highways 17 and 43.

According to the U.S. Census Bureau, in 2008 the population estimate for McDuffie County was 21,756 (U.S. Census Bureau, 2009).

McDuffie County's moderate climate consists of mild winters and warm summers. The annual rainfall averages approximately 50 inches. The wettest month is March while the driest months are September and October (National Weather Service, 2009).

2.3 Principal Flood Problems

The low-lying areas of the county adjacent to the major streams are subject to the periodic flooding that accompanies major storms.

2.4 Flood Protection Measures

No major structural flood protection measures exist or are planned for McDuffie County.

3.0 ENGINEERING METHODS

For the flooding sources studied in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 1-percent-annual-chance (100-year) flood in any 50-year period is approximately 40 percent (4 in

10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for the flooding source studied by detailed methods affecting the community.

For the hydrologic analyses of Boggy Gut Creek see the Columbia County LOMR, case number 07-04-4973P, dated March 19, 2008 (FEMA, 2008).

Peak discharge-drainage area relationships for Boggy Gut Creek studied in detail are shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
BOGGY GUT CREEK					
Approximately 2.39 miles upstream of Harlem Wrens Road	0.53	*	*	541	*

*Data not available

Discharges for approximate studies were developed using regression equations for rural areas in Georgia contained in the USGS report and available USGS gage record data (where applicable) (Stamey and Hess, 1993). Drainage areas were developed from USGS 10-meter Digital Elevation Models (DEMs) (USGS, 2009).

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use

the flood elevation data presented in this FIS report in conjunction with the data shown on the FIRM.

For the hydraulic analyses of Boggy Gut Creek see the Columbia County LOMR, case number 07-04-4973P, dated March 19, 2008 (FEMA, 2008).

For the streams studied by approximate methods, cross section data was obtained from the USGS 10-meter DEMs (USGS, 2009). Hydraulically significant roads were modeled as bridges, with opening data approximated from available inventory data or approximated from the imagery. Top of road elevations were estimated from the best available topography. The studied streams were modeled using HEC-RAS version 4.0 (Hydrologic Engineering Center, March 2008).

Floodplains of the approximate studies streams were delineated using the computer 1-percent annual chance water-surface elevations and the USGS 10-meter DEMs (USGS, 2009).

All qualifying bench marks within a given jurisdiction that are cataloged by the National Geodetic Survey (NGS) and entered into the National Spatial Reference System (NSRS) as First or Second Order Vertical and have a vertical stability classification of A, B, or C are shown and labeled on the FIRM with their 6-character NSRS Permanent Identifier.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Bench marks cataloged by the NGS and entered into the NSRS vary widely in vertical stability classification. NSRS vertical stability classifications are as follows:

- Stability A: Monuments of the most reliable nature, expected to hold position/elevation well (e.g., mounted in bedrock)
- Stability B: Monuments which generally hold their position/elevation well (e.g., concrete bridge abutment)
- Stability C: Monuments which may be affected by surface ground movements (e.g., concrete monument below frost line)
- Stability D: Mark of questionable or unknown vertical stability (e.g., concrete monument above frost line, or steel witness post)

In addition to NSRS bench marks, the FIRM may also show vertical control monuments established by a local jurisdiction; these monuments will be shown on the FIRM with the appropriate designations. Local monuments will only be placed on the FIRM if the community has requested that they be included, and if the monuments meet the aforementioned NSRS inclusion criteria.

To obtain current elevation, description, and/or location information for bench marks shown on the FIRM for this jurisdiction, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their Web site at http://www.ngs.noaa.gov.

It is important to note that temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with this FIS and FIRM. Interested individuals may contact FEMA to access this data.

3.3 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum in use for newly created or revised FIS reports and FIRMs was National Geodetic Vertical Datum 1929 (NGVD 29). With the finalization of NAVD 88, many FIS reports and FIRMs are being prepared using NAVD 88 as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD 88. Structure and ground elevations in the community must, therefore, be referenced to NAVD 88. It is important to note that adjacent communities may be referenced to NGVD 29. This may result in differences in Base Flood Elevations (BFEs) across the corporate limits between the communities.

For additional information regarding conversion between NGVD 29 and NAVD 88, visit the National Geodetic Survey website at http://www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each FIS provides 1-percent-annual-chance (100-year) flood elevations and delineations of the 1- and 0.2-percent-annual-chance (500-year) floodplain boundaries and 1-percent-annual-chance floodway to assist communities in developing floodplain management measures. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles, Floodway Data Table, and Summary of Stillwater Elevations Table. Users

should reference the data presented in the FIS report as well as additional information that may be available at the local map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community, although none were mapped for this study.

For Boggy Gut Creek, studied by detailed methods the boundaries were obtained from the McDuffie County LOMR, case number 07-04-4973P, dated December 31, 2007 (FEMA, 2007).

For the streams studied by approximate methods the boundaries were delineated using the USGS 10-meter DEMs (USGS, 2009).

The 1-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE).

For the streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM (Exhibit 2).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1 foot, provided that hazardous velocities are not produced.

No floodways have been computed for McDuffie County.

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance risk zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs or base flood depths are shown within this zone.

Zone AE

Zone AE is the flood insurance risk zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS by detailed methods. In most instances, whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance risk zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by levees. No BFEs or base flood depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 1-percent-annual-chance floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 1-percent-annual-chance floodplain.

The current FIRM presents flooding information for the entire geographic area of McDuffie County. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the County identified as flood-prone. Historical data relating to the maps prepared for each community are presented in Table 2, "Community Map History".

7.0 OTHER STUDIES

Information pertaining to flood hazards for each jurisdiction within McDuffie County has been compiled into this FIS. This FIS should be considered authoritative for purposes of the NFIP.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting FEMA, Federal Insurance and Mitigation Division, Koger Center – Rutgers Building, 3003 Chamblee Tucker Road, Atlanta, Georgia 30341.

9.0 BIBLIOGRAPHY AND REFERENCES

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COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Dearing, Town of*				
McDuffie County (Unincorporated Areas)	March 26, 1976	None	October 1, 2004	
Thomson, City of	September 29, 2010	None	September 29, 2010	

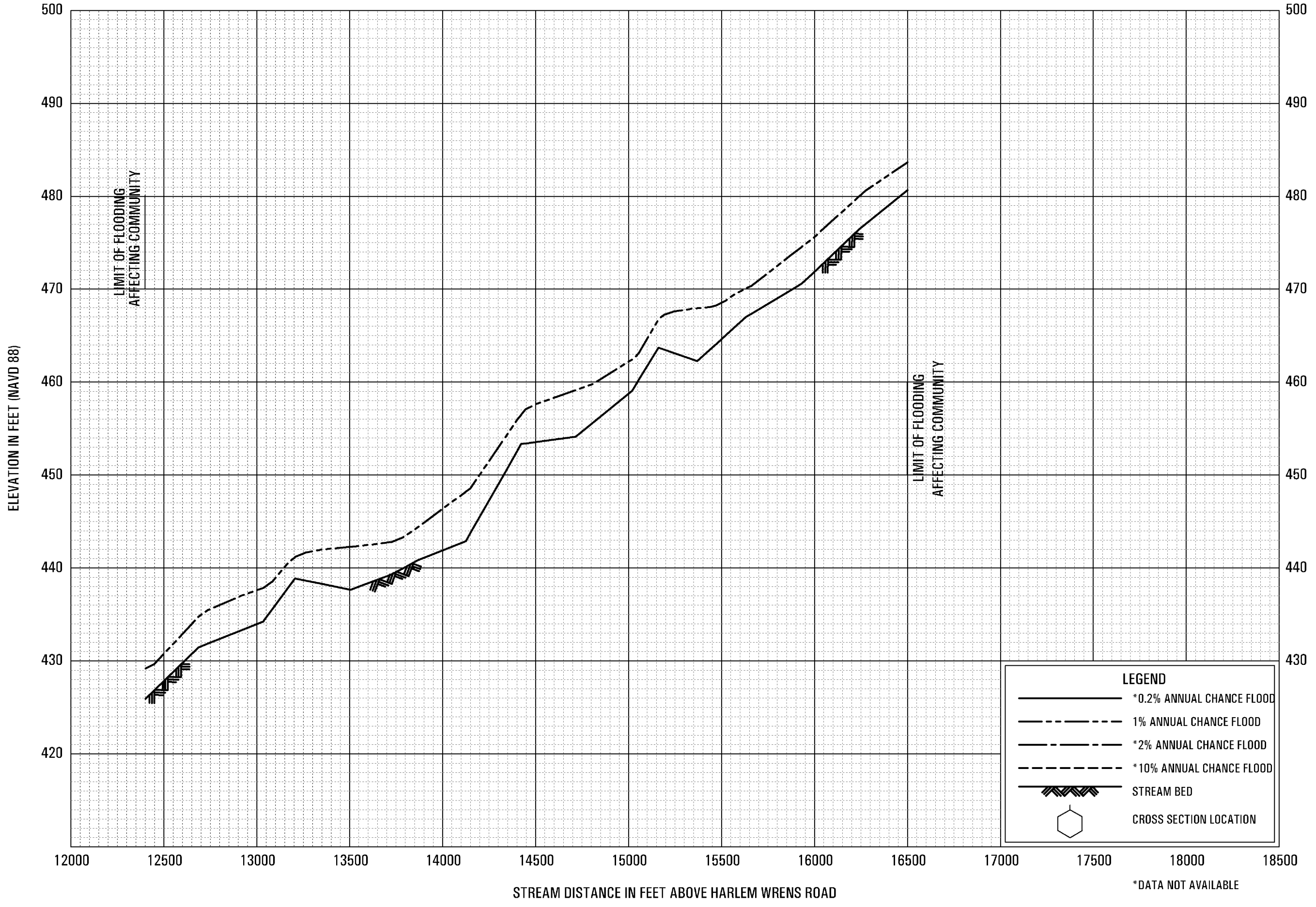
*Non-floodprone community

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

MCDUFFIE COUNTY, GA AND INCORPORATED AREAS

COMMUNITY MAP HISTORY



FLOOD PROFILES

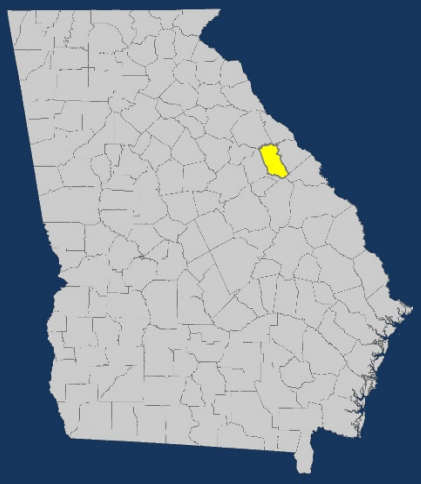
BOGGY GUT CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MCDUFFIE COUNTY, GEORGIA

AND INCORPORATED AREAS

01P



Hazard Risk Analyses
Supplement to the McDuffie County Joint Hazard Mitigation Plan

The Polis Center
INDIANA UNIVERSITY-PURDUE UNIVERSITY INDIANAPOLIS
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Introduction

The Federal Disaster Mitigation Act of 2000 (DMA2K) requires state, local, and tribal governments to develop and maintain a mitigation plan to be eligible for certain federal disaster assistance and hazard mitigation funding programs.

Mitigation seeks to reduce a hazard's impacts, which may include loss of life, property damage, disruption to local and regional economies, and the expenditure of public and private funds for recovery. Sound mitigation must be based on a sound risk assessment that quantifies the potential losses of a disaster by assessing the vulnerability of buildings, infrastructure, and people.

In recognition of the importance of planning in mitigation activities, FEMA Hazus-MH, a powerful disaster risk assessment tool based on geographic information systems (GIS). This tool enables communities of all sizes to predict estimated losses from floods, hurricanes, earthquakes, and other related phenomena and to measure the impact of various mitigation practices that might help reduce those losses.

In 2015, the Georgia Department of Emergency Management partnered with The Polis Center (Polis) at Indiana University Purdue University-Indianapolis (IUPUI) to develop a detailed risk assessment focused on defining hurricane, riverine flood and tornado in McDuffie County, Georgia. This assessment identifies the characteristics and potential consequences of the disaster, how much of the community could be affected by the disaster, and the impact on community assets.

Risk Assessment Process Overview

Hazus-MH Version 2.2 SP1 was used to perform the analyses for McDuffie County. The Hazus-MH application includes default data for every county in the US. This Hazus-MH data was derived from a variety of national sources and in some cases the data are also several years old. Whenever possible, using local provided data is preferred. McDuffie County provided building inventory information from the county's property tax assessment system. This section describes the changes made to the default Hazus-MH inventory and the modeling parameters used for each scenario.

County Inventory Changes

The default Hazus-MH site-specific point inventory was updated using data compiled from the Georgia Emergency Management Agency (GEMA). The default Hazus-MH aggregate inventory (General Building Stock) was also updated prior to running the scenarios. Reported losses reflect the updated data sets.

General Building Stock Updates

General Building Stock (GBS) is an inventory category that consists of aggregated data (grouped by census geography — tract or block). Hazus-MH generates a combination of site-specific and aggregated loss estimates based on the given analysis and user input.

The GBS records for McDuffie County were replaced with data derived from parcel and property assessment data obtained from McDuffie County. The county provided property assessment data was current as of January 2014 and the parcel data current as of July 2014. Records without improvements were deleted. The parcel boundaries were converted to parcel points located in the centroids of each parcel boundary; then, each parcel point was linked to an assessor record based upon matching parcel numbers. The parcel assessor match-rate for McDuffie County is 99.3%. The generated building inventory represents the approximate locations (within a parcel) of structures. The building inventory was aggregated by census block. Both the tract and block tables were updated. Table 1 shows the results of the changes to the GBS tables by occupancy class.

Table 1: GBS Building Exposure Updates by Occupancy Class*

Occupancy Classification	Default Count	Updated Count	Default Exposure	Updated Exposure
Agricultural	26	1	$6,295,000	$544,000
Commercial	514	680	$234,374,000	$618,201,000
Education	11	5	$19,395,000	$44,980,000
Government	13	22	$7,638,000	$40,857,000
Industrial	149	15	$88,867,000	$44,736,000
Religious	67	22	$44,474,000	$18,062,000
Residential	8,619	8,962	$1,329,029,000	$1,156,338,000
Total	**9,399**	**9,707**	**$1,730,072,000**	**$1,923,718,000**

*The exposure values represent the total number and replacement cost for all McDuffie County Buildings

For McDuffie County, the updated GBS was used to calculate hurricane wind losses. The flood losses and tornado losses were calculated from building inventory modeled in Hazus-MH as User-Defined Facility (UDF)[1], or site-specific points. Figure 1 shows the distribution of buildings as points based on the county provided data.

[1] The UDF inventory category in Hazus-MH allows the user to enter site-specific data in place of GBS data.

