

Appendix C
Risk Assessment Data

App. C – Risk Assessment Data

- 1.0 Summary of Vulnerability and Impacts
- 2.0 HAZUS-MH: Flood Event Report

1.0 Summary of Vulnerability and Impacts

Table C-1 summarizes the City of Tuscaloosa’s vulnerability to flooding and other natural hazards. This table is an abridged version, based upon the comparable Table 5-53 found in the 2014 Tuscaloosa County Multi-Hazard Mitigation Plan. Table C-1 includes a summary of all hazards identified in Section 4.2 of this plan. Community impacts include the following descriptions and measurements:

Location. Location measures the geographic extent of the identified hazard in one of three ways, as follows:

- 1) *Community-wide* - the entire geographic area is affected;
- 2) *Partial* - a significant portion of the community is affected; or
- 3) *Minimal* - a negligible area is affected.

Probability. Probability measures the likelihood of the hazard occurring within the community, based on historical incidence. The scale for frequency runs as follows:

- 1) *Very high* - annually;
- 2) *High* - every two to three years;
- 3) *Moderate* - every three to ten years;
- 4) *Low* - every ten years; or
- 5) *Very low* - rare.

Extent. Extent measures the severity of the hazard and its potential to cause casualties, business losses, and damage to structures. The scale utilized runs as follows:

- 1) *Devastating* - the potential for devastating casualties, business losses, and structure damage;
- 2) *Significant* - the potential for some casualties and significant, but less than devastating, business losses and structure damage;
- 3) *Moderate* – moderate potential for economic losses and structure damage; or
- 4) *Slight* – slight or minimal potential for economic losses and structure damage

Exposure. Exposure measures the percentage of structures within the community, including buildings, critical facilities, and infrastructure lifelines, that are exposed to the hazard. The classifications are defined as follows:

- 1) *High* - includes more than approximately 25 percent of the structures;
- 2) *Medium* - includes 10 percent to 25 percent of the structures; or
- 3) *Low* - includes less than 10 percent of the structures.

Damage Potential. Damage potential measures the damage that can be expected should an event take place. The classifications are defined as follows:

- 1) *High* - a hazard could damage more than 5 percent of the structures in a community;
- 2) *Medium* - a hazard could damage between 1 and 5 percent of the structures in a community; or
- 3) *Low* - a hazard could damage less than 1 percent of the structures in a community.

Table C-1. Summary of Hazards and Community Impacts

Hazard	Community Impacts			Impacts to Vulnerable Community Buildings, Critical Facilities, and Infrastructure	
	Location (Geographic Extent of Hazard in the Community)	Probability (Frequency of Hazard Occurrence in the Community)	Extent (Magnitude of Severity of Hazard in the Event of Occurrence)	Level of Exposure (Degree of Structures Exposed to the Hazard)	Level of Damage Potential (Percentage of Likely Damage to Exposed Structures)
<i>Floods</i>	Partial	Very High	Significant	Medium	Medium
<i>Dam/Levee Failures</i>	Minimal	Low	Slight	Low	Low
<i>Sinkholes (Land Subsidence)</i>	Minimal	Moderate	Moderate	Medium	Low
<i>Tornadoes</i>	Community-wide	High	Devastating	High	High
<i>Severe Storms</i>	Community-wide	Very High	Significant	High	Low
<i>Hurricanes</i>	Community-wide	Low	Moderate	High	Low
<i>Winter Storms/Freezes</i>	Community-wide	High	Significant	High	Low
<i>Drought/Heat Waves</i>	Community-wide	Moderate	Moderate	High	Low
<i>Wildfires</i>	Partial	Low	Slight	Low	High
<i>Landslides</i>	Minimal	Low	Slight	Low	Low
<i>Earthquakes</i>	Community-wide	Very Low	Slight	High	Medium

Source: 2014 Tuscaloosa County Multi-Hazard Mitigation Plan

2.0 HAZUS-MH: Flood Event Report

FEMA's HAZUS-MH risk assessment software was used to estimate losses due to flooding for the City of Tuscaloosa study area. The results of the modeled flood scenario are included in the following Flood Event Summary Report generated from HAZUS-MH, which have been integrated into this plan in Chapter 4. Risk Assessment.