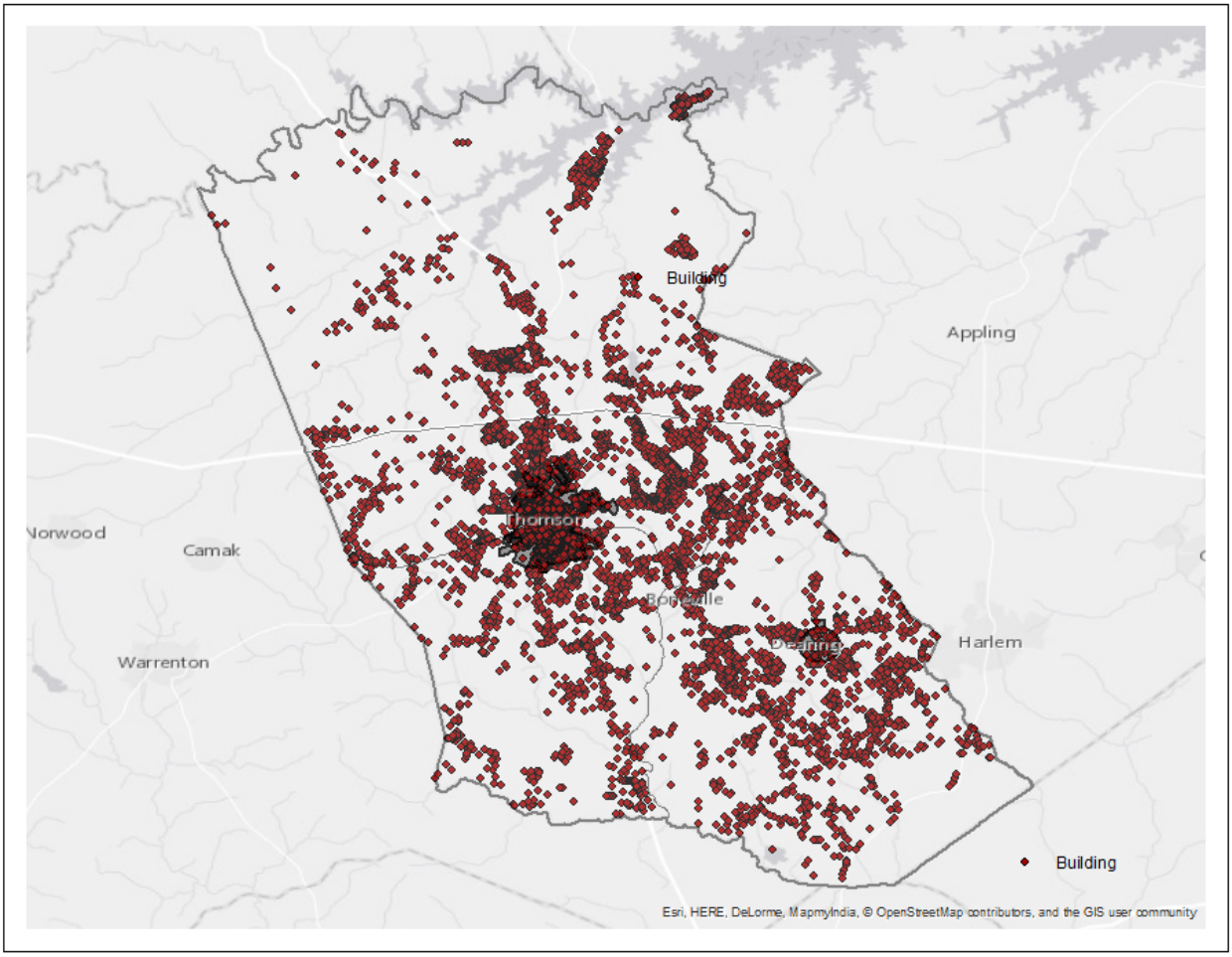


Figure 1: McDuffie County Overview

Essential Facility Updates

The default Hazus-MH essential facility data was updated to reflect improved information available in the Georgia Mitigation Information System (GMIS) as of June 2015. For these risk analyses, only GMIS data for buildings that Hazus-MH classified as Essential Facilities was integrated into Hazus-MH because the application provides specialized reports for these five types of facilities. Essential Facility inventory was updated for the analysis conducted for this report. The following table summarizes the counts and exposures, where available, by Essential Facility classification of the updated data for the county.

Essential facilities include:

- Care facilities
- EOCs
- Fire stations
- Police stations
- Schools

Table 2: Updated Essential Facilities

Classification	Updated Count	Updated Exposure
Dearing Town		
EOC	0	$0
Care	0	$0
Fire	0	$0
Police	1	$250,000
School	1	$4,500,000
Total	2	$4,750,000
Thomson City		
EOC	0	$0
Care	3	$21,230,000
Fire	3	$1,200,000
Police	2	$685,000
School	6	$38,150,000
Total	14	$61,265,000

Assumptions and Exceptions

Hazus-MH loss estimates may be impacted by certain assumptions and process variances made in this risk assessment.

- The McDuffie County analysis used Hazus-MH Version 2.2 SP1, which was released by FEMA in May 2015.
- County provided parcel and property assessment data may not fully reflect all buildings in the county. For example, some counties do not report not-for-profit buildings such as government buildings, schools and churches in their property assessment data. This data was used to update the General Building Stock as well as the User Defined Facilities applied in this risk assessment.
- GBS updates from assessor data will skew loss calculations. The following attributes were defaulted or calculated:
    - Foundation Type was set from Occupancy Class
    - First Floor Height was set from Foundation Type
    - Content Cost was calculated from Replacement Cost
- It is assumed that the buildings are located at the centroid of the parcel.
- The essential facilities extracted from the GMIS were only used in the portion of the analysis designated as essential facility damage. They were not used in the update of the General Building Stock or the User Defined Facility inventory.

The hazard models included in this risk assessment included:

- Hurricane assessment which was comprised of a wind only damage assessment
- Flood assessment based on the 1% annual chance event that includes riverine assessments
- Tornado assessment based on GIS modeling

Hurricane Risk Assessment

Hazard Definition

The National Hurricane Center describes a hurricane as a tropical cyclone in which the maximum sustained wind is, at minimum, 74 miles per hour (mph)[2]. The term hurricane is used for Northern Hemisphere tropical cyclones east of the International Dateline to the Greenwich Meridian. The term typhoon is used for Pacific tropical cyclones north of the Equator west of the International Dateline. Hurricanes in the Atlantic Ocean, Gulf of Mexico, and Caribbean form between June and November with the peak of hurricane season occurring in the middle of September. Figure 2 shows that many hurricanes have impacted the Atlantic and Gulf coasts of the United States.

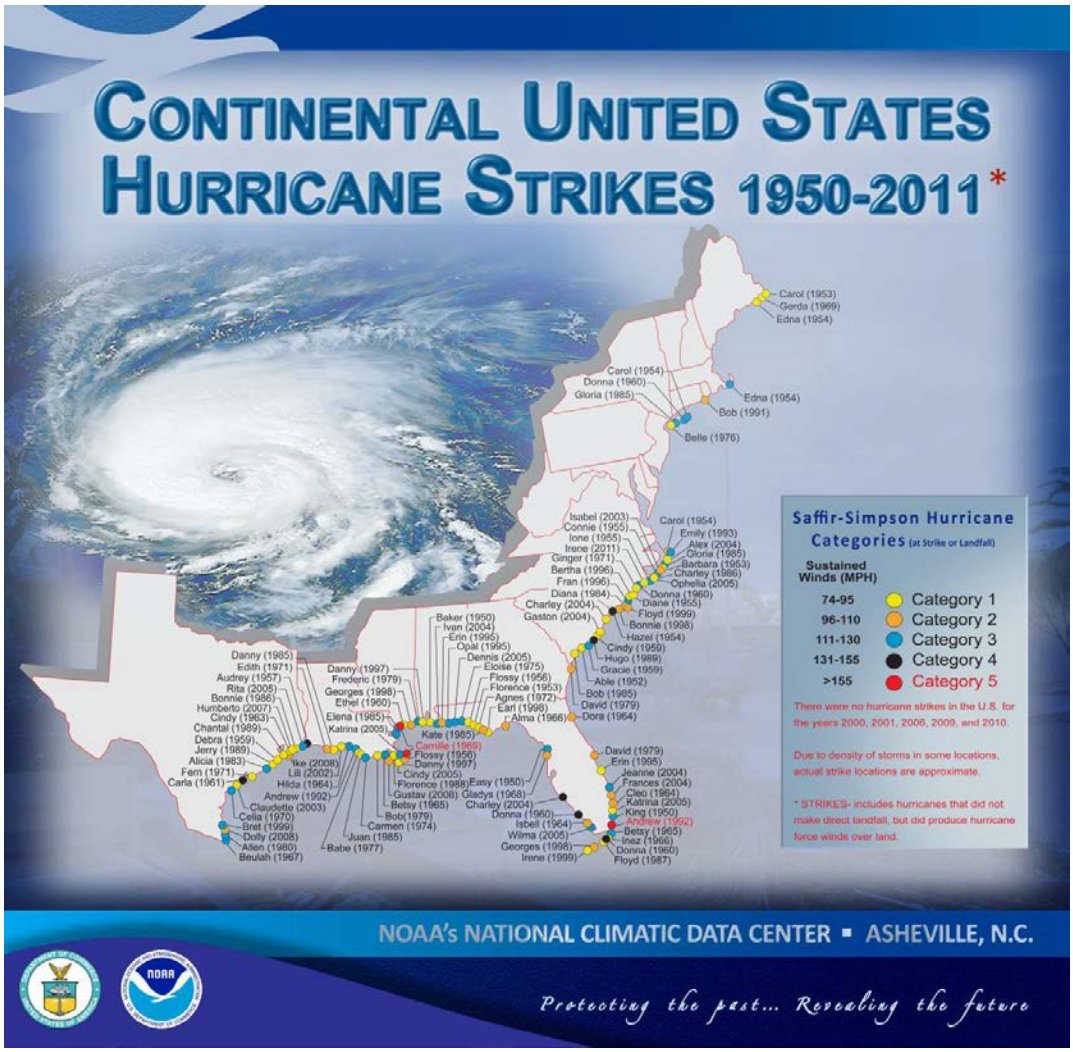


Figure 2: Continental United States Hurricane Strikes: 1950 to 2011[3]

[2] National Hurricane Center (2011). "Glossary of NHC Terms." National Oceanic and Atmospheric Administration. http://www.nhc.noaa.gov/aboutgloss.shtml#h. Retrieved 2-23-2012.

[3] Source: NOAA National Climatic Data Center

Hurricane intensities are measured using the Saffir-Simpson Hurricane Wind Scale (Table 3). This scale is a 1 to 5 categorization based on the hurricane's intensity at the indicated time.

Table 3: Saffir-Simpson Hurricane Wind Scale

Category	Wind Speed (mph)	Damage
1	74 – 95	Very dangerous winds will produce some damage
2	96 – 110	Extremely dangerous winds will cause extensive damage
3	111 - 130	Devastating damage will occur
4	131 -155	Catastrophic damage will occur
5	> 155	Catastrophic damage will occur

Hurricanes bring a complex set of impacts. The winds from a hurricane produce a rise in the water level at landfall called storm surge. Storm surges produce coastal flooding effects that can be as damaging as the hurricane's winds. Hurricanes bring very intense inland riverine flooding. Hurricanes can also produce tornadoes that can add to the wind damages inland. In this risk assessment, only hurricane winds, and coastal storm surge are considered.

The National Oceanic and Atmospheric Administration's National Hurricane Center created the HURDAT database, which contains all of the tracks of tropical systems since the mid-1800s. This database was used to document the number of tropical systems that have affected McDuffie County by creating a 20-mile buffer around the county to include storms that didn't make direct landfall in McDuffie County but impacted the county. Since 1851, McDuffie County has had 19 tropical systems within 20 miles of its county borders (Table 4).

Table 4: Tropical Systems affecting McDuffie County[4]

Year	Month	Day	Name	Wind (Knots)	Category
1852	August	27	UNNAMED	46	TS
1863	October	2	UNNAMED	-999	n/a
1871	August	28	UNNAMED	34.5	TD
1886	June	22	UNNAMED	51.75	TS
1889	September	24	UNNAMED	51.75	TS
1893	October	3	UNNAMED	51.75	TS
1903	September	16	UNNAMED	34.5	TD
1928	August	11	UNNAMED	34.5	TD
1933	September	7	UNNAMED	28.75	TD
1947	October	9	UNNAMED	23	TD
1949	August	28	UNNAMED	74.75	CAT_1

[4] Atlantic Oceanic and Meteorological Laboratory (2015). "Data Center." National Oceanic and Atmospheric Administration. http://www.aoml.noaa.gov/hrd/data_sub/re_anal.html. Retrieved 12-2-2015.

1959	June	2	ARLENE	28.75	TD
1964	August	30	CLEO	34.5	TD
1965	June	15	UNNAMED	46	TS
1968	June	8	ABBY	34.5	TD
1972	June	20	AGNES	34.5	TD
1995	August	27	JERRY	23	TD
2000	September	23	HELENE	28.75	TD
2004	September	28	JEANNE	28.75	TD

Category Definitions:
TS – Tropical storm
TD – Tropical depression
CAT_1 – Category 1 (same format for 2, 3, and 4)
E – Extra-tropical cyclone

Probabilistic Hurricane Scenario

The following probabilistic wind damage risk assessment modeled a Category 1 storm with maximum winds of 74 mph.

Wind Damage Assessment

Wind losses were determined from probabilistic models run for the Category 1 storm which equates to the 1% chance storm event. Figure 3 shows wind speeds for the modeled hurricane.

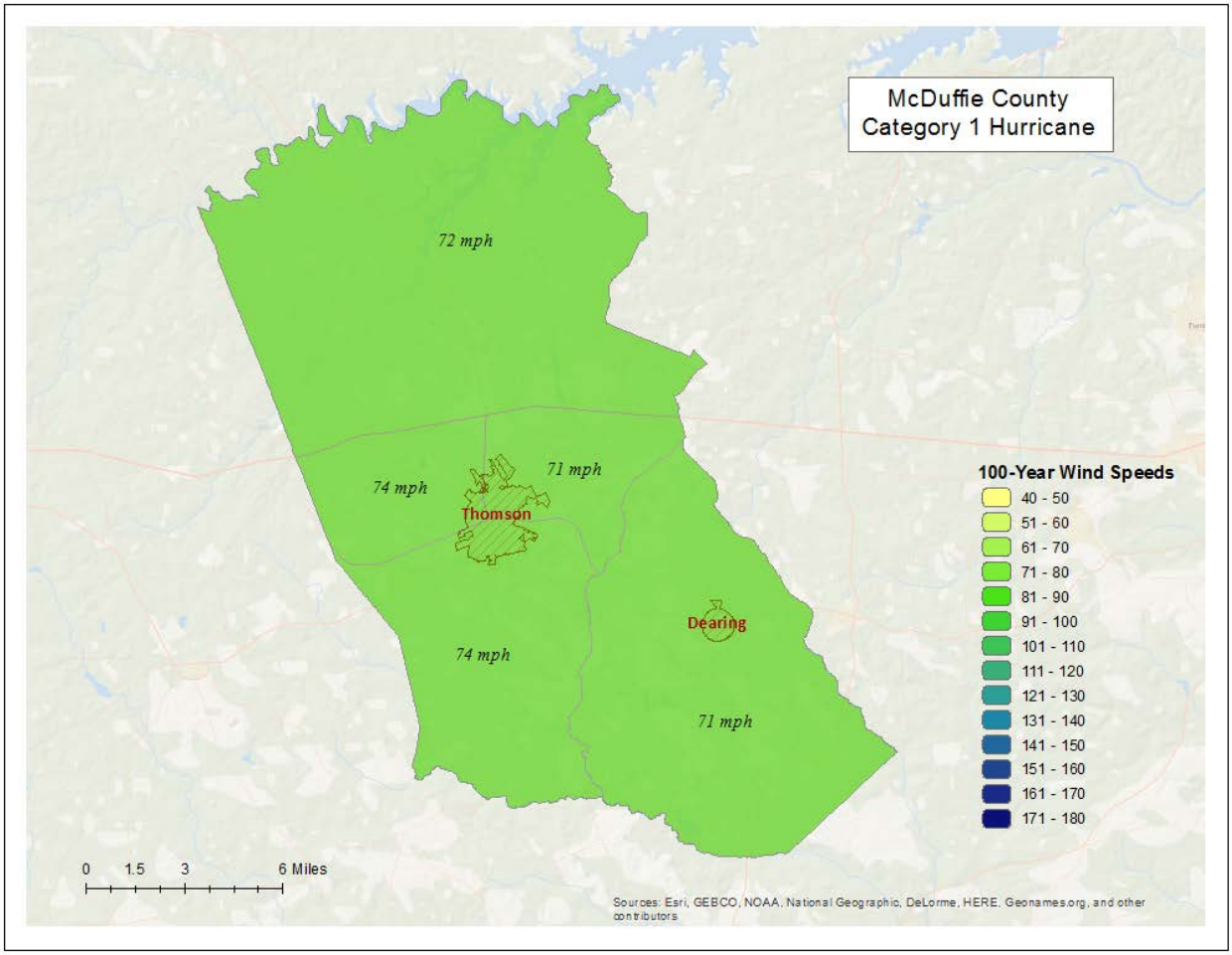


Figure 3: Wind Speeds by Storm Category

Wind-Related Building Damages

Buildings in McDuffie County are vulnerable to storm events, and the cost to rebuild may have significant consequences to the community. The following table shows a summary of the results of wind-related building damage in McDuffie County for the Category 1 (100 Year Event) storm. The loss ratio expresses building losses as a percentage of total building replacement cost in the county. Figure 4 illustrates the building loss ratios of the modeled Category 1 storm.

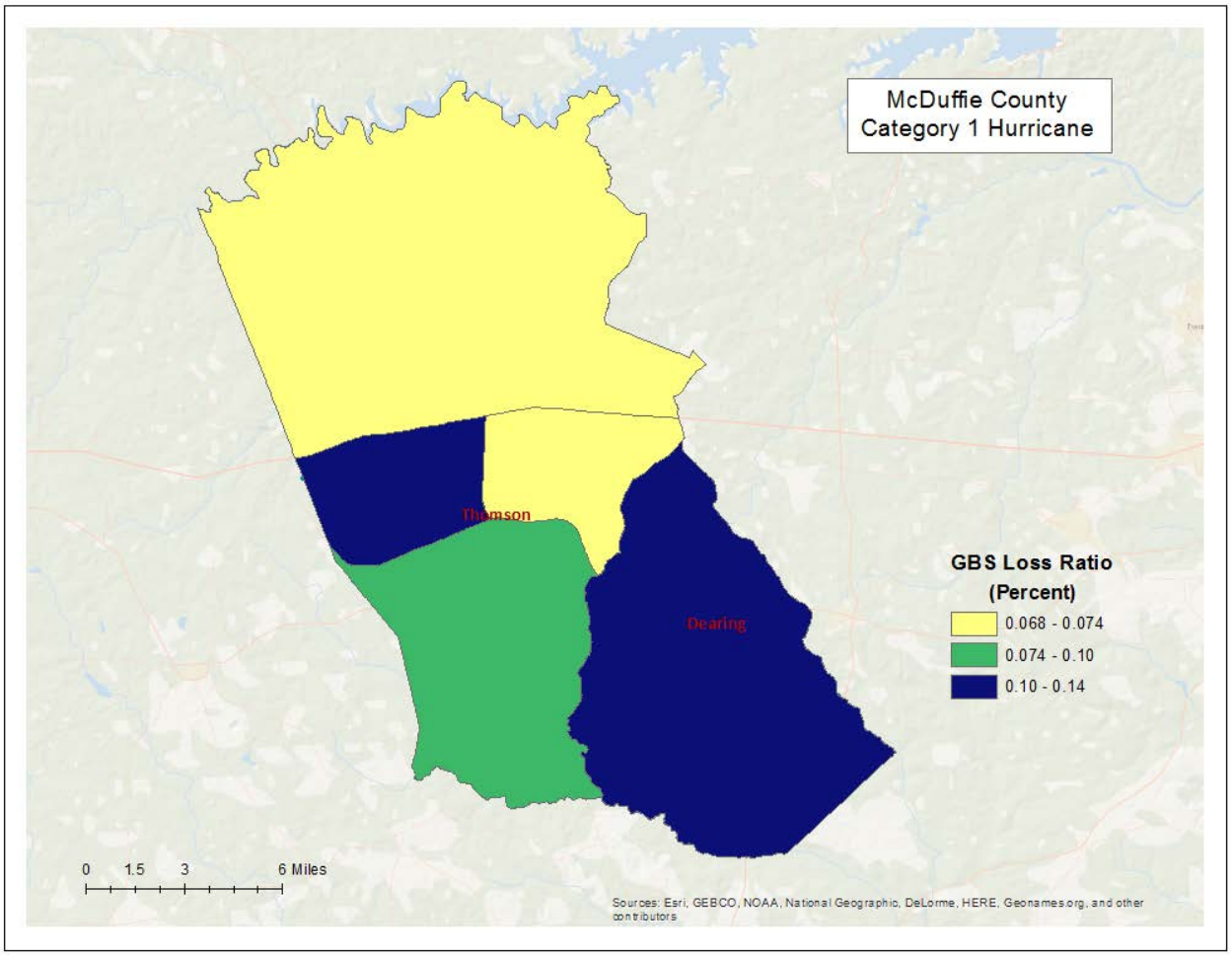


Figure 4: Hurricane Wind GBS Loss Ratios

Table 5 shows the Hurricane Wind Building Damage results including the number of buildings damaged, total building damage, and economic loss.

Table 5: Hurricane Wind Building Damage

Storm Classification	Number of Damaged Buildings	Building Damages	Total Economic Loss	Loss Ratio
Category 1	35	$2,513,710	$4,000	0.10

Essential Facility Losses

Essential facilities are also vulnerable to storm events, and the potential loss of functionality may have significant consequences to the community. Hazus-MH identified the essential facilities that may be moderately or severely damaged by winds. The results are compiled in Table 6.

There are 11 essential facilities in McDuffie County.

Classification	Number
EOCs	0
Fire Stations	9
Care Facilities	3
Police Stations	4
Schools	8

Table 6: Wind-Damaged Essential Facility Losses

Storm Classification	Facilities Moderately Damaged (>50%)	Facilities Completely Damaged (>50%)	Facilities with expected loss (<1day)
Category 1	0	0	24

Shelter Requirements

Hazus-MH estimates the number of households evacuated from buildings with severe damage from high velocity winds as well as the number of people who will require short-term sheltering. There were no shelter requirements resulting from the current scenario.

Debris Generated from Hurricane Wind

Hazus-MH estimates the amount of debris that will be generated by high velocity hurricane winds and quantifies it into three broad categories to determine the material handling equipment needed:

- Reinforced Concrete and Steel Debris
- Brick and Wood and Other Building Debris
- Tree Debris

Different material handling equipment is required for each category of debris. The estimates of debris for this scenario are listed in Table 7. The amount of hurricane wind related tree debris that is estimated to require pick up at the public's expense is listed in the eligible tree debris column.

Table 7: Wind-Related Debris Weight (Tons)

Storm Classification	Brick, Wood, and Other	Reinforced Concrete/Steel	Tree Debris	Other Tree Debris	Total
Category 1	116	0	1,108	15,676	16,900

Figure 5 shows the distribution of all wind related debris resulting from a Category 1 hurricane. Each dot represents 20 tons of debris within the census tract in which it is located. The dots are randomly distributed within each census tract and therefore do not represent the specific location of debris sites.

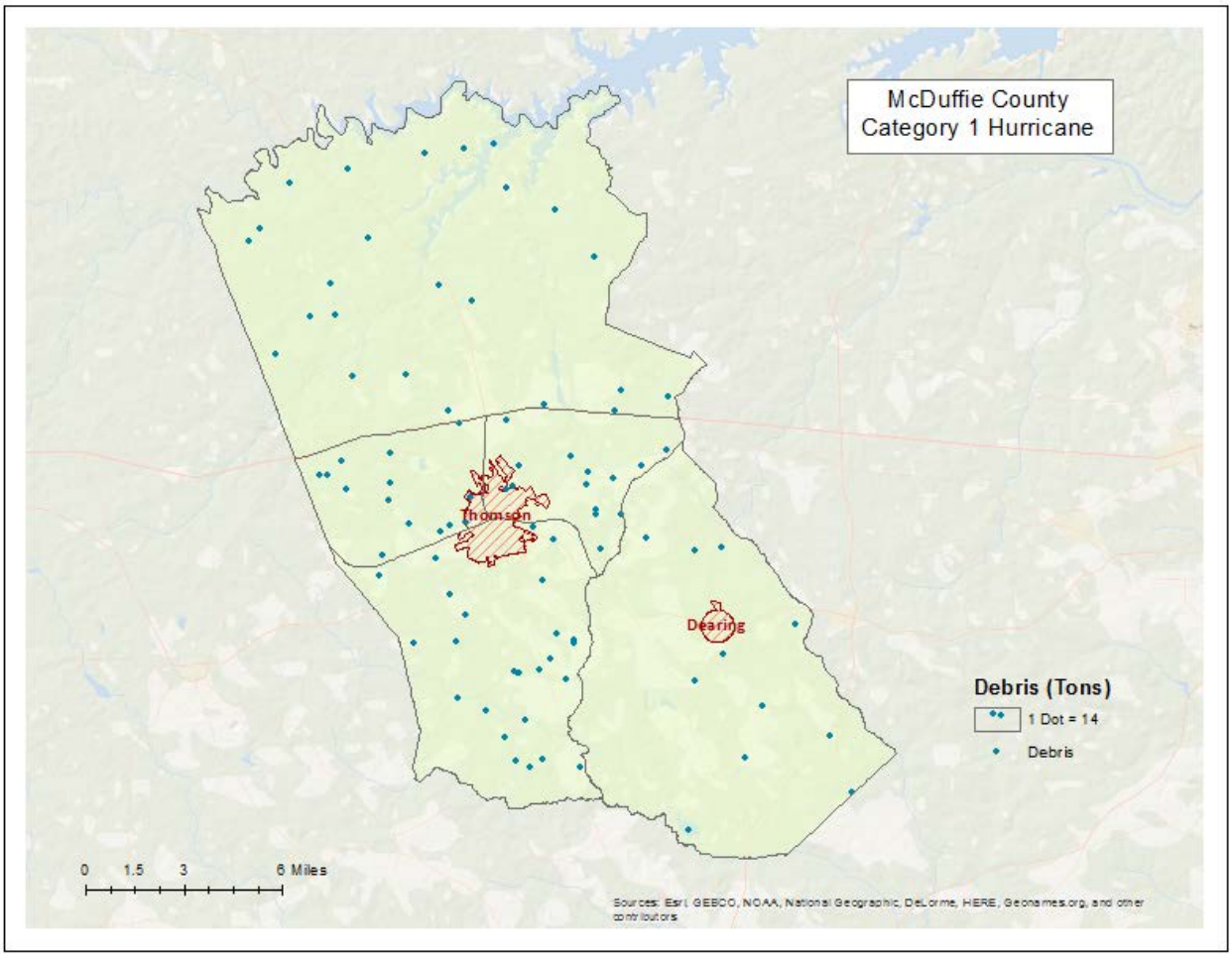


Figure 5: Wind-Related Debris Weight (Tons)

Flood Risk Assessment

Hazard Definition

Flooding is a significant natural hazard throughout the United States. The type, magnitude, and severity of flooding are functions of the amount and distribution of precipitation over a given area, the rate at which precipitation infiltrates the ground, the geometry and hydrology of the catchment, and flow dynamics and conditions in and along the river channel. Floods can be classified as one of three types: upstream floods, downstream floods, or coastal floods.

Upstream floods, also called flash floods, occur in the upper parts of drainage basins and are generally characterized by periods of intense rainfall over a short duration. These floods arise with very little warning and often result in locally intense damage, and sometimes loss of life, due to the high energy of the flowing water. Flood waters can snap trees, topple buildings, and easily move large boulders or other structures. Six inches of rushing water can upend a person; another 18 inches might carry off a car. Generally, upstream floods cause damage over relatively localized areas, but they can be quite severe in the local areas in which they occur. Urban flooding is a type of upstream flood. Urban flooding involves the overflow of storm drain systems and can be the result of inadequate drainage combined with heavy rainfall or rapid snowmelt. Upstream or flash floods can occur at any time of the year in Georgia, but they are most common in the spring and summer months.

Downstream floods, also called riverine floods, refer to floods on large rivers at locations with large upstream catchments. Downstream floods are typically associated with precipitation events that are of relatively long duration and occur over large areas. Flooding on small tributary streams may be limited, but the contribution of increased runoff may result in a large flood downstream. The lag time between precipitation and time of the flood peak is much longer for downstream floods than for upstream floods, generally providing ample warning for people to move to safe locations and, to some extent, secure some property against damage.

Coastal floods occurring on the Atlantic and Gulf coasts may be related to hurricanes or other combined offshore, nearshore, and shoreline processes. The effects of these complex interrelationships vary significantly across coastal settings, leading to challenges in the determination of the base (1-percent-annual-chance) flood for hazard mapping purposes. Land area covered by floodwaters of the base flood is identified as a Special Flood Hazard Area (SFHA). The McDuffie County flood risk assessment analyzed at risk structures in the SFHA.

> The SFHA is the area where the National Flood Insurance Program's (NFIP) floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies. The owner of a structure in a high-risk area must carry flood insurance, if the owner carries a mortgage from a federally regulated or insured lender or servicer.

The following probabilistic risk assessment involves an analysis of a 1% annual chance riverine flood event (100-Year Flood).

Riverine 1% Flood Scenario

Riverine losses were determined from the 1% flood boundaries downloaded from the FEMA Flood Map Service Center in October 2015. The flood boundaries were overlaid with the USGS 10 meter DEM using

the Hazus-MH Enhanced Quick Look tool to generate riverine depth grids. The riverine flood depth grid was then imported into Hazus-MH to calculate the riverine flood loss estimates. Figure 6 illustrates the riverine inundation boundary associated with the 1% annual chance.

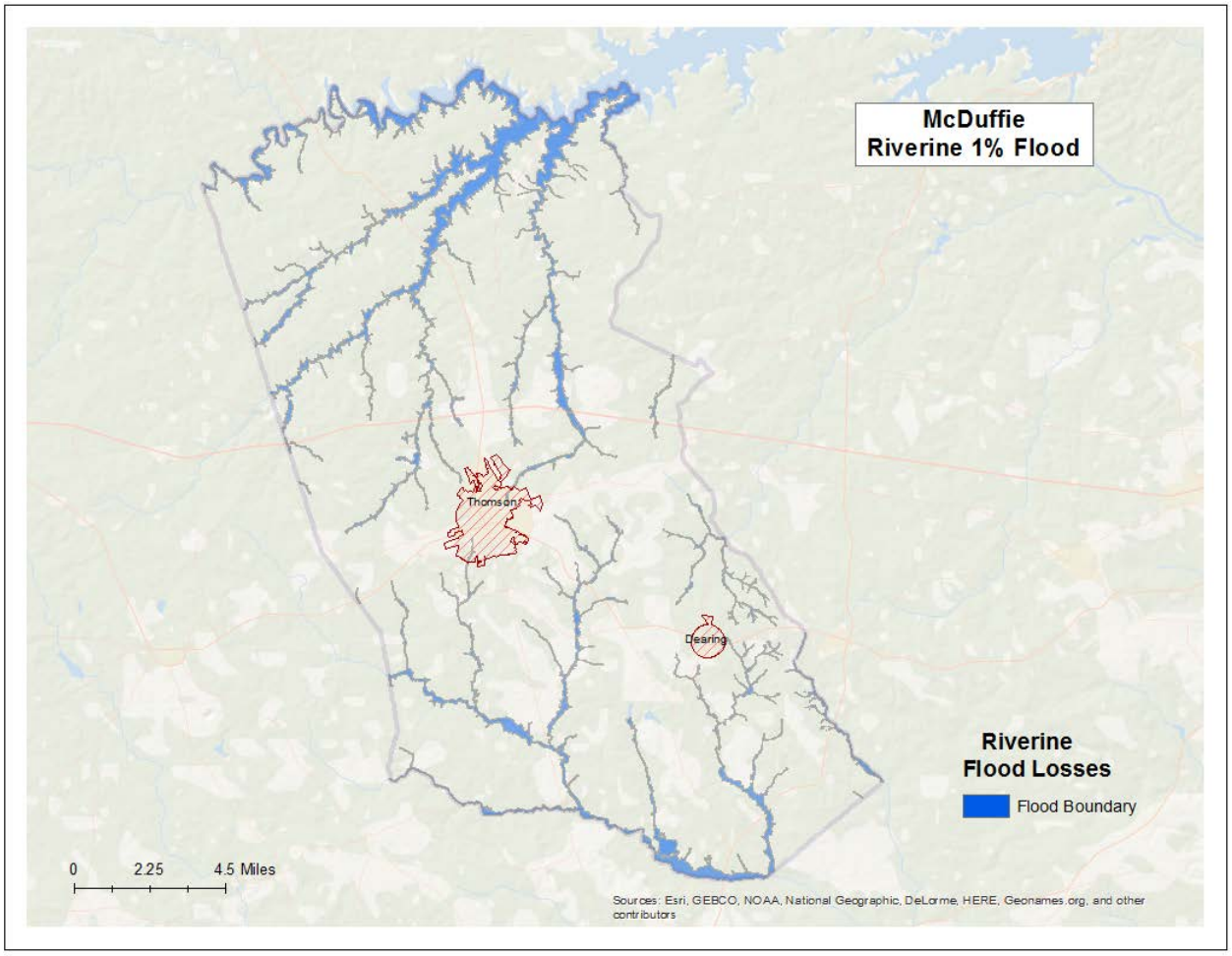


Figure 6: Riverine 1% Flood Inundation

Riverine 1% Flood Building Damages

Buildings in McDuffie County are vulnerable to flooding from events equivalent to the 1% riverine flood. The economic and social impacts from a flood of this magnitude can be significant. Table 8 provides a summary of the potential flood-related building damage in McDuffie County by jurisdiction that might be experienced from the 1% flood. Figure 7 maps the potential loss ratios of total building exposure to losses sustained to buildings from the 1% flood by 2010 census block and Figure 8 illustrates the relationship of building locations to the 1% flood inundation boundary.