Hazus-MH: Flood Event Report

Region Name: Tuscaloosa City Flood Event3

Flood Scenario: Tuscaloosa City Flood Event

Print Date: Thursday, August 27, 2015

Disclaimer:

This version of Hazus utilizes 2010 Census Data.

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Alabama

Note:

Appendix A contains a complete listing of the counties contained in the region .

The geographical size of the region is 778 square miles and contains 6,694 census blocks. The region contains over 56 thousand households and has a total population of 140,853 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B .

There are an estimated 51,225 buildings in the region with a total building replacement value (excluding contents) of 14,897 million dollars (2010 dollars). Approximately 90.66% of the buildings (and 74.74% of the building value) are associated with residential housing.

General Building Stock

Hazus estimates that there are 51,225 buildings in the region which have an aggregate total replacement value of 14,897 million (2010 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure (\$1000)	Percent of Total
Residential	11,133,539	74.7%
Commercial	2,384,936	16.0%
Industrial	715,633	4.8%
Agricultural	38,575	0.3%
Religion	339,252	2.3%
Government	61,716	0.4%
Education	223,577	1.5%
Total	14,897,228	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	3,151,554	77.8%
Commercial	493,406	12.2%
Industrial	271,668	6.7%
Agricultural	7,784	0.2%
Religion	88,414	2.2%
Government	6,697	0.2%
Education	32,240	0.8%
Total	4,051,763	100.00%

Essential Facility Inventory

For essential facilities, there are 3 hospitals in the region with a total bed capacity of 1,539 beds. There are 48 schools, 9 fire stations, 10 police stations and no emergency operation centers.

Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Tuscaloosa City Flood Event3
Scenario Name:	Tuscaloosa City Flood Event
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

General Building Stock Damage

Hazus estimates that about 1,577 buildings will be at least moderately damaged. This is over 20% of the total number of buildings in the scenario. There are an estimated 332 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

Occupancy	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	2	13.33	6	40.00	4	26.67	2	13.33	1	6.67	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	15	83.33	1	5.56	2	11.11	0	0.00	0	0.00
Religion	0	0.00	2	66.67	0	0.00	0	0.00	1	33.33	0	0.00
Residential	1	0.06	40	2.59	342	22.15	207	13.41	622	40.28	332	21.50
Total	3		63		347		211		624		332	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0.00	7	70.00	2	20.00	0	0.00	1	10.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	154	100.00
Masonry	0	0.00	8	13.79	6	10.34	3	5.17	34	58.62	7	12.07
Steel	1	3.85	17	65.38	3	11.54	3	11.54	2	7.69	0	0.00
Wood	0	0.00	29	2.19	333	25.11	205	15.46	590	44.49	169	12.75

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 1,539 hospital beds available for use. On the day of the scenario flood event, the model estimates that 1,539 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	9	0	0	0
Hospitals	3	0	0	0
Police Stations	10	1	0	1
Schools	48	4	0	4

If this report displays all zeros or is blank, two possibilities can explain this.

- (1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.
- (2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

Analysis has not been performed for this Scenario.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 3,785 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 9,361 people (out of a total population of 140,853) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 819.24 million dollars, which represents 20.22 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 816.92 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 57.60% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Building Loss</u>						
	Building	275.15	54.23	26.39	11.55	367.32
	Content	196.32	116.78	70.33	52.29	435.72
	Inventory	0.00	2.29	11.32	0.27	13.88
	Subtotal	471.47	173.30	108.04	64.11	816.92
<u>Business Interruption</u>						
	Income	0.00	0.56	0.01	0.13	0.70
	Relocation	0.25	0.11	0.01	0.06	0.43
	Rental Income	0.13	0.08	0.00	0.00	0.21
	Wage	0.01	0.51	0.01	0.45	0.98
	Subtotal	0.39	1.27	0.03	0.64	2.32
ALL	Total	471.86	174.57	108.07	64.74	819.24

Appendix A: County Listing for the Region

Alabama

- Tuscaloosa

Appendix B: Regional Population and Building Value Data

	Building Value (thousands of dollars)			Total
	Population	Residential	Non-Residential	
Alabama				
Tuscaloosa	140,853	11,133,539	3,763,689	14,897,228
Total	140,853	11,133,539	3,763,689	14,897,228
Total Study Region	140,853	11,133,539	3,763,689	14,897,228