Table 8: McDuffie County Riverine 1% Building Losses

Occupancy Classification	Total Buildings	Total Buildings Damaged	Total Building Exposure	Total Losses to Buildings	Loss Ratio of Exposed to Damaged
Unincorporated-McDuffie					
Residential	6,322	22	$765,464,164	$893,304	0.12%
County Total					
Total	**6,322**	**22**	**$765,464,164**	**$893,304**	

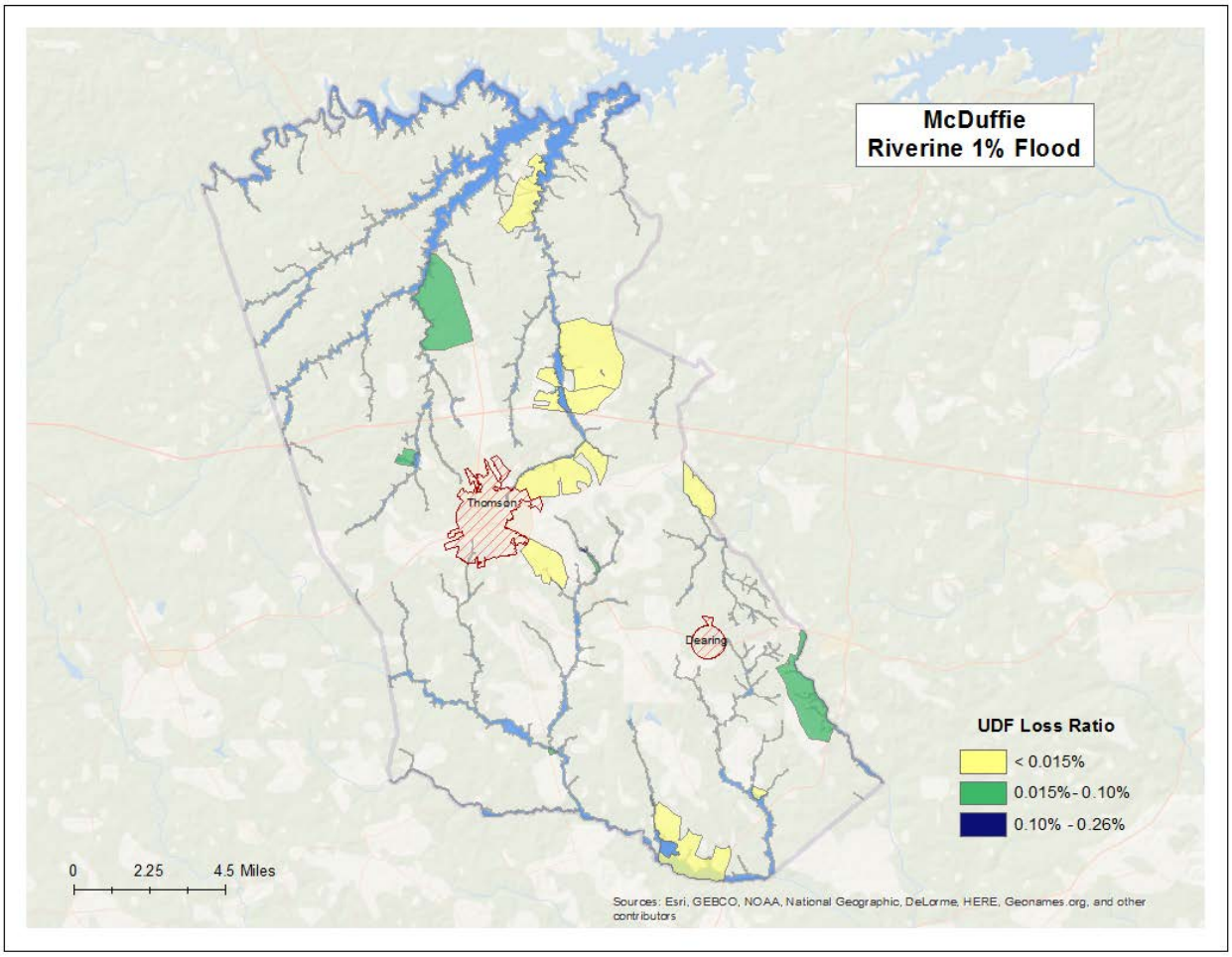


Figure 7: Potential UDF Loss Ratios from the 1% Riverine Flood

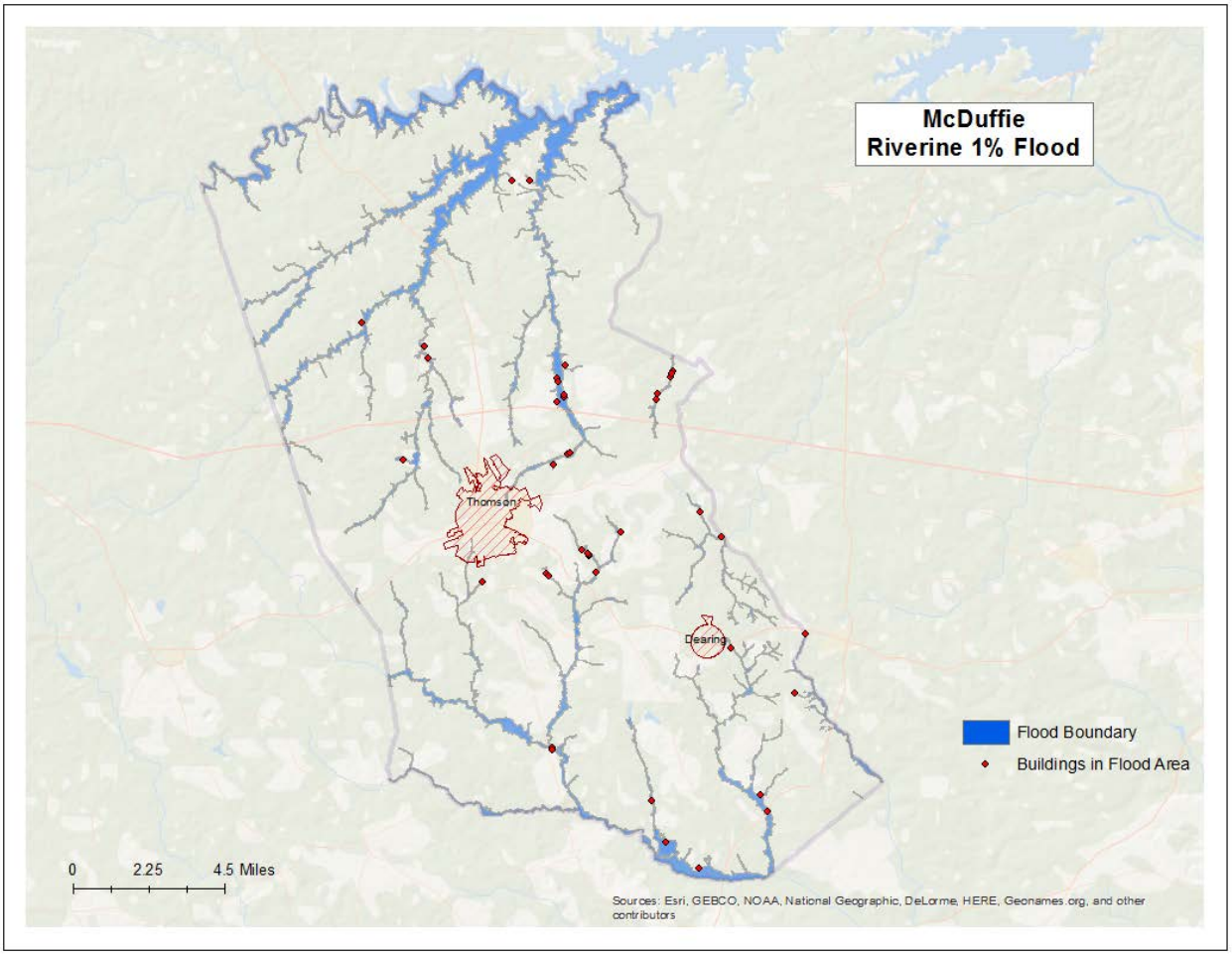


Figure 8: Damaged Buildings in 1% Riverine Flood

Riverine 1% Flood Essential Facility Losses

An essential facility may encounter many of the same impacts as other buildings within the flood boundary. These impacts can include structural failure, extensive water damage to the facility and loss of facility functionality (e.g. a damaged police station will no longer be able to serve the community). The analysis identified one Fire Station that was subject to damage in the McDuffie County riverine 1% probability floodplain.

Table 9: Essential Facility Losses

Name	Category	City
McDuffie County Fire Dept. Station	Fire Station	Thomson

Riverine 1% Flood Shelter Requirements

Hazus-MH estimates that the number of households that are expected to be displaced from their homes due to riverine flooding and the associated potential evacuation. The model estimates 149 households might be displaced due to the flood. Displacement includes households evacuated within or very near to

the inundated area. Displaced households represent 446 individuals, of which 47 may require short term publicly provided shelter. The results are mapped in Figure 9.

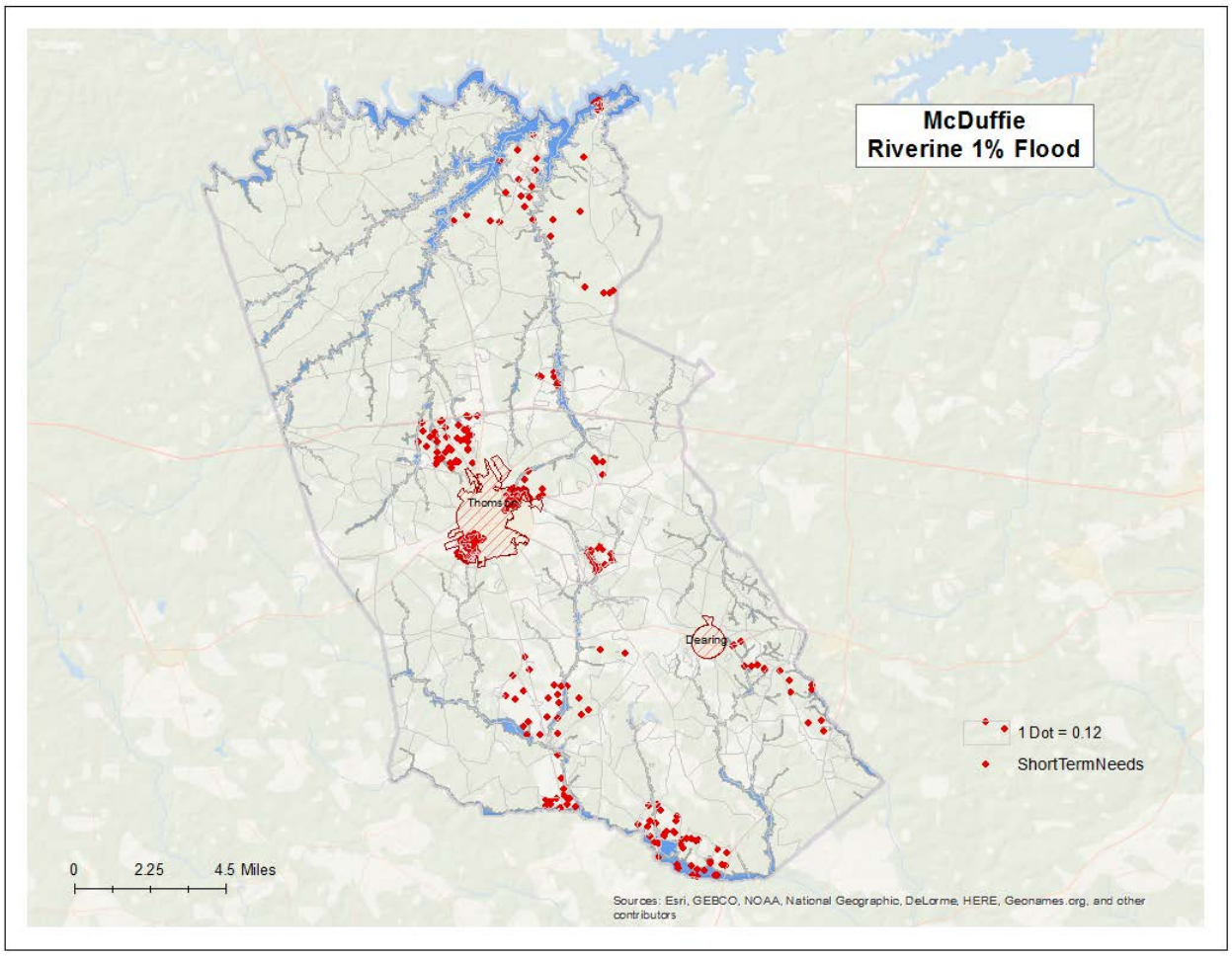


Figure 9: Estimated Flood Shelter Requirements in 1% Riverine Flood

Riverine 1% Flood Debris

Hazus-MH estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories:

- Finishes (dry wall, insulation, etc.)
- Structural (wood, brick, etc.)
- Foundations (concrete slab, concrete block, rebar, etc.)

Different types of material handling equipment will be required for each category. Debris definitions applied in Hazus-MH are unique to the Hazus-MH model and so do not necessarily conform to other definitions that may be employed in other models or guidelines.

The analysis estimates that an approximate total of 2512 tons of debris might be generated: 1) Finishes – 1,150 tons; 2) Structural - 541 tons; and 3) Foundations- 821 tons. The results are mapped in Figure 10.

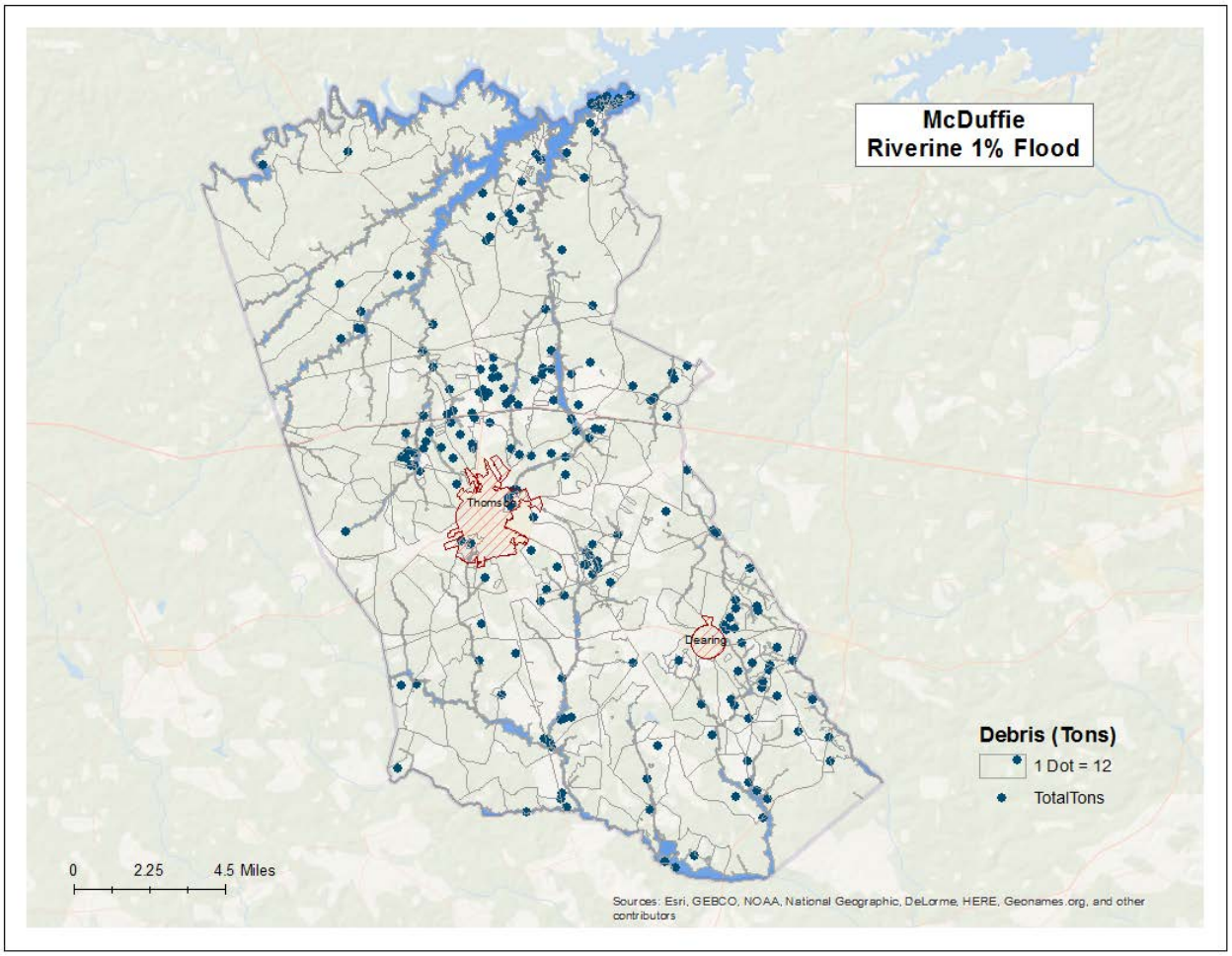


Figure 10: Flood Debris Weight (Tons) in 1% Riverine Flood

Tornado Risk Assessment

Hazard Definition

Tornadoes pose a great risk to the state of Georgia and its citizens. Tornadoes can occur at any time during the day or night. They can also happen during any month of the year. The unpredictability of tornadoes makes them one of Georgia's most dangerous hazards. Their extreme winds are violently destructive when they touch down in the region's developed and populated areas. Current estimates place the maximum velocity at about 300 miles per hour, but higher and lower values can occur. A wind velocity of 200 miles per hour will result in a wind pressure of 102.4 pounds per square foot of surface area—a load that exceeds the tolerance limits of most buildings. Considering these factors, it is easy to understand why tornadoes can be so devastating for the communities they hit.

Tornadoes are defined as violently-rotating columns of air extending from thunderstorms and cyclonic events. Funnel clouds are rotating columns of air not in contact with the ground; however, the violently-rotating column of air can reach the ground very quickly and become a tornado. If the funnel cloud picks up and blows debris, it has reached the ground and is a tornado.

Tornadoes are classified according to the Fujita tornado intensity scale. Originally introduced in 1971, the scale was modified in 2006 to better define the damage and estimated wind scale. The Enhanced Fujita Scale ranges from low intensity EF0 with effective wind speeds of 65 to 85 miles per hour, to EF5 tornadoes with effective wind speeds of over 200 miles per hour. The Enhanced Fujita intensity scale is included in Table 10.

Table 10: Enhanced Fujita Tornado Rating

Fujita Number	Estimated Wind Speed	Path Width	Path Length	Description of Destruction
EF0 *Gale*	65-85 mph	6-17 yards	0.3-0.9 miles	Light damage, some damage to chimneys, branches broken, sign boards damaged, shallow-rooted trees blown over.
EF1 *Moderate*	86-110 mph	18-55 yards	1.0-3.1 miles	Moderate damage, roof surfaces peeled off, mobile homes pushed off foundations, attached garages damaged.
EF2 *Significant*	111-135 mph	56-175 yards	3.2-9.9 miles	Considerable damage, entire roofs torn from frame houses, mobile homes demolished, boxcars pushed over, large trees snapped or uprooted.
EF3 *Severe*	136-165 mph	176-566 yards	10-31 miles	Severe damage, walls torn from well-constructed houses, trains overturned, most trees in forests uprooted, heavy cars thrown about.
EF4 D*evastating*	166-200 mph	0.3-0.9 miles	32-99 miles	Complete damage, well-constructed houses leveled, structures with weak foundations blown off for some distance, large missiles generated.
EF5 *Incredible*	Over 200 mph	1.0-3.1 miles	100-315 miles	Foundations swept clean, automobiles become missiles and thrown for 100 yards or more, steel-reinforced concrete structures badly damaged.

Source: http://www.srh.noaa.gov

Hypothetical Tornado Scenario

For this report, an EF3 tornado was modeled to illustrate the potential impacts of tornadoes of this magnitude in the county. The analysis used a hypothetical path based upon an EF3 tornado event running along the predominant direction of historical tornados (southeast to northwest). The tornado path was placed to travel through Arlington and Leary. The selected widths were modeled after a re-creation of the Fujita-Scale guidelines based on conceptual wind speeds, path widths, and path lengths. There is no guarantee that every tornado will fit exactly into one of these categories. Table 11 depicts tornado path widths and expected damage.

Table 11: Tornado Path Widths and Damage Curves

Enhanced Fujita Scale	Path Width (feet)	Maximum Expected Damage
EF5	2,400	100%
EF4	1,800	100%
EF3	1,200	80%
EF2	600	50%
EF1	300	10%

Within any given tornado path there are degrees of damage. The most intense damage occurs within the center of the damage path, with decreasing amounts of damage away from the center. After the hypothetical path is digitized on a map, the process is modeled in GIS by adding buffers (damage zones) around the tornado path. Figure 11 describes the zone analysis.

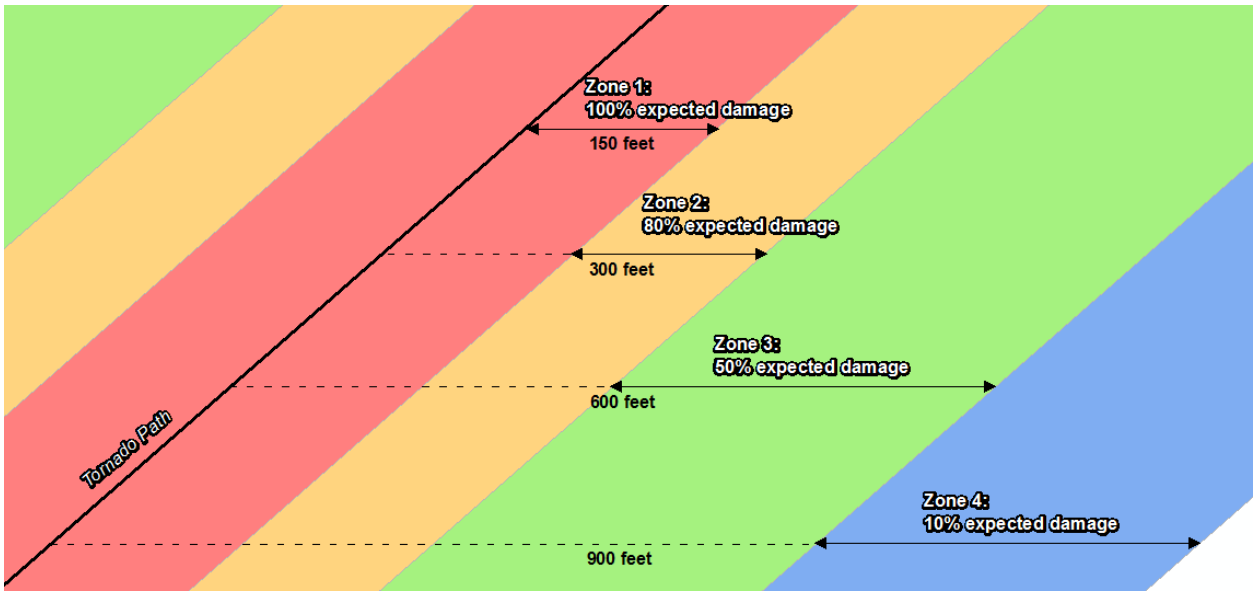


Figure 11: EF Scale Tornado Zones

An EF3 tornado has four damage zones, depicted in Table 12. Major damage is estimated within 150 feet of the tornado path. The outer buffer is 900 feet from the tornado path, within which buildings will not experience any damage. The selected hypothetical tornado path is depicted in Figure 12 and the damage curve buffer zones are shown in Figure 13.

Table 12: EF3 Tornado Zones and Damage Curves

Zone	Buffer (feet)	Damage Curve
1	0-150	80%
2	150-300	50%
3	300-600	10%
4	600-900	0%

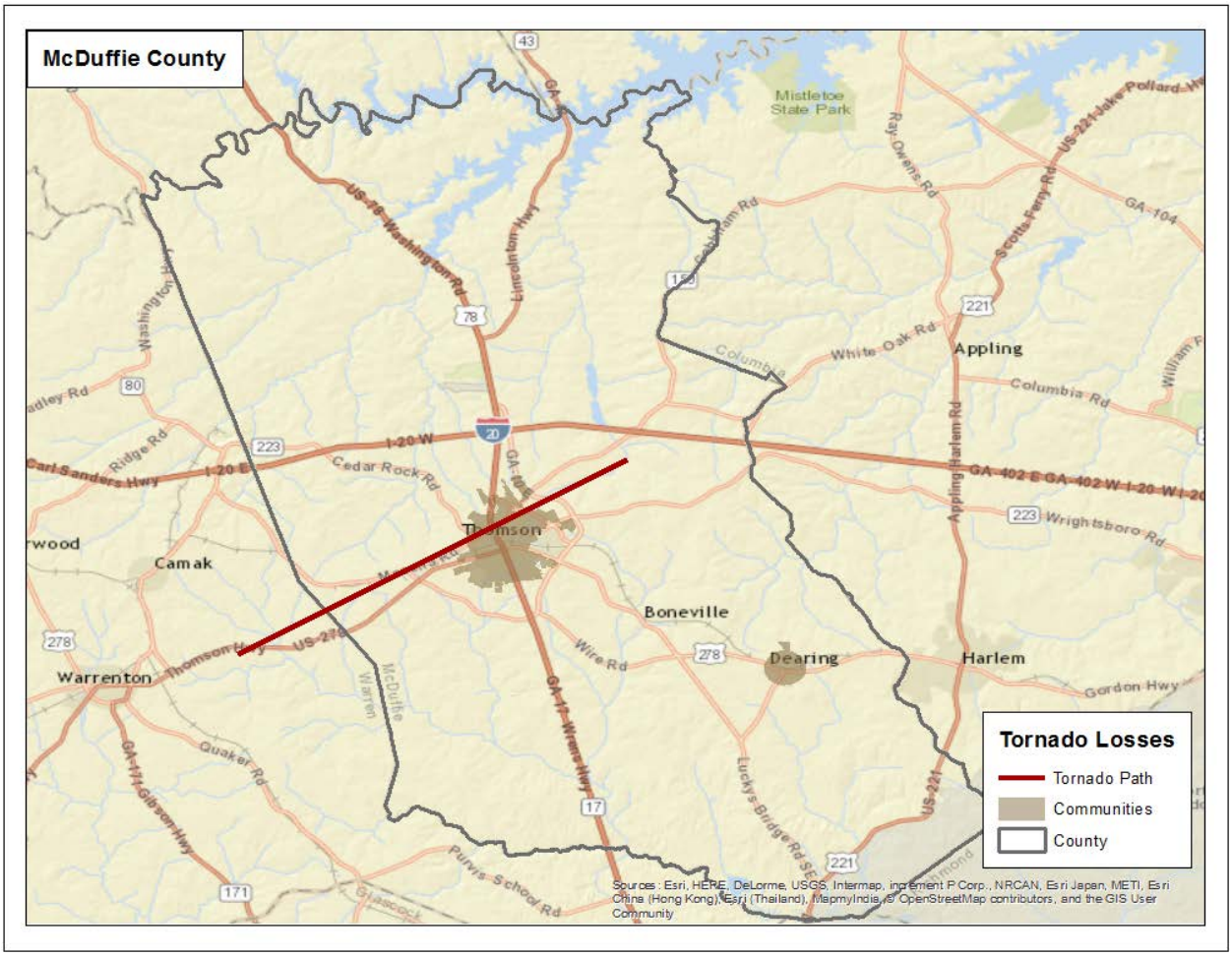


Figure 12: Hypothetical EF3 Tornado Path

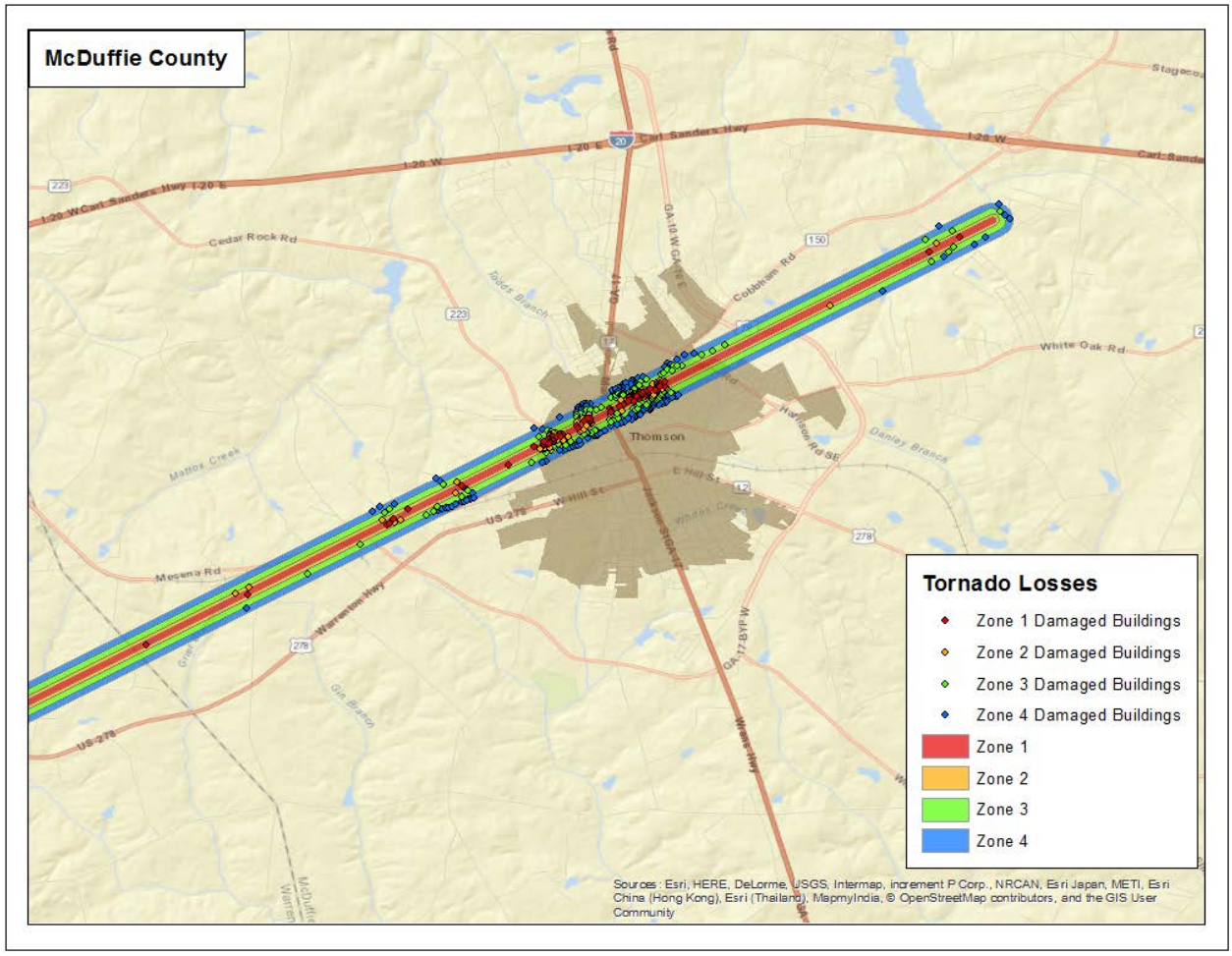


Figure 13: Modeled EF3 Tornado Damage Buffers

EF3 Tornado Building Damages

The analysis estimated that approximately 421 buildings could be damaged, with estimated building losses of $35 million dollars.The building losses are an estimate of building replacement costs multiplied by the percentages of damage. The overlay was performed against parcels provided by McDuffie County that were joined with Assessor records showing estimated property replacement costs. The Assessor records often do not distinguish parcels by occupancy class if the parcels are not taxable and thus the number of buildings and replacement costs may be underestimated. The results of the analysis are depicted in Table 13.

Table 13: Estimated Building Losses by Occupancy Type

Occupancy Classification	Buildings Damaged	Building Losses
Residential	388	$26741771
Commercial	29	$4,225,446
Education	2	$3,750,231
Religious	1	$355,902
Total	**421**	$35,259,387

EF3 Tornado Essential Facility Damage

There were two essential facilities located in the tornado path – McDuffie County Board of Education, Thomson Middle School. According to the modeling, these two facilities would suffer major damage should such a tornado strike occur.

According to the Georgia Department of Education, Thomson-McDuffie Middle School enrollment was approximately 840 students as of October 2015. Depending on the time of day, a tornado strike as depicted in this scenario could result in significant injury and loss of life. In addition, arrangements would have to be made for the continued education of the students in another location.

The location of the damaged Essential Facilities is mapped in Figure 14.

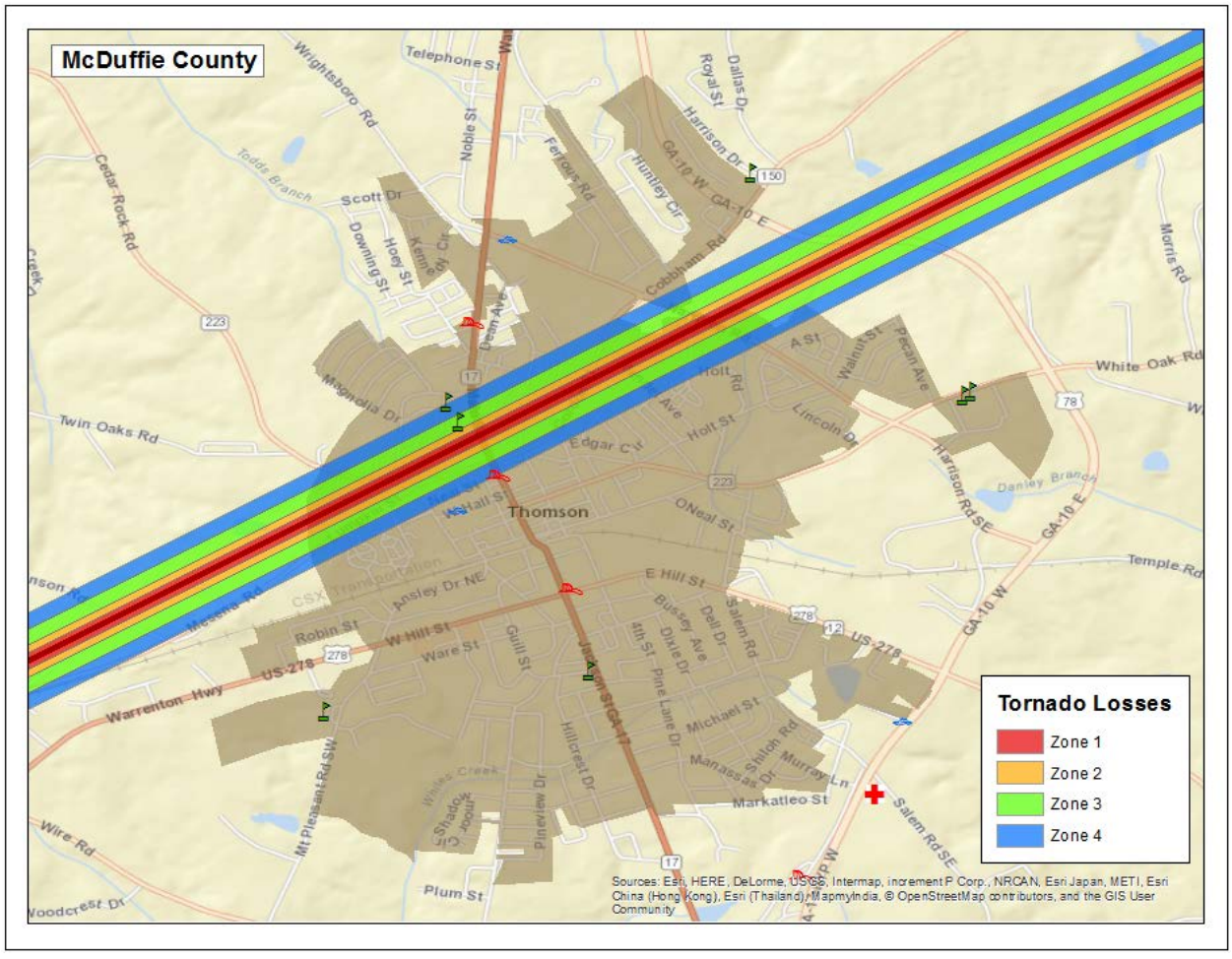


Figure 14: Modeled Essential Facility Damage in McDuffie County

Exceptions Report

Hazus Version 2.2 SP1 was used to perform the loss estimates for McDuffie County, Georgia. Changes made to the default Hazus-MH inventory and the modeling parameters used to setup the hazard scenarios are described within this document.

Reported losses reflect the updated data sets. Steps, algorithms and assumptions used during the data update process are documented in the project workflow named PDM_GA_Workflow.doc.

Statewide Inventory Changes

The default Hazus-MH Essential Facility inventory was updated for the entire state prior to running the hazard scenarios for McDuffie County.

Statewide facility data were supplied by GEMA through the GMIS in June 2015. These updates were applied by The Polis Center. Table 14 summarizes the difference between the original Hazus-MH default data and the updated data for McDuffie County.

Table 14: Essential Facility Updates

Occupancy Classification	Default Replacement Cost	Default Count	Updated Replacement Cost	Updated Count
Care	$0	0	$21,230,000	3
EOC	$0	0	$1,760,000	2
Fire	NA	1	$3,710,000	9
Police	$1,464,000	2	$1,685,000	4
School	$3,246,025	1	$50,150,000	8

County Inventory Changes

The GBS records for McDuffie County were replaced with data derived from parcel and property assessment data obtained from McDuffie County. The county provided property assessment data was current as of January 2014 and the parcel data current as of July 2014.

General Building Stock Updates

The parcel boundaries and assessor records were provided to The Polis Center by the University of Georgia, Carl Vinson Institute of Government who obtained them from McDuffie County. Records without improvements were deleted. The parcel boundaries were converted to parcel points located in the centroids of each parcel boundary. Each parcel point was linked to an assessor record based upon matching parcel numbers. The generated Building Inventory represents the approximate locations (within a parcel) of building exposure. The Building Inventory was aggregated by Census Block and imported into

Hazus-MH using the Hazus-MH Comprehensive Data Management System (CDMS). Both the 2010 Census Tract and Census Block tables were updated.

The match between parcel records and assessor records was based upon a common Parcel ID. For this type of project, unless the hit rate is better than 85%, the records are not used to update the default aggregate inventory in Hazus-MH. The Parcel-Assessor hit rate for McDuffie County was 99.3%.

Adjustments were made to records when primary fields did not have a value. In these cases, default values were applied to the fields. Table 15 outlines the adjustments made to McDuffie County records.

Table 15: Building Inventory Default Adjustment Rates

Type of Adjustment	Building Count	Percentage
Area Unknown	464	5%
Construction Unknown	2,151	22%
Condition Unknown	364	4%
Foundation Unknown	2,112	22%
Year Built Unknown	1,814	19%

Portions of the CAMA values were either missing (<Null> or '0'), did not match CAMA domains or were unusable ('Unknown', 'Other', 'Pending'). These were replaced with 'best available' values. Missing YearBuilt values were populated from average values per Census Block. Missing Condition, Construction and Foundation values were populated with the highest-frequency CAMA values per Occupancy Class. Missing Area values were populated with the average CAMA values per Occupancy Class.

The resulting Building Inventory was used to populate the Hazus-MH General Building Stock and User Defined Facility tables. The updated General Building Stock was used to calculate flood and tornado losses. Changes to the building counts and exposure that were modeled in McDuffie County are sorted by General Occupancy in Table 1 at the beginning of this report. If replacements cost or building value were not present for a given record in the Assessor data, replacement costs were calculated from the Building Area (sqft) multiplied by the Hazus-MH RS Means ($/sqft) values for each Occupancy Class.

Differences between the default and updated data are due to various factors. The Assessor records often do not distinguish parcels by occupancy class when the parcels are not taxable; therefore, the total number of buildings and the building replacement costs for government, religious/non-profit, and education may be underestimated.

User Defined Facilities

Local parcel and CAMA data were used to develop points representing the locations of buildings in the county, referred to as User Defined Facilities (UDF) in the Hazus model. For the flood model, this includes only buildings located in the 1% Annual Chance Riverine Flood Area. Table 16 identifies the total building count & exposure for the county and the total building count & exposure for buildings located in the 1% Annual Chance Riverine Flood Area.

Table 16: Building Count and Exposure for County and Riverine Flood Area

Feature	Counts	Exposure
Total buildings in the County	9,708	$154,049,260
Total buildings inside the 1% Annual Chance Riverine Flood Area	57	$6,910,566

It should be noted that UDFs are only used in the flood modeling process, due to the fact that it is important to identify if individual buildings are located within the flood area to obtain the depth of flood.

Assumptions

- Flood analysis was performed on UDF. The point locations are parcel centroid accuracy.
- The analysis is restricted to the county boundary within the flood area. Events that occur near the county boundary do not contain loss estimates from adjacent counties.
- The following attributes were defaulted or calculated:
  First Floor Height was set from Foundation Type
  Content Cost was calculated from Building Cost

CSRA REGIONAL PLAN 2035

REGIONAL ASSESSMENT
COMMUNITY PARTICIPATION PLAN
REGIONAL AGENDA

Central Savannah River Area
CSRA
RC
Regional Commission

Table of Contents

CSRA REGIONAL PLAN 2035

Regional Assessment

Section 1: INTRODUCTION

1.1 Regional Plan Overview

The CSRA Regional Plan 2035 (hereinafter 'the Plan') is the long-range plan for the management of the region's projected growth by local governments and the CSRA Regional Commission. The Plan's horizon is twenty years but will be updated in ten years to address changing regional conditions. The process is divided into three distinct parts, per the *Regional Planning Requirements* established by the Georgia Department of Community Affairs (DCA):

- Regional Assessment: Identification and analysis of existing conditions using available data
- Stakeholder Involvement Program: Strategy for public participation in the development of the Regional Agenda
- Regional Agenda: Regional vision and implementation program

The resulting analysis will assess the state of the region's socioeconomic, land use, and environmental opportunities and threats. The CSRA's vision and goals, together with an appraisal of the region, will set the strategic direction for the regional agenda. The regional agenda establishes program priorities for implementation.

This document contains the Regional Assessment and the Stakeholder Involvement Program, which will set the stage for the development of the Regional Agenda.

1.2 Regional Assessment Overview

This Regional Assessment includes a thorough analysis of issues and opportunities backed by extensive data gathering and analysis. It contains a map of Projected Development Patterns and an assessment of Areas Requiring Special Attention, which includes a range of categories, such as areas where rapid development is occurring or where infill or redevelopment is desirable. Finally, it includes an assessment of the region's development patterns in light of the state's Quality Community Objectives.

1.3 Stakeholder Involvement Program

This program outlines the process for participation by stakeholders in the creation of the Regional Agenda. It identifies stakeholders, outlines participation techniques and includes a schedule for the completion of the Regional Agenda.

1.4 Regional Agenda

The Regional Agenda is the culmination of the planning process. It will include a vision of the CSRA's future, along with an implementation program for how to get there.

1.5 How to Use This Plan

The CSRA Regional Plan is intended to serve as a reference and implementation point for potential users. A number of companion planning documents should be used in conjunction with the Regional Plan. These include:

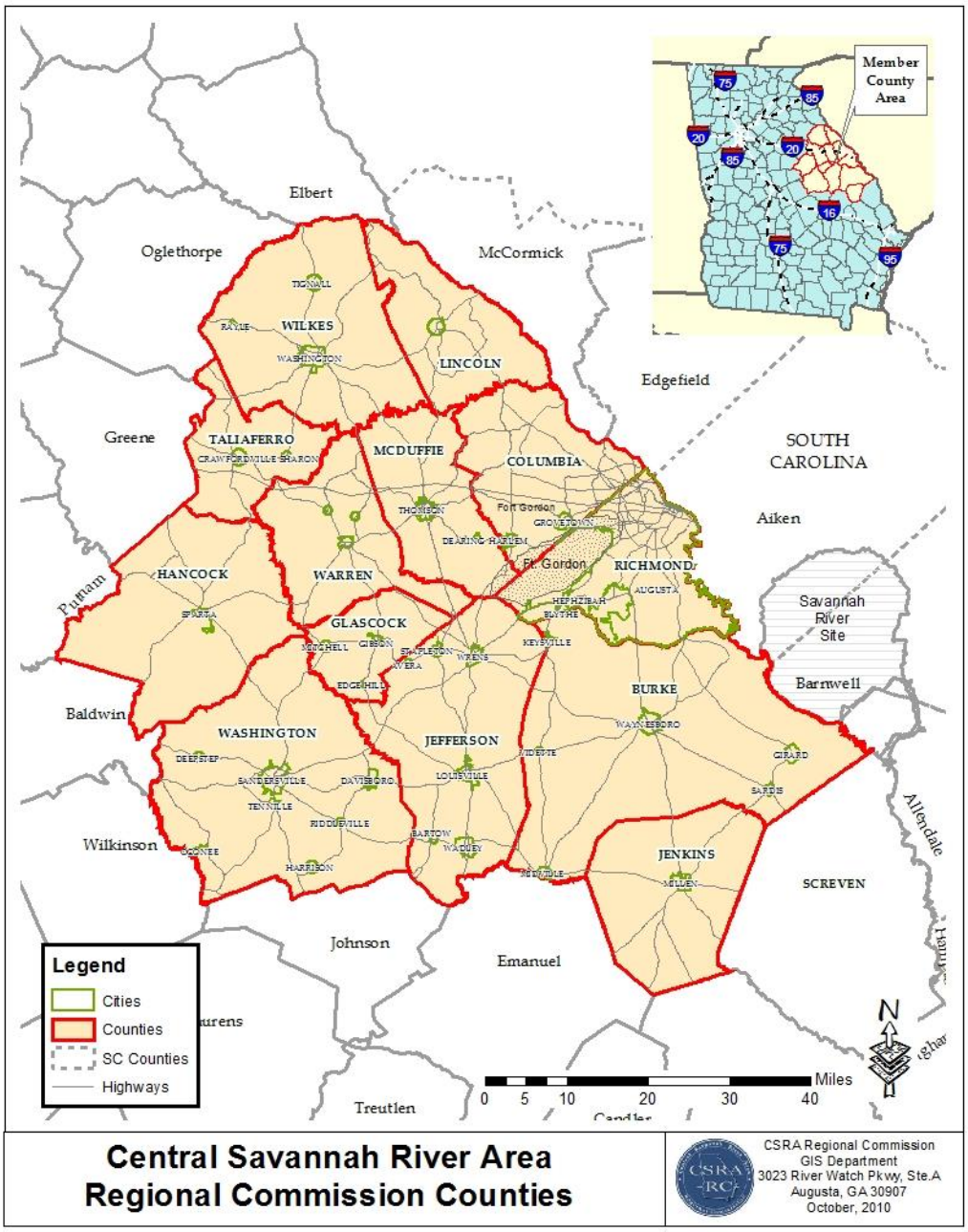
- CSRA Comprehensive Economic Development Strategy
- Augusta Area Diversification Initiative
- Fort Gordon Joint Land Use Study
- CSRA Regionally Important Resources Plan
- County and City Comprehensive Plans

- Statewide Plans

1.6 The Central Savannah River Area

The Central Savannah River Area (CSRA) encompasses an area nearly 6,500 square miles — the largest political region in the state. Located in the east-central Georgia, along the Savannah River, the CSRA includes 13 counties: Burke, Columbia, Glascock, Hancock, Jefferson, Jenkins, Lincoln, McDuffie, Richmond, Taliaferro, Warren, Washington, and Wilkes (Figure 1). The largest city in the CSRA is Augusta – the economic core of the region.

Figure 1: CSRA Location Map



1.6 About the CSRA Regional Commission

The CSRA Regional Commission (CSRA RC) serves thirteen counties and 41 municipalities in east-central Georgia, providing services in the areas of planning and land-use development, grant writing and administration, economic development, historic preservation, and geographic information systems development and implementation to member jurisdictions.

Additionally, the CSRA RC serves as the state-designated Area Agency on Aging (AAA) for the region. In this capacity, the CSRA RC works with local providers to ensure that services for the elderly are provided and monitored. By utilizing pass-through funds from state and federal sources, the Commission's AAA serves as a gateway for programs and resources aimed at helping senior citizens improve the quality of their lives during their retirement years.

The CSRA RC is also the parent company of the CSRA Business Lending. CSRA Business Lending makes loans to small and start-up businesses for the purposes of creating jobs and economic development opportunities within its service area.

Section 2: POTENTIAL REGIONAL ISSUES AND OPPORTUNITIES

2. Potential Issues and Opportunities

This section provides an objective, professional analysis (not based on public or stakeholder input) of the region. This section, presented in divisions relating to classical planning analysis areas such as housing and transportation, presents a preliminary catalog of potential focal points to be examined during the development of Plan.

The Georgia Department of Community Affairs (DCA) publishes a list of typical issues and opportunities as part of the *State Planning Goals and Objectives*. This list, in addition to an evaluation for the region's consistency with the DCA's *Quality Community Objectives*, was used as the starting point for developing the Potential Issues and Opportunities list (please refer to the Appendix of this document for an assessment of the region based on these objectives). Further issues and opportunities were identified as part of a thorough analysis of regional datasets and regional development patterns. The issues and opportunities compiled in this Regional Assessment are preliminary in nature; they will be reexamined and a final list will be assembled as part of the Regional Agenda planning process.

2.1 Population

The population growth illustrated in historical trends is expected to continue over the twenty-year period. However, this growth is not uniform across the CSRA.

- By 2035, the 13-county region's population is projected at 575,304, an increase of approximately 26.5 percent over the 2010 population and 67.4 percent from 1980. This increase will have implications for housing, jobs, transportation, land use, environmental resources, and infrastructure.
- While the urbanized area (Augusta-Richmond and Columbia Counties) has enjoyed population growth, the rural areas continue to lag. Eight of eleven rural counties lost population since the last census. What little population growth is occurring in rural areas is further away from incorporated municipalities, where infrastructure is already established. Should this trend continue, county governments will have to pay more to extend and maintain public services in these areas.
- Household incomes continue to lag the state average. Most concerning, nearly a third of CSRA households are at income levels near or below the poverty line.
- The CSRA is aging rapidly. The proportion of residents 45 years and older has increased 10 percent since 1990, while the proportion of residents under 29 years declined by 8 percent. Needs associated with an aging population (affordable housing, transportation, and medical services) are anticipated to increase over the next twenty years.

Detailed data on population can be found on pages 21 through 25.

2.2 Housing

***State Planning Housing Goal**: To ensure that all residents of the state have access to adequate and affordable housing.*

The CSRA's housing stock is both a strength and weakness for residents.

- The region's housing stock contains a good balance of owner and rental units (55 percent and 30 percent respectively).
- Housing stocks are plentiful in the urbanized area but inadequate in rural counties. Although the official vacancy rate stands at 15 percent, over a third of vacant units are unavailable for purchase or rent. Another 17.2 percent of the region's housing is valued at less than $50,000, an indicator of poor housing conditions.
- Median ($99,937) and average ($127,997) housing values are among the lowest in the state and nation. Low housing costs are a major reason for the CSRA's low cost of living, and a major strength for new residents and business attraction.
- While affordable housing values are a benefit for the region, sprawl threatens county budgets by requiring public services further away from established municipalities. Sprawl also makes it more likely that transportation costs will increase for residents as they have to commute farther to work.

Detailed data on housing can be found on pages 25 through 27.

2.3 Economic Development

***State Planning Economic Development Goal**: To achieve a growing and balanced economy, consistent with the prudent management of the state's resources, that equitably benefits all segments of the population.*

The CSRA region's economy is diverse, and communities typically make concerted efforts to attract new business. However, coordinated economic development planning and promotion could be strengthened, both on a region-wide scale and between proximately-located communities.

- The CSRA RC serves as the region's Economic Development District in coordination with the U.S. Economic Development Administration (EDA), and encourages cooperation between local government officials, community-based organizations, and the private sector. Per EDA requirements, the CSRA RC developed a Comprehensive Economic Development Strategy (CEDS) in 2011.
- The CSRA's job base has shifted significantly in the last two decades. The service sector now accounts for 60 percent of all CSRA jobs, an increase of 20 percent since 1990. The goods-producing sector has declined from 35 percent in 1990 to less than 15 percent of employment today.

- The region's jobs balance is heavily slanted towards the urbanized area. Augusta-Richmond and Columbia Counties account for 78 percent of the CSRA's 233,147 jobs. The urbanized area also accounted for over 90 percent of job growth since 1990. Seven of 11 rural CSRA counties have fewer jobs today than they did in 1990. This corresponds to trends in population, which saw eight of those counties lose residents since 2000.

- Unemployment levels in the CSRA's rural counties have been chronic during the last decade. All rural counties have unemployment rates above the state average (9.7 percent). Three counties (Hancock, Jenkins, and Warren) have unemployment rates of 17 percent or higher. All rural counties meet the criteria of Economically Distressed Areas, according to the federal Public Works and Economic Development Act. The rapid increase in rural unemployment was caused by the closure of major manufacturing employers, which had sustained local economies.

- The CSRA lags behind the state in educational performance, raising concerns about workforce readiness in the new service economy. CSRA scores on the Scholastic Aptitude Test, Georgia High School Graduations Tests, and End-of-Course Assessments all fall below the state average.

Detailed data on economic development can be found on pages 27 through 50.

2.4 Land Use

State Planning Land Use and Transportation Goal*: To ensure the coordination of land use planning and transportation planning throughout the state in support of efficient growth and development patterns that will promote sustainable economic development, protection of natural and cultural resources and provision of adequate and affordable housing.*

The CSRA is a primarily rural region, with an urban core in the Augusta-Richmond County and Columbia County area. Approximately 88 percent of the region's land area is rural.

- The vast majority of the region's housing and commercial growth has occurred in the urbanized area. This corresponds to population trends, which saw the two urban counties gain 35,509 residents since 2000, while the 11 rural counties saw a net gain of only 433 people. Even that figure masks population decline in much of the area. In fact, eight counties - Hancock, Jefferson, Jenkins, Lincoln, Taliaferro, Warren, Washington and Wilkes – combined to lose 2,550 residents since 2000.

- The growth effect that has occurred in the last three decades (development away from established municipalities) resulted in sprawl beyond cities and city centers.

- While cities and downtown areas still have the largest densities, this is quickly eroding as residents locate into unincorporated areas. Revitalization efforts are critical in stemming city population decline.

- If the trend of growth in unincorporated areas continues, this will result in the region's county governments incurring additional costs of providing public infrastructure (such as water & sewer lines, parks, libraries, etc.) further away from established population centers.

Detailed data on land use can be found on pages 50 through 52.

2.5 Transportation and Community Facilities

State Planning Community Facilities and Services Goal*: To ensure the provision of community facilities and services throughout the state to support efficient growth and development patterns that will protect and enhance the quality of life of Georgia's residents.*

The region's physical infrastructure is extensive and diverse, featuring state and federal highways, hospitals, facilities to manage solid waste and wastewater, and other resources. Most community facilities are locally operated and maintained.

- The CSRA has a small network of interstates and four-lane U.S. highways that provide east-west and north-south access to regional and national markets. Interstates 20 and 520, as well as U.S. 1 and U.S. 25 link the CSRA's major cities to each other as well as to the state's major cities, such as Atlanta, Macon, and Savannah (Figure 25). However, the highway system does not fully meet needs throughout the region. Combined, the interstates and U.S 1 and U.S. 25 serve only portions of the CSRA, leaving large areas in the northern and southern part of the region without adequate highway infrastructure.

- While the transportation system serves automobiles relatively well, it is less friendly to other users. Many streets are designed only with vehicle traffic in mind, making them unsafe or unpleasant for pedestrians and cyclists. Moreover, development patterns in many cases continue to separate uses and rely on arterial roads to make connections. These two factors limit mobility for many residents and contribute to inactivity and growing obesity levels for children and adults in the region.

- The region's two primary rail freight carriers: Norfolk Southern and CSX Rail Service carry among the lowest volumes of rail freight in the state. Only Augusta-Richmond and Warren Counties have direct connections to major rail freight hubs in Atlanta and Macon.

- Augusta Regional Airport provides regularly-scheduled commercial flights. The airport currently has 21 daily departures and 22 daily arrivals to three major hubs (Atlanta, Charlotte and Dallas) from three carriers (Delta, U.S. Air and American). In calendar year 2010, the annual passenger volume at the Augusta airport was 246,587, compared to 198,489 (24.2 percent increase) in 2009. Between 2005 and 2010, Augusta Regional's growth rate was 57.9 percent, making it one of the fastest growing small commercial services airports in the nation. Air freight information is unavailable.

- Fixed-route public transit in the CSRA is limited to Augusta-Richmond County. Augusta Public Transit operates nine routes from Monday through Saturday, with daily ridership averaging approximately 3,000. The rest of the CSRA is served with demand-response service.

- Most areas of the CSRA outside of the urbanized parts of Columbia and Augusta-Richmond Counties lag in both choice and quality of broadband service. Most of these areas are not served by any land broadband service provider, making slower satellite internet service the only option. The CSRA RC considers broadband the region's top infrastructure priority and has been aggressively pursuing state and federal funding to remedy this deficiency by extending broadband infrastructure to areas of the region that currently lack it.

- Local community facilities such as parks, water and sewage services, public water, libraries, and medical facilities, are mostly located within incorporated municipalities. Access to some public facilities, however, remains a concern as rural county populations are widely dispersed.

Detailed data on transportation and community facilities can be found on pages 52 through 58.

2.6 Natural and Environmental Resources

***State Planning Natural and Cultural Resources Goal**: To conserve and protect the environmental, natural and cultural resources of Georgia's communities, regions and the state.*

The CSRA contains a wealth of natural and environmental resources that provide the region with numerous social, economic, and environmental benefits. However, these same resources are in need of protection if they are to continue providing these benefits.

- Timber resources account for 2.3 million acres in the CSRA, and are a major driver of the region's forest products industry.

- Kaolin, a type of clay, is the major mineral extracted in the region, providing substantial employment in Jefferson and Washington counties. This sector is under pressure from South American kaolin, which is now being exported around the world.

- Farmland accounts for 22.1 percent of the CSRA's land mass, and sustains approximately 5 percent of the region's employment. The number of farms in the region today is less than half the number of farms in operation in 1982, highlighting a trend towards large, industrial-scale farming.

- The CSRA contains a number of protected watershed areas in Lincoln, Wilkes, McDuffie, Warren, Burke, and Augusta-Richmond counties. The region's watersheds will need to be monitored to ensure future development does not render them vulnerable.

- The region's river basins and major lakes ensure adequate water supplies. However, continued growth of the urbanized area and out-of-region impacts over the next twenty years will place pressure on these supplies, as well as pollution threats from growth.

- The CSRA has a rich history and counts no less than 184 properties and districts listed in the National Register of Historic Places, including National Historic Landmarks, State Historic Parks and Sites. Most of these resources, however, lack preservation plans.

Detailed data on natural and environmental resources can be found on page 58 through 73.

2.7 Intergovernmental Coordination

***State Planning Intergovernmental Coordination Goal**: To ensure the coordination of local planning efforts with other local service providers and authorities, with neighboring communities and with state and regional plans and programs.*

The CSRA RC, founded in 1962, offers member governments avenues to coordinate planning, economic development, workforce development, and aging services. Other instances of intergovernmental coordination takes place between municipalities within a given county, between counties, from region to region, and with state and federal government agencies.

- The CSRA RC Area Agency on Aging provides consolidated services for seniors (including transportation) for the CSRA.
- The CSRA RC serves as the Economic Development District for the region.
- The CSRA RC serves as the coordinating mechanism for CSRA Unified Development Council (UDC). The UDC is a project-oriented volunteer organization comprised of economic, industrial, and regional development organizations, as well as service and educational institutions representing the entire CSRA. The UDC serves as the marketing arm for the CSRA.
- The CSRA RC serves as the coordinating mechanism for CSRA Unified Development Authority (UDA). The UDA promotes the economic development of the CSRA and encourages cooperation among economic development organizations within the member counties.
- The CSRA RC reviews and comments on applications for federal and state grant, loan, and permit assistance submitted by local governments and other applicants within the region. This is known as the Georgia Intergovernmental Consultation Process (Executive Order 12372), and is intended to offer comment on a proposed project's consistency with local and regional comprehensive plans.
- The CSRA RC develops and maintains the CSRA Regionally Important Resources Plan and the CSRA Comprehensive Economic Development Strategy.

TIMBER IMPACT ASSESSMENT

Georgia Ice Storm, February 11-13, 2014

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(jjohnson@gfc.state.ga.us; cbates@gfc.state.ga.us ; gwhite@gfc.state.ga.us)

BACKGROUND

A winter storm impacted multiple southern states and more than 90 Georgia counties experienced some form of winter precipitation, beginning February 11th and lasting through the 13th. Northern tier counties recorded snowfalls of up to 13" (Rabun County), and although some timber / tree impacts occurred in this "snow zone," they were not widespread or considered severe.

During the storm, ice accumulation was measured from between a tenth of an inch and one inch (or possibly higher) in a zone from roughly north metro Atlanta to Augusta in northern Georgia, and from Macon to Sylvania in central Georgia. Because ice is much heavier than snow, widespread tree damage occurred, resulting in power disruption to nearly a million customers.

Governor Deal declared a state of emergency on Monday, February 10th, and a presidential declaration of emergency was issued as the storm hit the state. The map below depicts this zone (*Figure 1*).

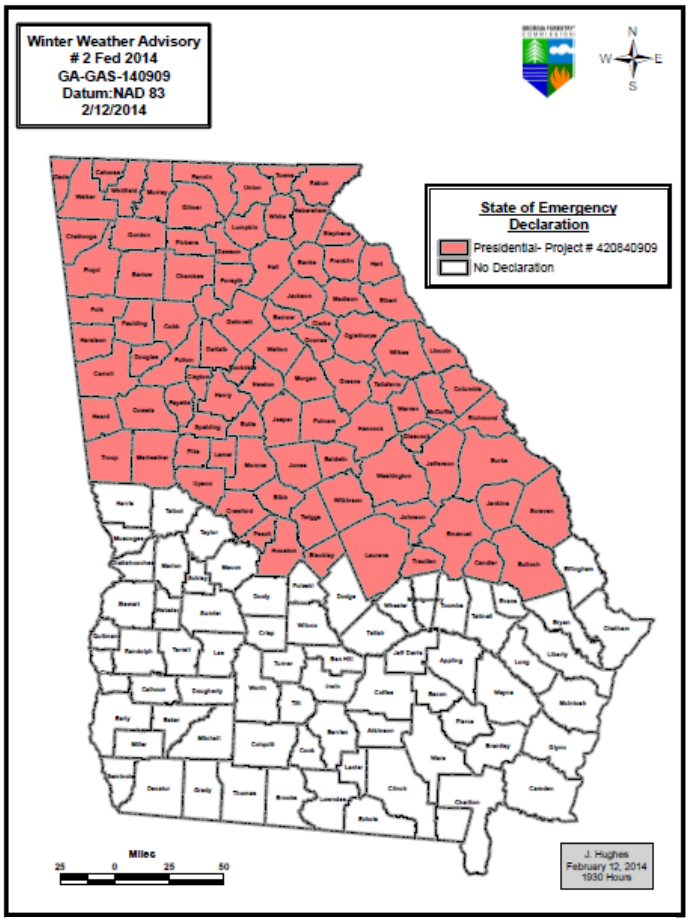


Figure 1: Counties included in the presidential declaration zone

The National Weather Service provided estimates of ice accumulations, and this information, coupled with field observation reports, helped define the area surveyed by the Georgia Forestry Commission for timber impact accounts. Small amounts of ice are known to affect trees, and higher amounts (especially exceeding three-fourths of an inch) can cause serious damage to certain timber types and age classes.

Another factor that affects tree damage is wind. Once ice accumulations peaked, a cold front moved through the state. Although wind speed varied, some areas reported winds of up to 35mph. Even minor winds during ice-loading can break or uproot trees. These occurrences were a major factor in the timber / tree damage associated with this storm, and may account for some of the variability detected.

OBSERVATIONS

A team of Georgia Forestry Commission foresters surveyed the zone believed to have endured the greatest impacts to our forests, and developed the map below. Please note that damage was observed beyond these counties, but it tended to be less intense than those shown by the map's shaded areas. Some of the highlighted counties had tremendous variations in the amount of damage observed. In addition, timber damage evaluation surveys were separated into rough categories of damage (at the county level), isolated timber stands within counties in the two lesser categories may have severe damage, and stands in the severe counties may only have minor damage. The variability of damage to similar stands even a few miles apart was extreme, so mangers should carefully evaluate timber throughout this broad region.

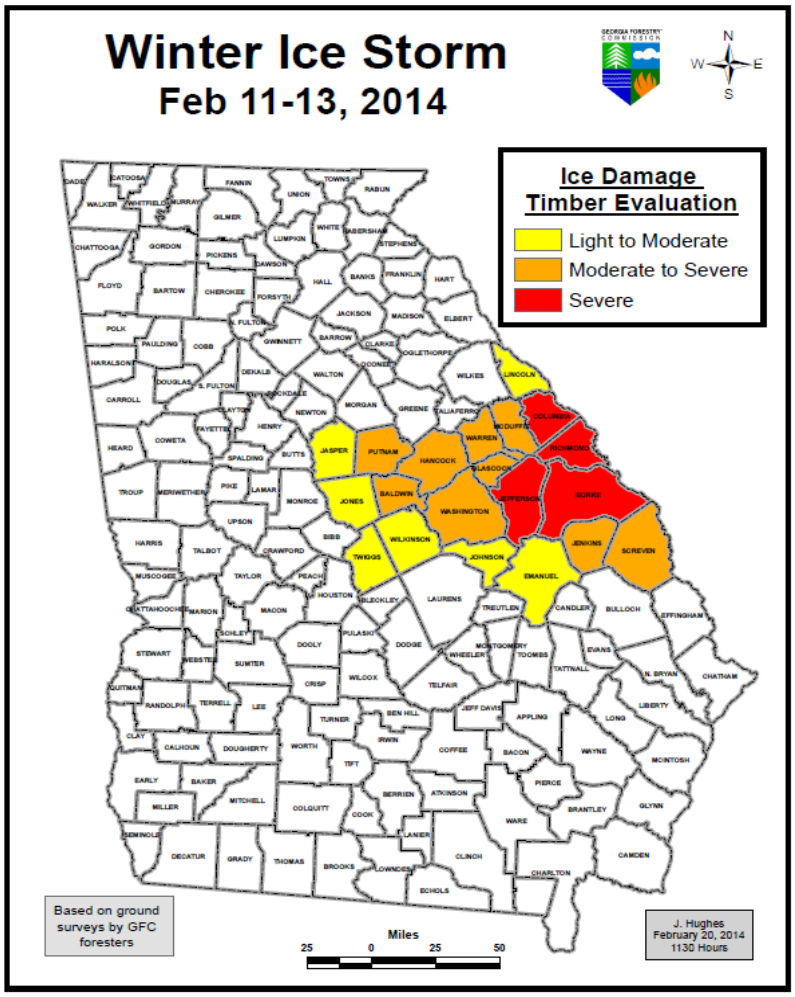


Figure 2: Counties with widespread Ice Damage

This survey examined landscape-level impacts and classifies them accordingly.

The categories of damage are based upon field observations about:

- Occurrence (frequency) of damage within a county.
- Levels of damage within two types of pine that were most frequently damaged (young pine stands, and pine stands on which a first-thinning had recently occurred.)

Ice Damage Intensity:

Light to moderate damage – Only branches and limbs broken from the tree, with minor damage to the overall stand and trees bent less than 45 degrees. No salvage operation will be necessary and the stand should recover with no additional management requirements, though long term yields will likely be impacted.

Moderate to severe damage – Branches and limbs broken from the trees with damage to the overall stand. More than 25% of stems broken and a salvage operation should be considered to minimize losses and remove trees that likely will not survive.

Severe damage – More than 30% of stems broken, tops broken out across the stand, limbs stripped, and trees bent more than 45 degrees. A salvage operation must be considered and a clearcut may be the prudent management decision.

Ice damage was not detected on most timber types but was concentrated on two types of pine: recently thinned pine stands, and younger stands less than 25 feet in height.

Recently thinned pine stands: These are primarily pine plantations that were thinned for the *first time* within the past several years. Trees adjust to the amount of space and competition within a stand, and those that have been thinned for the first time are adjusting to reduced protection from neighboring trees and are growing in diameter, which strengthens the main stem. They also respond by accelerating root growth which helps anchor the tree and aids in the increased moisture uptake needed to support larger live crowns. Depending on residual stand-density after thinning, it takes trees about five years to fully respond to the increased growing space. In the meantime, they are more prone to wind (and ice) damage.

These stands were particularly hard hit, which is unfortunate for landowners who have invested 15 to 20-plus years of growth getting their trees to this size. First-thinnings typically remove lower value wood (such as pulpwood / fuel wood), with the objective of allowing the residual stand to produce higher value products (such as sawtimber, plywood, and poles). From an investment standpoint, timber growth following a first thinning maximizes profits, so salvaging an ice-damaged stand is a devastating blow to expected returns.

Photo (left) – Twenty-one year old loblolly stand in Burke County; suffered over 30% stem breakage.

Thinning likely occurred two years ago.

Photo (right) – Nineteen year old loblolly stand in Jefferson County; suffered almost 50% stem breakage.

Thinning occurred within the past year.

Numerous older pine stands that had been thinned twice (or more) were also examined. Although some had damage, most would be considered minor, with many not requiring a salvage operation. The damage in these stands tended to be uprooted trees rather than stem breakage. This type of wind throw (tree that is completely uprooted) in older stands seemed prevalent throughout the region.

Landowners and managers of storm-damaged stands are highly encouraged to read and understand the implications of ice on different types of stands. Web links which provide detailed guidance are provided on the last page of this document.

Young pine stands: Pine plantations (of most species) that were 25 feet and taller - and *had never been thinned* - seemed to weather this ice storm well. The ability of dense stands to provide tree-to-tree support and prevent winds from uprooting individual trees was a big factor in these stands' withstanding minimal damage. Younger (and shorter) stands, however, didn't fare as well. One of the critical factors seemed to be that the trees still had many live branches almost to ground level, which likely accumulated so much ice that breaking points were reached for limbs and main stems.

Young stands of about six feet in height also seemed to fair well. Some of these have many bent stems (with some breakage), but young trees tend to correct this problem.

Some younger loblolly stands were damaged (especially in the counties noted as "Severe" on the map on page 2), but more damage occurred on longleaf and slash pine. Longleaf stands suffered the worst damage with stem and limb breakage but no stands seen were completely leveled. The resiliency of nature can be surprising, and the fate of these stands will become evident over the next few years. When tops break out, a lateral branch will assume dominance and there will be variation in long-term stem straightness.

Careful examination will be needed to determine the amount of permanent problems this storm has inflicted on each stand. Re-evaluation after the next growing season should give managers a better perspective on what lies ahead.

Photo (Left) – Five year old slash pine stand in Burke County showing many bent and leaning trees, with some breakage. Note the many leaning trees with limb breakage.

Photo (Right) – Nine year old longleaf pine stand in Burke County showing top and limb breakage. Note the many tops broken and some limb breakage.

EXTENT OF DAMAGE

GFC foresters evaluated the counties noted on the previous map and developed estimates of damage based upon a combination of this field work combined with a geospatial analysis of this region. These estimates do not include areas outside this zone, nor do they include hardwood, which was also impacted. Most hardwood damage consisted of limb and top breakage with most trees retaining enough live branches to support survival. Damage can be expected in the growth form of these trees and possibly in sluggish growth rates.

For pine type timber, an estimated 70,000+ acres were impacted, valued in excess of $65 million. The majority of these acres (61,000+) were in the recently thinned pine category. This estimate doesn't include damage outside of the zone shown on the map (page 2), and it does not account for hardwood damage acreages or values, so it should be considered conservative. Some of the merchantable pine will likely be salvaged, which could reduce the damage estimate somewhat. However, the values used were based upon landowners intending to grow these stands for at least 30 years, with the growing objective of solid wood products (sawtimber, plywood, and poles). So even if salvage occurs, part of the "loss" is in the future growth of these higher value products.

RECOMMENDATIONS

With the wide range of damage inflicted by this ice storm, there will likely be three distinct categories by which landowners make their evaluations:

1) Light damage or losses that may not warrant a salvage operation. This could include merchantable stands (trees are large enough to sell), which simply don't have enough timber damage to warrant a commercial harvest, or pre-merchantable stands where there is a good chance they will recover over time.

2) Stands with significant damage, mandating a salvage operation to recoup whatever value can be obtained from the stand. This might include a complete harvest for widespread damage, or a partial harvest of damaged timber to provide a commercial harvest.

3) Situations falling between the two scenarios above, in which a good bit of the timber is damaged but there might be enough timber to leave growing. In these cases, landowners are encouraged to use the services of a professional forester to help make the best decision for the situation. Immediately following a storm, it is difficult for landowners to accurately gauge how well a stand may recover, or to measure the amount of timber that could be allowed to remain for future growth and income.

For landowners facing a complete harvest to salvage their damaged timber, please consider reforesting the area. The Farm Service Agency has a cost share program that can assist with site preparation and planting costs called the Emergency Forest Restoration Program (EFRP). Apply at your local office.

Special thanks to other GFC foresters who helped develop this information:
Jeff Kastle, Chris Thompson, Chris Howell, Chris Barnes, Jeremy Hughes and Charles Bailey

URBAN TREE ASSESSMENTS

Georgia Forestry Commission certified arborist/foresters surveyed damage and storm-generated tree debris left to be removed from urban and rural communities. Survey results showed counties that experienced the most damage to their rural stands also suffered the most damage to their urban trees. The highest amount of damage, as one might expect, was found in Burke County.

Neighborhoods with large pine trees experienced the most loss, with the bulk of damage to branches and tree tops which were broken by the weight of ice. Additionally, "leaf on" trees, such as magnolia and cherry laurel, and old water oaks with structural issues, made up a large component of community forest tree failure. Crews observed very few trees that were completely destroyed or uprooted by the storm.

Much debris remains to be cut and stacked by homeowners and tree care companies before its removal from community rights-of-way can begin. Many trees that have lost more than 50% of their limbs, and trees that have been uprooted or split so that heartwood of the main trunk is evident, will need to be removed. Otherwise, impacted trees will require pruning, with particular attention being paid to higher risk trees with “hangers” (limbs broken, but not yet detached) and split limbs (see photo below). This will likely increase beyond initial assessments the total biomass that will eventually be collected.

Although the tree at left suffered minor ice damage, notice the branches that are broken and still hanging in the tree. These could impact the structure, the vehicle or humans. These “hangers” should be removed.

The pine tree at right lost half of the living portion of its crown and pruning is needed to remove branch stubs.

Special thanks to GFC foresters who helped with field work: Gary White, Joe Burgess, Joan Scales, Mark McClellan, Jeremy Hughes, Keith Murphy, Chris Howell and also Mark Millirons.

These resources can help forest landowners learn more about options and considerations for situations in which trees have been damaged by winter weather:

TIMBERLAND WIND / ICE DAMAGE:

How to Evaluate and Manage Storm-Damaged Forest Areas:
http://www.fs.fed.us/r8/foresthealth/pubs/storm_damage/contents.html

Evaluating wind / ice damage stands:
http://www.forestry.uga.edu/outreach/pubs/pdf/forestry/assessing_tornado_damaged_forest_stands5-30-08_1.pdf

Wind Wood Utilization (this has numerous documents and links that are beneficial):
http://www.windwoodutilization.org/salvage.asp

URBAN AND HAZARD TREE SAFETY:

http://www.gatrees.org/community-forests/management/trees-storm-safety/

Excellent site for Storm Damage…with an Urban Forestry angle:
http://hort.ifas.ufl.edu/treesandhurricanes/

TAXES:

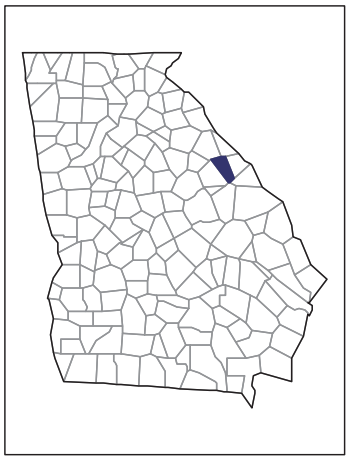
National Timber Tax website (Master Index has good list of subject areas):
http://www.timbertax.org/

TIMBER SALES:

General information:
http://www.gatrees.org/forest-management/private-forest-management/timber-selling/

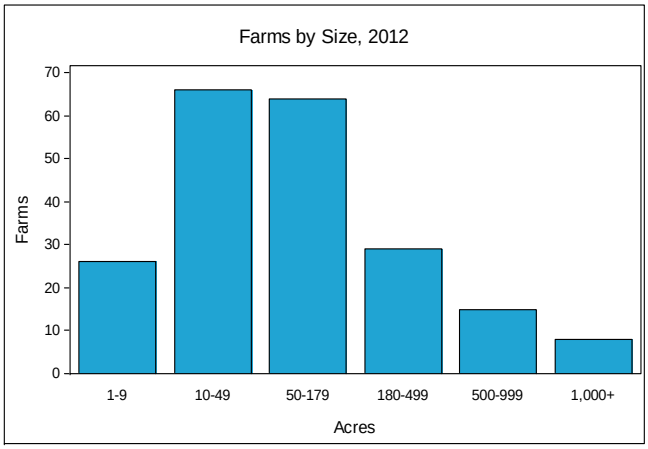
Landowners are encouraged to utilize professional foresters and arborists to help with decisions about timber management or potentially hazardous trees around homes and urban environments. Seeking independent advice is a sound way to reduce hasty judgments and insure all available options are considered.

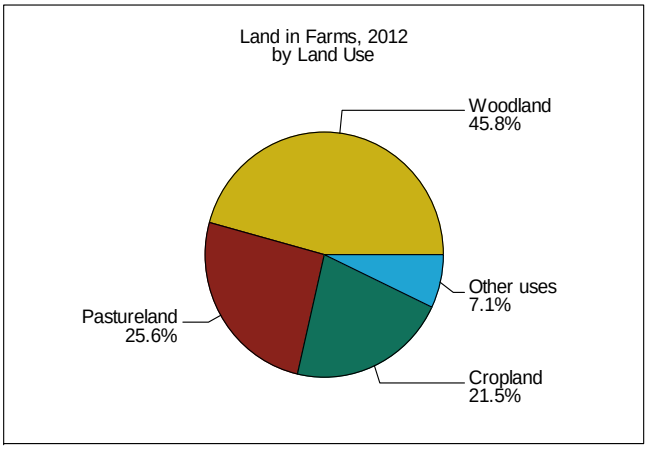
2012 CENSUS OF AGRICULTURE
COUNTY PROFILE



McDuffie County
Georgia

	2012	2007	% change
Number of Farms	208	213	- 2
Land in Farms	37,989 acres	36,109 acres	+ 5
Average Size of Farm	183 acres	170 acres	+ 8
Market Value of Products Sold	$27,785,000	$24,926,000	+ 11
Crop Sales (D)			
Livestock Sales (D)			
Average Per Farm	$133,584	$117,022	+ 14
Government Payments	$251,000	$90,000	+ 179
Average Per Farm Receiving Payments	$8,382	$2,423	+ 246





2012 CENSUS OF AGRICULTURE
COUNTY PROFILE

McDuffie County – Georgia

Ranked items among the 159 state counties and 3,079 U.S. counties, 2012

Item	Quantity	State Rank	Universe [1]	U.S. Rank	Universe [1]
MARKET VALUE OF AGRICULTURAL PRODUCTS SOLD ($1,000)					
Total value of agricultural products sold	27,785	89	159	2,192	3,077
Value of crops including nursery and greenhouse	(D)	50	159	(D)	3,072
Value of livestock, poultry, and their products	(D)	100	159	(D)	3,076
VALUE OF SALES BY COMMODITY GROUP ($1,000)					
Grains, oilseeds, dry beans, and dry peas	59	127	151	2,705	2,926
Tobacco	-	-	29	-	436
Cotton and cottonseed	-	-	84	-	635
Vegetables, melons, potatoes, and sweet potatoes	28	122	152	2,363	2,802
Fruits, tree nuts, and berries	32	132	156	1,960	2,724
Nursery, greenhouse, floriculture, and sod	(D)	2	144	(D)	2,678
Cut Christmas trees and short rotation woody crops	(D)	51	65	(D)	1,530
Other crops and hay	306	110	157	2,629	3,049
Poultry and eggs	106	111	153	1,379	3,013
Cattle and calves	2,025	65	158	2,321	3,056
Milk from cows	(D)	19	67	(D)	2,038
Hogs and pigs	4	71	124	2,432	2,827
Sheep, goats, wool, mohair, and milk	26	61	154	2,306	2,988
Horses, ponies, mules, burros, and donkeys	37	50	143	2,438	3,011
Aquaculture	(D)	44	57	(D)	1,366
Other animals and other animal products	(D)	(D)	135	(D)	2,924
TOP CROP ITEMS (acres)					
Forage-land used for all hay and haylage, grass silage, and greenchop	4,318	46	159	2,302	3,057
Corn for silage	(D)	18	73	(D)	2,237
Nursery stock crops	(D)	6	113	(D)	2,077
Short-rotation woody crops	(D)	(D)	48	(D)	793
Wheat for grain, all	(D)	(D)	120	(D)	2,537
TOP LIVESTOCK INVENTORY ITEMS (number)					
Cattle and calves	6,384	61	158	2,266	3,063
Pullets for laying flock replacement	1,036	48	116	546	2,637
Layers	804	79	156	2,027	3,040
Horses and ponies	690	19	159	1,680	3,072
Goats, all	368	69	155	1,587	2,996

Other County Highlights, 2012

Economic Characteristics	Quantity
Farms by value of sales:	
Less than $1,000	83
$1,000 to $2,499	29
$2,500 to $4,999	21
$5,000 to $9,999	21
$10,000 to $19,999	21
$20,000 to $24,999	4
$25,000 to $39,999	11
$40,000 to $49,999	-
$50,000 to $99,999	9
$100,000 to $249,999	5
$250,000 to $499,999	-
$500,000 or more	4
Total farm production expenses ($1,000)	23,016
Average per farm ($)	110,655
Net cash farm income of operation ($1,000)	5,716
Average per farm ($)	27,479

Operator Characteristics	Quantity
Principal operators by primary occupation:	
Farming	73
Other	135
Principal operators by sex:	
Male	179
Female	29
Average age of principal operator (years)	59.1
All operators by race [2]:	
American Indian or Alaska Native	-
Asian	-
Black or African American	9
Native Hawaiian or Other Pacific Islander	-
White	302
More than one race	3
All operators of Spanish, Hispanic, or Latino Origin [2]	2

See "Census of Agriculture, Volume 1, Geographic Area Series" for complete footnotes, explanations, definitions, and methodology.
- Represents zero. (D) Withheld to avoid disclosing data for individual operations.
[1] Universe is number of counties in state or U.S. with item. [2] Data were collected for a maximum of three operators per farm.